

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

CONTRACT DOCUMENTS

PARTS 1 - 8

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

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SCOPE OF SERVICES PACKAGE

PART 1 - AGREEMENT

AGREEMENT

for

CONTRACT NO. 26-073-03

Federal Aid Project No. BRN-S050(14)

THIS AGREEMENT, made and executed in quadruplicate, the day, month, and year affixed by the signature of the Department of Transportation's representative.

BY AND BETWEEN THE DELAWARE DEPARTMENT OF TRANSPORTATION (**Department**), a department created under the laws of the State of Delaware, party of the first part, and ~CONTRACTOR NAME~, ~CONTRACTOR ADDRESS~, ~CONTRACTOR CITY~, ~CONTRACTOR STATE~ ~CONTRACTOR ZIP~ (**Design-Builder**), party of the second part.

WITNESSETH that the **Design-Builder** in consideration of the covenants and agreements herein contained and made by the **Department**, agrees with the **Department** as follows:

ARTICLE ONE. The **Design-Builder** shall and will provide and furnish all the material, machinery, implements, appliances, and tools, and perform the work and labor required to ~JOB DESCRIPTION~ in Sussex County in the State of Delaware, as shown in the contract documents identified by the signature of the **Design-Builder** and the Secretary of the **Department** or designee and are hereby incorporated by reference as part of this contract. The Contract consists of the "Contract Documents" including, but not limited to, the following:

- A) Part 1 – Agreement (this instrument);
- B) Appendix A – Project Scope, to this Agreement;
- C) Payment/Performance Bonds;
- D) Part 2 – Design-Build Section 100;
- E) Part 3 – Design Requirements and Performance Specifications;
- F) Part 4 – Design-Build Special Provisions;
- G) Part 5 – Utility and Right-of-Way Statements;
- H) Part 6 – Scope of Services Packages Plans;
- I) Part 7 – Environmental Requirements;
- J) Part 8 – **Design-Builder's** Proposal; and
- K) The **Department's** Errors and Omissions Policy.

For these purposes, all of the provisions contained in the listed Contract Documents are incorporated herein by reference with the same force and effect as though said Contract Documents were herein set out in full.

The **Design-Builder**, after the execution of the Contract and approval of the bond, shall begin work within ten (10) days from the Notice to Proceed, as the Engineer may direct, and shall complete the Contract on or before September 30, 2010.

ARTICLE TWO. It is understood and agreed by and between the parties hereto that all the construction and work included in this Contract is to be done under the direction of the Secretary of the **Department** and that his/her decision as to the true construction and meaning of the proposal, plans and

specifications shall be final.

It is understood and agreed by and between the parties hereto that such additional drawings, plans and specifications as may be necessary to detail and illustrate the work to be done are to be furnished by the Engineer, and they agree to conform to and abide by the same so far as it may be consistent with the purpose and intent of the original proposal, plans and specifications incorporated by reference as part of this Contract as provided in Article One.

ARTICLE THREE. If the construction or work to be done under this Contract shall be abandoned, or if this contract, or any part thereof shall be sublet without the previous written consent of the **Department**, or if the Contract shall be assigned by the **Design-Builder**, otherwise than as herein specified, or if at any time the Director shall be of the opinion, and shall so certify in writing, that the work, or any part thereof, is unnecessarily or unreasonably delayed, or that the **Design-Builder** has violated any provision of this contract, the **Department** may notify the **Design-Builder** to discontinue all work or any part thereof; and thereupon the **Design-Builder** shall discontinue such work or such part thereof as the **Department** may designate, and the **Department** may thereupon, by a Contract or otherwise, as it may determine, complete the work, or such part thereof, and charge the entire expense of so completing the work or part thereof to the **Design-Builder**; and for such completion the **Department** for itself or its contractors, may take possession of or use or cause to be used in the completion of the work or any part thereof, any of such machinery, implements, tools, or materials of any description as shall be bound upon the line of the work, and thereafter accounting for, or paying to the **Design-Builder** a reasonable compensation for the use of the machinery, implements, tools, or materials.

All costs and charges that may be incurred under this article or any damages that should be borne by the **Design-Builder**, shall be withheld or deducted from any moneys then due, or to become due to the **Design-Builder**, under this contract, or any part thereof; and in such accounting the **Department** shall not be held to obtain the lowest cost for the work of completing the Contract or any part thereof, but all sums actually paid therefore shall be charged to the **Design-Builder**. In case the costs and charges incurred are less than the sum which would have been payable under the contract, if the same had been completed by the **Design-Builder**, the **Design-Builder** shall be entitled to receive the difference and in case such cost and charges shall exceed the sum, the **Design-Builder** shall pay the amount of excess to the **Department** for the completion of the work.

ARTICLE FOUR. It is further mutually agreed between the parties hereto that no estimate given or payment made under this Contract shall be conclusive evidence of the performance of this Contract either wholly or in part, and that no payment shall be construed to be an acceptance of defective work or improper materials.

(REMAINDER OF THE PAGE LEFT BLANK.)

Delaware Department of Transportation

IN WITNESS WHEREOF, the parties to these presents have duly executed this agreement in quadruplicate the day, month and year affixed by their signatures.

SEALED, AND DELIVERED IN THE
presence of

CORPORATE SEAL

Name of **Design-Builder**

Attest: _____

By: _____

Authorized Signature

Title

Dated: _____

In the case of a corporation, firm, or partnership, this contract must be signed by the appropriate officials of such corporation, firm, or partnership and their corporate seal must be affixed hereto.

DEPARTMENT OF TRANSPORTATION

SEAL

Attest: _____

Martha N. Dobson
Director, Technology and Support Services

By: _____

Signature

Director of Transportation Solutions

Title

Dated: _____

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

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PART 1

APPENDIX A – PROJECT SCOPE

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1.0 INTRODUCTION

This Part 1 – Agreement, Appendix A, to the Design-Build (DB) Agreement provides a summary description of the physical components of the Project that the Design-Builder shall design, construct, and/or install and the associated management, control, monitoring, compliance, and professional services and other elements of the Work.

The Design-Builder shall not rely solely on the description contained in this Appendix A to identify all Project components to be designed, constructed, and/or installed. The Design-Builder shall determine the full scope of the Project through thorough examination of the Contract Documents and the Project Site or as may be reasonably inferred from such examination.

The Design-Builder shall, for the generally described improvements, perform all design engineering and analysis; provide construction engineering and inspection services; provide quality control services; and furnish, construct, and/or install all materials and components of the Project required to meet the requirements of the Contract Documents, except where the Department will furnish and/or install items as listed in Section 5.0.

2.0 PROJECT CONFIGURATION

The Project shall include the major components listed in this Appendix A.



2.1 PROJECT LIMITS

The total Project shall be no more than 0.72 miles in length and is located on the Eastern Seaboard between Bethany Beach to the south and Dewey Beach to the north in Sussex County, Delaware. The Proposer will be responsible for defining the overall Project Limits within the maximum extents defined herein.

The Proposer must allow for the proper alignment and tie-ins of all Work associated with the adjacent Roadway Contract (see Plans for Roadway Contract #23-073-03 in Part 6- Scope of Services Package Plans). If the Design-Builder's proposed design requires the removal or de-construction of any portion of the existing MSE walls and/or approach embankments depicted in the Plans for Roadway Contract #23-073-03, then the Design-Builder's longitudinal Project Limits shall be defined by either the required limits of excavation or the bridge approach slab limits, whichever is greater. In either case, the Design-Builder is responsible for all costs associated with the removal, design and reconstruction of any disturbed areas. These responsibilities shall include, but are not limited to: design, construction, and removal of any temporary shoring related to existing embankment or MSE wall removal, proper removal and replacement of embankment materials, proper disposal of any excess material, design, removal and reconstruction of MSE walls including concrete facing to match the aesthetics established in the Roadway Contract, design and construction of drainage systems, pavement and subgrade, guardrails, sidewalks, traffic barriers and railings, topsoil seeding, and pavement striping within the Design-Builder's Project Limits. Any new retaining structures shall be backfilled in accordance with Contract #23-073-03 Plans and Specifications.

If the proposed design requires changes to elements of Contract #23-073-03 that have not been constructed as of the date of submission for the Final Technical Proposal, the Design-Builder shall demonstrate in his Proposal that any and all transitions or modifications required are feasible, can fit within the maximum project termini and do not compromise the design criteria specified in the Contract Documents. These changes may include, but are not limited to, changes in the horizontal alignment of the roadway due to changes in the median widths between the bridge and approach embankments, or changes

to the proposed pedestrian and bicycle paths on the east side of the bridge. The Department will provide any revised design for this work and it will be constructed as part of the Roadway Contract #23-073-03.

The maximum available Project termini are as follows:

- A) Beginning of Project (BOP) – South of the Indian River Inlet on State Route 1 (SR 1) Station 282 + 00 as measured along the Baseline Construction Northbound SR 1 and as shown on the Plans for Contract # 23-073-03 in Part 6 – Scope of Services Package Plans; and
- B) End of Project (EOP) – North of the Indian River inlet on SR 1 Station 320 + 00 as measured along the Baseline Construction Northbound SR 1 and as shown on the Plans for Contract #23-073-03 in Part 6 – Scope of Services Package Plans.



The maximum lateral limits are as follows:

- A) Eastern Limit - The eastern limits of disturbance shall not extend beyond the back (western) face of the portable concrete barrier located along the western shoulder of Southbound SR 1. Permanent above ground structures and/or fill shall be located within the existing Right-of-Way. Total permanent impact areas shall not exceed those of the original bridge design in Contract 25-073-02.
- B) Western Limits - The western limits of disturbance shall extend no more than 20 feet west of the front (west) face of Retaining Walls 1 and 7, located south and north of the inlet, respectively. Retaining wall limits are depicted in the Roadway Contract Drawings in Part 6 - Scope of Services Package Plans. Permanent above ground structures and/or fill shall be located within the existing Right-of-Way. Total permanent impact areas shall not exceed those of the original bridge design in Contract 25-073-02.

Staging areas available to the Design-Builder are depicted on Directive Plan Sheet B-003 and are included in the Part 6 – Scope of Services Package Plans.

All Work shall be limited to existing Right-of-Way (ROW). ROW limits vary throughout the Project Limits. The lateral limits of the Project are shown on the ROW Plans in Part 6 – Scope of Services Package Plans.

At a minimum, the Proposer's Project Limits designated for the Work shall extend from the beginning (southernmost point) of approach slab on the south bridge approach to the end (northernmost point) of bridge approach slab on the north bridge approach. The lateral limits shall be within the existing ROW and as limited herein.

2.2 PROJECT-WIDE REQUIREMENTS

The Project includes the following:

- A) A new bridge structure with a minimum 100-year design life that is centered over the navigational channel west of the existing structure and provides the minimum above deck and below deck clearance envelopes specified in the Directive Plans (*see* Part 6 – Scope of Services Package Plans);

- B) Joining the new bridge and approach slabs to the new roadway approaches currently being constructed north and south of the inlet, or as modified by the Design-Builder's Proposal, and within the existing ROW and maximum Project Limits;
- C) Provisions for maintaining minimum navigational clearance of 200 feet horizontally (measured perpendicular to the flow of the Indian River Inlet and centered on the navigational channel) and 45 feet vertically above mean high water (Elev. 0.84 feet), with
- D) No temporary piers, supporting elements, or other temporary bridge components located in the waters of the existing 500-foot wide inlet;
- E) Capacity to withstand extreme weather events during construction and after completion in accordance with the *Bridge Design Requirements* Performance Specification included in Part 3 of the Contract Documents;
- F) Provisions for infrastructure protection and security controlled access to critical bridge areas and/or components in accordance with the *Bridge Security Program* Performance Specification included in Part 3 of the Contract Documents;
-  G) Design and construction of all necessary roadway approach modifications within the Project Limits with bridge roadway surface dimensions that match the typical roadway section currently under construction including as a minimum two 12-foot travel lanes, a 10-foot outside shoulder, and a 4-foot inside shoulder all in each direction, and one 12-foot combined use recreational bicyclist and pedestrian walkway on the ocean (east) side of structure, **a continuous 2-foot wide sand by-pass system utility corridor (on ocean side of structure)**, and necessary width to accommodate all traffic barriers, cushions, and railings required by the Contract Documents (*see* Directive Plans, Part 6 – Scope of Services Package Plans);
- H) Design, reconstruction and/or removal of approach roadway embankment, retaining walls and scour protection, if proposed, within the Project Limits;
- I) Safe and efficient accommodations for bicycles and pedestrians in accordance with the Design Criteria, including, but not limited to, appropriate rail height, bicycle-safe bridge joints, and separation from vehicular traffic, and American Disabilities Act (ADA) compliance;
- J) Provisions for utility conveyance across the bridge including, but not limited to, electrical service and maintenance lighting, mechanical and natural ventilation, DelDOT Intelligent Traffic Management Systems (ITMS), bridge monitoring instrumentation, and load-carrying capacity and installation (by others) of a sand-bypass system over the Indian River Inlet as specified in Part 5 – Utility Requirements;
- K) Provisions for the positive prevention of vermin/bird habitat/nesting within and on any and all bridge components and/or elements;
- L) Development of a Context Sensitive Bridge Design that gives consideration to previous and/or future public preferences, as specified in the *Aesthetic Requirements* Performance Specification in Part 3 of the Contract Documents, and as determined through the Department's earlier Public Involvement Process for the Bridge; and
-  M) **Provisions for corrosion-resistant expansion joint assemblies, bridge bearings, access doors, equipment, bridge railings, casings, lighting, and all other bridge incidentals. The use of structural steel members directly exposed to the environment shall not be permitted.**

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The plan layout of the Project shall allow for the future widening of the Indian River Inlet up to 800 feet centered on the navigational channel and shall be within the ROW limits shown on the ROW Plans in Part 6 – Scope of Services Package Plans. Accordingly, no below surface bridge components may be located within 50 feet of the limits of the potential future inlet widening, requiring a clear area of 900 feet. The minimum clearance envelopes to be provided above and below the bridge deck shall be as shown in the Directive Plans, Part 6 – Scope of Services Package Plans.

2.2.1 Adjacent and Concurrent Projects

The Replacement of Bridge 3-156, SR 1 Over the Indian River Inlet Design-Build Project is just one component of four concurrent but separate Indian River Inlet contracts as listed below (Construction start and completion dates and durations are approximate and subject to change):

Contract	Contract Title	Anticipated Construction Start	Estimated Completion
23-073-03	BR 3-156 on SR 1 Over Indian River Inlet (Roadway and Approaches)	In progress	Dependent Upon DB Schedule Proposal
25-073-03	BR 3-156, Indian River Inlet Park Enhancements	Fall 2008	Fall 2011
25-073-04	BR 3-156, Indian River Inlet Bridge Demolition	Fall 2010	Summer 2011
26-073-03	Replacement of BR 3-156, SR 1 Over Indian River Inlet (Design-Build)	Summer 2007	Fall 2010
DNREC	Delaware Seashore State Park Administration Building	Summer 2007	Summer 2008
TBD	Sand-Bypass System Installation	Spring 2011	Winter 2011
-	Underground Electric Transmission and Distribution	Fall 2007	Summer 2008

The Department reserves the sole right to unilaterally alter the scope, nature, construction start and completion dates of all future Contracts.

The Design-Builder is hereby alerted and advised that any of the above and/or other contracts may be ongoing simultaneously with this Contract. All Contractors, including Design-Builders, working on any portion of the Indian River Inlet Project shall coordinate and cooperate with the Department and Contractors and/or other Design-Builders working on the associated and/or adjacent contracts in accordance with DB Section 105 – Control of Work in Part 2. Contractors and/or Design-Builders shall not impede or limit access to the work being performed by others. All costs associated with the Design-Builder’s coordination and cooperation shall be included in the Lump Sum Contract Price.

3.0 ASSOCIATED WORK

The Design-Builder shall, in association with the design and construction of the physical components of the Project, perform the following elements of Work:

- A) Associated aesthetics and landscaping;
- B) Design and construction management;
- C) Project-related Public Outreach (*see* Part 3 – Design Requirements and Performance Specifications, *Public Outreach Requirements* Performance Specification);
- D) Coordination with Project stakeholders and other contractors adjacent to the Work;

- E) Design Quality Control and Design Review (*see* Part 2 – DB Section 111);
- F) Construction Quality Control (*see* Part 2 – DB Section 112);
- G) Environmental mitigation and compliance monitoring (*see* Part 3 – Design Requirements and Part 7 – Permit Requirements);
- H) All additional environmental investigations and monitoring associated with or resulting from the Design-Builder’s actions;
- I) Maintenance of traffic, access to property (both temporary and permanent), and maintenance and coordination of inlet and park traffic;
- J) Project safety and security;
- K) All engineering (including, but not limited to, supplemental surveys and geotechnical investigations) in addition to that provided by the Department;
- L) All harmful and hazardous materials remediation created by the design-builder through design and/or construction or as identified in the RFP (none known to exist by the Department);
- M) Drainage and erosion control;
- N) Construction waste disposal and handling;
- O) Required clearances, licenses, construction easements, and permits for the Design-Builder’s Work, Work sites, and storage areas on- or off-site;
- P) All modifications to existing permits previously obtained by the Department as required for the Project and/or as a result of the Design-Builder’s design, actions, and construction scheduling;
- Q) All ancillary Work, such as, access roads, driveways, temporary fencing, relocation of drainage, Work sites, and temporary Work;
- R) Location, acquisition, permits, and transportation for Material;
- S) Coordination of the relocation of any utilities and municipal drainage facilities and the design and relocation of any utilities as designated in Part 5 – Utility and Right-of-Way Statements;
-  T) Site clearing and restoration;
- U) Maintenance of the Project during the Contract period; and
- V) All other activities, functions, or elements necessary to the successful completion and subsequent approval of the Project by the Department.

4.0 BASIC PROJECT CONFIGURATION

The Basic Project Configuration shall consist of the following:

- A) The Project Limits;
- B) The horizontal and vertical alignments for the roadway surface;
- C) The new bridge;
- D) Any retaining wall modifications within the Project Limits;

- E) Number and width of lanes, shoulders, sidewalks, barriers, rails, and tie-ins to planned roadway approaches;
- F) The minimum vertical and horizontal underclearances for navigational and vehicular traffic; and
- G) The Right-of-Way limits.

4.1 STANDARD FOR DETERMINING MATERIALITY OF CHANGE IN BASIC PROJECT CONFIGURATION

The following are the standards for determining materiality of Basic Project Configuration changes:

- A) A change in the Project Limits by more than ten feet longitudinally;
- B) A change in the roadway geometrics accommodated by the bridge;
- C) A change in the proposed bridge type;
- D) Any reduction in minimum vertical and/or horizontal underclearances;
- E) A change in the Contract utility provisions;
- F) Any change in the Project Right-of-Way limits depicted; and/or
- G) Any change in this Section requiring a change in the Environmental Assessment/Finding of No Significant Impact.

5.0 DEPARTMENT-PROVIDED MATERIAL OR EQUIPMENT

The Department will not be providing any design, Material, or Equipment for the Design-Builder's use.

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SCOPE OF SERVICES PACKAGE

PART 1

APPENDIX B – ERRORS AND OMISSIONS

**DEPARTMENT POLICY IMPLEMENT A-26
ERRORS AND OMISSIONS**



The following document is a policy implement of the Department required in all Agreements that involve professional services. The policy was not created with Design-Build procurement in mind. Therefore, for this Project the word “Consultant” as used in this policy shall be interpreted to mean “Design-Builder.”

 POLICY IMPLEMENT
STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION

P.I. Number: A-26

Errors and Omissions Policy

References:

Issued: 1/1/1999

Revised: n/a

Expires: n/a

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I. Insurance

II. Assignment of Responsibility

III. Error and/or Omission Discovery

This document includes a general discussion on errors and/or omissions occurring during project implementation, how to initiate a correction for an error or omission, and what each party's responsibilities are in making the correction. The Department intends to seek reimbursement for additional costs (defined below) associated with correcting errors and omissions during planning, design and construction, including but not limited to, multiple report rewrites, construction costs, and construction engineering.

I. INSURANCE

This document does not address the types of liability insurance a firm may need to carry. Insurance usually carried by consultants includes Comprehensive General Liability, Comprehensive Automobile Liability, Workers Compensation and Employers Liability, Professional Liability, and other specialty insurance required in an agreement or that a firm may consider prudent based on the scope of work. The actual agreement covering the work will specify the minimum insurance requirements.

II. ASSIGNMENT OF RESPONSIBILITY

Services procured under the auspices of this document are considered "Professional Services". This in itself infers that, no matter what the scope of work entails, there are associated, industry professional, standards which are expected to be met. For projects involving public safety, meeting these standards takes on even more significance. Firms selected through the process described in the DelDOT Professional Services Procurement Manual are the best technically qualified, with a proven history of meeting similar contract obligations. Such designation carries with it an acknowledgement of the firm's responsibility to know the accepted standards for doing business in Delaware. Because of the Department's review process and the involvement of many internal support sections as well as other state agencies, utility companies, public groups, municipalities, and the like, acceptance of the responsibility for an error and/or omission in a professional manner will depend on good project monitoring. The Project Manager must ensure that full and complete review and comment records are kept by both the Consultant and the Department. It is required that an office copy of each marked or edited review

submission and comments be prepared and retained for future reference. Detailed minutes of project review meetings are also required.

Because of the underlying expectation that a firm will comply with established standards throughout project development, there are occasions when a Project Manager and their Section Head will determine that a firm may not have met this obligation. When discovered, the error and/or omission should be reported immediately to the Consultant for resolution. While invoices should annotate the time and associated costs for correcting the lapse, the Department shall not be charged to correct errors and/or omissions.

III. ERROR AND/OR OMISSION DISCOVERY

Definitions:

Errors are defined as unknown, ignorant, or unintentional deviations from accuracy or correctness. Errors may arise from mistaken judgment, misplaced confidence, incorrect belief as to the existence or effect of matters of fact, or other actions. Errors also include failure to meet established Delaware requirements, or design standards for that type of project, (i.e., AASHTO, FHWA, EPA, FTA, DelDOT or other established government requirements or design standards).

Omissions are defined as missing or unmentioned detail or requirements through either failure to perform properly, neglect, or failure to use reasonable care. Omissions also include failure to identify and implement cost-effective solutions.

Additional costs refers to that portion of the project cost the consultant is responsible for which includes those expenses over and above the cost the Department would have incurred had the error or omission not been made.

Example #1: A mistaken quantity that results in an unbalanced bid situation shall constitute an error whereas a mistaken quantity that results in the expense of additional materials to the Department shall not cause additional costs to the consultant except for the recalculation.

Example #2: If the consultant under-designs a sign structure, the consultant shall be responsible for the re-design as well as the construction cost, if any, of the under-designed structure. Likewise, if the consultant overdesigns a sign structure, the consultant shall be responsible for the redesign as well as the increased cost of the over-designed structure.

Example #3: The Department will pay the expense of the first re-write of any reports being developed under contract. The cost of report re-writes after that first re-write will be considered additional costs to the consultant.

During Project Development

Errors and/or omissions discovered during project development are relatively easy to resolve when identified early because the Consultant's Project Manager and the Department's Project Manager are both aware of the circumstances surrounding the problem. The major issue remaining involves arriving at a mutual agreement on whether full, partial or no compensation is due the Consultant to correct the problem. (See Resolution below.)

During Implementation or Construction

Most often it will be obvious if a Consultant error and/or omission truly occurred. Frequently, however, there is a time lapse between the completion of professional services to develop the project and actual implementation of the plan, project, or construction. Associated with this delay is the updating and modification of completed work because of changes in specifications, updated regulations, legislative initiatives, or additional valid comments for improving a project. Most often, corrections or modifications

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are performed by Department staff, however, they must be immediately reported to the Department's Project Manager and in turn, to the Consultant. In essence, the quality and content of a project become a shared responsibility. Changes of specifications, updated regulations, legislative initiatives, or comments for improving a project after acceptance of the final design, shall in no way be construed as an error/or omission.

Professional responsibility of the Consultant preparing the project does not terminate with acceptance of the product and/or final payment for its development. Failure to discover the error and/or omission during the design, review or implementation of the project does not relieve the Consultant of their responsibility to correct the effects of the error and/or omission. The extent of the responsibility of the consultant for payment for correcting any errors and/or omissions may be in question, but the active participation of the firm in resolving a problem upon request is mandatory. The level of the Consultant's participation shall be determined by the Department.

The procedure to initiate the correction of an error and/or omission lies with the person responsible for ensuring proper implementation of the plan, project, or construction. At the first indication of an error and/or omission, the Department's representative should notify the project Supervisor. All subordinates should be instructed to keep detailed documentation on the work being performed.

At this same time, the Department's Project Manager responsible for developing the project, if not the person identifying the error and/or omission, should be notified. Depending upon how critical a correction is to project scheduling, report preparation and review may be impractical. When such timing is critical, the Project Manager is verbally notified, and guidance is requested with emphasis on what additional data is needed to document and resolve the error and/or omission. The Department's Project Manager, in turn, should immediately advise the consultant, the supervisor, and up through the chain of command as necessary.

The Department holds the prime Consultant responsible for all work performed or not performed under an agreement including that of any subconsultants. When necessary, based on the opinion of the Department's Project Manager, section head, District Engineer, Deputy Director, and/or Director, the prime consultant will be notified of the problem and requested to participate in a solution in cooperation with Department staff. There will be no compensation to either the prime or subconsultant for services related to the verification and correction of an error and/or omission unless as otherwise agreed. The primary objective is to keep the project on schedule by proposing a viable alternative. Records should be kept of any immediate action taken to correct the situation.

Resolution

The Department's Project Manager shall document the error and/or omission that was identified, collect all supporting materials, review their findings with the Consultant, determine the required action to correct the error and/or omission and analyze the cost impact of the resolution (including but not limited to materials, overtime, and force account). All documentation shall be presented to the Section Head. The prime Consultant is expected to participate at the appropriate level, from site visits to preparation of corrective documents. Much of this participation is mutually agreed to as solutions are developed.

The Section Head (or Assistant Chief Engineer for Project Management Team) will review the materials, discuss the resolution options with the Consultant and make a final recommendation to their Assistant Director (or Chief Engineer for Project Management Team) for review. At the conclusion of the Assistant Director's review, the recommendation will be presented to the Director or Deputy Director for approval. For the Project Management Team, the Chief Engineer's decision shall govern.

Appeal

Should the Consultant not participate in the resolution process or disagree with the finding of financial responsibility as presented, the Consultant can schedule a review with the Deputy Director or Director

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(Chief Engineer for Project Management Team). The Deputy Director or Director can modify the terms of the resolution or refer the appeal to the Secretary per the Consultant agreement's appeal process.

Default

Should the Consultant not honor the terms of the final resolution, the Department, for just and definable acts, has the option of filing a Consultant insurance claim, filing legal process for restitution, terminating all current agreements, or barring the firm from further work with the Department for up to five years, or any combination thereof.

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SCOPE OF SERVICES PACKAGE

PART 2 – SECTION 100

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

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**DB SECTION 101
ACRONYMS AND ABBREVIATIONS
AND DEFINITIONS**

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DB SECTION 101

ACRONYMS AND ABBREVIATIONS AND DEFINITIONS

DB 101-1 REFERENCES

Section, subsection, and subpart titles and heading provide reference only, not interpretation.

Cited publications refer to the most recent issue, including interim publications, in effect on the Proposal due date, unless otherwise specified.

Wherever in these Plans, Specifications, or other Contract Documents the following terms, abbreviations, or symbols are used, the intent and meaning shall be interpreted as follows in this Section 101.

DB 101-2 ACRONYMS AND ABBREVIATIONS

Wherever the following abbreviations or acronyms are used in these Contract Documents, they are to be interpreted as follows.

AA	Aluminum Association
AAN	American Association of Nurserymen
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AED	Associated Equipment Distributors
ACOE	Army Corps of Engineers
AED	Associated Equipment Distributors
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturers Association
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute, Inc.
API	American Petroleum Institute
ARA	American Railway Association
AREA	American Railway Engineering Association
ARML	AASHTO Reference Materials Laboratory
ARTBA	American Road and Transportation Builders Association
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWPA	American Wood-Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BDM	Delaware Department of Transportation Bridge Design Manual
CCRL	Cement and Concrete Reference Laboratory
CD-ROM	Compact Disc – Read Only Memory

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CE	Construction Engineering
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CPM	Critical Path Method
CRSI	Concrete Reinforcing Steel institute
CSL	Contract Submittal List
CFR	Code of Federal Regulations
DB	Design-Build
DU	Design Unit
DelDOT	Delaware Department of Transportation
DNREC	Division of Natural Resources and Environmental Control (State of Delaware)
DVD-ROM	Digital Video (or “Versatile”) Disc – Read Only Memory
EOR	Engineer of Record
EASA	Electrical Apparatus Service Association
EPA	Environmental Protection Agency of the United States Government
FAA	Federal Aviation Administration, United States Department of Transportation
FHWA	Federal Highway Administration, United States Department of Transportation
FONSI	Finding Of No Significant Impact
FSS	Federal Specifications and Standards, General Services Administration
IA	Independent Assurance
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IPCEA	Insulated Power Cable Engineers Association
ISO	International Standards Organization
ITE	Institute of Transportation Engineers
ITMS	Intelligent Transportation Management System
ITP	Instructions to Proposers
JV	Joint Venture
LLC	Limited Liability Company
LPI	Lightning Protection Institute
LOI	Letter of Interest
MIL	Military Specifications
MS	Milestones
MUTCD	Manual of Uniform Traffic Control Devices
N/A	Not Applicable
NAAMM	National Association of Architectural Metal Manufacturers
NCHRP	National Cooperative Highway Research Program
NCR	Non-Conformance Report
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NIST	National Institute of Standards and Technology
NFPA	National Fire Protection Association
NOAA	National Oceanic and Atmospheric Administration
NTP	Notice to Proceed
OSHA	Occupational Safety and Health Administration, United State Department of Labor
PC	Project Component
PCA	Portland Cement Association
PCD	Project Component Description
PCI	Prestressed Concrete Institute

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PCP	Progress Check Point
PCV	Project Component Value
PE	Preliminary Engineering
PPS-C	Contract Periodic Payment Schedule
PPS-P	Proposed Periodic Payment Schedule
PTI	Post Tensioning Institute
QA	Quality Assurance
QC	Quality Control
RFI	Request For Information
RFQ	Request for Qualifications
RFP	Request for Proposals
RMA	Rubber Manufacturers Association
ROW	Right Of Way
SAE	Society of Automotive Engineers
SHPO	State Historic Preservation Office
SHA	State Highway Administration
SI	Systeme Internationale - International System of Units
SV	Schedule of Values
SOQ	Statement of Qualifications
SSPC	Steel Structures Painting Council
TBD	To Be Determined
UL	Underwriters Laboratories, Inc.
US	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USDOL	United States Department Of Labor
US DOT	United States Department Of Transportation
VE	Value Engineering
WBS	Work Breakdown Structure

DB 101-3 DEFINITIONS

When the following words or expressions are used in the Plans, Specifications, other Contract Documents, they are to be defined as follows:

Acceptance Program - All factors that comprise the Delaware Department of Transportation's (DelDOT) determination of the quality of the product as specified in the Contract Documents. These factors include Verification Sampling and Testing and Department Oversight and auditing of the Design-Builder's activities and may include the Design-Builder's Quality Control (QC).

Act of God - An unusual, sudden, and unexpected manifestation of the forces of nature (force Majeure), the effect of which could not have been prevented by reasonable human foresight, plans, and care.

Addenda - Additions, deletions, and modifications to the provisions of the Scope of Services Package after the Advertisement date and prior to the Proposal acceptance date.

Administrative Plans - Those Plans that contain general Project or Plan information such as cover sheets, index sheets, and similar non-technical information.

Advertisement - A public announcement stating the Department's Notice of Intent (NOI) for the procurement of a particular project and inviting prospective Proposers to obtain a Request for

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Qualifications (RFQ) or Scope of Services Package and submit a Statement of Qualifications (SOQ) or a Proposal, as applicable.

Affiliate - Any Person, directly or indirectly, through one or more intermediaries, controls, is controlled by, or is under common control with the following:

- A) The Design-Builder; or
- B) Any Principal Participant.

An Affiliate may also be any Person for which ten percent or more of the equity interest in such Person is held directly or indirectly, beneficially or of record, by the following:

- 1) The Design-Builder;
- 2) Any Principal Participant; or
- 3) Any Affiliate of the Design-Builder under part (A) of this definition.

For purposes of this definition, the term “control” means the possession, directly or indirectly, of the power to cause the direction of the management of a Person, whether through voting securities, by contract, by family relationship, or otherwise.

Amendment - A formal alteration by addition, deletion, or modification of the terms of the executed Contract. Amendment is an umbrella term and includes Change Orders or supplemental agreements.

Approval - The Department’s written statement indicating that the subject Work complies with Contract requirements. Approvals will only be given for those submittals, activities, or Work specifically identified for “Approval” or “approval” in the Contract Documents. *See also* DB Section 105-11.

As-Built Conditions - The Work as actually performed under the Contract and as recorded on the Record Drawings.

Award - The decision of the Department to accept a responsive Proposal from a responsible Proposer for the Work identified in the Scope of Services Package, subject to the execution and approval of a satisfactory Contract, provision of Payment and Performance Bonds to secure the payment and performance thereof, provision of such insurance as is required under the Contract, and the satisfaction of such other conditions as may be specified or otherwise required by law.

Baseline Progress Schedule - The time-scaled, cost-loaded, and resource-loaded Critical Path network depicting the Project Components (PC) and subordinate activities and their respective prices (distributed over time), durations, sequences, and interrelationships that represent the Design-Builder’s Work plans; the Design-Builder’s Work Breakdown Structure (WBS) for designing, constructing, and completing the Project; and the total Lump Sum Contract Price, distributed over the period of the Contract.

Basic Project Configuration - The salient characteristics of the Project as defined and/or illustrated in the Scope of Services Package, including any permitted deviations thereto contained in the Design-Builder’s Proposal. Basic Project Configuration elements may include the following:

- A) The horizontal and vertical alignments;
- B) Number and size of lanes, shoulders, and sidewalks;
- C) The general location of the limits of the Project;
- D) The minimum horizontal and vertical underclearances; and

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E) The Right-of-Way limits.

Basic Project Configuration Plan - The Plan designated as such in the Contract Documents that depicts the Basic Project Configuration within the limits specified in the Contract. In general, the Basic Project Configuration Plan describes fundamental elements of the Project that must be included as part of the final design and construction to be furnished by the Design-Builder.

Bridge – A structure, including supports, erected over a depression or an obstruction, such as, water, highway, or railway, which has a track or passageway for carrying traffic or other moving loads and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments, spring lines of arches, or extreme ends of openings for multiple boxes. A Bridge may include multiple pipes where the clear distance between openings is less than ½ the smaller contiguous opening.

Bridge Length – The greater dimension of a structure measured along the center of the roadway between backs of abutment backwalls or between ends of Bridge floor.

Bridge Roadway Width – The clear width of structure measured at right angles to the center of the roadway between the bottom of curbs or, if curbs are not used, between the inner faces of parapet or railing.

Calendar Day – Every Day on the calendar, beginning and ending at midnight, local time.

Change Order – A written order issued by the Project Manager to the Design-Builder for a change to the Contract. Changes to the Contract are extra work, increases or decreases in Contract item quantities, or alterations to the Contract, and are within the scope of the Contract. A change order also establishes the basis and amount of payment for the change to the Contract and provides for any time extension necessitated by the change to the Contract.

Conditional Notice to Proceed – Written notice to the Design-Builder to proceed with portions of the Contract Work, including, but not limited to, preparatory Work for Material fabrications, such as, test piles or other activities which hinder progress in the beginning stages of construction.

Construction Subcontractor - A Subcontractor (or Affiliate) retained by the Design-Builder that is involved in the actual construction of the Project.

Constructor - A Principal Participant, Subcontractor or Affiliate retained by the Design-Builder and licensed by the State of Delaware, that is involved in the actual construction of the Project. (Del. Code Title 30 §§ 2501.)

Consultation and Written Comment - The Department's reviews, observations, and/or inspections based solely on information submitted by the Design-Builder (not based on any independent investigation or inquiry by the Department) and the Department's written responses resulting from such Department actions. *See also* DB Section 105-11.

Consultant – The Professional Engineer or Engineering Firm, registered in the State of Delaware and under contract or subcontract to the Department to perform professional services.

Contract - The written agreement between the Department and the Design-Builder setting forth the obligations of the parties thereunder, including, but not limited to, for the performance of the prescribed Work. The Contract includes the Advertisement; Contract Documents identified in the Scope of Services

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Package; the Design-Builder's Proposal Information; the Design-Builder's lump sum Price Proposal (with the exception of the Proposal Bond); the Notice to Proceed (NTP); Payment, Performance, and Retainage Bonds; Specifications; Supplemental Specifications; Special Provisions; Plans; and any Supplemental Agreements, Amendments, and Change Orders that are required to complete the Work in an acceptable manner and Contract time, including authorized extensions thereof, all of which constitute one instrument. The Contract shall not be modified, altered, or otherwise changed by any oral promise, statement, or representation made either by the Department or Design-Builder, unless such modification, alteration, or change is reduced to writing in accordance with the Contract.

Contractor – See Design-Builder.

Contract Bond – The security furnished by the Design-Builder and the surety as a guaranty that the Design-Builder shall fulfill the terms of the Contract and pay all legal debts pertaining to the design and construction of the project.

Contract Claim (Claim) – A written demand submitted to the Department by the Design-Builder in compliance with the Contract seeking additional monetary compensation, time, or other adjustments to the Contract, the entitlement or impact of which is disputed by the Department.

Contract Documents – The Contract Documents shall include the Agreement, DB Section 100, Design Requirements and Performance Specifications, DB Special Provisions, the Utility and Right-of-Way Statements, the Scope of Services Package Plans, the Environmental Requirements, the Design-Builder's Proposal, and all provisions required by law to be inserted in the Contract whether actually inserted or not. Whenever separate publications and the Department's Standard Specifications are referenced in the Contract Documents, it is understood to mean the publications and Specifications, as amended, current as of the Proposal due date, unless otherwise noted.

Contract Item – A specific portion of Work for which a price is provided in the Contract.

Contract Payment and Performance Bond. The security furnished by the Design-Builder and the Design-Builder's surety or sureties to guarantee payment and performance of all obligations incurred by the Design-Builder on any Contract.

Contract Price – See Lump Sum Contract Price.

Contract Time – The number of Calendar Days allowed for completion of the Contract, including authorized time extensions. Calendar day contracts shall be completed on or before the day indicated even when that date is Saturday, Sunday, or holiday.

Control of Access – The condition where the right of owners or occupants of abutting land or other persons to access, light, air, or view in connection with a highway is controlled by public authority.

Controlled Access Highway – Any highway to or from which access is denied or controlled from or to abutting land or intersecting streets, roads, highways, alleys, or other public or private ways.

Critical Path - Each path shown on the Baseline Progress Schedule for which there is zero total float.

Cultural Resource - Any prehistoric or historic period artifact, site, building, structure, material remain, or traditional use area resulting from, or associated with, human cultural activity. Historically important cultural resources are those eligible for inclusion on the National Register of Historic Places.

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Culvert – Any structure that provides an opening under any roadway, but is not classified as a Bridge.

Day - A Calendar Day, unless otherwise defined or modified.

Dedicated Stockpile – A stockpile assembled for a specific project.

Definitive Design - The point in the design process at which the design concepts are defined and the Basic Project Configuration is finalized.

Delaware Department of Transportation Plans - Those Scope of Services Package Plans included in the Contract Documents that were created by the Department.

Delay – Any unanticipated event, action, force or factor, which extends the Design-Builder’s time of performance of any critical work item under the Contract. The term “delay” is intended to cover all such event, action, force or factor, whether styled “delay”, “disruption”, “interference”, “impedance”, “hindrance”, or otherwise, which are beyond the control of and not caused by the Design-Builder, or the Design-Builder’s consultants, subcontractors, materialsmen, suppliers or other agents. This term does not include “extra work”.

Department – The Delaware Department of Transportation .

Department-Directed Changes - Any changes in the Work as described in the Contract (including changes in the standards applicable to the Work) that the Department has directed the Design-Builder to perform as described in the Contract.

Department’s Project Manager - The engineer representing the Department and having direct supervision of the administration and execution of the Contract.

Design Acceptance - Written confirmation by the Department after submittal and review of the Record Drawings that the design conforms to the Contract Documents and reflects the As-Built Conditions. Design Acceptance is required as part of Final Acceptance.

Design-Build - The Project’s delivery methodology under which the Department contracts with a single legal entity that has responsibility for the design and construction of the Project under a single contract with the Department.

Design-Build Team - *See* Design-Builder.

Design-Builder - The single legal entity selected pursuant to the Scope of Services package that enters into the Contract with the Department to design and construct the Project (also referred to as the “Design-Build Team”).

Design-Builder’s Project Manager - The Design-Builder’s on-site designated competent representative and single point of contact capable of reading and understanding the Contract and experienced in all aspects the type of Work being performed.

Design Plan - The Plan prepared by the Designer during the design development to represent the Project.

Design Review - A comprehensive and systematic examination of the design as specified in the Contract

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to verify that it is in conformance with the requirements of the Contract, as performed by the Design-Builder for all stages of the design including Record Drawings. During all stages of the design, the Department will contribute to the review through Oversight, including, participation, auditing, and spot-checking.

Design Unit - A distinct portion of the Project of which the design is performed as a contiguous, integrated unit. *See* DB Section 111-3.

Designer - A Principal Participant, specialized Subcontractor, or in-house Design-Build designer authorized to perform work in the State of Delaware that leads the team furnishing or performing the design of the Project. (Del Code Title 24, §§2801.)

Differing Site Condition - Subsurface or latent physical conditions that are encountered at the Site and differ materially from the conditions indicated in the Contract. Also, unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the type of Work provided for in the Contract, provided in all cases that the Design-Builder had no actual or constructive knowledge of such conditions as of the Proposal due date.

Directive Plans - Those Plans that depict required elements and components of the Project within specifically defined parameters. The Design-Builder has limited or no latitude to adjust components or details shown on Directive Plans. Examples of Directive Plans include the following:

- A) Basic Project Configuration Plans that depict the Basic Project Configuration within the limits defined in the Contract;
- B) Delaware Department of Transportation Plans; and
- C) Right-of-Way Plans.

Dispute - A matter of Contract performance or Contract compensation, including granting of extensions of time, in which there is or may be disagreement between the Design-Builder and the Department and which may involve adjustment of Contract Items or the addition of new items to the Contract, extension of time for performance, and/or adjustments in compensation necessitated by the resolution of such disagreement.

Engineer – The Chief Engineer of the Department, acting directly or through an assistant or other authorized representative, such as the Department’s Project Manager, responsible for engineering and administration supervision of the Contract.

Engineer of Record (EOR) – Designer who is in responsible charge of and seals the plans and specifications.

Equipment - All machinery, equipment, tools, and apparatus necessary for acceptable completion of the Work.

Escrow of Proposal Documentation - Pricing data assembled by the Design-Builder, placed in escrow, which supports and explains the basis of the lump sum Price Proposal. The Escrowed Proposal Documents are used during Project execution for negotiation of Change Orders and resolution of contract disputes and claims and other purposes set forth in the Contract.

Extra Work – Work not provided for in the Contract as awarded but found essential by the Department for satisfactory completion of the Contract within its intended scope.

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Falsework – Temporary construction Work on which main Work is wholly or partly built and supported until it is strong enough to support itself; a temporary framework used to support part or all of a structure during demolition.

Formwork – A temporary structure or mold used to retain the plastic or fluid concrete in its designated shape until it hardens. Formwork must have enough strength to resist the fluid pressure exerted by plastic concrete and any additional fluid pressure effects generated by vibration.

Final Acceptance - The acceptance of the Work by the Department upon the completion of the Work as defined in the Contract and through Oversight of that Work by the Department.

Force Account - Payment for the directed performance of design and/or construction Work based on the actual cost of labor, Equipment, and Materials furnished, overhead, and profit.

Free Float – Float time in a CPM schedule which, if used, will not delay the early start of any succeeding activity.

Full Control – Preference is given to through traffic by providing access connections with selected public roads only and by prohibiting crossings at grade or direct private driveway connections.

General Notices – Federal and State regulations contained in the Contract Documents that govern Contract operations.

Hazardous Materials - The term Hazardous Materials shall mean any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 United States Code (USC) 9601, et seq.; the Hazardous Materials Transportation Act, 49 USC 5101, et seq.; the Resource Conservation and Recovery Act, 42 USC 6901, et seq.; the Toxic Substances Control Act, 15 USC 2601, et seq.; the Clean Water Act of 1977, 33 USC 1251, et seq.; the Clean Air Act, 42 USC 7401, et seq.; or any other federal, state, or local statute, law, ordinance, resolution, code, rule, regulation, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning any hazardous, toxic, or dangerous waste, substance, or material.

Headings – The Titles or Headings of Parts, Sections, and subsections herein are intended for convenience of reference and shall not be considered as having any bearing on their content or interpretation.

Highway, Street, or Road – A general term indicating a public way used by vehicles and pedestrians, including the entire area within the Right-of-Way.

Holidays – The following days shall be considered legal holidays in the State of Delaware.

- A. New Years Day
- B. Martin Luther King’s Birthday
- C. President’s Day
- D. Good Friday
- E. Memorial Day
- F. Independence Day
- G. Labor Day
- H. Columbus Day

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- I. General Election Day (biennial)
- J. Return Day (Sussex County only after 12:00 Noon)
- K. Veteran's Day
- L. Thanksgiving Day
- M. Friday after Thanksgiving
- N. Christmas Day

If additional days are designated as legal holidays for State employees by Executive Order of the Governor, and the Design-Builder chooses to honor the days by not working, the State will extend the Contract time accordingly.

If any holiday falls on Sunday, the Monday following shall be the holiday. If any holiday falls on a Saturday, the Friday preceding shall be the holiday.

Independent Assurance - Review, analysis, checking, and/or testing performed by an independent firm or firms as contracted by the Department.

Independent Checker– Engineer under Designer-Builder's team to perform independent calculations and check of Designer's plans and specifications.

Independent Check Certificate – Issued by Independent Checker certifying that calculations, plans and specifications have been prepared in accordance with Contract requirements.

Indicative Plans - Plans that represent the nature and type of Work to be designed and constructed as part of the Project and reflect items for which the Department has no particular view on the specific configuration or Material used in the final product, such as the following:

- A) Structure type;
- B) Pavement type (concrete or asphalt);
- C) Drainage Material or size; or
- D) Pile type.

Indicative Plans do not necessarily reflect the final locations, quantities, or all elements required to complete the design.

Inspector - A Department and/or Design-Builder representative authorized to inspect methods and Materials, Equipment, and Work both on and off the Site of the Project.

Instructions to Proposers - Those documents contained within the Scope of Services Package that provide directions for the preparation and submittal of information by the Proposers in response to the Scope of Services Package.

Key Personnel – Members of the Design-Build Team meeting minimum requirements as set forth in Part 4 – Special Provisions, Special Provision 108C.

Laboratory – The Department's testing laboratory or any other testing laboratory approved by the Department.

Lead Principal Participant - The Principal Participant that is designated by the Proposer as having the

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lead responsibility for managing the Design-Builder's organization.

Liquidated Damages – An amount due and payable to the Department by the Design-Builder for additional costs incurred by the Department resulting from the Design-Builder's failure to complete the work within the Contract time.

Local Road – A street or road not in the state maintained system.

Local Traffic – That traffic which has either its origin or destination, or both, within the limits of the Project.

Lump Sum Contract Price - The total lump sum amount paid for the Work to be performed under the Contract, including adjustments to account for Change Orders. The Lump Sum Contract Price may also be known as the Contract Price.

Lump Sum Price Proposal - The portion of the Proposal that addresses the Project's cost, PCs, PCPs, payment schedule, and Proposal Bond. With the exception of the Proposal Bond, the Price Proposal is included in the Contract Documents at Award. The Lump Sum Price Proposal may also be known as the Price Proposal.

Lump Sum Price Proposal Form - The approved form on which the Department requires a Lump Sum Price Proposal to be prepared and submitted as part of the Proposal for the Work. The Lump Sum Price Proposal Form may also be known as the Price Proposal Form.

Material - Any substances used in the Work.

Materials and Research Manual – The manual used to establish and standardize construction and maintenance sampling and Material acceptance requirements for the Department.

Median – The portion of a Highway separating traveled ways for traffic in opposite directions.

Necessary Basic Project Configuration Change - Material changes in the Basic Project Configuration by either party that are necessary to correct an error, omission, or defect in the Basic Project Configuration Plans as shown or described in the Contract (with the understanding that a change shall be deemed "necessary" only if the error, omission, or defect creates a problem which cannot reasonably be corrected without a material change in the Basic Project Configuration).

Notice to Proceed - Written notice to the Design-Builder to proceed with Contract Work, including the date of beginning of Contract Time.

Oversight - Actions by the Department to satisfy itself that the Design-Builder is designing, constructing, and managing the Work in accordance with the Contract Documents. It includes actions identified in the Contract Documents by the terms Quality Assurance (QA), accept/acceptance, inspect/inspection, audit, ensure, certify, confirm, review, verify, or terms of similar import. Delaware Department of Transportation comments as a result of Oversight are conveyed to the Design-Builder through Consultation and Written Comment. Neither the activity of Oversight nor the lack of Consultation and Written Comment on the part of the Department shall be construed to relieve the Design-Builder and its organization from the responsibility and costs for meeting all Contract and regulatory requirements.

Part - A major subdivision of the Contract Documents.

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Partnering - Those actions taken to include all parties with an appropriate and vested interest in the Project in the management of the Project, such that the Project is completed in the most efficient, timely, safe, and cost effective manner for the mutual benefit of all concerned. These actions include, but are not limited to, communication, organization, establishing goals, continuous improvement, problem identification, conflict resolution, and managing change. Interested parties may include, but are not limited to, the Department; the Design-Builder; Subcontractors; Suppliers of goods and services to the Project; the community within which the Project is constructed; the community served by the Project; federal, state, and local governments or other public agencies; and utilities.

Pavement Structure – The combination of base course and surface course placed on a subgrade across the roadbed.

Payment/Performance Bond - The approved form of security, executed by the Design-Builder and Surety, guaranteeing complete execution of the Contract and supplemental agreements thereto, and payment of all legal debts, including liens and monies due the Department, pertaining to the Contract.

Performance Specification - A specification that establishes Contract requirements in terms of design parameters and performance parameters to be met. Performance Specifications also may include parameters for determining performance and corrective action to be taken.

Periodic Payment Schedule - The schedule submitted with the Design-Builder's Proposal (which schedule may be amended by Change Order) that will be the basis for the assessment of periodic payments for each PC.

Person - Any individual, firm, corporation, company, Limited Liability Company (LLC), Joint Venture (JV), voluntary association, partnership, trust, or unincorporated organization, or combination thereof.

Plans - The Contract drawings that show location, type, dimensions, and other details of the prescribed Work.

Price Proposal – *See* Lump Sum Price Proposal.

Price Proposal Form – *See* Lump Sum Price Proposal Form.

Principal Participant - Any of the following entities:

- A) The Design-Builder (or Proposer);
- B) An individual firm, all general partners, or LLC or JV members of the Design-Builder (or Proposer); and/or
- C) All Persons and legal entities holding (directly or indirectly) a 15% or greater interest in the Design-Builder (or Proposer).

Profile Grade – The trace of a vertical plane intersecting the top surface of the proposed wearing surface or other designed course usually along the longitudinal centerline of the roadbed. Profile grade means either elevation or gradient of such trace according to the context.

Progress Check Point - A defined step towards the completion of Work within a PC identified in the Schedule of Progress Check Points.

Project - The improvements to be designed and constructed by the Design-Builder and all other Work

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product to be provided by the Design-Builder in accordance with the Contract Documents.

Project Component - A component of the Project for which the Design-Builder provides a Project Component Value (PCV) for all Work included in that component. A PC may be a major contract item or series of interrelated items as identified in the Pricing Information.

Project Component Value - That value allocated by the Design-Builder to a Project Component (PC) as set out in the Pricing Information.

Project Number – A number used to identify the Project.

Project Specifications - Those Specifications developed by the Design-Builder to define and control the specific requirements, conditions, means, and methods to be used on the Project. Project Specifications will be based on the Contract requirements and shall provide finished products that meet or exceed the quality requirements of the Contract. Project Specifications are subject to the review and Consultation and Written Comment of the Department’s Project Manager during Design Reviews.

Proposal - The offer of the Proposer for the Work when executed and submitted in response to the Scope of Services Package in the prescribed format and on the prescribed forms. The Proposal includes the Technical Proposal and the Price Proposal.

Proposal Documentation - All writings, working papers, computer printouts, charts, and data compilations that contain or reflect information, data, or calculations used by the proposer to prepare the Proposal submitted, including but not limited to material relating to the determination and application of:

- A. Equipment rates
- B. Overhead rates and related time schedules
- C. Labor rates
- D. Efficiency or productivity factors
- E. Arithmetic extensions
- F. Subcontractor and material supplier quotations

Any manuals standard to the industry used by the Proposer in determining the Proposal are also considered Proposal Documentation. These manuals may be included in the Proposal Documentation by reference and shall show the name and date of the publication and the publisher.

The term “Proposal Documentation” does not include documents provided by the Department for the Proposer’s use in the preparation of the Proposal.

Proposal Information - The documents so designated in the ITP and submitted to the Department by the Proposer/Design-Builder in accordance with the ITP that will be included in the Contract Documents at Award.

Proposer - A Person submitting an SOQ for the Project in response to an RFQ, and if selected for the Short-List, an entity submitting a Proposal.

Quality Assurance - All planned and systematic Oversight actions by the Department necessary to provide confidence that the Design-Builder is performing QC in accordance with the Quality Plan; that all Work complies with the Contract; and that all Materials incorporated in the Work, all Equipment, and all elements of the Work will perform satisfactorily for the purpose intended. Oversight actions include, but are not limited to, monitoring and verification of design through auditing; spot-checking and participation

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in the review of the design; and monitoring and verification of construction through auditing, spot inspections, and Verification Sampling and testing at production sites and the Project Site. Quality Assurance also includes IA, the Department's Consultation and Written Comment, documentation of QA activities, final inspection, and Final Acceptance.

Quality Assurance Inspector - Inspector representing the Department to perform IA and QA inspection at the site.

Quality Assurance Program - The overall quality program and associated activities including Department QA, Design-Builder QC, the Contract's quality requirements, and the Design-Builder's Quality Plan.

Quality Control - The total of all activities performed by the Design-Builder, Designer, Subcontractor, producer, or Manufacture to ensure that the Work meets Contract requirements. For design this includes, but is not limited to, procedures for design quality; checking; design review, including reviews for constructability; and review and approval of Working Drawings. For construction this includes, but is not limited to, procedures for Materials handling and construction quality. Inspection, sampling, and testing of Materials, plants, production, and construction; Material certifications; calibration and maintenance of Equipment; production process control; and monitoring of environmental compliance. Quality Control also includes documentation of all QC design and construction efforts.

Quality Control Engineer – *See* Quality Control Engineering Firm.

Quality Control Engineering Firm - An independent engineering/testing firm responsible for administering, managing, and conducting the construction QC inspection, sampling, and testing specified in the Contract Documents and the Design-Builder's Quality Plan. The QC Engineering Firm shall not be owned in any part or controlled by any Principal Participant or by any Construction Subcontractor, but shall contractually be part of the Design-Builder. The Designer or a firm associated with or subsidiary to the Designer may serve as the QC Engineering Firm except any Designer who is a Principal Participant or any Designer (or subsidiary of a Designer) that is an Affiliate of any Principal Participant or Construction Subcontractor shall not serve in the capacity of QC Engineering Firm. The QC Engineering Firm may also be known as the QC Engineer.

Quality Control Manager - The individual employed by the Design-Builder who is responsible for the overall QC program of the Design-Builder, including the quality of management, design, and construction.

Quality Plan - The plan that sets out the Design-Builder's means of complying with its obligations in relation to QC, which plan shall be provided and maintained in accordance with the Contract following Consultation and Written Comment thereof by the Department's Project Manager.

Record Drawings – Final plan documents reflecting the Work as actually performed under the Contract. Record Drawings are to be prepared by the Design-Builder and submitted to the Department for final review and Approval.

Reference Documents - The documents provided with and so designated in the Scope of Services Package. The Reference Documents, including Plans contained therein and/or so designated, are not Contract Documents and were provided to Design-Builder for informational purposes only and are relied upon at the Design-Builder's own risk.

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Request for Information - The written request from Design-Builder to Designer for clarification on plans and specifications during construction. If the response by Designer requires changes to plans and/or specifications, the revised plans and/or specifications shall be subjected to the same Design Review process required for design.

Request for Proposals – *See* Scope of Services Package.

Request for Qualifications - The written solicitation issued by the Department seeking SOQs to be used to identify and Short-List the Proposers to receive the Scope of Services Package for the Project.

Resident Engineer - Engineer representing the Department at the project site.

Right-of-Way – Land, property, or interest therein, acquired for or devoted to transportation purposes.

Right-of-Way Acquisition Schedule - The schedule for acquisition of Right-of-Way (ROW) permits or easements by the Department set forth in the Contract and/or ITP.

Roadbed - The graded portions of a Highway within top and side slopes, prepared as a foundation for the pavement structure including the shoulders.

Roadside – The areas between the outside edges of the shoulders and the right-of-way boundaries. Unpaved median areas between inside shoulders of divided highways and infield areas of interchange are included.

Roadside Development – Those items necessary to the complete Highway which provide for preservation of landscape materials and features; rehabilitation and protection against erosion of areas disturbed by construction through seeding, sodding, mulching, and placing of other ground covers; and suitable planting or other improvements to increase the effectiveness and enhance the appearance of the Highway.

Roadway - The portion of a highway, including shoulders, for vehicular use. A divided highway has two or more roadways.

Safety Plan - The plan that sets out the Design-Builder's means of complying with its obligations in relation to Project safety. The plan shall be provided and maintained in accordance with DB Section 107-5 following Consultation and Written Comment by the Department's Project Manager.

Schedule of Progress Check Points - The schedule describing the PCPs and stipulating dates by which PCPs are to be achieved in order to maintain periodic payments in accordance with the Contract.

Scope of Services Package - The document identifying the Project and its Work to be performed and Materials to be furnished in response to which a Proposal may be submitted by a Proposer/Design-Builder. The Scope of Services Package includes the ITP, Contract Documents, and Reference Documents. The Scope of Services Package is issued only to Persons who are on the Short-List. The Scope of Services Package may also be referred to as the RFP.

Scope of Services Package Plans - Plans prepared by the Department during its PE to the extent they are identified in the Contract Documents.

Scope of the Project - The brief description of the Work to be performed to design and construct the

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Project as contained in the Contract.

Secretary – The Secretary of Transportation for the State of Delaware.

Secretary of Transportation – As used in DB Section 102, General Notices, Requirements and Conditions, means the Secretary of Transportation for the United States Department of Transportation.

Section - A subdivision of the Project or a subdivision of a Part of the Contract Documents.

Short-List - The list of those Proposers that have submitted SOQs that the Department determines, through evaluation of the SOQs, are eligible to receive a Scope of Services Package and invited to submit Proposals.

Site Security Plan - The plan that sets out the Design-Builder's means of complying with its obligations in relation to Site security, which plan shall be provided and maintained in accordance with the Contract following Consultation and Written Comment thereof by the Department's Project Manager.

Specialty Item - Work not usually performed by highway contractors and so designated in the Contract. Work that requires specialized knowledge, skill, or Equipment not ordinarily available in construction organizations and in general limited to minor components of the overall Contract. For purposes of this Contract, all engineering and design Work are considered Specialty Items.

Specifications – The compilation of provisions and requirements for the performance of the prescribed Work.

- A. *Standard Specifications.* A book of specifications approved for general application and repetitive use.
- B. *Supplemental Specifications.* Approved additions and revisions to the Standard Specifications, which is part of the Contract Documents.
- C. *Special Provisions.* Special directions, provisions, or requirements particular to the Project not otherwise detailed in the Standard Specifications or Supplemental Specifications.

Specified – Set forth or stipulated in the Plans or Specifications or elsewhere in the Contract, such as, Materials, Equipment, or methods.

Standard Construction Details – Delaware Department of Transportation drawings approved for repetitive use, showing the details to be used where appropriate. The Standard Construction Details are a Reference Document for the purposes of this Project.

Standard Plans – *See* Standard Construction Details.

Standard Specifications – A book of Specifications entitled “Delaware Standard Specifications, for Road and Bridge Construction, 2001” for general application and repetitive use. The Standard Specifications are a Reference Document for the purposes of this Project.

State - The State of Delaware, acting through its authorized representative.

Statement of Qualifications - The information prepared and submitted by a Proposer in response to the RFQ.

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Street – *See* Highway.

Structures - Bridges, culverts, catch basins, junction boxes, retaining walls, cribbing, manholes, endwalls, buildings, sewers, service pipes, underdrains, foundation drains, and other similar features encountered in the Work.

Subcontractor – An individual, partnership, corporation, JV, LLC, or any other legal entity or any acceptable combination thereof, to which the Design-Builder sublets part of the Work. Any individual, partnership, corporation, or any other legal entity shall not be considered to be a Subcontractor if it is a subsidiary which is wholly-owned or majority-owned by the Design-Builder or the Principal Participants of the Design-Builder, or an Affiliate of the Design-Builder, or affiliated or otherwise controlled by the Design-Builder or Principal Participants of the Design-Builder such that a true and independent Subcontractor-Design-Builder relationship reached by bidding or arms-length negotiation does not result therefrom.

Subgrade – The surface upon which the pavement structure for on-grade roadways, including shoulders, are constructed.

Substantial Completion - The point at which all Contract items are complete and accepted excluding any warranties or vegetation growth.

Substantial Completion Date - The date on which the Design-Builder achieves Substantial Completion, as per the Contract Documents. The Substantial Completion Date shall be the last chargeable day for the Contract.

Substructure - That part of the structure below the bearings of simple and continuous spans, skewbacks, or arches and tops of footings of rigid frames, including, backwalls, wingwalls, and wing protection railings.

Superstructure – The entire Structure except Substructure.

Supplemental Agreement – A written agreement between the Design-Builder and the Department covering work not otherwise provided for, or revisions in or amendments to terms of the Contract, or conditions specifically prescribed in the Specifications as requiring Supplemental Agreements. Such Supplemental Agreement becomes part of the Contract when approved and properly executed.

Supplemental Selection Information - The Supplemental Selection Information will not be made a part of the Contract Documents at Award. The Supplemental Selection Information is part of the Technical Proposal and includes an executive summary, summary statement, and other requested forms and information.

Surety - The corporation, partnership, or individual, other than the Design-Builder, executing a bond furnished by the Design-Builder.

Surface Course – The top course of the pavement structure.

Technical Proposal - The portion of the Proposal consisting of the Proposal Information and the Supplemental Selection Information.

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Through Traffic – That traffic which has neither its origin nor destination within the limits of the Project.

Time Related Dispute - Any dispute arising from any event not within the Design-Builder's control, performance, action, force, or factor which materially and adversely affects the scheduled time of performance depicted in the Design-Builder's most recent Baseline Progress Schedule submitted to the Department.

Titles – *See* Headings.

Total Float – The time differential between any activities late finish and early start, less the activity duration.

Total Lump Sum Proposal Price - The total proposed amount that will be considered to be the correct lump sum of all proposed PCVs. The Total Lump Sum Proposal Price may also be known as the Total Proposal Price.

Total Proposal Price – *See* Total Lump Sum Proposal Price.

Traffic/Travel Lane – The portion of Traveled Way for movement of a single lane of vehicles.

Traffic Control Manual – The manual titled *Delaware Traffic Controls for Streets and Highway Construction, Maintenance, Utility and Emergency Operations* and adopted by the Department for a uniform system of traffic control devices used throughout the state.

Traveled Way - The portion of Roadway for movement of vehicles, exclusive of shoulders and auxiliary lanes.

Unit – A quantity adopted as a standard for measurement of Work.

Utility Relocation Plans - The Design Plans for relocation of a utility impacted by the Project, to be prepared by the Design-Builder or the utility owner, as designated in any applicable utility agreements.

Value Engineering Proposal - A proposal developed and documented by the Design-Builder which (A) produces a net savings to the Department without impairing essential functions or characteristics of the Project (including the meeting of requirements contained in all governmental approvals); and (B) would modify or require a change in any of the requirements of or constraints set forth in the Contract Documents in order to be implemented. A Value Engineering (VE) Proposal cannot be based solely upon a change in quantities.

Verification Sampling and Testing - Sampling and testing performed to validate the quality of the product. The Department, or a firm retained by the Department, will perform Verification Sampling and Testing.

Warranty – Assurance by the Design-Builder that specified elements or components of the Work will be repaired or replaced, as required by the Contract, during the time period(s) stipulated.

Work – The furnishing of labor, Materials, services, Equipment, and incidentals necessary for successful completion of the Project and the carrying out of all obligations imposed by the Contract.

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Working Day - Any calendar day, except: 1) Saturdays, Sundays, and holidays; 2) days where conditions identified in the Contract require the Constructor to suspend construction operations; 3) days with inclement weather that prevent prosecution of the scheduled work; 4) days from December 16 to March 15 inclusive. On inclement weather days that result in partial prosecution of the work, partial working days will be charged as determined by the Project Manager. Partial working days will be charged in one-quarter day increments. If the Constructor receives permission from the Project Manager to work on any Sunday or holiday, full working days will be charged, weather permitting. No time charge will be assessed if the Constructor elects to work on Saturdays. Should the Constructor prepare to begin work on any day on which inclement weather prevents the work from beginning at the usual starting time and the crew is dismissed as a result, the Constructor will not be charged for a working day whether or not conditions change during the day and the rest of the day becomes suitable for construction operations.

Working Drawings - Those Plans prepared and reviewed by the Design-Builder to supplement Design Plans provided by the Design-Builder to specify additional details and procedures for construction of the Project, including, but not limited to, the following:

- A) Framework plans;
- B) Cofferdam plans;
- C) Construction details;
- D) Erection plans;
- E) Fabrication plans;
- F) Field design change plans;
- G) Stress sheets;
- H) Shop drawings;
- I) Lift plans;
- J) Bending diagrams for reinforcing steel;
- K) Falsework plans; and
- L) Similar data required for the successful completion of the Work.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 102

**GENERAL NOTICES, REQUIREMENTS AND
CONDITIONS**

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DB SECTION 102
GENERAL NOTICES, REQUIREMENTS AND CONDITIONS

DB 102-1 NO MISUNDERSTANDING

The Proposer certifies that it has examined the Contract Documents and the Site of the Work and has fully informed itself from its personal examination of the same regarding the quantities, character, location, and other conditions affecting the Work to be performed including the existence of poles, wires, pipes, ducts, conduits, and other facilities and structures of municipal and other public service corporations on, over, or under the Site.

The Proposer agrees that its proposed Lump Sum Contract Price includes all costs arising from existing conditions shown or specified in the Contract Documents and/or readily observable from a Site inspection prior to the Proposal due date and/or generally recognized as inherent in the nature of the Work.

The Department in no way warrants or guarantees that the information made available by the Department or found in the Contract Documents covers all conditions at the Site or that said information and Contract Documents should act as a substitute for personal investigation, interpretation, and judgment by the Proposer.

The intent of the Contract Documents is to include all items/aspects of the Work that are necessary for the proper initiation, execution, and completion of the Work to the sole satisfaction of the Department. A requirement occurring in any component of the Contract Documents is as binding as though occurring in all.

The components of the Contract Documents are intended to be complementary and to describe and provide for a complete Project. The following components of the Contract Documents complement one another in the following order of precedence: the Agreement (Part 1), this DB Section 100 (Part 2), the Design Requirements and Performance Specifications (Part 3), the Special Provisions (Part 4), the Supplemental Specifications to the DelDOT Standard Specifications (Part 4), the DelDOT Standard Specifications, the Utility and Right-of-Way Statements (Part 5), the Environmental Requirements (Part 7), the Request for Proposals (RFP) Plans (Part 6), and the Design-Builder's Proposal (Part 8). However, where the Design-Builder's Proposal presents Work or products of a higher quality than that shown elsewhere in the Contract Documents, and the Department has accepted the proposed change to the Work and products to that of a higher quality, the Design-Builder's Proposal will take precedence for that specific higher quality Work and products, as applicable.

Dimensions given on the Plans or which can be calculated will govern over scale dimensions.

When it appears that there is an apparent error or omission in the Contract or there is an apparent conflict or contradiction between any of the various documents mentioned above, or between the documents and the actual Work Site, the Design-Builder has a duty to immediately notify the Department's Project Manager of the discrepancy. The Department's Project Manager shall resolve the discrepancy in writing before the Design-Builder proceeds further. The Department's Project Manager may require the Design-Builder to modify Plans and other documents to correct the error or omission. The Work shall be paid for by the Department pursuant to DB Section 109-8, except under conditions related to Hazardous Materials, covered by DB Section 104-8.3.

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Failure of the Design-Builder to notify the Department's Project Manager of an apparent discrepancy may be deemed a waiver of the Design-Builder's right to claim any adjustment in the Lump Sum Contract Price for Extra Work. In addition, the Design-Builder may be fully liable for damages suffered by the Department resulting from this failure to timely notify the Department's Project Manager of a discrepancy.

DB 102-2 ATTESTING TO NON-COLLUSION

The Department requires as a condition precedent to acceptance of bids (Price Proposals) a sworn statement executed by, or on behalf of, the person, firm, association, or corporation to whom such contract is to be awarded, certifying that such person, firm, association, or corporation has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with such contract. The form for this sworn statement is included in Appendix C of the ITP and must be properly executed and submitted in order to have the Proposal considered responsive.

DB 102-3 REQUIREMENT BY DEPARTMENT OF LABOR FOR SWORN PAYROLL INFORMATION

Delaware Code, Title 29, Chapter 69, Section 6960, Paragraph (c) states:

"(c) Every contract based upon these specifications shall contain a stipulation that certified sworn payroll reports be maintained by every contractor and subcontractor performing work upon the site of construction. The contractor and subcontractor shall keep and maintain the sworn payroll information for a period of two (2) years from the last day of the work week covered by the payroll. A certified copy of these payroll reports shall be made available:

1. For inspection or furnished upon request to a representative of the Department of Labor;
2. Upon request by the public or for copies thereof. However, a request by the public must be made through the Department of Labor. The requesting party shall, prior to being provided the records, reimburse the costs of preparation by the Department of Labor in accordance with the Department's copying fee policy. The public shall not be given access to the records at the principal office of the contractor or subcontractor; and
3. The certified payroll records shall be on a form provided by the Department of Labor or shall contain the same information as the form provided by the Department and shall be provided within ten (10) days from receipt of notice requesting the records from the Department of Labor."

Contractor may contact:

Department of Labor
Division of Industrial Affairs
4425 No. Market Street
Wilmington, DE 19802
Telephone (302) 761-8200

DB 102-4 PREFERENCE FOR DELAWARE LABOR

Delaware Code, Title 29, Chapter 69, Section 6962, Paragraph (d), Subsection (4)b states:

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"In the construction of all public works for the State or any political subdivision thereof, or by firms contracting with the State or any political subdivision thereof, preference in employment of laborers, workmen or mechanics shall be given to bona fide legal citizens of the State who have established citizenship by residence of at least 90 days in the State. Each public works contract for the construction of public works for the State or any political subdivision thereof shall contain a stipulation that any person, company or corporation who violates this section shall pay a penalty to the Secretary of Finance equal to the amount of compensation paid to any person in violation of this section."

DB 102-5 CONFLICT WITH FEDERAL STATUTES OR REGULATIONS

Delaware Code, Title 29, Chapter 69, Section 6904, Paragraph (a) states:

"If any provision of this subchapter conflicts or is inconsistent with any statute, rule or regulation of the federal government applicable to a project or activity, the cost of which is to be paid or reimbursed in whole or in part by the federal government, and due to such conflict or inconsistency the availability of federal funds may be jeopardized, such provision shall not apply to such project or activity."

For all contracts which are identified as Federal-aid projects by having a Federal-aid number inserted in the appropriate space on the cover sheet of the proposal, if there is a conflict between the above Section 6962 and Federal law and the requirements of the above Section 6962 shall not apply.

DB 102-6 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

Delaware Code, Title 29, Chapter 69, Section 6962, Paragraph (d), Subsection (7) states:

"a. As a condition of the awarding of any contract for public works financed in whole or in part by State appropriation, such contracts shall include the following provisions:

During the performance of this contract, the contractor agrees as follows:

- i. The contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex or natural origin. The contractor will take positive steps to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.
- ii. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex or national origin.'

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DB 102-7 TAX CLEARANCE

As payments to each vendor or contractor aggregate \$2,000, the Division of Accounting will report such vendor or contractor to the Division of Revenue, who will then check the vendor or contractor's compliance with tax requirements and take such further action as may be necessary to insure compliance.

DB 102-8 LICENSE

A person desiring to engage in business in this State as a contractor shall obtain a license upon making application to the Division of Revenue. Proof of said license compliance to be made prior to, or in conjunction with, the execution of a contract to which he has been named.

DB 102-9 TO REPORT BID RIGGING ACTIVITIES

To report bid rigging activities CALL 1-800-424-9071.

The U. S. Department of Transportation (DOT) operates the above toll-free "hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m. eastern time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the "hotline" to report such activities.

The "hotline" is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse and is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

DB 102-10 CONVICT PRODUCED MATERIALS

Convict produced materials are defined as:

- (a) Materials produced after July 1, 1991, by convict labor may only be incorporated in a Federal-aid highway construction project if such materials have been:
 - (1) Produced by convicts who are on parole, supervised release, or probation from a prison or
 - (2) Produced in a qualified prison facility and the cumulative annual production amount of such materials for use in Federal-aid highway construction does not exceed the amount of such materials produced in such facility for use in Federal-aid highway construction during the 12-month period ending July 1, 1987.
- (b) Qualified prison facility means any prison facility in which convicts, during the 12-month period ending July 1, 1987, produced materials for use in Federal-aid highway construction projects.

DB 102-11 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

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<u>Goals for Minority Participation In Each Trade</u>	<u>Goals for Female Participation In Each Trade</u>
12.3% (New Castle County) 14.5% (Kent & Sussex Counties)	6.9% (Entire State)

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the Executive Order and the regulations in CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.
4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is Sussex County.

REV. 11-3-80

**DB 102-12 STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS (EXECUTIVE ORDER
11246)**

1. As used in these specifications:
 - a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
 - b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
 - c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
 - d. "Minority" includes:

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- i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.
3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.
4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Program Office or from the Federal procurement contracting offices. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.
5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.
6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities.

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Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:
 - a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
 - b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
 - c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.
 - d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
 - e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.
 - f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

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- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as Superintendents, General Foreman, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
 - h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
 - i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
 - j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
 - k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
 - l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
 - m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
 - n. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
 - o. Document and maintain a record of all solicitations of offers for subcontractors from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
 - p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor

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association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participating, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is under utilized).
10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.
11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.
12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Order of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.
14. The Contractor shall designate a responsible official to monitor all employment-related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

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15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

DB 102-13 TRAINING SPECIAL PROVISIONS

This Training Special Provision supersedes subparagraph 7b of the Special Provision entitled "Specific Equal Employment Opportunity Responsibilities", (Attachment 1), and is in implementation of 23 U.S.C. 140(a).

As part of the contractor's equal employment opportunity affirmative action program, training shall be provided as follows:

The contractor shall provide on-the-job training aimed at developing full journeyman in the type of trade or job classification involved. The number of trainees to be trained under the special provision will be Three (3). In the event the contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided however, that the contractor shall retain the primary responsibility for meeting the training requirements imposed by this special provision. The contractor shall also insure that this Training Special Provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year apprenticeship or training.

The number of trainees shall be distributed among the work classification on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. Prior to commencing construction, the contractor shall submit to the Department of Highways and Transportation for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the contractor shall specify the starting time for training in each of the classifications. The contractor will be credited for each trainee employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter.

Training and upgrading of minorities and women toward journeyman status is a primary objective of this Training Special Provision. Accordingly, the contractor shall make every effort to enroll minority trainees and women (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this Training Special Provision. This training commitment is not intended, and not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he has successfully completed a training course leading to journeyman status or in which he has been employed as a journeyman. The contractor should satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the contractor's records should document the findings in each case.

The minimum length and type of training for each classification will be as established in the training program selected by the contractor and approved by the Department of Highways and Transportation and the Federal Highway Administration. The Department of Highways and Transportation and the Federal

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Highway Administration shall approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training shall also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from the State prior to commencing work the classification covered by the program. It is the intention of these provisions that the training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted provided that significant and meaningful training is provided and approved by the division office. Some off-site training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

Except as otherwise noted below, the contractor will be reimbursed 80 cents per hour of training given an employee on this contract in accordance with an approved training program. As approved by the engineer, reimbursement will be made for training persons in excess of the number specified herein. This reimbursement will be made even though the contractor receives additional training program funds from other sources, provided such other sources does not specifically prohibit the contractor from receiving other reimbursement. Reimbursement for off-site training indicated above may only be made to the contractor where he does one or more of the following and the trainees are concurrently employed on a Federal-aid project; contributes to the cost of the training; provides the instruction of the trainee; or pays the trainee's wages during the off-site training period.

No payment shall be made to the contractor if either the failure to provide the required training, or the failure to hire the trainees as a journeyman, is caused by the contractor and evidences a lack of good faith on the part of the contractor in meeting the requirements of this Training Special Provision. It is normally expected that a trainee will begin his training on the project as soon as feasible after start of work utilizing the skill involved and remain on the project as long as training opportunities exist in his work classification or until he has completed his training program. It is not required that all trainees be on board for the entire length of the contract. A contractor will have fulfilled his responsibilities under this Training Special Provision if he has provided acceptable training to the number of trainees specified. The number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid a least 60 percent of the appropriate minimum journeymen's rate specified in the contract for the first half of the of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In fact case, the appropriate rates approved by the Department of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification who are covered by this Training Special Provisions.

The contractor shall furnish the trainee a copy of the program he will follow in providing the training.

The contractor shall provide each trainee with a certification showing the type and length of training satisfactorily completed.

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Business Administration regulations implementing it (13 CFR part 121) that also does not exceed the cap on average annual gross receipts specified in 49 CFR §26.65(b).

Socially and economically disadvantaged individuals means any individual who is a citizen (or lawfully admitted permanent resident) of the United States and who is - (1) any individual who a recipient finds to be a socially and economically disadvantaged individual on a case-by-case basis; (2) any individual in the following groups, members of which are rebuttably presumed to be socially and economically disadvantaged:

- (i) Black Americans which includes persons having origins in any of the Black racial groups of Africa;
- (ii) Hispanic Americans which includes persons of Mexican, Puerto Rican, Cuban, Dominican, Central or South American, or other Spanish or Portuguese culture or origin, regardless of race;
- (iii) Native Americans which includes persons who are American Indians, Eskimos, Aluets, or Native Hawaiians;
- (iv) Asian-Pacific Americans which includes persons whose origins are from Japan, China, Taiwan, Korea, Burma (Myanmar), Vietnam, Laos, Cambodia (Kampuchea), Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the U.S. Trust Territories of the Pacific Islands (Republic of Palau), the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kirbati, Juvalu, Nauru, Federated States of Micronesia, or Hong Kong;
- (v) Subcontinent Asian Americans which includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives Islands, Nepal or Sri Lanka;
- (vi) Women;
- (vii) Any additional groups whose members are designated as socially and economically disadvantaged by the SBA, at such time as the SBA designation becomes effective.



The Department will establish specific goals for each particular DOT-assisted project that will be expressed as a percentage the respective portion of the total dollar amount of contract bid.

The specific contract goals for this contract are:

Professional Services goal:

Disadvantaged Business Enterprise Seven (7) Percent of professional services.

Construction goal:

Disadvantaged Business Enterprise Six (6) Percent of construction.

The Department continues to reserve the right to approve DBE subcontractors and all substitutions of DBE subcontractors prior to award and during the time of the contract.

Proposers are required to submit with their Proposals the completed DBE Program Assurance portion of the Certification document which will state the Proposers' intent of meeting the goals established for this Contract; or in the instance where a Design-Builder cannot meet the assigned DBE Goals for this contract, he/she shall at the time of Proposal submission submit documentation required to verify that he/she has made a Good Faith Effort to meet the DBE Goals. Guidance for submitting a Good Faith Effort is identified in the next section and in the DBE Program Plan. Further, the apparent successful Proposer must submit to the Department within ten (10) Calendar Days after the Price opening, executed originals of each and every DBE subcontract to satisfy contract goals consistent with the DBE Program Assurance submitted as part of the bid package.

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No contract work shall be performed by a DBE subcontractor until the executed DBE subcontract is approved in writing by the Department and the Department has issued the required Notice to Proceed. Any DBE subcontract relating to work to be performed pursuant to this contract, which is submitted to the Department for approval, must contain all DBE subcontractor information, the requirements contained in this contract, and must be fully executed by the contractor and DBE subcontractor.

Each contract between the prime contractor and each DBE subcontractor shall at the minimum include the following:

1. All pertinent provisions and requirements of the prime contract.
2. Description of the work to be performed by the DBE subcontractor.
3. The dollar value of each item of work to be completed by the DBE subcontractor and the proposed price of each item of work to be completed by the DBE subcontractor.

DB 102-16 CRITICAL DBE REQUIREMENTS

A bid may be held to be non-responsive and not considered if the required DBE information is not provided. In addition, the bidder may lose its bidding capability on Department projects and such other sanctions as the Department may impose. It is critical that the bidder understands:

1. In the event that the bidder cannot meet the DBE goal as set forth in this specification, he/she shall at the time of bid submit to the Department that percentage of the DBE Goal that will be met, if any, on the written and notarized assurance made a part of this contract. The contractor shall also at the time of bid submit all documentation that the contractor wishes to have the Department consider in determining that the contractor made a Good Faith Effort to meet contract DBE Goals. The Department will not accept Good Faith Effort documentation other than on the scheduled date and time of the bid opening. However, the Department may ask for clarification of information submitted should the need arise.
2. A bid which does not contain either a completely executed DBE Program Assurance and/or Good Faith Effort documentation, where appropriate, shall be declared non-responsive and shall not be considered by the Department.
3.  ~~Bidders shall submit with their bid the name, address, age of the firm, and the gross annual receipts of each DBE and non-DBE subcontractor that supplied a quote or a bid to the prime on this project. The Department has attached this document following the Certification document at the end of the Proposal. Failure to submit this information will result in the bid being declared non-responsive and will be rejected.~~
4. Failure of the apparent low bidder to present originals of all DBE subcontracts to substantiate the volume of work to be performed by DBE's as indicated in the bid within ten (10) calendar days after the bid opening shall create a rebuttable presumption that the bid is not responsive.
5. Bidders are advised that failure to meet DBE Goals during the term of the contract may subject them to Department sanctions as identified in the DBE Program Plan.
6. In the execution of this contract, the successful bidder agrees to comply with the following contract clauses:

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The contractor will provided for the maintenance of records and furnish periodic reports documenting his performance under this Training Special Provision.

DB 102-14 INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT & TRANSPORTATION EQUITY ACT

Recipients of Federal-aid highway funds authorized under Titles I (other than Part B) and V of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), or Titles I, III, and V of the Transportation Equity Act for the 21st Century (TEA-21) are required to comply with the regulations of 49 Code of Federal Regulations (CFR) Part 26 - Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs.

DB 102-15 DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM SPECIFICATION

The U.S. Department of Transportation (DOT) requires that the Delaware Department of Transportation continue the established Disadvantaged Business Enterprise (DBE) Program for participation in U.S. DOT programs and that the program follow the final rules as stated in 49 CFR Part 26 and the Department's approved DBE Program plan.

The following definitions apply to this subpart:

Disadvantaged Business Enterprise or DBE means a for-profit small business concern (1) that is at least 51 percent owned by one or more individuals who are both socially and economically disadvantaged or, in the case of a corporation, in which 51 percent of the stock is owned by one or more such individuals; and, (2) whose management and daily business operations are controlled by one or more of the socially and economically disadvantaged individuals who own it.

DOT-assisted contract means any contract between a recipient and a contractor (at any tier) funded in whole or in part with DOT financial assistance, including letters of credit or loan guarantees, except a contract solely for the purchase of land.

Good Faith Efforts means efforts to achieve a DBE goal or other requirement of this part which, by their scope, intensity, and appropriateness to the objective, can reasonably be expected to fulfill the program requirement.

Joint Venture means an association of a DBE firm and one or more other firms to carry out a single, for-profit business enterprise, for which the parties combine their property, capital, efforts, skills and knowledge, and in which the DBE is responsible for a distinct, clearly defined portion of the work of the contract and whose share in the capital contribution, control, management, risks, and profits of the joint venture are commensurate with its ownership interest.

Race-conscious measure or program is one that is focused specifically on assisting only DBEs, including women-owned DBEs.

Race-neutral measure or program is one that is, or can be, used to assist all small businesses. For the purposes of this part, race-neutral includes gender neutrality.

Small Business concern means, with respect to firms seeking to participate as DBEs in DOT-assisted contracts, a small business concern as defined pursuant to section 3 of the Small Business Act and Small

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Prompt Payment: The Design-Builder receiving payments shall, within 30 days of receipt of any payment, file a statement with the Department on a form to be determined by the Department that all subcontractors furnishing labor or material have been paid the full sum due them at the stage of the contract, except any funds withheld under the terms of the contract as required by Chapter 8, Title 17 of the Delaware Code, annotated and as amended. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the Department. This clause applies to both DBE and non-DBE subcontractors.

Retainage: If retainage is held, the Design-Builder agrees to return retainage to each subcontractor within 30 calendar days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the Department. This clause covers both DBE and non-DBE subcontractors. As guidance, once a subcontractor has satisfactorily completed the physical work, and has given to the prime contractor a certified statement that all laborers, lower tier contractors, and materialmen who have furnished labor and materials to the subcontractor have been paid all monies due them, the prime contractor shall return retainage to the subcontractor within 30 calendar days.

7. In the execution of this Contract, the successful Proposer agrees to comply with the following Contract assurance and will include this same language in each subcontractor contract:

"The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such remedy as the recipient deems appropriate." 49 CFR Section 26.13

8. In addition to this specification, bidders must comply with all provisions of the rules and regulations adopted by the U.S. Department of Transportation for DBE participation in U.S. DOT and DelDOT Programs (49 CFR Part 26) and the Delaware Department of Transportation Disadvantaged Business Enterprise Program Plan; each of which is hereby incorporated and made part of this specification. Bidders are also reminded that they must be responsible and responsive bidders in all other aspects aside from the DBE Program in order to be awarded the contract.

DB 102-17 GUIDANCE FOR GOOD FAITH EFFORT

When the DBE Goals established for a contract by DelDOT are not met, the contractor shall demonstrate good faith efforts to meet the DBE contract goals. The contractor shall demonstrate that the efforts made were those that a contractor actively and aggressively seeking to meet the goals established by DelDOT would make, given all relevant circumstances. Evidence of this good faith effort will be submitted with the bid at the time of the bid opening.

The contractor is expected to demonstrate good faith efforts by actively and aggressively seeking out DBE participation in the project to the maximum extent, given all relevant circumstances. Following are the kinds of efforts that may be taken but are not deemed to be exclusive or exhaustive and DelDOT will consider other factors and types of efforts that may be relevant:

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1. Efforts made to select portions of the work proposed to be performed by DBEs in order to increase the likelihood of achieving the stated goal. Selection of portions of work are required to at least equal the goal for DBE utilization specified in this contract.
2. Written notification at least ten (10) calendar days prior to the opening of a bid soliciting DBE interest in participating in the contract as a subcontractor or supplier and for specific items of work.
3. Efforts made to obtain and negotiate with DBE firms for specific items of work:
 - a. Description of the means by which firms were solicited (i.e. by telephone, e-mail, written notice, advertisement).
 - b. The names, addresses, telephone numbers of DBE's contacted, the dates of initial contact; and whether initial solicitations of interest were followed-up by contacting the DBEs to determine with certainty whether the DBEs were interested.
 - c. A description of the information provided to DBE firms regarding the plans, specifications and estimated quantities for portions of the work to be performed.
 - d. A statement of why additional agreements with DBE's were not reached in order to meet the projected goal.
 - e. Listing of each DBE contacted but not contracted and the reasons for not entering a contract.
4. Efforts made to assist DBEs that need assistance in obtaining bonding, insurance, or lines of credit required by the contractor.
5. Reasons why certified DBEs are not available or not interested.
6. Efforts to effectively use the services of available disadvantaged community organizations; disadvantaged contractor's groups; local, state and federal DBE assistance offices; and other organizations that provide assistance in recruitment and placement of DBEs.

The following are examples of actions that may not be used as justification by the contractor for failure to meet DBE contract goals:

1. Failure to contract with a DBE solely because the DBE was unable to provide performance and/or payment bonds.
2. Rejection of a DBE bid or quotation based on price alone.
3. Rejection of a DBE because of its union or non-union status.
4. Failure to contract with a DBE because the contractor normally would perform all or most of the work in the contract.

Administrative reconsideration:

Within five (5) days of being informed by the Department that it is not responsive because it has not documented sufficient good faith efforts, a bidder may request administrative reconsideration. Bidder should make this request in writing to the following reconsideration official: Delaware Department of Transportation, Director of Technology and Support Services, P. O. Box 778, Dover, Delaware 19903. The reconsideration official will not have played any role in the original determination that the bidder did not document sufficient good faith efforts.

As part of this reconsideration, the bidder will have the opportunity to provide written documentation or argument concerning the issue of whether it met the goal or made adequate good faith efforts to do so. The bidder will have the opportunity to meet in person with the reconsideration official,

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explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so. The final decision made by the reconsideration official will be communicated to the bidder in writing. The result of the reconsideration process is not administratively appealable to the U.S. Department of Transportation.

DB 102-18 REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS (EXCLUSIVE OF APPALACHIAN CONTRACTS)

I. GENERAL

1. These contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.
2. Except as otherwise provided for in each section, the contractor shall insert in each subcontract all of the stipulations contained in these Required Contract Provisions, and further require their inclusion in any lower tier subcontract or purchase order that may in turn be made. The Required Contract Provisions shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with these Required Contract Provisions.
3. A breach of any of the stipulations contained in these Required Contract Provisions shall be sufficient grounds for termination of the contract.
4. A breach of the following clauses of the Required Contract Provisions may also be grounds for debarment as provided in 29 CFR 5.12:
 - Section I, paragraph 2;
 - Section IV, paragraphs 1, 2, 3, 4, and 7;
 - Section V, paragraphs 1 and 2a through 2g.
5. Disputes arising out of the labor standards provisions of Section IV (except paragraph 5) and Section V of these Required Contract Provisions shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the U.S. Department of Labor (DOL) as set forth in 29 CFR 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the DOL, or the contractor's employees or their representatives.
6. Selection of Labor: During the performance of this contract, the contractor shall not:
 - a. discriminate against labor from any other State, possession, or territory of the United States (except for employment preference for Appalachian contracts, when applicable, as specified in Attachment A), or
 - b. employ convict labor for any purpose within the limits of the project unless it is labor performed by convicts who are on parole, supervised release, or probation.

II. NONDISCRIMINATION

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

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1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630 and 41 CFR 60) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The Equal Opportunity Construction Contract Specifications set forth under 41 CFR 60-4.3 and the provisions of the American Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:
 - a. The contractor will work with the State highway agency (SHA) and the Federal Government in carrying out EEO obligations and in their review of his/her activities under the contract.
 - b. The contractor will accept as his operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, preapprenticeship, and/or on-the-job training."
2. EEO Officer: The contractor will designate and make known to the SHA contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active contractor program of EEO and who must be assigned adequate authority and responsibility to do so.
3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:
 - a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.
 - b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.
 - c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minority group employees.
 - d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

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- e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.
4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minority groups in the area from which the project work force would normally be derived.
 - a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minority group applicants. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority group applicants may be referred to the contractor for employment consideration.
 - b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he is expected to observe the provisions of that agreement to the extent that the system permits the contractor's compliance with EEO contract provisions. (The DOL has held that where implementation of such agreements have the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Executive Order 11246, as amended.)
 - c. The contractor will encourage his present employees to refer minority group applicants for employment. Information and procedures with regard to referring minority group applicants will be discussed with employees.
 5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:
 - a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.
 - b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.
 - c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.
 - d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with his obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant,

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- such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of his avenues of appeal.
6. Training and Promotion:
 - a. The contractor will assist in locating, qualifying, and increasing the skills of minority group and women employees, and applicants for employment.
 - b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision.
 - c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.
 - d. The contractor will periodically review the training and promotion potential of minority group and women employees and will encourage eligible employees to apply for such training and promotion.
 7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use his/her best efforts to obtain the cooperation of such unions to increase opportunities for minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the contractor either directly or through a contractor's association acting as agent will include the procedures set forth below:
 - a. The contractor will use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority group members and women for membership in the unions and increasing the skills of minority group employees and women so that they may qualify for higher paying employment.
 - b. The contractor will use best efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.
 - c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the SHA and shall set forth what efforts have been made to obtain such information.
 - d. In the event the union is unable to provide the contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The DOL has held that it shall be no excuse that the union with which the contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In

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- the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the SHA.
8. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment.
- a. The contractor shall notify all potential subcontractors and suppliers of his/her EEO obligations under this contract.
 - b. Disadvantaged business enterprises (DBE), as defined in 49 CFR 23, shall have equal opportunity to compete for and perform subcontracts which the contractor enters into pursuant to this contract. The contractor will use his best efforts to solicit bids from and to utilize DBE subcontractors or subcontractors with meaningful minority group and female representation among their employees. Contractors shall obtain lists of DBE construction firms from SHA personnel.
 - c. The contractor will use his best efforts to ensure subcontractor compliance with their EEO obligations.
9. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following completion of the contract work and shall be available at reasonable times and places for inspection by authorized representatives of the SHA and the FHWA.
- a. The records kept by the contractor shall document the following:
 - (1) The number of minority and non-minority group members and women employed in each work classification on the project;
 - (2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women;
 - (3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees; and
 - (4) The progress and efforts being made in securing the services of DBE subcontractors or subcontractors with meaningful minority and female representation among their employees.
 - b. The contractors will submit an annual report to the SHA each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. If on-the job training is being required by special provision, the contractor will be required to collect and report training data.

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III. NONSEGREGATED FACILITIES

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$10,000 or more.)

- a. By submission of this bid, the execution of this contract or subcontract, or the consummation of this material supply agreement or purchase order, as appropriate, the bidder, Federal-aid construction contractor, subcontractor, material supplier, or vendor, as appropriate, certifies that the firm does not maintain or provide for its employees any segregated facilities at any of its establishments, and that the firm does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The firm agrees that a breach of this certification is a violation of the EEO provisions of this contract. The firm further certifies that no employee will be denied access to adequate facilities on the basis of sex or disability.
- b. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are, in fact, segregated on the basis of race, color, religion, national origin, age or disability, because of habit, local custom, or otherwise. The only exception will be for the disabled when the demands for accessibility override (e.g. disabled parking).
- c. The contractor agrees that it has obtained or will obtain identical certification from proposed subcontractors or material suppliers prior to award of subcontracts or consummation of material supply agreements of \$10,000 or more and that it will retain such certifications in its files.

IV. PAYMENT OF PREDETERMINED MINIMUM WAGE

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural minor collectors, which are exempt.)

1. General:
 - a. All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week and without subsequent deduction or rebate on any account [except such payroll deductions as are permitted by regulations (29 CFR 3) issued by the Secretary of Labor under the Copeland Act (40 U.S.C. 276c)] the full amounts of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment. The payment shall be computed at wage rates not less than those contained in the wage determination of the Secretary of Labor (hereinafter "the wage determination") which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor or its subcontractors and such laborers and mechanics. The wage determination (including any additional classifications and wage rates conformed under paragraph 2 of this Section IV and the DOL poster (WH-1321) or Form FHWA-1495) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. For the purpose of this Section, contributions made or costs reasonably anticipated for bona fide

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fringe benefits under Section 1(b)(2) of the Davis-Bacon Act (40 U.S.C. 276a) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of Section IV, paragraph 3b, hereof. Also, for the purpose of this Section, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in paragraphs 4 and 5 of this Section IV.

- b. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.
- c. All rulings and interpretations of the Davis-Bacon Act and related acts contained in 29 CFR 1, 3, and 5 are herein incorporated by reference in this contract.

2. Classification:

- a. The SHA contracting officer shall require that any class of laborers or mechanics employed under the contract, which is not listed in the wage determination, shall be classified in conformance with the wage determination.
- b. The contracting officer shall approve an additional classification, wage rate and fringe benefits only when the following criteria have been met:
 - (1) the work to be performed by the additional classification requested is not performed by a classification in the wage determination;
 - (2) the additional classification is utilized in the area by the construction industry;
 - (3) the proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination; and
 - (4) with respect to helpers, when such a classification prevails in the area in which the work is performed.
- c. If the contractor or subcontractors, as appropriate, the laborers and mechanics (if known) to be employed in the additional classification or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the DOL, Administrator of the Wage and Hour Division, Employment Standards Administration, Washington, D.C. 20210. The Wage and Hour Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
- d. In the event the contractor or subcontractors, as appropriate, the laborers or mechanics to be employed in the additional classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated

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- for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. Said Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary
- e. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 2c or 2d of this Section IV shall be paid to all workers performing work in the additional classification from the first day on which work is performed in the classification.
3. Payment of Fringe Benefits:
- a. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor or subcontractors, as appropriate, shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly case equivalent thereof.
- b. If the contractor or subcontractor, as appropriate, does not make payments to a trustee or other third person, he/she may consider as a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.
4. Apprentices and Trainees (Programs of the U.S. DOL) and Helpers:
- a. Apprentices:
- (1) Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the DOL, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau, or if a person is employed in his/her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State apprenticeship agency (where appropriate) to be eligible for probationary employment as an apprentice.
- (2) The allowable ratio of apprentices to journeyman-level employees on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate listed in the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor or subcontractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates

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(expressed in percentages of the journeyman-level hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

- (3) Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator for the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.
- (4) In the event the Bureau of Apprenticeship and Training, or a State apprenticeship agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor or subcontractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the comparable work performed by regular employees until an acceptable program is approved.

b. Trainees:

- (1) Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the DOL, Employment and Training Administration.
- (2) The ratio of trainees to journeyman-level employees on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.
- (3) Every trainee must be paid at not less than the rate specified in the approved program for his/her level of progress, expressed as a percentage of the journeyman-level hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman-level wage rate on the wage determination which provides for less than full fringe benefits for apprentices, in which case such trainees shall receive the same fringe benefits as apprentices.
- (4) In the event the Employment and Training Administration withdraws approval of a training program, the contractor or subcontractor will no longer be permitted to utilize

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trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. **Helpers:**

Helpers will be permitted to work on a project if the helper classification is specified and defined on the applicable wage determination or is approved pursuant to the conformance procedure set forth in Section IV.2. Any worker listed on a payroll at a helper wage rate, who is not a helper under an approved definition, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

5. **Apprentices and Trainees (Programs of the U.S. DOT):**

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

6. **Withholding:**

The SHA shall upon its own action or upon written request of an authorized representative of the DOL withhold, or cause to be withheld, from the contractor or subcontractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements which is held by the same prime contractor, as much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the SHA contracting officer may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. **Overtime Requirements:**

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, watchmen, or guards (including apprentices, trainees, and helpers described in paragraphs 4 and 5 above) shall require or permit any laborer, mechanic, watchman, or guard in any workweek in which he/she is employed on such work, to work in excess of 40 hours in such workweek unless such laborer, mechanic, watchman, or guard receives compensation at a rate not less than one-and-one-half times his/her basic rate of pay for all hours worked in excess of 40 hours in such workweek.

8. **Violation:**

Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph 7 above, the contractor and any subcontractor responsible thereof shall be liable to the affected employee for his/her unpaid wages. In addition, such contractor and

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subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, watchman, or guard employed in violation of the clause set forth in paragraph 7, in the sum of \$10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 7.

9. Withholding for Unpaid Wages and Liquidated Damages:

The SHA shall upon its own action or upon written request of any authorized representative of the DOL withhold, or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 8 above.

V. STATEMENTS AND PAYROLLS

(Applicable to all Federal-aid construction contracts exceeding \$2,000 and to all related subcontracts, except for projects located on roadways classified as local roads or rural collectors, which are exempt.)

1. Compliance with Copeland Regulations (29 CFR 3):

The contractor shall comply with the Copeland Regulations of the Secretary of Labor which are herein incorporated by reference.

2. Payrolls and Payroll Records:

- a. Payrolls and basic records relating thereto shall be maintained by the contractor and each subcontractor during the course of the work and preserved for a period of 3 years from the date of completion of the contract for all laborers, mechanics, apprentices, trainees, watchmen, helpers, and guards working at the site of the work.
- b. The payroll records shall contain the name, social security number, and address of each such employee; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalent thereof the types described in Section 1(b)(2)(B) of the Davis Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. In addition, for Appalachian contracts, the payroll records shall contain a notation indicating whether the employee does, or does not, normally reside in the labor area as defined in Attachment A, paragraph 1. Whenever the Secretary of Labor, pursuant to Section IV, paragraph 3b, has found that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis Bacon Act, the contractor and each subcontractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, that the plan or program has been communicated in writing to the laborers or mechanics affected, and show the cost anticipated or the actual cost incurred in providing benefits. Contractors or subcontractors employing apprentices or trainees under approved

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- programs shall maintain written evidence of the registration of apprentices and trainees, and ratios and wage rates prescribed in the applicable programs.
- c. Each contractor and subcontractor shall furnish, each week in which any contract work is performed, to the SHA resident engineer a payroll of wages paid each of its employees (including apprentices, trainees, and helpers, described in Section IV, paragraphs 4 and 5, and watchmen and guards engaged on work during the preceding weekly payroll period). The payroll submitted shall set out accurately and completely all of the information required to be maintained under paragraph 2b of this Section V. This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents (Federal stock number 029-005-0014-1), U.S. Government Printing Office, Washington, D.C. 20402. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.
 - d. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his/her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
 - (1) that the payroll for the payroll period contains the information required to be maintained under paragraph 2b of this Section V and that such information is correct and complete;
 - (2) that such laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR 3;
 - (3) that each laborer or mechanic has been paid not less than the applicable wage rate and fringe benefits or cash equivalent for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.
 - e. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 2d of this Section V.
 - f. The falsification of any of the above certifications may subject the contractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 231.
 - g. The contractor or subcontractor shall make the records required under paragraph 2b of this Section V available for inspection, copying, or transcription by authorized representatives of the SHA, the FHWA, or the DOL, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the SHA, the FHWA, the DOL, or all may, after written notice to the contractor, sponsor, applicant, or owner, take such actions as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

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VI. RECORD OF MATERIALS, SUPPLIES, AND LABOR

1. On all Federal-aid contracts on the National Highway System, except those which provide solely for the installation of protective devices at railroad grade crossings, those which are constructed on a force account or direct labor basis, highway beautification contracts, and contracts for which the total final construction cost for roadway and bridge is less than \$1,000,000 (23 CFR 635) the contractor shall:
 - a. Become familiar with the list of specific materials and supplies contained in Form FHWA-47, "Statement of Materials and Labor Used by Contractor of Highway Construction Involving Federal Funds," prior to the commencement of work under this contract.
 - b. Maintain a record of the total cost of all materials and supplies purchased for and incorporated in the work, and also of the quantities of those specific materials and supplies listed on Form FHWA-47, and in the units shown on Form FHWA-47.
 - c. Furnish, upon the completion of the contract, to the SHA resident engineer on Form FHWA-47 together with the data required in paragraph 1b relative to materials and supplies, a final labor summary of all contract work indicating the total hours worked and the total amount earned.
2. At the prime contractor's option, either a single report covering all contract work or separate reports for the contractor and for each subcontract shall be submitted.

VII. SUBLETTING OR ASSIGNING THE CONTRACT

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the State. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635).
 - a. "Its own organization" shall be construed to include only workers employed and paid directly by the prime contractor and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the prime contractor.
 - b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.
2. The contract amount upon which the requirements set forth in paragraph 1 of Section VII is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.
3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and

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(b) such other of its own organizational resources (supervision, management, and engineering services) as the SHA contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the SHA contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the SHA has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

VIII. SAFETY: ACCIDENT PREVENTION

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the SHA contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.
2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).
3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333).

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS

18 U.S.C. 1020 reads as follows:

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"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more that \$10,000 or imprisoned not more than 5 years or both."

X. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

(Applicable to all Federal-aid construction contracts and to all related subcontracts of \$100,000 or more.)

By submission of this bid or the execution of this contract, or subcontract, as appropriate, the bidder, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any facility that is or will be utilized in the performance of this contract, unless such contract is exempt under the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Pub.L. 91-604), and under the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Pub.L. 92-500), Executive Order 11738, and regulations in implementation thereof (40 CFR 15) is not listed, on the date of contract award, on the U.S. Environmental Protection Agency (EPA) List of Violating Facilities pursuant to 40 CFR 15.20.
2. That the firm agrees to comply and remain in compliance with all the requirements of Section 114 of the Clean Air Act and Section 308 of the Federal Water Pollution Control Act and all regulations and guidelines listed thereunder.
3. That the firm shall promptly notify the SHA of the receipt of any communication from the Director, Office of Federal Activities, EPA, indicating that a facility that is or will be utilized for the contract is under consideration to be listed on the EPA List of Violating Facilities.
4. That the firm agrees to include or cause to be included the requirements of paragraph 1 through 4 of this Section X in every nonexempt subcontract, and further agrees to take such action as the government may direct as a means of enforcing such requirements.

XI. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

1. `Instructions for Certification - Primary Covered Transactions:

Delaware Department of Transportation

(Applicable to all Federal-aid contracts - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.
- b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.
- c. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause of default.
- d. The prospective primary participant shall provide immediate written notice to the department or agency to whom this proposal is submitted if any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- e. The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- f. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.
- g. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the nonprocurement portion of the "Lists of Parties Excluded From Federal Procurement or

Delaware Department of Transportation

Nonprocurement Programs" (Nonprocurement List) which is compiled by the General Services Administration.

- i. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- j. Except for transactions authorized under paragraph f of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Instructions for Certification - Lower Tier Covered Transactions:

(Applicable to all subcontracts, purchase orders and other lower tier transactions of \$25,000 or more - 49 CFR 29)

- a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.
- b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
- c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.
- d. The terms "covered transaction," "debarred," "suspended," "ineligible," "primary covered transaction," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
- e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
- f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and

Delaware Department of Transportation

Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

- g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List.
- h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Covered Transactions:

- 1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- 2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XII. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

(Applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 - 49 CFR 20)

- 1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:
 - a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any

Delaware Department of Transportation

cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

- b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.
3. The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

Form FHWA-1273 (Rev. 3-94)

DB 102-19 DIFFERING SITE CONDITIONS

SUSPENSIONS OF WORK and SIGNIFICANT CHANGES IN THE CHARACTER OF WORK:

Differing site conditions: During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those indicated in the Contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the Contract are encountered at the site, the party discovering such conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected Work is performed.

Upon written notification, the Department's Project Manager will investigate the conditions, and if he/she determines that the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the contract, an adjustment, excluding loss of anticipated profits, will be made and the contract modified in writing accordingly. The Project Manager will notify the Design-Builder of his/her determination whether or not an adjustment of the Contract is warranted.

No Contract adjustment which results in a benefit to the contractor will be allowed unless the contractor has provided the required written notice.

No contract adjustment will be allowed under their clause for any effects caused on unchanged work.

Suspensions of Work ordered by the Department: If the performance of all or any portion of the work is suspended or delayed by the Department in writing for an unreasonable period of time (not originally anticipated, customary or inherent to the construction industry) and the Design-Builder believes that additional compensation and/or Contract Time is due as a result of such suspension or delay, the Design-Builder shall submit to the Department's Project Manager in writing a request for adjustment within 7

Delaware Department of Transportation

Calendar Days of receipt of the notice to resume work. The request shall set forth the reasons and support for such adjustment.

Upon receipt, the Project Manager will evaluate the Design-Builder's request. If the Project Manager agrees that the cost and/or time required for the performance of the Contract has increased as a result of such suspension and the suspension was caused by conditions beyond the control of and not the fault of the Design-Builder, its suppliers, or subcontractors at any approved tier, and not caused by weather, the Project Manager will make an adjustment (excluding profit) and modify the Contract in writing accordingly. The Project Manager will notify the Design-Builder of his/her determination whether or not an adjustment of the Contract is warranted.

No Contract adjustment will be allowed unless the Design-Builder has submitted the request for adjustment within the time prescribed.

No Contract adjustment will be allowed under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided for or excluded under any other term or condition of this Contract.

Significant changes in the character of work: The Project Manager reserves the right to make, in writing, at any time during the work, such changes in quantities and such alterations in the work as are necessary to satisfactorily complete the project. Such changes in quantities and alterations shall not invalidate the Contract nor release the surety, and the Design-Builder agrees to perform the Work as altered.

If the alterations or changes in quantities significantly change the character of the Work under the Contract, whether or not changed by any such different quantities or alterations, an adjustment, excluding loss of anticipated profits, will be made to the Contract. The basis for the adjustment shall be agreed upon prior to the performance of the Work. If a basis cannot be agreed upon, then an adjustment will be made either for or against the Design-Builder in such amount as the Project Manager may determine to be fair and equitable.

DB 102-20 PREVAILING WAGES

Included in Appendix 102A of this Scope of Services Package are the minimum wages to be paid various classes of laborers and mechanics as determined by the Department of Labor of the State of Delaware in accordance with Title 29 Del.C. §6960, relating to wages and the regulations implementing that Section.

Title 29 Del.C. §6960 relating to wages further stipulates "that the employer shall pay all mechanics and laborers employed directly upon the site of the work, unconditionally and not less often than once a week and without subsequent deduction or rebate on any account, the full amounts accrued at time of payment, computed at wage rates not less than those stated in the specifications, regardless of any contractual relationship which may be alleged to exist between the employer and such laborers and mechanics", and ... "that the scale of wages to be paid shall be posted by the employer in a prominent and easily accessible place at the site of the work, and that there may be withheld from the employer so much of accrued payments as may be considered necessary by the Department of Labor to pay to laborers and mechanics employed by the employer the difference between the rates of wages required by the contract to be paid laborers and mechanics on the work and rates of wages received by such laborers and mechanics to be remitted to the Department of Labor for distribution upon resolution of any claims."

Proposers (bidders) are specifically directed to note the Department of Labor's regulations implementing §6960 relating to the effective date of the wage rates, at Part VI., Section C., which in relevant part states:

Delaware Department of Transportation

"Public agencies (covered by the provisions of 29 De1.C. §6960) are required to use the rates which are in effect on the date of the publication of specifications for a given project. In the event that a contract is not executed within one hundred twenty (120) days from the date the specifications were published, the rates in effect at the time of the execution of the contract shall be the applicable rates for the project."

DB 102-21 PREVAILING WAGE REQUIREMENTS

It is the Department understands that the Davis-Bacon Act is not a preemptive statute in the broad sense, and does not preempt or displace State of Delaware prevailing wage requirements.

When a contract for a project contains both Federal Davis-Bacon and State of Delaware prevailing wage standards because of concurrent Federal and State coverage, the employer's minimum wage obligations are determined by whichever standards are higher.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

APPENDIX 102A

PREVAILING WAGE RATES

Delaware Department of Transportation

STATE OF DELAWARE PREVAILING WAGE RATES

PREVAILING WAGE DETERMINATION - Heavy Construction

Delaware Department of Labor
Division of Industrial Affairs
Office of Labor Law Enforcement
Phone: 302 761-8200

Mailing Address:
P.O. Box 9954
Wilmington, DE 19809-9954

Located at:
4425 No. Market Street
Wilmington, DE 19802

Prevailing Wages for **HEAVY CONSTRUCTION** Effective March 15, 2006

<u>Classification</u>	<u>New Castle County</u>	<u>Kent County</u>	<u>Sussex County</u>
Asbestos Workers	\$32.35	\$18.60	\$40.43
Boilermakers	\$53.58	\$30.73	\$41.61
Bricklayers	\$34.98	\$22.19	\$23.83
Carpenters	\$40.59	\$40.59	\$32.48
Cement Finishers	\$36.39	\$34.47	\$17.35
Electrical Line Workers	\$33.88	\$26.30	\$25.89
Electricians	\$38.76	\$26.30	\$25.89
Glaziers	\$19.54	\$16.96	\$11.48
Insulators	\$40.43	\$39.03	\$39.03
Iron Workers	\$45.25	\$25.54	\$41.80
Laborers	\$30.35	\$18.33	\$20.82
Millwrights	\$50.30	\$42.30	\$33.78
Painters	\$34.91	\$34.91	\$34.91
Piledrivers	\$37.64	\$37.64	\$29.30
Plasterers	\$18.40	\$15.97	\$10.80
Plumbers/Pipefitters/Steamfitters	\$30.50	\$25.85	\$17.12
Power Equip. Operators	\$36.82	\$41.31	\$32.34
Sheetmetal Workers	\$29.40	\$18.23	\$17.13
Sprinkler Fitters	\$31.68	\$11.99	\$ 9.93
Truck Drivers	\$28.21	\$19.24	\$15.94

CERTIFIED: March 15, 2006

BY: /s/ _____

ANTHONY J DELUCA, ADMINISTRATOR
LABOR LAW ENFORCEMENT SECTION

NOTICE TO CONTRACTORS

1. These rates are promulgated and enforced pursuant to the Prevailing Wage Regulations adopted by the Department of Labor on April 3, 1992.

Delaware Department of Transportation

2. Classifications of workers are determined by the Department of Labor. For assistance in classifying workers, or for a copy of the regulations or classifications, phone (302)761-8200.
3. Nonregistered apprentices must be paid the mechanic's rate.

Delaware Department of Transportation

GENERAL WAGE DECISION NO. DE030011 02/04/2005

Superseded General Decision No. DE020011
State: DELAWARE
Construction Type: HEAVY
County(ies):
SUSSEX

Modification Number	Publication Date
0	06/13/2003
1	02/04/2005

CARP2012-001 05/01/2002

	Rates	Fringes
CARPENTERS (Including Formsetting and Scaffold Building)	21.24	6.64

SUDE2002-008 07/30/2002

	Rates	Fringes
Laborers		
Pipelayers	12.90	.31
Unskilled	10.80	.95
Power Equipment Operators		
Backhoes	18.31	3.43
Excavator	19.00	.25
Loaders	20.44	5.47
Truck Drivers		
Dump	14.72	.56

WELDERS - Receive rate prescribed for craft performing operations to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(ii)).

In the listing above, the "SU" designation means that rates listed under that identifier does not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

Delaware Department of Transportation

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U. S. Department of Labor
200 Constitution Avenue, N.W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
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Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 103

**PARTNERING, BONDS, AND
NOTICE TO PROCEED**

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Payment/ Performance Bond Form

DB SECTION 103

PARTNERING, BONDS, AND NOTICE TO PROCEED

DB 103-1 PARTNERING

It is the Department's intent to use the principles of partnering to guide the management of this Contract within the parameters covered by the laws, regulations, and other policies that govern work in the public sector.

These partnering principles are intended to promote quality through continuous improvement at all stages of design and construction. The goal of the Department is to complete this Project in the most efficient, timely, safe, and cost effective manner to the mutual benefit of the Design-Builder and the Department, meaning a quality Project delivered on time, within budget, and without significant disputes.

None of the actions identified as part of, or taken in the course of, partnering shall be construed to alter, modify, delete, or waive any of the provisions or requirements of the Contract Documents or any applicable laws or regulations.

The Department and the Design-Builder will manage the Contract in a cooperative manner utilizing the following principles of Project partnering:

- A) Establish communications with all involved parties early in the partnering process;
- B) Establish a relationship of shared trust, equity, and commitment;
- C) Develop strategies for identifying mutual goals;
- D) Develop strategies for timely communications and decision making;
- E) Establish a process for timely response to changes or variations in field conditions;
- F) Solve potential problems at the lowest level before they negatively impact the Project;
- G) Encourage the use of products, technology, and processes that provide a demonstrated level of improved quality; and
- H) Develop a plan for periodic joint evaluation based on mutually agreed goals.

This Contract is to be implemented in an equitable fashion that recognizes the problems that are inherent in design and construction, addresses the different-than-expected field conditions, resolves disputes in an open communications manner, and makes Contract adjustments in a timely and fair manner consistent with the terms of the Contract. This Contract is intended to fairly allocate risk, resulting in a balanced contractual approach to risk-sharing.

The Design-Builder shall be responsible for creating and implementing, with input and comment from the Department, a partnering program for use during this Project. The costs of such partnering program shall be borne by the Design-Builder. The Department and Design-Builder shall consider the incorporation of partnering into the coordination and cooperation required with third parties such as Subcontractors, suppliers, utility owners, and park representatives.

The Design-Builder's partnering program shall include periodic partnering meetings at least once every 3 months. The partnering meetings should be held in a convenient location away from the site office and

Delaware Department of Transportation

should be attended by Department, Project Stakeholders, and the Design-Builder team. The Design-Builder shall coordinate the meeting schedule and prepare the meeting agenda prior to the meetings.

DB 103-2 PAYMENT, PERFORMANCE, AND MAINTENANCE BONDS

At the time of execution of the Contract, the Design-Builder shall furnish the following bonds on the form provided by the Department:

- A) A Payment/Performance Bond in a sum equal to 100% of the Contract Price;
- B) The bonds shall be written by a Surety or insurance company that is in good standing and currently licensed to write surety bonds in the State of Delaware by the Delaware Department of Insurance and:
- C) Is currently on the United States (US) Department of Treasury's Financial Management list of approved bonding companies which is published annually in the Federal Register and the bond amount will be within the underwriting limits as listed for that Surety; or
- D) All signatures on the Bond Form shall be original signatures, in ink, and shall not be mechanical reproductions or facsimiles of any kind.

Upon Final Acceptance of the Work, the Design-Builder shall furnish to the Department a Maintenance Bond in a sum equal to 50% of the value of the guaranteed items included in the Design-Builder's Proposal and Part 8 of the Contract Documents. The Maintenance Bond shall meet the requirements of (B) through (D) of this DB Section 103-2.

DB 103-3 NOTICE TO PROCEED

The Department will issue the Design-Builder Notice to Proceed (NTP) or a Conditional NTP as soon as possible after Contract execution. If the Department has not issued the Design-Builder an NTP or a Conditional NTP within 60 Calendar Days of Contract execution, and written consent of the Design-Builder to extend this time period has not been obtained prior to its expiration, the Design-Builder may request to withdraw from the Contract.

STATE OF DELAWARE



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DESIGN-BUILD PROJECT

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Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

APPENDIX 103A

PAYMENT/PERFORMANCE BOND FORM

BOND NUMBER _____

PERFORMANCE/PAYMENT BOND

TO ACCOMPANY AND FOR CONTRACT NO. 26-073-03, FAP NO. BRN-S050(14)
(In the amount of 100% of the total contract award)

KNOW ALL MEN BY THESE PRESENTS That: ~CONTRACTOR NAME~ of
~CONTRACTOR CITY~ in the County of ~CONTRACTOR COUNTY~ and the State of
~CONTRACTOR STATE~ as **Principal** and

_____ of _____ in the County of
_____ and State of _____ as **Surety**, legally authorized to do
business in the State of Delaware ("**State**"), are held firmly bound unto the **State** in the sum of
~AWARD PRICE WORDS~ (\$ ~AWARD PRICE FIG~), to be paid to the **State** for the use and
benefit of the Delaware Department of Transportation ("**Department**"), as well as for the use and benefit of
the Division of Revenue in the case of claims under this bond for any and all taxes due the **State** relating to
this contract, for which payment well and truly to be made, we do bind ourselves, our and each and every of
our heirs, executors, administrators, successors, and assigns, jointly and severally for and in the whole firmly
by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the said above bounden
Principal who had been awarded by the **Department** of the **State** a certain contract designated by the
parties thereto as Contract No. 26-073-03, FAP NO. BRN-S050(14), and the associated agreement, for
construction and completion of a certain Public Works contract within the **State**, shall well and truly provide
and furnish all the materials, appliances and tools and perform all the construction work and labor required
under and pursuant to the terms and conditions of this Contract, and of the proposal, plans and specifications
contained therein, and shall also indemnify and keep harmless the **State** and the **Department**, from all costs,
damages, and expenses growing out of or by reason of the construction work and completion of this
Contract, and shall well and truly pay all and every person furnishing material and performing labor in and
about the construction of this Contract, all and every sum or sums of money due him, them or any of them,
for all such labor and materials for which the **Principal** is liable; then this obligation shall be void or else to
be and remain in full force and virtue; and every person furnishing materials or performing labor or services
for the **Principal** under the said contract may maintain an action on this bond for his own use in the name of
the **State** in any court of competent jurisdiction for recovery of such sum or sums of money as may be due
such person from **Principal**.

Sealed with _____ seal and dated this _____ day of _____ in the year of our Lord two thousand and _____ (20__).

SEALED, AND DELIVERED IN THE
presence of

Corporate Seal

Name of Contractor

Attest _____

By: _____
Authorized Signature

Title

Corporate Seal

NAIC# (**REQUIRED**)

Name of **Surety**

ADDRESS OF SURETY

TELEPHONE NUMBER OF SURETY

Witness: _____

By: _____
Signature

Title

Social Security Number

ADDRESS

TELEPHONE NUMBER OF SIGNER _____

NOTE: (1) All surety insurers must be licensed and authorized to transact business in the State of Delaware in accordance with Delaware Code, Title 18, Insurance Code.

(2) Pursuant to the licensing requirements of Delaware Code, Title 30, Section 2101, bidder is required under this contract to attach a copy of his trade and/or business license obtained from the State of Delaware, Department of Finance.

STATE OF DELAWARE



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SCOPE OF SERVICES PACKAGE

DB SECTION 104

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**DB SECTION 104
SCOPE OF WORK**

DB 104-1 WORK REQUIRED

The Design-Builder shall be required to perform all Work included in Part 1, Agreement, Appendix A as well as any other Work outlined in the Contract. The Design-Builder shall be required to protect all properties, utilities, and existing Highway facilities within or adjacent to the Right of Way (ROW) and to repair or replace any such properties, utilities and facilities damaged or destroyed by construction operations by him or any employee or Subcontractor.

The Design-Builder shall be responsible for the Work of its various Subcontractors and for the coordination of all construction activities. Their respective operations shall be arranged and conducted so as to avoid delays. The Design-Builder shall closely coordinate Subcontractor Work, Material deliveries and construction operations when the Work of the Design-Builder overlaps or ties into Work of another Contractor.

Any modification, removal, and/or replacement of Work already in place due to delays or oversights by the Design-Builder or its Subcontractors shall be performed at the Design-Builder's expense. Such modification, replacement or repair work shall not be the basis for a claim for extra compensation.

The Design-Builder shall provide preventive and corrective maintenance of all Work until Final Acceptance by the Department.

DB 104-2 INTENT OF CONTRACT

The intent of the Contract is to provide for performance and completion of the Work described. The Design-Builder shall furnish all labor, Materials, Equipment, tools, transportation, and supplies required to complete the Work in accordance with the Plans, Project Specifications, and terms of the Contract.

When an item in the Contract requires the Design-Builder to make a choice between more than one Material, standard, procedure, etc., the Design-Builder shall indicate the choice to the Department's Project Manager in writing.

When the Project Specifications reference or require the use of "manufacturer's recommendations or specifications," the Design-Builder shall provide the Department's Project Manager with a current copy of these recommendations or Specifications prior to initiating Work that incorporates such information.

DB 104-3 ALTERATION OF THE CONTRACT

The Department reserves the right to order Work not provided for in the Contract whenever such Work is found essential or desirable to satisfactorily complete the Contract within its intended scope. Such Work shall be performed in accordance with the Specifications and as directed. Payment for such Work will be made as provided in DB Section 109.

The Department reserves the right to order changes in details, including changes in Materials, processes, and sequences, whenever such changes are in the best interests of the public or are necessary or desirable to satisfactorily complete the Work. Such changes in details shall be performed in accordance with the Specifications and as directed. Payment will be made as provided in DB Section 109.

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Alterations to the Contract as provided for by this DB Section 104-3 shall not invalidate the Contract nor release the Surety. The Design-Builder agrees to accept the Work as altered as if it had been part of the original Contract. The Design-Builder shall notify the Surety of any alterations to the Contract.

Alterations of the Contract shall not involve Work beyond the physical limits of the proposed Work, as shown on the Scope of Services Package Plans, except as necessary to satisfactorily complete the Project or as addressed by DB Section 104-7.

DB 104-4 MAINTAINING TRAFFIC

The Design-Builder shall keep all roads open to all traffic during the construction. Where provided in the Contract or approved by the Project Manager, traffic may be bypassed over an approved detour route. The Design-Builder shall keep the section of the Project being used by public traffic in a condition that safely and adequately accommodates traffic. The Design-Builder shall furnish, erect, and maintain barricades, suitable lights, drums, warning signs, delineators, striping, and flaggers, in accordance the Department's Traffic Control Manual. The Traffic Control Manual may be obtained from the Contract Administration Office.

The Design-Builder shall bear all expense of maintaining the section of road undergoing improvement including all temporary approaches or crossings and intersections with trails, roads, streets, businesses, parking lots, residences, garages, farms, and other features as may be necessary. Snow removal along routes open to traffic will not be required of the Design-Builder.

If the Design-Builder does not complete the Work within the Contract completion time (including approved extension time), the cost of all traffic control items to maintain traffic as required in accordance with the Traffic Control Manual (including all subsequent revisions up to the date of the advertisement of the Project), the Plans, and Specifications shall be borne by the Design-Builder to complete the remaining work beyond the Contract time. Traffic control items shall include but not be limited to warning lights, warning signs, barricades, plastic drums, portland cement concrete safety barrier, flaggers, police officers, arrow panel, message board, and portable impact attenuator.

See Part 4 – Special Provisions, 763588 - Maintenance of Traffic for additional requirements.

DB 104-5 FINAL CLEANING OF PROJECT SITE

Before final inspection of the Project, the Project, publicly owned borrow sources, and all areas occupied or affected by the Design-Builder in connection with the Work within the right-of-way shall be cleaned of all rubbish, excess materials, temporary structures, and equipment. All surfaces and slopes, whether old or new, shall be trimmed to the cross-section, all grass and weeds, which are taller than 6" shall be cut and all parts of the work shall be left in an acceptable condition. The acceptability of the final cleanup shall be at the sole determination of the Department. The cost of the final cleanup shall be incidental to the Contract and no separate payment will be made.

DB 104-6 GUARANTEES

The Design-Builder guarantees, by signing the Contract, mechanical and electrical equipment, apparatus, materials, and workmanship provided under the Contract for a minimum period of one year after Final Acceptance. Other items included in the Design-Builder's warranty proposal shall be guaranteed for the period and terms specified elsewhere in the Technical Proposal included in Part 8 of the Contract

Documents. A Maintenance Bond shall be submitted to the Department per DB Section 103-2 for all guaranteed and warranted items.

Instruction sheets are required and shall be furnished by the manufacturer for all Materials, equipment, apparatus, supplies, and operation. The information shall be delivered by the Design-Builder to the Department's Project Manager prior to Final Acceptance of the Project, with the following written warranties and guarantees:

- A) The manufacturer's standard warranty for each piece of mechanical and electrical Equipment or apparatus furnished under the Contract;
- B) The Design-Builder's guarantee that, during the guarantee period, necessary repair or replacement of the warranted Equipment, apparatus, and other items included in the Design-Builder's warranty proposal shall be made by the Design-Builder; and
- C) The Design-Builder's guarantee for satisfactory operation of the mechanical and electrical systems furnished and constructed under the Contract for the guarantee period.

DB 104-7 DIFFERING SITE CONDITIONS, SUSPENSIONS OF WORK, AND SIGNIFICANT CHANGES IN THE CHARACTER OF THE WORK

DB 104-7.1 Differing Site Conditions

Additional compensation via Change Order shall be made for time related costs, if any, pursuant to DB Section 109-8. For any increased costs of the Work resulting from the Differing Site Condition, payment shall be made pursuant to DB Sections 109-8, but the Equipment compensation shall be governed and controlled by the provisions of DB Section 109-8.2.2(D).

DB 104-7.2 Suspensions of Work Ordered by the Department's Project Manager

See DB Section 102-19 and DB Section 109-12.

DB 104-7.3 Significant Changes in the Character Of Work

See DB Section 102-19 and DB Section 109-12.

DB 104-7.4 Notification of Differing Site Conditions and Extra Work

The Design-Builder shall immediately notify the Project Manager of alleged changes to the Contract due to differing site conditions, extra work, altered work beyond the scope of the Contract, or action(s) or lack of action(s) taken by the Department that have allegedly changed the Contract terms and conditions.

- A. No further work is to be performed or Contract costs incurred on the change after the date the change occurs unless directed otherwise by the Project Manager.
- B. Within seven days of the initial notification, the Design-Builder shall provide the following applicable information to the Project Manager in writing:
 - 1. The date of occurrence and the nature and circumstances of the occurrence that constituted the alleged change.
 - 2. Name, title, and activity of each Department representative knowledgeable of the alleged change.
 - 3. Identify any documents and the substance of any oral communications involved in the alleged change.

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4. Basis for an allegation of accelerated schedule performance, if applicable.
5. Basis for an allegation that the work is not required by the Contract, if applicable.
6. Particular elements of Contract performance for which additional compensation may be sought under this Section including:
 - a. Project Component(s) that have been or may be affected by the alleged change.
 - b. Labor or Materials, or both, that will be added, deleted, or wasted by the alleged change and what equipment will be idled or required.
 - c. Delay and disruption to the manner and sequence of performance that has been or will be caused by the alleged change.
 - d. Estimated adjustments to Project Component Value(s), delivery schedule(s), staging, and Contract time necessary due to the alleged change.
 - e. Estimate of the time within which the Department must respond to the notice to minimize cost, delay, or disruption of performance.

The failure of the Design-Builder to provide required notice in accordance with this Subsection shall constitute a waiver of any and all entitlement to adjustments in the Contract Price or time as a result of the alleged change.

- C. Within ten days after the receipt of notice, the Project Manager will respond in writing to the Design-Builder to:
 1. Confirm that a change occurred and, when necessary, direct the method and manner of further performance.
 2. Deny that a change occurred and, when necessary, direct the method and manner of further performance.
 3. Advise the Design-Builder that additional time is required to evaluate the allegation or adequate information has not been submitted to decide whether 1. or 2. above applies, and indicate the needed information and date it is to be received by the Project Manager for further review.

Any adjustments made to the Contract shall not include increased costs or time extensions for delays resulting from the Design-Builder's failure to provide requested additional information in accordance with this clause.

See also DB Section 102.19.

DB 104-8 CHANGES IN BASIC PROJECT CONFIGURATION; UTILITY RELOCATIONS; HAZARDOUS MATERIALS; ENVIRONMENTAL MITIGATION

DB 104-8.1 Changes in Basic Project Configuration

The Department acknowledges and agrees that the Design-Builder's Proposal was based on certain basic information presented by the Department regarding the nature of the Project to be constructed. This basic information is considered the Basic Project Configuration. Except as authorized by a Change Order, the Design-Builder shall not make any material change in Basic Project Configuration. Non-material Department-directed changes will be covered by a Change Order whether they are within the parameters of the Basic Project Configuration or not. Department-directed changes within the Basic Project Configuration specified in this Section may be ordered without any change in the Lump Sum Contract

Price or extension of the Contract Time, provided the change is ordered prior to completion of the Preliminary Design Review for the affected Design Unit(s).

DB 104-8.1.1 Standard for Determining Materiality of Change in Basic Project Configuration

See Part 1 - Agreement, Appendix A.

DB 104-8.1.2 Necessary Basic Project Configuration Change

This Contract generally obligates the Design-Builder to undertake all Work necessary to complete the Project without changes in the Lump Sum Contract Price. This Section provides for changes to the Lump Sum Contract Price due to Necessary Basic Project Configuration Changes. If any Necessary Basic Project Configuration Change increases or decreases the cost of performing the Work, then the Department will issue a Change Order to adjust the Lump Sum Contract Price accordingly. If a Necessary Basic Project Configuration Change changes the time required for performance of the Work, the time adjustment will be covered by a Change Order. Furthermore, if the Design-Builder commences any construction Work affected by the change prior to delivery of appropriate notice of the change to the Department under this Section, the Change Order shall allow the Department a credit for the cost of any unnecessary Work performed and/or shall exclude any additional costs associated with redoing the Work already performed. The Change Order shall also account for any offsets from Change Orders previously issued.

In the event that the Department approves a Necessary Basic Project Configuration Change that reduces the Design-Builder's costs, the Change Order shall note the amount of cost decrease available for future offsets.

DB 104-8.1.3 Relationship to Value Engineering Proposals

If an approved Value Engineering (VE) Proposal as described in DB Section 105 results in a material change in Basic Project Configuration, any cost savings from such VE Proposal(s) shall be shared in accordance with DB Section 105. In such cases, savings resulting from reduction in quantities shall be shared per DB Section 105.

DB 104-8.1.4 Inaccuracies in Design-Builder's Preliminary Design

Any cost increases and/or delays resulting from changes to the Basic Project Configuration due to inaccuracies in the Preliminary Design shall be borne by the Design-Builder. In such event, no change in the Work shall be deemed to have occurred and no Change Order will be issued for any such cost increases and/or delays. Accordingly, any non-material changes in the Basic Project Configuration (other than non-material Department-directed changes following the Preliminary Design Review) shall be the responsibility of the Design-Builder.

DB 104-8.1.5 Applicability of Change Orders

In general, the Design-Builder may implement non-material changes in the Basic Project Configuration, if approved by the Department, without a Change Order, unless the change involves a circumstance for which a Change Order is specifically required hereunder. The Design-Builder acknowledges and agrees that constraints set forth in the environmental approvals and other Contract Documents, as well as the site conditions and the planned ROW limits, will impact the Design-Builder's ability to make non-material changes in the Basic Project Configuration.

DB 104-8.2 Changes Applicable to Utility Relocations

The following provisions govern entitlement to Change Orders with respect to relocation of utilities.

DB 104-8.2.1 Change in Design

In as much as the Design-Builder is both furnishing the design of and constructing the Project, the Design-Builder may have significant opportunities to reduce the costs of certain portions of the Work, which may increase the costs of certain other portions of the Work. In considering such opportunities, the Design-Builder shall at all times consider the impact of design changes on relocations of utilities and related facilities with the overall goal of minimizing the necessity for relocations of such utilities and related facilities to the extent practicable. Accordingly, if, as a result of a change made by the Design-Builder to the Design-Builder's preliminary design, either the costs of a utility relocation are reduced (including avoidance of a proposed utility relocation shown in the Contract Documents), new relocations are required, or relocation costs are otherwise increased, then the following shall apply to any resulting cost increases or decreases affecting the Design-Builder and/or the Department:

- A) The Design-Builder shall not be entitled to a Change Order for any such additional costs it incurs, including both additional relocation costs and the costs of any additional Work on other aspects of the Project undertaken in order to facilitate the avoidance or reduction of relocation costs;
- B) The Design-Builder shall reimburse the Department for any mutually agreed upon additional expenses incurred by the Department; and
- C) The Design-Builder shall not be obligated to provide a credit to the Department on account of reductions in the cost of the Work due to any such avoided or reduced relocation.

DB 104-8.2.2 Additional Restrictions on Utility-Related Change Orders

A) Avoidance of Relocations

Whenever the Design-Builder claims entitlement to a Change Order under this Section, the Design-Builder shall bear the burden of proving that the utility relocation could not reasonably have been avoided and of proving the amount of any costs and/or delays claimed by the Design-Builder.

B) Incremental Costs Only

In cases where the Design-Builder is entitled to a Change Order under this Section, the Change Order shall allow a price increase only for the incremental costs directly arising from the circumstances giving rise to such Change Order.

C) Coordination Costs

In no event will the Design-Builder be awarded any increase in the Lump Sum Contract Price for any increased costs of coordinating with the affected utility owner on account of any utility relocation for which a Change Order is merited under this Section.

D) Timing of Change Orders

In general, the parties anticipate that Change Orders for utility relocations will be executed as the changes occur. However, the Department and Design-Builder may agree to consolidate certain changes into a single Change Order. The Design-Builder's mark-ups under DB Section 109-8.2.2(D)(6) shall be deemed to include compensation for all costs associated with any time differential between performance of the relocation Work and the date of issuance of the Change Order.

E) No Change Orders for Utility Service Lines or Temporary Relocations of Utilities

The Design-Builder shall not be entitled to a Change Order for increased costs of the Work resulting from, or for any extension of time for, delays associated with the following:

- 1) Any relocation of any utility service lines; and/or
- 2) Any temporary relocations of utilities implemented for the convenience of the Design-Builder's own construction operations.

DB 104-8.3 Hazardous Materials Change Order

If unforeseen Hazardous Materials are found to exist within the limits of disturbance for the Project, the Department will issue a Change Order for any necessary remediation. The Design-Builder shall utilize the services of previously qualified, trained, and/or appropriately certified personnel and Subcontractors for hazardous and contaminated substance remediation. No training costs (or costs for physical examinations) will be allowed in any Change Orders for hazardous and contaminated substance remediation.

DB 104-8.4 Changes in Environmental Mitigation Requirements

Changes in environmental mitigation requirements may occur as the result of changes in governmental rules, as the result of changes in the Work directed by the Department, or as the result of design decisions made by the Design-Builder or its construction methodologies. The Department shall issue a Change Order for changes in the scope of environmental mitigation requirements to be performed by the Design-Builder to the extent that they are directly attributable to changes in governmental rules or changes in the Work directed by the Department (including any assignment of mitigation requirements to the Design-Builder that were originally contemplated to be performed by the Department or others). The Design-Builder shall bear full responsibility for performance of any mitigation measures required as the result of its design decisions or construction methodologies. The Design-Builder shall also bear full responsibility for obtaining modifications to existing permits to accommodate its design decisions or construction methodologies. No additional compensation or extensions of time will be granted because of delays in obtaining approvals from the appropriate permitting agencies. Work that is proposed outside of the requirements or limits of the existing permits will not be allowed until the appropriate permitting agency approves the modification. Furthermore, the Design-Builder shall be entitled to compensation only for the incremental costs associated with compliance with the new requirements and shall not be entitled to additional compensation for Work relating to such compliance that was included in its original scope, including any commitments made in the Design-Builder's Proposal.

DB 104-8.5 General

Changes under this DB Section 104-8 shall be governed by the notice, record keeping, and other requirements of DB Sections 104 and 109. For any increased costs of the Work resulting from a significant change in the character of the Work, payment shall be made pursuant to DB Section 109-8.2, but the Equipment compensation shall be governed and controlled by the provisions of DB Section 109-8.2.2(D)(4).

Adjustments in Contract Time shall be included in the Change Order to reflect changes in the Critical Path for the Project.

The Design-Builder or the Department must make written notification to the other party of the existence of the apparent "significant change" if that party wishes to adjust the Lump Sum Contract Price or the Contract Time. Such notice shall be given within ten Calendar Days of the time at which the party had, or should have had, knowledge of an event, matter, or occurrence that results in a significant change in the character of the Work. Work that is substantially completed prior to the issuance of notice may not be considered for Contract adjustment.

Timely issuance of notice shall be a necessary requirement for consideration of Contract adjustment as provided in this Section.

DB 104-9 RETENTION OF RECORDS

The Design-Builder shall retain all records for six years after final payment is made under the Contract. Required records shall include all accounts, papers, maps, plans, drawings, engineering calculations, reports, photographs, or other documentary materials, regardless of physical form or characteristics, made or received by the Design-Builder in connection with the Contract. Legible electronic copies are acceptable, provided they are so arranged, identified, and indexed that any individual document, or component of the records, can be located with reasonable facility.

The Design-Builder shall maintain records of all required payrolls and of the details that comprise the total Lump Sum Contract Price. These records shall be available at any time within six years following the date of final payment of the Project at the request of the Department for review and audit, if it is so deemed necessary by the Secretary. In case all or part of such records are not made so available, the Design-Builder understands and agrees that any items not supported by reason of such unavailability of the records shall be disallowed, or if payment has already been made, the Design-Builder shall, upon demand in writing by the Secretary, refund to the Department the amount so disallowed.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 105

CONTROL OF WORK

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**DB SECTION 105
CONTROL OF WORK**

**DB 105-1 DEPARTMENT'S PROJECT ORGANIZATION AND AUTHORITY OF
DEPARTMENT'S PROJECT MANAGER**

As designee of the Secretary, the Department's Project Manager has immediate charge of the Project. The Department's Project Manager is responsible for the administration and satisfactory completion of the Project. The Department's Project Manager will be delegated authority commensurate with that responsibility, including the authority to reject defective Material and construction and disapprove and reject design documents that do not comply with Contract requirements. It is understood that the Department's Project Manager may further delegate authority commensurate with responsibility for certain decisions assigned to other Department personnel.

The Design-Builder is required to submit all issues related to the Project through the Department's Project Manager. The Department's Project Manager will decide all questions that may arise, including, but not limited to, the following topics:

- A) Acceptability of design documents;
- B) The quality and acceptability of Material furnished;
- C) Work performed;
- D) The rate of progress of the Work;
- E) Interpretation of the Contract;
- F) Acceptable performance of the Contract requirements; and
- G) Administration of monthly progress payments.

The decision of the Department's Project Manager of the aforementioned shall be in writing and shall be delivered to the Design-Builder's Project Manager as quickly as possible.

In addition to the authority to administer the Contract, modify the Contract by Change Order, and oversee and terminate the Contract as expressly provided in other Sections of the Contract, the Department's Project Manager will have the authority to suspend the Work, wholly or in part, or withhold progress payments due to the following:

- 1) Conditions such that unsatisfactory Work might result, regardless of responsibility;
- 2) Improper Material or procedures being used;
- 3) Unsafe conditions for the workers or the general public as a result of the failure of the Design-Builder to correct those conditions;
- 4) The Design-Builder's failure to carry out provisions of the Contract;
- 5) The Design-Builder's failure to carry out directions of the Department's Project Manager;
- 6) The Design-Builder's failure to comply with state or federal law or regulation;
- 7) The Design-Builder's non-conformance with the Maintenance of Traffic provisions of the Contract, causing serious disruptions to traffic operations; or

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- 8) The Department's Project Manager's determination that suspension is necessary because of unsuitable weather.

The Design-Builder or the Department's Project Manager may suspend Work if conditions exist that are potentially injurious to the Project, including Work performed in the absence of Department accepted Design Plans and Project Specifications and/or Work being performed in the absence of the Department's qualified Inspectors and/or sampling and testing personnel. No additional compensation will be paid to the Design-Builder because of such suspension. The Design-Builder shall not suspend Work without written authority from the Department's Project Manager. *See* DB Sections 102-19 and 109-12.2 for more information on the Department Project Manager's authority to suspend Work.

The Department's Project Manager may also suspend the Work wholly or in part for other conditions or reasons beyond the control of the Design-Builder or not connected with the construction of the Project when deemed necessary in the public interest. Additional Work caused by such suspensions will be paid for by the Department pursuant to DB Section 104 and DB Section 109.

Any adjustment of Contract Time for suspension of Work shall be made as provided in DB Section 108-6.

DB 105-2 CONFORMITY WITH DESIGN PLANS AND PROJECT SPECIFICATIONS

All Work performed and all Material furnished shall conform to the lines, grades, cross sections, dimensions, and Material requirements of the Contract.

When the Department's Project Manager finds the Materials furnished, Work performed, or the finished product not within reasonably close conformity with the Contract but that reasonably acceptable Work has been produced, the Department's Project Manager will determine to what extent the Work will be accepted and remain in place. If accepted, the Department's Project Manager will document the basis of determination by Contract modification that will provide for an appropriate adjustment in the Lump Sum Contract Price for such Work or Material as he/she deems necessary to conform to his/her determination based on engineering judgment.

In the event the Department's Project Manager finds the Materials, the Work performed, or finished product have resulted in an inferior or unsatisfactory product, the Work or Materials shall be removed and replaced or otherwise corrected by and at the expense of the Design-Builder.

DB 105-3 COOPERATION BY THE DESIGN-BUILDER

The Design-Builder shall give the Work the constant attention necessary to facilitate the progress thereof and shall cooperate with the Department's Project Manager, other Department representatives, and other contractors.

The Design-Builder shall have on the Work site at all times, as the Design-Builder's agent, a competent superintendent capable of reading and understanding the Plans and Project Specifications and experienced in the type of Work to be performed. Prior to the start of construction, the Design-Builder shall submit the qualifications of a proposed superintendent to the Department for review and approval.

At the pre-construction meeting, the Design-Builder shall furnish the Department's Project Manager written notice of the superintendent's name and his or her home, office, and mobile telephone numbers. The superintendent shall have authority to execute orders or directions of the Department's Project

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Manager without delay and to promptly supply such Materials, Equipment, tools, labor, and incidentals as required. The superintendent shall be furnished regardless of the amount of Work sublet.

DB 105-4 COOPERATION WITH UTILITIES

The Department will notify all known utility companies, pipeline owners, or other parties affected by the Work and endeavor to have the necessary adjustments of public or private utility fixtures, pipelines, and other appurtenances within or adjacent to the limits of construction made as soon as possible. The Design-Builder shall assist the Department by providing any information required by the affected or interested parties.

Upon award of the Contract, utility companies affected will be advised by the Department of the name and address of the Design-Builder, approximate date Work will begin, and other pertinent information.

Except as hereinafter provided, and regardless of whether the utility is shown on the Plans or referred to in the Project Specifications, all water lines, sanitary sewer lines (force main and gravity lines), gas lines, electric lines, fiber optic cables, telephone lines, cable television lines, service connections, water and gas valve boxes, light standards, cableways, signals, and other utility appurtenances within construction limits which prevent completion of the Design-Builder's Work will be relocated or adjusted by the owners at no expense to the Design-Builder. Part 5 – Utility and Right-of-Way Statements of this Contract, indicates utility items to be relocated, adjusted, or constructed by the Design-Builder.

It is agreed that the Design-Builder has considered in its Proposal all permanent and temporary utility appurtenances in their present or proposed relocated positions and that no additional compensation will be allowed for delays, inconvenience, or damage sustained due to interference from the said utility appurtenances or the operation of moving them.

When the Department's Project Manager determines that the Design-Builder is experiencing significant delays in the Work because of delays by others in removing, relocating, or adjusting utility appurtenances, an extension of Contract Time will be considered in accordance with DB Section 104-8.2.

When the Design-Builder's Work involves excavating or underground demolition activity, the Design-Builder is required to reach Miss Utility of Delmarva a minimum of two but not more than ten working days prior to starting any Work, by calling (800) 282-8555 in Delaware or toll-free (800) 441-8355 in order to comply with Delaware Code, Chapter 8, Title 26. See DelDOT Standard Specifications, August 2001, Section 105.09 for further details concerning utilities.

DB 105-5 COOPERATION BETWEEN THE DESIGN-BUILDER AND OTHER CONTRACTORS

The Department reserves the right to contract for and perform additional work on or near the Work covered by this Contract.

When separate contracts are let within, adjoining, or adjacent to the limits of this Project, the Design-Builder and each other contractor shall conduct the work not to hinder the progress of work by other contractors and shall cooperate with each other as directed.

The Design-Builder shall arrange the Work and shall place and dispose of Materials, equipment, temporary works, and other construction-related items so as not to interfere with the operation of other contractors within, adjoining, or adjacent to the limits of the Project. The Design-Builder shall acceptably

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join the Work with that of other contractors and shall perform the Work in proper sequence to that of the others and without causing disruption or delay to the schedule of Project completion.

The Design-Builder shall assume all liability, financial or otherwise, in connection with the Contract and shall hold the Department harmless and indemnify the Department from all damages or claims that may arise because of inconvenience, delay, or loss experienced by the Design-Builder or caused to other contractors due to the presence and operations of other contractors working within, adjoining, or adjacent to the limits of the Project.

DB 105-6 INSPECTION

The Design-Builder shall have the primary responsibility for Inspection of all Project Work through its Quality Control (QC) Manager, Design QC Manager, and Construction QC Manager and their respective staffs. *See* DB Sections 112 and 113 of the Contract Documents for the specific Design-Builder QC responsibilities.

The Department shall have the primary responsibility for Quality Assurance of all Project Work through its Design Project Manager and Construction Project Manager and their respective staffs.

DB 105-6.1 Delaware Department of Transportation's Inspection

The Department's designated representative(s) shall be authorized to inspect any Work done and Material furnished, including all or any part of the Work and the preparation, fabrication, or manufacture of the Material to be used. The Department's inspection shall include, but not be limited to, the Design-Builder's compliance with applicable safety requirements set forth in DB Section 107. The Department's designated representative(s) is not authorized to either alter or waive the provisions of these Specifications or the Contract or to issue instructions contrary to the Department accepted Design Plans and Project Specifications without written approval of the Department's Project Manager or to act as foreman for the Design-Builder. However, he/she shall have the authority to reject unacceptable Work or Material. The Department's Inspections and tests are for the sole benefit of the Department and do not constitute any of the following:

- A) Relief of the Design-Builder's responsibility for providing adequate Quality Control measures;
- B) Relief of the Design-Builder's responsibility for damage to or loss of the Material before Final Acceptance;
- C) Implication of Final Acceptance; or
- D) Affectation of the continuing rights of the Department after Final Acceptance of the completed Work.

DB 105-6.2 Delaware Department of Transportation's Inspection of Work

All Material and each part or detail of the Work will be subject to Inspection by the Department's Project Manager and/or designated representative(s). The Department's Project Manager and staff shall be allowed full Work access and shall be furnished with necessary information and assistance by the Design-Builder to make a complete and detailed inspection, as deemed appropriate by the Department's Project Manager or designated representative.

If the Department's Project Manager requests it, the Design-Builder, at any time before Final Acceptance of the Work, shall remove or uncover such portions of the finished Work as may be directed. After examination, the Design-Builder shall restore said portions of the Work to the standard required by the Project Specifications. If the Work thus exposed or examined proves acceptable, the uncovering or

removing and the replacing of the covering or making good of the parts removed may be paid for as Extra Work under DB Section 109-8. But, if the Work so exposed or examined proves unacceptable, or if the Design-Builder failed to document its Work or complete and/or document its QC activities related to the Work, the uncovering or removing and the replacing of the covering or making good of the parts removed will be at the Design-Builder's expense.

Work done or Material used without Inspection by an authorized Department representative may be ordered removed and replaced at the Design-Builder's expense if the Department was not given the required notice that the Work was to be performed. When a utility, unit of government, political subdivision, or railroad is to pay a portion of the cost of the Work covered by this Contract, its representative(s) shall have the right to inspect the Work. *See also* Part 5 – Utility and Right-of-Way Statements. Such Inspection shall in no sense make the utility, unit of government, political subdivision, or railroad a party to this Contract and shall in no way interfere with the rights of either party hereunder.

DB 105-6.3 Removal of Unacceptable and Unauthorized Work

All Work that does not conform to the requirements of the Contract shall be considered unacceptable unless otherwise determined acceptable under the provisions in DB Section 105.

Unacceptable Work, whether caused by poor Work, defective Material, damage through carelessness, or any other cause found to exist prior to the Final Acceptance of the Work shall be removed immediately and replaced in an acceptable manner irrespective of the presence of, or lack of, a Department designated representative at the time the Work was originally completed. This clause shall have full effect regardless of the fact that the defective Work may have been done or the defective Material used with the full knowledge of the Department's representative. The fact that the Department's Project Manager or designated representative may have previously overlooked such defective Work shall not constitute an Approval or Final Acceptance of any part of it.

DB 105-7 LOAD RESTRICTIONS

The Design-Builder shall comply with all legal and contractual load restrictions in the hauling of materials or equipment on public roads. A hauling permit or other special permit will not relieve the Design-Builder of liability for damage to public or private property which may result from the movement of such loads or equipment.

Vehicles transporting construction materials to Department projects shall not exceed the gross vehicle weight (GVW) or licensed weight, if less, as specified in the Delaware Code. Materials inspection weigh tickets will not be issued by Department personnel for GVWs in excess of the allowable maximum.

Payment for Materials delivered to the Project shall not exceed the allowable GVW minus the truck tare weight. An average tare weight may be established on a basis approved by the Department's Project Manager so that empty weighing is not necessary before every load. No payment will be made for any excess material weight.

It shall be the responsibility of the Design-Builder to notify its subcontractors, vendors, and suppliers of this requirement.

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The maximum GVW for different vehicle axle configurations is as follows; provided that in the case of three-axle vehicles the extra weight fee has been paid and is so noted on the registration card:

Customary Values

<i>Single Unit Values</i>	<i>GVW, Maximum</i>
2-axle vehicle (e.g., 2-axle dump truck)	40,000 lbs.
3-axle vehicle (e.g., 3-axle dump truck)	65,000 lbs. *70,000 lbs.
4-axle vehicle (e.g., 4-axle dump truck)	73,280 lbs.
 <i>Tractor-Semi-Trailer Combinations</i>	
3-axle combination unit	60,000 lbs.
4-axle combination unit	70,000 lbs.
5-axle combination unit	80,000 lbs.

* When extra weight fee has been paid and is so noted on registration card.

The Design-Builder shall be responsible for all damages done by hauling equipment. Operating Equipment or hauling loads that may damage Structures, Roadway, utilities, and or any construction is prohibited unless protective measures are taken by the Design-Builder. *See also* Part 5 – Utility and Right-of-Way Statements.

DB 105-8 MAINTENANCE DURING CONSTRUCTION

The Design-Builder shall satisfactorily maintain the areas designated for bridge construction (staging areas, construction accesses, etc.) within the ROW limits of the Project, from the effective date of the Notice to Proceed (NTP) until the date of Final Acceptance. Adjacent and parallel Roadways within the Project limits utilized to access staging areas or work areas shall be the maintenance responsibility of the Design-Builder. This maintenance responsibility includes, but is not necessarily limited to, maintaining drainage (sediment from construction shall be removed so as not to block drainage outside of the ROW), periodic watering and mowing of roadside vegetation, and removing of debris to the satisfaction of the Department's Project Manager, as well as such striping, patching, and shoulder maintenance which will provide safe and convenient conditions at all times for the public. The Design-Builder shall continuously and effectively satisfy its maintenance responsibilities with such Equipment and forces as may be necessary to maintain a safe and satisfactory condition for the duration of the Project.

DB 105-9 FAILURE TO MAINTAIN ROADWAY OR STRUCTURE

If the Design-Builder fails to comply with DB Section 105-8, the Department's Project Manager will immediately notify the Design-Builder in writing of such noncompliance. If the Design-Builder fails to remedy the condition within 24 hours after receipt of the written notice, the Department's Project Manager may immediately remedy the condition, and the cost thereof will be deducted from payments for the Work.

When the condition requires more immediate remedy due to hazard to life, health, and property, the Department's Project Manager may immediately remedy the condition and the costs thereof will be deducted from payments for the Work.

DB 105-10 DESIGN-BUILDER'S RESPONSIBILITY FOR WORK

The Design-Builder is responsible for carrying out the provisions of the Contract at all times, regardless of whether an authorized Department designated representative is present or not. Any Work or item that is, at any time, found to be out of Specification or not in compliance with the Design Plans shall remain the responsibility of the Design-Builder and shall be subject to such corrective measures that are approved in writing by the Design-Builder's Designer and accepted in writing by the Department's Project Manager.

DB 105-11 DELDOT's CONSULTATION AND WRITTEN COMMENT, APPROVALS, AND NON-CONFORMANCE REPORTS

Except for items specifically designated for "Approval" or "approval" in the Contract Documents, The Department's Consultation and Written Comment regarding reviews, observations, and/or inspections of design documents, Working Drawings, other required submittals, and construction means and methods shall be considered and addressed by the Design-Builder. While the Design-Builder is not required to revise its Work in response to such comments, the Design-Builder shall provide a timely written response to the Department's Project Manager regarding its disposition of each of the Department's individual comments. Any issues raised during Consultation and Written Comment by the Department if not properly addressed by the Design-Builder, could affect the Department's Final Acceptance of the Project.

Deficiencies, non-compliance, errors, and/or omissions will be documented by the Department in written Non-Conformance Reports (NCRs). The Design-Builder shall respond to and address issues covered by NCRs and shall bring the Work into compliance with Contract requirements. In such cases, the Design-Builder's corrective actions will be subjected to further Consultation and Written Comment by the Department.

Approvals will only be given by the Department for those submittals or Work specifically identified in the Contract Documents as for "Approval" or "approval."

Consultation and Written Comments or Approval by the Department of design documents, Working Plans, other required submittals, activities/actions, construction means and methods, and/or the Design-Builder's construction detail does not relieve the Design-Builder of the full responsibility for providing adequate QC measures and does not relieve the Design-Builder of providing proper and sufficient Material, Equipment, and labor to complete the Work in accordance with the Contract, Design Plans, and Project Specifications.

DB 105-12 MEETINGS

The Design-Builder shall participate in meetings as indicated in this Section. The party leading the meeting shall record minutes of all meetings and distribute them within five Working Days of the meeting. Meeting minutes shall clearly identify the following:

- A) Action items and issues;
- B) The party responsible for the action item;
- C) The status of issues; and
- D) Due dates for identified action items.

Action items and issues shall be retained in the minutes of subsequent meetings until the required action is completed and/or the issue is resolved.

DB 105-12.1 Value Engineering Proposals

The Department's Project Manager will consult with the Design-Builder and arrange and lead meetings within 30 Calendar Days of NTP to review any initial Value Engineering (VE) Proposals (*see* DB Section 105-13) submitted by the Department or the Design-Builder.

If requested by the Department's Project Manager, the Design-Builder shall prepare an estimate of effects (time and cost) for VE Proposals.

Attendance at the meetings and the preparation of the estimate of effects shall be at no increase in the Lump Sum Contract Price or Contract Time to the Department.

Other VE meetings may be called by the Design-Builder or the Department as necessary, to discuss and evaluate additional VE Proposals that may arise.

DB 105-12.2 Design Mobilization Meeting

Within 30 calendar days of NTP, the Design-Builder's Project Manager will consult with the Department's Project Manager and will arrange and lead a meeting at the Designer-Builder's Project office prior to the Design-Builder initiating additional design Work.

The agenda shall be developed and prepared by the Design-Builder in consultation with the Department's Project Manager and shall include the following:

- A) The organization for design including all sub-consultants, subcontractors, or similar entities;
- B) A review of qualifications of design Quality Control staff;
- C) A design workshop agenda (*see* DB Section 111-16);
- D) The location of design personnel;
- E) The design schedule and time allocations for Design Reviews; and
- F) Design Quality Control and Quality Assurance.

The Department's Project Manager or the Design-Builder may add other items to the agenda.

DB 105-12.3 Site Mobilization Meeting

The Design-Builder's Project Manager will consult with the Department's Project Manager and arrange and lead a meeting at the Design-Builder's office prior to the Design-Builder's occupying any part of the site. The Design-Builder's Key Personnel who will be responsible for activities on the agenda shall attend the meeting. *See* DB Section 108-3 for more information on the Design-Builder's Key Personnel.

The agenda shall be developed and prepared by the Design-Builder in consultation with the Department's Project Manager and the Design-Builder and prepared by the Design-Builder and shall include, but not be limited to, the following items:

- A) Assigned staging areas and shared use of site with other contractors;
- B) DelDOT and DNREC requirements;
- C) Temporary utilities and facilities;
- D) Security and "housekeeping;"
- E) Maintenance responsibilities on-site and surrounding areas;

- F) Temporary works; and
- G) Plans for early construction, if any.

DB 105-12.4 Preconstruction Meeting

The Department's Project Manager will contact the Design-Builder to schedule a Preconstruction Meeting prior to each major phase of any construction work. Agenda items shall include, but are not limited to the following:

- A) Construction Schedule;
- B) Personnel, including subcontractors;
- C) Required drawings;
- D) Material approvals and testing;
- E) Coordination with other contractors; and
- F) Progress Payments.

It is expected that multiple preconstruction meetings will be required in accordance with the Design-Builder's phasing plans to construct the project. The Department's Project Manager or the Design-Builder may add agenda topics that are consistent with the meeting goals, meeting schedule, and the general purpose for the meeting. The initial preconstruction meeting is expected to be a full day meeting.

DB 105-12.5 Progress Meetings

Progress meetings shall be held at least weekly throughout the progress of the Project. The Design-Builder shall prepare the agenda in consultation with the Department's Project Manager and distribute copies together with draft minutes of the previous meeting to all planned participants at least two Calendar Days prior to the meeting. The Design-Builder shall lead the meetings.

The Design-Builder's Key Personnel shall attend the progress meetings. *See* DB Section 108-3 for more information on the Design-Builder's Key Personnel.

A typical agenda shall include the following items:

- A) A confirmation of minutes of the previous meeting and status of action items arising at previous meetings;
- B) A review of Work progress;
- C) Design problems and decisions;
- D) Field observations, problems, and decisions;
- E) Identification of issues affecting planned progress;
- F) Planned activities (design and construction) for the coming two week period;
- G) Maintenance of quality and Work standards;
- H) Safety;
- I) Environmental issues
- J) Coordination with other Contracts;

- K) Schedule updates (monthly);
- L) Public Outreach items/issues;
- M) Maintenance of Traffic; and
- N) The status of Change Orders, if any.

DB 105-12.6 Special Meetings

The Department's Project Manager may require special meetings at any time and that all or specified Design-Builder Key Personnel attend. These meetings may include discussions with the Public concerning aesthetic issues, construction and/or design schedule updates, etc. in accordance with the Design-Builder's Proposal and Part 8 of the Contract Documents. See DB Section 108-3 for more information on Design-Builder's Key Personnel.

DB 105-13 VALUE ENGINEERING PROPOSALS

This provision is to share with the Design-Builder only the cost savings generated on this Contract as a result of a VE Proposal(s) offered by the Design-Builder and Approved by the Department. Any time savings resulting from a VE Proposal will be considered at the completion of the Project as an incentive to the Design-Builder, provided the Contract contains an incentive clause for early completion of the Work and the Design-Builder has not met the incentive limit in the Contract. A time only reduction will not be considered as a VE Proposal. The purpose is to encourage the use of the Design-Builder's ingenuity and experience in recommending approaches and methods different from existing Contract specifications that will reduce the overall cost of the Contract. After the NTP is issued for the Contract, the successful Proposer will be permitted to submit to the Department's Project Manager, written VE Proposals, for modifying the Plans, Specifications, or other requirements of the Contract for the purpose of reducing the total cost of the Project. The VE Proposal shall not impair, in any manner, the essential functions and characteristics of the Project, including, but not limited to, safety, service life, reliability, economy of operation, ease of maintenance, desired appearance, traffic flow during construction, or necessary standardized features.

The VE Proposal shall be specifically identified by the Design-Builder as a cost reduction proposal. The Design-Builder has the option of submitting a conceptual VE Proposal to the Department for review prior to making formal submission. However, the Design-Builder may submit the formal VE Proposal directly.

The conceptual VE Proposal shall provide the following minimum information:

- A) A description of the VE Proposal;
- B) A listing of Work items affected by the proposed change, including any change in Contract Time and/or Maintenance of Traffic; and
- C) An initial estimate of the net cost savings that the change is expected to generate.

The Design-Builder may proceed to the formal VE Proposal upon the Department's Approval of the conceptual VE Proposal. The Department is not obligated to approve the Design-Builder's formal VE Proposal, even if the conceptual VE Proposal is initially considered acceptable.

At a minimum, the following information shall be submitted by the Design-Builder with the formal VE Proposal:

- 1) A statement that the proposal is submitted as a VE Proposal;

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- 2) A detailed description of all differences between the existing Contract requirements and the proposed change(s), and the comparative advantages and disadvantages of each, including, effects on service life, economy of operations, ease of maintenance, desired appearance, necessary standardized features, reliability, traffic flow during construction, safety, and Contract Time;
- 3) Complete Plans, Specifications, and calculations showing all proposed revisions relative to the original Contract features and requirements. All Plans and engineering calculations shall bear the signature and seal of a Professional Engineer licensed to practice in the State of Delaware;
- 4) Detailed estimates of the cost to the Department for performing the Work under the existing Contract and under the VE Proposal;
- 5) An assessment of any effects that adoption of the VE Proposal could have on other costs to the Department including future maintenance and operation;
- 6) A statement of the latest time or date that any agreement adopting the VE Proposal must be executed in order to obtain the maximum cost reduction during the remainder of the Contract and the reasoning for this time schedule. This date must allow the Department time for review and processing. Should the Department find insufficient time is available for review and processing, it may reject the VE Proposal on such basis. If the Department fails to respond to the VE Proposal by the date or time specified, the Design-Builder shall consider the proposal rejected and shall have no claim against the Department;
- 7) A statement of the effect that adoption of the VE Proposal will have on the time for completion of the Contract; and
- 8) A description of any previous use or testing of the final VE Proposal on another Department project or elsewhere and the conditions and results therewith. If the VE Proposal was previously submitted on another Department project, the Design-Builder shall indicate the date, the project, and the action taken by the Department.

The provisions of this DB Section 105-13 shall not be construed to require the Department to consider any VE Proposal that may be submitted. The Department reserves the right to reject any and all VE Proposals. Proposers are cautioned to not base their Price Proposals on the anticipated Approval of a VE Proposal and to recognize that the VE Proposal may be rejected. In the event of rejection, the Design-Builder will be required to complete the Contract as executed. If the Department is already considering certain revisions to the Contract or has approved certain changes in the Contract for general use that are subsequently incorporated in a VE Proposal, the Department will reject the Design-Builder's VE Proposal and may proceed without obligation to the Design-Builder. The Department will not be liable to the Design-Builder for failure to act upon or accept any VE Proposal or for any delays to the Work attributable to such VE Proposal. The Design-Builder may withdraw, in whole or in part, any VE Proposal not accepted by the Department within the period specified in the VE Proposal. The decision of the Department as to the acceptance or rejection of VE Proposals shall be final.

The Design-Builder will be notified in writing of the Department's decision to accept or reject each VE Proposal submitted under this DB Section 105-13. If a VE Proposal is accepted, the necessary Contract modifications will be implemented by execution of a Change Order, which will provide for equitable price adjustments giving the Design-Builder and the Department equal shares in the resulting net savings. Until a VE Proposal is incorporated by such Contract modification, the Design-Builder shall perform the Work in accordance with the terms of the existing Contract.

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The net cost savings to be shared shall be determined as the difference in costs between the original Lump Sum Contract Price for the involved Work and the actual final costs to the Department occurring as a result of the proposed change. Only that Work directly affected by the Change Order will be considered in making the final determination of net cost savings. Subsequent Change Orders affecting the modified Work, but not related to the VE Proposal, will be excluded from such determination. In reviewing the VE Proposal, the Department reserves the right to reject the VE Proposal if, in its sole judgment, the proposed net cost savings do not represent a reasonable measure of the value of the Work to be performed or deleted.

All costs incurred by the Design-Builder in developing the VE Proposal shall be borne by the Design-Builder. The Change Order implementing the necessary Contract modifications shall include a lump sum estimate of the approximate net cost savings anticipated as a result of the VE Proposal. The Design-Builder's 50% share of the net cost savings shall constitute full compensation for implementing all changes pursuant to the Change Order. Any time saving for early completion of the Project resulting from the VE Proposal will be considered upon completion of the Project as an incentive to the Design-Builder provided the Contract contains an incentive clause for early completion of the Work and the Design-Builder has not met the incentive limit in the Contract.

The Department reserves the right to include in the Change Order any conditions it deems appropriate for consideration, approval, and implementation of the VE Proposal. The Department also reserves the right to require the Design-Builder to share in the Department's costs of investigating a VE Proposal submitted by the Design-Builder as a condition of considering such VE Proposal. The Department will have the option to perform the investigation in-house or by consultants. When such a condition is imposed, the Design-Builder shall indicate his acceptance in writing, and such acceptance shall constitute full authority for the Department to deduct costs incurred by such investigation from any monies due or that may become due to the Design-Builder under the Contract.

The Department reserves the right to adopt a VE Proposal for general use when it determines that said VE Proposal is suitable for application to other contracts. When an accepted VE Proposal is adopted for general use, only the contractor that first submitted such VE Proposal will be eligible for compensation pursuant to this DB Section 105-13, and in that case, only as to those contracts awarded to that contractor prior to submission of the accepted VE Proposal. Value Engineering Proposals identical or similar to previously submitted VE Proposals will be eligible for consideration and compensation under this DB Section 105-13 if the identical or similar previously submitted VE Proposals were not adopted for general application to other Department contracts. Subject to the provisions of this Contract, the state or any other public agency shall have the right to use all or any part of any submitted VE Proposal without obligation or compensation of any kind to the contractor.

Any changed conditions arising as a result of the acceptance of a VE Proposal will not be considered as the basis for any claim for additional compensation.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 106

CONTROL OF MATERIALS

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**DB SECTION 106
CONTROL OF MATERIALS**

DB 106-1 MATERIAL REQUIREMENTS

Materials used on the Project must, at a minimum, be certified or tested prior to use. The certification process, which is administered by the DeIDOT Materials & Research's Materials (M&R) Administration Unit, is described in DB Section 106-2 below. The various units within M&R will test materials used on the Project that are not accepted based on certification. Minimum testing requirements on Project materials and the assorted types of tests performed are described in DB Section 106-3.

DB 106-2 MATERIALS CERTIFICATION

DB 106-2.1 Product Approval / Vendors & Suppliers.

The Department does not maintain an "approved products list," through which a vendor can submit prospective materials to the Department for testing and approval. The Department accepts materials on a project basis.

If a vendor, or supplier, wishes to have their materials used on the Project, they must have the Design-Builder submit each proposed material for review. Each material will then be verified for conformance to specifications by historical information or testing. A complete description of the submittal and approval process is located in the Materials Administration Unit in Part G of the DeIDOT Materials Manual.

When M&R has completed its review and evaluation of a submitted material, and finds the material to meet the requirements, both the Design-Builder and the vendor are notified in writing as to what steps are required for incorporation of that material into the Project. If, upon evaluation, the material does not meet Specification requirements, both the Design-Builder and the vendor are notified in writing as to why the material cannot be incorporated into the Project. Although materials may be accepted through this procedure for use on the Project, final acceptance of all materials depends on acceptable field performance.

Buy American Contract Requirement: In accordance with Section 165 of the Surface Transportation Assistance Act of 1982, Title 23 of the United States Code, the following applies to all contracts:

For this Contract, all iron, coating materials, steel materials, and coating of steel must be produced in the United States, except a minimal amount of foreign cement and steel materials may be used provided the cost of materials does not exceed 0.1% of the total Contract cost or \$2,500.00, whichever is greater.

A. Certificate of Compliance.

A Certificate of Compliance shall be furnished to the Department by the Contractor. The Certificate shall be signed by the Contractor to the effect that the materials and/or assembled materials will be of domestic origin and will comply in all respects with the requirements of the Contract. Mill test reports verifying that steel products are of domestic origin as defined in the Special Provisions shall be provided. All materials accepted on the basis of Certificate of Compliance may be sampled and tested at any time. Use of material on the basis of Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating

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material in the Project conforming to the requirements of the Contract. Any material not conforming to such requirements shall be subject to rejection whether in place or not. The Department reserves the right to refuse to permit the use of material on the basis of Certificate of Compliance.

B. *Domestic Material.*

Domestic materials are those which are melted, cast-formed, shaped, drawn, extruded, forged, fabricated, or otherwise processed in the United States.

DB 106-2.2 Certificates of Compliance.

The Contract or the Department's Standard Material and Testing Schedule will designate the materials that can be incorporated in the Work if accompanied by certificates of compliance from the manufacturer. The certificates of compliance shall state that the materials or assemblies provided by the Design-Builder fully comply with the specification requirements for this Contract. The manufacturer shall sign all certificates of compliance. Each lot of certified materials or assemblies delivered to the Project must be accompanied by a certificate of compliance clearly identifying the materials delivered and that the Contract requirements are specifically satisfied for this Project. Generic material certifications will not be accepted by the Department.

The Department may sample and test any materials used by the Design-Builder on the basis of certification of compliance. If the Department determines that materials or assemblies are not in conformance with Contract requirements, the materials, or assemblies will be rejected in accordance with DB Section 105-6.2.

DB 106-3 SAMPLING AND TESTING

DB 106-3.1 General.

Sampling and testing performed on the Project will follow the American Association of State Highway and Transportation Officials (AASHTO), American Society for Testing and Materials (ASTM), or Department of Highway (DOH) standards. When a reference is made to any of the aforementioned test procedures, it is understood that the reference is to the most current revision at the time of Proposal Submission. It is also understood that the Specifications and procedures applicable to the Project shall include all modifications current on the Proposal due date for the Project. Sampling and testing procedures are referred to using the following designations:

M – AASHTO Materials Specification

T – AASHTO Test Procedure

ASTM – ASTM Materials Specification or Test Procedure

DOH – Standard Test Procedure used by the department for which no corresponding ASTM or AASHTO procedure exists or modification of the ASTM or AASHTO procedures have been deemed appropriate.

DB 106-3.2 Sampling and Testing Procedures.

All materials used on the Project will be sampled and tested at consistent rates, based on estimated plan quantities to be developed and furnished by the Design-Builder. Table B-1 of the DelDOT Materials Manual lists the minimum testing frequencies for materials used on Department projects. In addition to the testing frequency of the materials, test procedures performed are also listed.

The Department reserves the right to increase the sampling rates from the minimums when conditions warrant. All materials are sampled at a project rate, not by total job rate. Sampling and testing is performed throughout the Project on a random basis to assure all materials are tested.

DB 106-3.3 Rounding Requirements of Sampling and Testing Results.

All measurements and calculations for materials sampling and testing will adhere to the rounding and accuracy requirements of the applicable AASHTO, ASTM, or DOH specifications. If there are no specific requirements included in the applicable specification, all items are to be measured in the field to two decimal places, and then calculated to three decimal places when calculations are required.

DB 106-4 QUALITY CONTROL, QUALITY ASSURANCE, AND INDEPENDENT ASSURANCE TESTING PROGRAMS

DB 106-4.1 Quality Control (QC) Requirements.

All Materials and products proposed to be used in construction shall be inspected, sampled, and tested by Design-Builder, as described in DB Section 112 and Appendices 112A and 112B to DB Section 112 and as indicated by the Contract Documents. The Design-Builder shall perform all tests required by the Contract and other tests the Design-Builder determines are necessary to verify the quality and suitability of all materials used on the Project. For all required tests, the Design-Builder shall submit test results or samples as requested by the Department, and shall obtain necessary approvals prior to using the materials on the Project. The approval of any material or source of supply of such material shall not relieve the Design-Builder of the responsibility to supply a material that is compatible with all other materials used on the Project, as such materials are normally used, without defect and for the specified design life of the Project. The Design-Builder shall warrant that all materials used in the Work or Project shall be made, manufactured, processed, or produced by suitable means, that all materials have been tested with satisfactory results, and that all materials may be compatibly incorporated into the Work or Project without defect.

The implementation and fulfillment of the Design-Builder's QC/QA plan will be reviewed by the Department for conformance to the program proposed by the Design-Builder and included in Part 8 of the Contract Documents.

DB 106-4.2 Quality Assurance (QA) and Independent Assurance (IA) Requirements.

The purpose of the Quality Assurance Program is to prescribe policies, procedures, and guidelines to assure that quality materials are used on the Project. The Department will perform all Quality Assurance Sampling/Testing for the Work.

It is the Department's policy to have a Quality Assurance Program that will assure materials, products, and workmanship incorporated into the Department's projects are in conformity with the requirements of

the approved plans and specifications, including all approved changes.

DB 106-4.3 Quality Assurance Program.

The Quality Assurance Program follows the minimum sampling requirements described under DB Section 106-3. Using these guidelines, the Department's Quality Assurance supervisor will determine the materials to be tested on the Project. The number and type of tests are to be documented.

Sampling and testing of materials used on the Project, as described under DB Section 106-3, is the responsibility of Quality Assurance technicians (Field Control). All samples used for assurance sampling and testing are random samples. In addition to the minimum sampling, more samples may be taken at any point in the production for verification of quality. (Where more than one sampling location is permitted, the Department reserves the right to further designate the sampling location). The results of these tests can be used in the acceptance decision as specified in the Contract requirements and all approved changes.

All sampling and testing is performed in close cooperation with Project Manager or an authorized representative. The Project Manager, or an authorized representative, should be aware of all sampling and testing on the Project and must be informed of all test results as soon as possible to ensure sufficient time for corrective action, if necessary. Results of testing are documented on various forms, which are provided in Part E of the DelDOT Materials Manual, and are described in Part C of the DelDOT Materials Manual for each material.

The ultimate responsibility for providing direction to the Design-Builder regarding the Work rests with the Department's Project Manager or an authorized representative. M&R is responsible only for testing project materials; the administration and results of the testing are the responsibility of the Department's Project Manager or an authorized representative. Quality Assurance technicians are only to direct the Design-Builder with the mutual consent of the Department's Project Manager and the Design-Builder's Project Manager.

DB 106-4.4 Independent Assurance Program.

The Independent Assurance (IA) Program is an internal program administered and performed by Department personnel or designated agents from an AASHTO accredited laboratory not assigned to the QA program. The IA supervisor will act in an advisory capacity in carrying out this program.

IA sampling, witnessing, testing, and equipment verification will be performed by M&R technicians, or their designated agents who have no direct responsibility for project verification sampling and testing, using equipment other than that used by the Quality Assurance (Field Control) technician assigned to the Project. IA sampling and testing, by either actual testing or by observation of Department personnel, or designated agents employed by an AASHTO accredited laboratory performing the sampling and testing, will be a minimum of 10% of Quality Assurance testing.

On the Project, test equipment will be evaluated by using calibration checks, testing split samples of verification or proficiency samples, or any combination of these methods. Person(s) observing the Quality Assurance sampling and testing will inspect project equipment used for acceptance testing to assure that the equipment is adequate for the designated procedure. The equipment will also be checked at the time of the required calibration, if applicable, and ensure that proper documentation of the calibration checks are on file.

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Field reviews of IA samples will be documented by signing and dating entries on test reports. IA test results that agree with non-IA test results within the limits in the “IA Sample Comparison Sheet” (LB Forms –110-112 as included in Appendix 106A) will not require any further comments on the reporting form. If IA samples have significant or major differences, greater than the acceptable percentages defined in the aforementioned forms, the supervisor will conduct an investigation to determine the possible cause of the difference. This investigation may be as simple as having all testing technicians run their retained splits of the samples. If, after comparing results of the retained splits, significant or major differences still exist, the supervisor shall conduct a thorough investigation into the sampling, testing, and equipment used to perform the tests. The results of this investigation shall be documented on the appropriate form.

The IA supervisor makes acceptance decisions based on verification sampling and testing and factors relating to the quality of the material or product. IA testing is not performed solely for the purpose of verifying quality, but it is also meant to evaluate technicians and equipment. When the Project is completed, the IA supervisor certifies that the IA schedule has been substantially followed and the results of the split sample testing are in close agreement. Exceptions and corrective actions are noted on a form or on an attached sheet.

IA technicians are not responsible for the verification of materials and their conformance to specification requirements. IA testing is used solely to verify results obtained from Project Quality Assurance (Field Control) for procedure and equipment verification.

Prompt and appropriate action will be taken by the Department’s Chief Materials & Research Engineer to correct or improve sampling and/or test methods if the need is indicated.

DB 106-5 TEST DOCUMENTATION AND RECORD KEEPING.

All material forms must have the appropriate Contract Number and Project Component/Description. All document and reporting forms must be dated and signed by the appropriate technicians.

All originating materials records for projects are to be kept in the Project file. Copies of product and material reports for acceptance decisions and IA test reports will be retained for all Department projects in the Central Laboratory. Copies of records cited above will be retained for the period specified by the most current Department policy.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 107

**LEGAL RELATIONS AND RESPONSIBILITY TO
PUBLIC**

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DB SECTION 107

LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

DB 107-1 LAWS TO BE OBSERVED

The Design-Builder is required to investigate and shall strictly comply with, all Federal, State, or county laws and regulations, and city or town ordinances and regulations. The Design-Builder shall indemnify and save harmless the State of Delaware, the Department of Transportation, its Secretary and all officers, agents, and servants against any claim or liability arising from or based upon the violation of any such laws, ordinances, regulations, orders, or decrees by its employees.

If the Design-Builder should discover any provisions in the Contract that are contrary to or inconsistent with any law, ordinance, regulation, order, or decree, the Design-Builder shall immediately report it to the Department's Project Manager in writing.

DB 107-2 PERMITS AND LICENSES, TAXES AND INSURANCE

DB 107-2.1 Permits and Licenses

The Design-Builder shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful prosecution of the Work.

Prior to the execution of any contract, the successful bidder shall be required to show that it has satisfied the requirements of Sections 2502 and 2503, Chapter 25, Title 30 of the Delaware Code, and if the bidder is a non-resident corporation, that the bidder has complied with the requirements of Subchapter XIV, Title 8 of the Delaware Code, Annotated Revised 1974, and as amended.

DB 107-2.2 Insurance

The Design-Builder shall maintain, at a minimum, the following insurance coverages:

-  A) Professional liability coverage with combined single limits of Ten Million Dollars (\$10,000,000.00) per claim and aggregate during the period starting on the date of Notice to Proceed (NTP) and ending on the Final Acceptance date. The policy shall have a retroactive date no later than the date on which the Scope of Services Package was issued and shall have and with a five year extended reporting period with respect to events that occurred but were not reported during the term of the policy. The policy shall protect against any negligent act, error, or omission arising out of the professional services that includes coverage for acts by others for whom the Design-Builder is legally responsible. The policy shall apply to the activities of all design, engineering, and construction management professionals assigned to the Project. ~~DelDOT and the State of Delaware shall not be named insureds under the policy, but the policy shall include an endorsement to provide them and their respective officers, directors, agents, and employees with vicarious liability coverage.~~

For professional liability coverage only: In the event no principle participants of the Design-Builder are providing services that require professional liability coverage as required above, coverage shall be provided by the Designer of record for the Design-Builder;

-  B) Workers' compensation insurance in compliance with state law, with the exception that the Design-Builder's Employer's Liability shall be at least One Million Dollars (\$1,000,000.00) when Work is to be over water and involves maritime exposures. For

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the coverage provided in this DB Section 107-2.2 the Design-Builder's insurer will have no right of recovery or subrogation against the State of Delaware or DelDOT;

- C) Commercial General Liability (CGL) insurance with a combined single limit per occurrence for bodily injury; and property damage. The aggregate loss limit must be on a per project basis. This insurance shall include coverage for bodily injury fire legal liability, premises-operation; broad form contractual liability; products and completed operation; use of contractors and subcontractors; personal injury; broad form property damage; and explosion, collapse, and underground (XCU) coverage. The required limits shall be not less than Five Million Dollars (\$5,000,000.00) per occurrence, with annual aggregates of Ten Million Dollars (\$10,000,000.00). The policy shall include products and completed operations extended coverage for a minimum of five years following Final Acceptance. If the Design-Builder's CGL insurance or other form with a general aggregate limit and products and completed operations aggregate limit is used, then the annual aggregate limits shall apply separately to the Project, or the Design-Builder may obtain separate insurance to provide the required limit which shall not be subject to depletion because of claims arising out of any other project or activity of the Design-Builder; Any such excess insurance shall be at least as broad as the Design-Builder's primary insurance. The Design-Builder shall be the named insured, its Subcontractors, and any Persons for whom the Design-Builder is legally or contractually responsible, whether occurring on or off the Site;



- D) Umbrella excess coverage in excess of commercial general liability, with a required combined single limit amount of insurance of Fifty Million Dollars (\$50,000,000.00). This limit of liability shall apply "collectively" and not "separately" for the Design-Builder and Subcontractors on the Project.



- E) A blanket builder's risk insurance policy on an "all risk" basis for the entire Project including (1) coverage for any ensuing loss from faulty workmanship, nonconforming Work materials, omission, or deficiency in design or specifications; (2) coverage against damage or loss caused by wind, earth movement, flood, fire, theft, vandalism and malicious mischief, and machinery accidents and operational testing; (3) coverage for removal of debris and insuring the buildings, structures, machinery, equipment, facilities, fixtures, and all other properties constituting a part of the Project; (4) transit coverage, including ocean marine coverage (unless insured by the supplier), with sub-limits sufficient to insure the full replacement value of any key equipment item; and (5) coverage with sub-limits sufficient to insure the full replacement value of any property or equipment stored either on or off the Site. Such insurance shall be on a form acceptable to the Department and shall have a limit equal to One Hundred Million Dollars (\$100,000,000.00) plus shall include "soft cost expense cover" (including advertising, design fees, professional fees, financing, lease administration, realty taxes, general administration, lease expenses, permit fees, insurance premiums and other costs associated with such damage or loss and with any governmental approvals) with a Five Million Dollar minimum annual aggregate limit and shall include earthquake insurance with a ~~One Hundred~~ Twenty Million Dollar (\$20,000,000.00) minimum annual aggregate limit and flood insurance with a ~~One Hundred~~ Twenty Five Million Dollars (\$25,000,000.00) minimum annual aggregate limit. There shall be no coinsurance penalty provision in any such policy.



- F) Environmental liability insurance during the period starting on the date of issuance of the NTP to design the improvements and ending on the date of Final Acceptance, with a five year extended reporting period with respect to events that occurred but were not reported during the term of the policy. The policy shall cover ~~professional errors and omissions~~

Work related to environmental remediation ~~Work performed by~~, and environmental losses resulting from, the Design-Builder or its Subcontractors and any Persons for whom the Design-Builder is legally or contractually responsible. The required combined single environmental liability limit amount shall be Ten Million Dollars (\$10,000,000.00). The Design-Builder shall be the named insured, its Subcontractors, and any Persons for whom the Design-Builder is legally or contractually responsible, whether occurring on or off the Site; and



G) The Design-Builder and all named subcontractors shall maintain Business Automobile Liability insurance with a combined single limit per occurrence for bodily injury and property damage. This insurance shall include bodily injury and property damage coverage arising from the ownership, maintenance, or use of all for owned/leased automobiles, hired automobiles, and non-owned automobiles used in the performance of the of the Work, including loading and unloading. The required combined single limit amount of insurance shall be Two Million Dollars (\$2,000,000.00). ~~The Design-Builder shall be the named insured, its Subcontractors, and any Persons for whom the Design-Builder is legally or contractually responsible, whether occurring on or off of the Site.~~ Subcontractors to provide the Design-Builder and the Department evidence of insurance for Automobile Insurance as specified in Section DB 107-2.2.1.

The following shall be included as provisions in each policy:

- 1) The insurance company(ies) issuing the policy(ies) shall have no recourse against the State of Delaware and DelDOT for payment of any premiums or for assessments under any form of the policy;
- 2) Any and all deductibles and self-insured retentions in the above described insurance policy(ies) shall be assumed by and be at the sole risk of the Design-Builder.

Insurance is to be placed with insurance companies authorized in the State of Delaware with an A. M. Best's rating of A-: VI or higher. This rating requirement may be waived for Workers' Compensation coverage only.

Should any policies be canceled, the Design-Builder shall immediately notify the Department.

Upon failure of the Design-Builder to furnish, deliver, and maintain such insurance as required or provide proof of insurance on a yearly basis or as requested by the Department, this Contract, at the election of the Department, may be immediately declared suspended, discontinued, or terminated or payment on Price Center (PC) 1 may be suspended. Failure of the Design-Builder to maintain any required insurance shall not relieve the Design-Builder from any liability under the Contract, nor shall the insurance requirements be construed to conflict with the obligations of the Design-Builder concerning indemnification under this DB Section 107-2.2.

The Design-Builder is responsible for requiring and verifying that all Subcontractors working on the Project maintain appropriate types and levels of insurance coverage.

DB 107-2.2.1 Verification of Coverage

A) Policies

Concurrently with the Design-Builder's execution hereof, the Design-Builder shall deliver to the Department the following items:

- 1) A certificate of insurance with respect to each policy required to be provided by the Design-Builder under this DB Section 107-2.2; and
- 2) Each certificate of insurance with respect to each policy required to be provided by the Design-Builder under this DB Section 107-2.2 shall clearly identify the Department as a certificate holder; and
- 3) Copies of all endorsement to the policies that set forth the required additional insureds and other amendments to the policy forms.

The required certificates must include original signatures by the authorized representative of the insurance company shown on the certificate with proof that he/she is an authorized representative thereof and is authorized to bind the named underwriter(s) and their company to the coverage, limits, and termination provisions shown thereon. The Department shall have no duty to pay or perform under this Contract until such certificate(s) and endorsements, in compliance with all requirements of this DB Section 107-2.2 have been provided. Upon the Department's request, certified, true, and exact copies of each of the insurance policies (including renewal policies) required under this DB Section 107-2.2 shall be provided to the Department.



B) Renewal Policies

The Design-Builder shall promptly deliver to the Department a certificate of insurance and copies of all endorsements with respect to each renewal policy, as necessary to demonstrate the maintenance of the required insurance coverages for the terms specified herein. Such certificate shall be delivered not less than ~~30~~ 60 calendar days prior to the expiration date of any policy and shall bear a notation evidencing payment of the premium thereof. If requested by the Department from time to time, certified duplicate copies of the renewal policy shall also be provided.

DB 107-2.2.2 Endorsements and Waivers

All insurance policies required to be provided by the Design-Builder hereunder shall contain or be endorsed to comply with the following provisions, provided that, for the workers' compensation policy, only the following clauses (D) and (F) shall be applicable:

- A) For claims covered by the insurance specified herein, said insurance coverage shall be primary insurance with respect to the insureds, additional insureds, and their respective members, directors, officers, employees, agents, and consultants and shall specify that coverage continues notwithstanding the fact that the Design-Builder has left the Site. Any insurance or self-insurance beyond that specified in this Contract that is maintained by an insured or additional insured shall be excess of such insurance and shall not contribute with it;
- B) Any failure on the part of a named insured to comply with reporting provisions or other conditions of the policies, any breach of warranty, any action or inaction of a named insured or others, any foreclosure relating to the Project, or any change in ownership of all or any portion of the Project shall not affect coverage provided to the other insureds or additional insureds (and their respective members, directors, officers, employees, agents, and consultants);
- C) The insurance shall apply separately to each insured and additional insured against whom a claim is made or suite is brought, except with respect to the aggregate limits of the insurer's liability;

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- D) Each policy shall be endorsed to state that coverage shall not be suspended, voided, canceled, modified, or reduced in coverage or in limits except after 60 calendar days' prior written notice by certified mail, return receipt requested, has been given to the Department. Such endorsement shall not include any limitation of liability of the insurer for failure to provide such notice;
- E) All endorsements adding additional insureds to required policies shall be on a form providing additional insureds with coverage for "completed operations";
-  F) Each policy shall provide coverage on an "occurrence" basis and not a "claims made" basis (with the exception of professional liability and pollution insurance policies);
- G) The commercial general liability insurance policy shall be endorsed to state that coverage for Subcontractor employees shall not be excluded; and
- H) The automobile liability insurance policy shall be endorsed to include Motor Carrier Act Endorsement-Hazardous materials clean up (MCS-90).

DB 107-2.2.3 Waivers of Subrogation

The Department and Design-Builder waive all rights against each other and their respective members, directors, officers, employees, agents, and consultants for any claims, but only to the extent covered by insurance obtained pursuant to this DB Section 107-2.2, except such rights as they may have to the proceeds of such insurance and provided further that the Design-Builder shall not be entitled to additional compensation or time extension under this Contract to the extent compensated by any insurance specified herein. The Design-Builder shall require all Subcontractors to provide similar waivers in writing each in favor of all other parties enumerated above.

DB 107-2.2.4 Commercial Unavailability of Required Coverages

If, through no fault of the Design-Builder, any of the coverages required in this DB Section 107-2.2 (or any of the required terms of such coverages, including policy limits) become unavailable or are available only with commercially unreasonable premiums, the Department will work with the Design-Builder to find commercially reasonable alternatives to the required coverages that are acceptable to the Department. The Design-Builder shall not be entitled to any increase in the Lump Sum Contract Price for increased costs resulting from the unavailability of coverage and the requirement to provide acceptable alternatives. The Department shall be entitled to a reduction in the Price if it agrees to accept alternative policies providing less than equivalent coverage, with the amount to be determined by extrapolation using the insurance quotes included in the Escrowed Proposal Documents (or based on other evidence of insurance premiums as of the Proposal due date if the Escrowed Proposal Documents do not provide adequate information). The Department's right to a reduction in the Lump Sum Contract Price as set forth in the preceding sentence shall be without regard to the insurance costs expended by the Design-Builder for the less than equivalent coverage or on other insurance required under this DB Section 107-2.2.

DB 107-2.2.5 Prosecution of Claims

Unless otherwise directed by the Department in writing, the Design-Builder shall be responsible for reporting and processing all potential claims by the Department or Design-Builder against the insurance required to be provided under this DB Section 107-2.2. The Design-Builder agrees to report timely to the insurer(s) any and all matters which may give rise to an insurance claim and to promptly and diligently pursue any and all insurance claims on behalf of the Department, whether for defense or indemnity or both. The Department agrees to promptly notify the Design-Builder of the Department's incidents, potential claims, and matters which may give rise to an insurance claim by the Department, to tender its defense or the claim to the Design-Builder, and to cooperate with the Design-Builder as necessary for the Design-Builder to fulfill its duties hereunder.

DB 107-2.2.6 Commencement of Work

The Design-Builder shall not commence Work under this Contract until it has obtained the insurance required under this DB Section 107-2.2, has furnished original certificates of insurance evidencing the required coverage as required under DB Section 107-2.2 and such insurance has been approved in writing by the Department, nor shall the Design-Builder allow any Subcontractor (or shall such Subcontractor be entitled) to commence Work under it Subcontract until the insurance required of the Subcontractor has been obtained and approved by the Design-Builder.

DB 107-2.2.7 Delaware Department of Transportation’s Right to Remedy Breach by the Design-Builder

If the Design-Builder or any Subcontractor fails to provide insurance as required herein, the Department shall have the right, but not the obligation, to purchase such insurance or to suspend the Design-Builder’s right to proceed until proper evidence of insurance is provided. Any amounts paid by the Department shall, at the Department’s sole option, be deducted from amounts payable to the Design-Builder or reimbursed by the Design-Builder upon demand, with interest thereon from the date of payment by the Department to the reimbursement date, at the maximum rate allowable under applicable law. Nothing herein shall preclude the Department from exercising its rights and remedies under DB Section 108-8 as a result of the failure of the Design-Builder or any Subcontractor to satisfy the obligations of this DB Section 107-2.2.

DB 107-2.2.8 Disclaimer

The Design-Builder and each Subcontractor have the responsibility to make sure that their insurance programs fit their particular needs, and it is their responsibility to arrange for a secure any insurance coverage which they deem advisable, whether or not specified herein.

DB 107-3 PATENTED DEVICES, MATERIALS, AND PROCESSES

The Design-Builder and the surety shall hold and save harmless the State, the Department, their officers or agents, in accordance with the terms of these Specifications, from any and all claims because of the use of any patented design, device, material, or process in connection with the work agreed to be performed under this Contract. Any patent agreement between patentee and the Design-Builder shall be furnished to the Department.

DB 107-4 RESTORATION OF SURFACES OPENED BY PERMIT

The right to construct or reconstruct any utility service in the highway or street or to grant permits to construct or reconstruct is, at any time during construction, hereby expressly reserved by the Department. The Design-Builder shall not be entitled to any damages for unauthorized digging or any delay occasioned thereby.

Any individual, firm, or corporation wishing to make an opening in the highway outside of the project limits must secure a permit from the Department. The Design-Builder shall allow parties bearing such permits and only those parties, to make openings in the highway. When ordered, the Design-Builder shall make all necessary repairs due to such openings and such necessary work will be paid for as extra work or as provided in the Contract and will be subject to the same Contract conditions as the original work performed.

DB 107-5 SANITARY CODE AND SAFETY PLAN

It is a condition of all contracts, and shall be made a condition of each subcontract entered into pursuant to the prime contract, that the Design-Builder, and any subcontractor, shall not require any person

employed in performance of the Contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to such person's health or safety.

The Design-Builder shall provide and maintain in a neat and sanitary condition, such accommodations for the use of its employees as may be necessary to comply with the requirements of the State and local Boards of Health, or of other bodies or tribunals having jurisdiction.

DB 107-5.1 Design-Builder's Safety Obligations

The Design-Builder shall perform all actions necessary for safety and be solely and completely responsible for conditions on the site, including safety of all persons and property on the site during the Contract. This requirement shall apply continuously for the duration of the Contract and shall not be limited to normal business hours or other time constraints or be reduced or diminished in any way because the Design-Builder is not given sole possession of the site. The Design-Builder is fully responsible for the safety of workers engaged upon the Project and all other persons working at or visiting the site and the protection of the public in the vicinity.

DB 107-5.2 Design-Builder's Safety Plan

The Design-Builder shall submit a written Project-specific Safety Plan that documents the Design-Builder's safety policy and which identifies and addresses specific health and safety concerns to be encountered on the Project to the Department for review and approval. Before the Work begins, and periodically throughout the Project, the Design-Builder's Project supervision staff shall meet with the Department's Project Manager to review and discuss the status of safety issues on the Project. A notice indicating that the Project's Safety Plan is available for examination by any worker employed on the Project shall be posted at the job site.

The Design-Builder shall implement, review, and update the Safety Plan and introduce a program for assuring that the Safety Plan is followed at all times. The Design-Builder shall coordinate with all authorities and relevant entities as necessary to ensure compliance with the Safety Plan.

The Departments Project Manager or designated representative will monitor and audit the Design-Builder's safety performance.

The Design-Builder's Safety Plan shall provide for the following:

- A) Planning, management, and design to avoid hazards;
- B) Detection of potential hazards;
- C) Timely correction of hazards;
- D) Dedication to the protection of the public and the workers;
- E) Active participation of all persons involved with the Contract;
- F) Dedicated safety staff; and
- G) Safety training and safety meetings.

The Design-Builder shall ensure that all its employees and those of the Subcontractors of any tier (including labor-only) are under an obligation at all times to fully conform to the provisions of the Safety Plan. In the event that the Design-Builder's employees or its Subcontractors fail to conform to the provisions of the Safety Plan, the Design-Builder shall take appropriate disciplinary measures. Such measures shall include suspension, removal of offending employees from the site, and dismissal. The obligations and requirements of this DB Section 107-5.2 shall be included in the terms and conditions of

employment of all employees of the Design-Builder and all Subcontractors of any tier, including labor-only Subcontractors.

DB 107-5.3 Content of the Safety Plan

The Safety Plan shall be comprehensive and include all required actions, activities, rules, and mitigation relative to the safety of the Work. It shall include the following items:

- A) A policy statement indicating the Design-Builder's commitment to safety, goals stated as maximum lost hours, and no loss of life goals;
- B) Identification of Department and Design-Builder safety officers, including responsibility definitions, an organization chart, reporting procedures, safety inspection procedures, and audit programs;
- C) References to all applicable governmental rules;
- D) An education and training plan for required training for all workers, including a separate program and Hazardous Materials communications plan for workers involved with hazardous and contaminated substances remediation, required toolbox meetings, and required posting of information;
- E) Procedures to address Project health and safety concerns, including housekeeping, Material handling and storage, personal protective equipment, wall and floor openings, scaffolds, ladders, welding, flame cutting, electrical Equipment, lock-out or tag-out, motor vehicles, heavy Equipment, small tools, concrete forms, steel erection, cranes and hoisting, Work platforms, fire prevention and protection, sanitation, confined space entry, blasting and explosives, and other items;
- F) Industrial hygiene, including respiratory protection, noise, Hazardous Materials, and lists of hazardous chemicals present;
- G) Fire protection and prevention;
- H) Emergency and rescue procedures, including detailed procedures for all types of emergencies, such as, medical, fire, chemical spill, property damage, bomb threat, severe weather, flooding, explosion, and earthquakes;
- I) Incident investigation, reporting, and record keeping;
- J) Policy for substance abuse;
- K) Security provisions;
- L) Safety requirements and procedures for surveyors and engineering personnel conducting site investigations and verification sampling and testing; and
- M) Procedures for compelling worker compliance with health and safety requirements.

The Safety Plan shall contain a list of the detailed safety procedures to be followed. Safety procedures shall be prepared separately for individual activities and these detailed procedures shall be appendices to the Safety Plan.

Certain of these items may be submitted in the format of the Design-Builder's health and safety program, with the Project's Safety Plan limited to Project-specific issues.

The Design-Builder shall be responsible for ensuring that each Subcontractor employed on the Project complies with this requirement. The Design-Builder shall provide to the Department a Project Safety Plan

covering all Work to be done by a specific Subcontractor prior to that Subcontractor starting Work. As an alternate, the Design-Builder may provide a certification that all activities performed by, and workers employed by, Subcontractors will be subject to the Design-Builder's Project Safety Plan. Submission of the required Project Safety Plan by the Design-Builder and its acceptance by the Department shall not be construed to imply approval of any particular method or sequence for addressing health and safety concerns or to relieve the Design-Builder from the responsibility to adequately protect the health and safety of all workers involved in the Project as well as any members of the public who are affected by the Project.

DB 107-5.4 Submittal of the Safety Plan

Prior to the start of any field Work or construction, the Design-Builder shall submit its Safety Plan to the Department's Project Manager for written approval. Upon receipt of approval, the Design-Builder shall issue the complete Safety Plan, which will be based on the Design-Builder's Safety Plan information contained in its Proposal along with the incorporated comments of the Department's Project Manager and any other required updating. The Safety Plan shall be a controlled document to be issued by the Design-Builder to, at least, the following persons:

- A) The Department's Project Manager;
- B) The Department's designated representative;
- C) The Design-Builder's Project Manager;
- D) The Design-Builder's Safety Manager; and
- E) Subcontractors of any tier, including labor-only Subcontractors.

Other controlled copies shall be distributed as determined by the Design-Builder and the Department's Project Manager. Uncontrolled copies shall be issued as considered necessary by the Design-Builder.

The Design-Builder shall maintain a traceable record of the issuance of the controlled copies including numbering and acknowledgement of receipt. Revisions of the Safety Plan shall be issued to all recipients of the controlled copies and managed in the same way as the controlled copies.

DB 107-5.5 Revisions to the Safety Plan and Procedures

The Department's Project Manager may require a revision to the Safety Plan or any safety procedure in order to ensure compliance with the Contract. The Design-Builder shall, following discussion with the Department's Project Manager, issue such revision within 30 Calendar Days of receipt of the instruction. A revision shall include an addition, omission, or revision, as applicable.

The Design-Builder shall review the Safety Plan and any safety procedure in order to revise it in accordance with activities and experiences on the site. Such revision, from time to time, shall enhance the standards of safety being implemented on the site. At the very least, procedures shall be reviewed and new procedures issued whenever the character or extent of any activity is changed or a new activity of a different nature is introduced which necessitates such revision.

In addition to such revision, the Design-Builder shall make a formal review of the Safety Plan once every 12 months on or near the anniversary of NTP. Such formal review shall consider all matters pertaining to safety planning and implementation, including, accident reports, inspections, audits, suggestions from meetings, and other sources, such as, the Department's Project Manager and hazard analysis reviews. Within seven Calendar Days of finishing this review, the Design-Builder shall issue a review report to the Department's Project Manager, giving the conclusions of the review and identifying the revisions to be made to the Safety Plan.

Within 30 Calendar Days of the issue of the review report, the Design-Builder shall issue a revised Safety Plan for review and written Approval by the Department's Project Manager.

DB 107-5.6 Compliance with Laws and Regulations

The Safety Plan and its implementation shall comply in all respects with all applicable federal, state, and local laws, regulations, and governmental rules.

DB 107-5.7 The Design-Builder's Safety Organization

The Design-Builder shall designate a member of its board of directors, if it is a corporation or a Joint Venture (JV), or a principal of its organization who shall be responsible and directly accountable to the Department in all matters concerning safety. The Design-Builder shall also require the Design-Builder's Project Manager to be responsible and directly accountable to this designated safety board member or principal in all matters concerning construction safety.

The Design-Builder shall appoint, within 30 Calendar Days of NTP, a Safety Manager whose Project duties shall be solely connected with the safety aspects of the Project and who shall report directly to the designated safety board member or principal. Such an appointment shall be subject to written acceptance by the Department's Project Manager. The Safety Manager shall be suitably qualified and experienced as specified in Part 4 – Special Provisions, Special Provision 108B. The Safety Manager shall implement, maintain, and monitor compliance with the Safety Plan and all safety procedures, and be based full-time at the site.

The Design-Builder shall provide and maintain an organizational structure that shall ensure the effective control of the Project's safety assurance tasks by the Design-Builder's safety staff. Such staff shall be engaged solely in safety assurance. Responsibilities and task subdivision shall be clearly identified in the Safety Plan, and shall show direct lines of communication and reporting between the Design-Builder's Safety Manager and the designated safety board member or principal and between the Design-Builder's Safety Manager and the Design-Builder's Project Manager.

The Design-Builder shall not remove the appointed Safety Manager without the prior written consent of the Department's Project Manager. The Design-Builder shall nominate a replacement at the same time consent is sought.

If the Safety Manager is removed, a suitably qualified and immediately available replacement shall be proposed to the Department's Project Manager within 14 Calendar Days of receipt of the notice requiring the removal.

The Design-Builder shall provide adequate numbers of supporting staff for the Safety Manager, including a deputy to act in his/her absence.

The Design-Builder shall not commence any Work on the site until the safety manager has been appointed and accepted by the Department's Project Manager and has commenced duties on the site.

The Design-Builder shall ensure that all Subcontractors of any tier whatsoever, including labor-only Subcontractors, shall provide adequate safety staff.

Each Subcontractor of every tier, including labor-only Subcontractors, shall have a safety supervisor who shall have appropriate experience and training. Each Subcontractor safety supervisor shall be responsible for implementing and maintaining its respective safety plan. Subcontractor safety supervisors shall

devote a substantial amount of their time to such duties. All Subcontractor safety plans shall at all times conform to the Design-Builder's Safety Plan.

Breaches of the Design-Builder's Safety Plan or other conduct prejudicial to safety may be cause for the Department's Project Manager to require the removal of any employee, including the Design-Builder's Project Manager or Safety Manager, from the site.

The Design-Builder shall give authority to the Safety Manager and safety staff to issue stop orders that instruct employees of the Design-Builder and its Subcontractors of any tier, including labor-only Subcontractors, to cease operations and take urgent and appropriate action to make the site safe and prevent unsafe working practices or other infringements of the Safety Plan or breach of any governmental rules.

The Design-Builder shall require its Safety Manager to verify by inspection that the requirements of this DB Section 107-5 and the Design-Builder's Safety Plan and safety procedures are being strictly complied with. In the event of any non-compliance, the Safety Manager shall forthwith issue an instruction to stop Work until the non-compliance is rectified. If the Design-Builder considers the non-compliance to be of a minor nature implementation may be delayed 24 hours, with the Department's consent. If the Department's Project Manager states that such delay is acceptable, the Design-Builder may suspend implementing the instruction for 24 hours and resume working. During the 24-hour period, the Design-Builder shall rectify the non-compliance.

No Work shall be performed on site unless the Design-Builder's Safety Manager or designated deputy is on site. Work shall not be performed at the site unless the specified safety supervisors are on the site.

The Design-Builder shall make provisions for local emergency service to respond to any emergencies or problems at the Project site and shall provide adequate emergency medical care to personnel working on the site. The Design-Builder shall also have personnel trained in First Aid and Cardio-Pulmonary Resuscitation (CPR) at the Project site at all times that Work is on-going.

DB 107-5.8 Safety Considerations in Design

The Design-Builder shall identify and analyze the hazards and risks associated with the Work, including during construction and its ultimate use, and shall design the Work so as to eliminate, mitigate, or control such hazards.

DB 107-6 SITE SECURITY

DB 107-6.1 Requirements

The Design-Builder shall be responsible for the security of the site and the Work, including the facilities provided by the Design-Builder for the Department, from the date the Project is released to the Design-Builder until Final Acceptance. This shall include the protection of offices, workshops, Equipment, Material, and the Work from damage by vandalism, flood, storm, fire, and theft.

The site shall be adequately protected at all times to prevent unauthorized access onto the site, particularly to areas of high safety risk. This protection shall include security fencing at areas of high safety risk to the public as well as areas with high risk of vandalism and other areas where necessary for the Design-Builder to fulfill obligations under the Contract. All necessary access for the public through the site shall be adequately protected.

The Design-Builder shall provide adequate lighting and guarding at main security areas, such as, offices, facilities for the Department provided by the Design-Builder, Work areas, and storage yards.

The Design-Builder shall establish and maintain a system and people to control and guide visitors to and around the site.

DB 107-6.2 Site Security Plan

The Design-Builder shall prepare and submit to the Department's Project Manager, for written approval, a Site Security Plan within 60 Calendar Days of NTP, describing the Design-Builder's procedures for securing the site. The Site Security Plan shall include the security requirements described in DB Section 107-06.1. If the Department's Project Manager objects to the Site Security Plan, it shall be amended so as to resolve all objections. The Design-Builder shall review and update the Site Security Plan on a regular basis, and provide copies of any changes to the Department's Project Manager for written approval.

DB 107-6.3 Reports

The Design-Builder shall submit a security report, reporting any security-related incident, with the monthly progress report.

DB 107-7 PUBLIC CONVENIENCE AND SAFETY

In performing the work, the Design-Builder shall interfere as little as possible with traffic. The Design-Builder shall provide and maintain ingress and egress for all residences and places of business located along the construction route. So far as practicable, materials stored upon the highway shall be placed so as to cause as little obstruction to the traveling public as possible. If, as determined by the Project Manager, it is necessary to keep the road or any portion of it open to travel during the construction thereof, the Design-Builder shall so perform the work and provide such means that travel will not be obstructed or endangered. The Design-Builder shall provide and maintain in an acceptable condition such temporary roadways and bridges as may be necessary to accommodate the traffic using or diverted from the roadway under construction, and shall provide and maintain in a safe condition temporary approaches to and crossing of intersecting highways. All sidewalks, gutters, sewers, inlets, and portions of the highway adjoining the roadways under construction shall not be obstructed more than is absolutely necessary.

DB 107-8 NAVIGABLE WATERS AND WETLANDS

All Work in, over, or adjacent to navigable waters or wetlands shall be conducted in accordance with rules and regulations of the United States (US) Army Corps of Engineers and US Coast Guard.

Navigable clearances on waterways shall not be infringed upon, and existing navigable depths shall not be impaired except as allowed by permits issued by the responsible agency.

The Department has obtained permits from the US Coast Guard and US Army Corps of Engineers relative to approval of construction plans for bridges, causeways, embankments, dredging, and spoil disposal for the Indian River Inlet Project (includes bridge, roadway approaches, demolition and park improvements). The Design-Builder will be furnished a copy of the permit and shall comply with all provisions and conditions of the permits. When required by permit, upon completion and before Final Acceptance of the Project, the Design-Builder shall furnish the Department's Project Manager 8-by-10-inch color photographs of the bridge from abutment to abutment, two photographs looking from the ocean side and two looking from the bay side . The prints shall be glossy finish, mounted on linen. These photographs will be furnished at no direct pay.

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The Design-Builder shall prepare reproducible drawings complying with the standards of the US Coast Guard and the US Army Corps of Engineers showing falsework construction, test piles or other temporary pile driving operations, erection sequence, temporary navigational lighting, location of Equipment and barges in the navigable limits, and other drawings required by the permit agencies. Drawing sizes shall be a minimum of 8-by-10 1/2 inches with a one-inch border on the top or short side or as required by the permitting agency. The drawings shall be submitted to the Department's Project Manager for transmittal to the appropriate agency. Construction of falsework, or operation of construction Equipment within the navigable limits shall not commence until drawings are approved. The installation of test piles and/or permanent piles within the waterway will not be permitted by the Department.

The Design-Builder shall display lights on Equipment operating, berthed, or moored in navigable waters, and provide temporary navigational lighting on temporary and permanent construction in the navigable limits as required by the US Coast Guard.

Should the Design-Builder sink, lose, or throw overboard any Material, machinery, or Equipment that may be dangerous to navigation, it shall be immediately removed or recovered. The Design-Builder shall give immediate notice of such obstruction to proper authorities and, if required, shall mark or buoy such obstruction until it is removed.

The Design-Builder shall not deposit excavated material into the water-way or wetland without a permit from the appropriate agency.

All operations in connection with the Work shall be in accordance with permits, rules, and regulations of the US Army Corps of Engineers and the US Coast Guard. Deviations therefrom shall be only by special permission or special permit which shall be the responsibility of the Design-Builder to obtain. Failure of the Design-Builder to become familiar with the terms, conditions, and provisions of the permits, rules, and regulations applicable to the Work shall not relieve the Design-Builder of responsibility under this Contract.

The Design-Builder shall conduct operations to cause minimum interference with marine operations. If such interference is necessary, the Design-Builder shall notify the Department's Project Manager, in writing, sufficiently in advance so that the Department may obtain approval from the US Coast Guard at least three weeks prior to said interference.

Copies of permits previously obtained by the Department are available in Part 3 -Appendix A. Any permit modifications or new permits required to accommodate the bridge design shall be obtained by the Design-Builder. Any necessary requests for time extensions will be made by the Department for existing Department-obtained permits.

Copies of any special permits obtained by the Design-Builder shall be submitted immediately to the Department's Project Manager.

DB 107-9 BARRICADES AND WARNING SIGNS

The Design-Builder shall provide, erect, and maintain necessary barricades, suitable lights, danger signals, signs, and other traffic control devices, including flaggers, and shall take all necessary precautions for protection of the Work and safety of the public. Highways closed to traffic shall be protected by effective barricades. Suitable warning signs shall be provided to direct traffic.

The Design-Builder shall erect and maintain warning signs in advance of any place on the Project where operations may interfere with vehicular and/or pedestrian traffic and at intermediate points where new Work crosses or coincides with an existing Road, sidewalk, or pathway.

DB 107-10 *SEE D B SECTION 104-4 FOR ADDITIONAL REQUIREMENTS. USE OF EXPLOSIVES*

Explosives shall not be used without prior written approval by the Department's Project Manager. When the use of explosives is necessary for the prosecution of the work, the Design-Builder shall exercise the utmost care not to endanger life or property, including new work. The Design-Builder shall be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Project Manager and not closer than 1000 feet from the road or from any building or camping area or place of human occupancy.

The Design-Builder shall notify each public utility company having structures in proximity to the site of the work of its intention to use explosives. Such notice shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from damage.

The use of explosives will not be permitted within 200 feet of any existing, newly finished, or partly finished structure on a project unless authorized in writing by the Project Manager. No explosives shall be stored overnight on the Project.

DB 107-11 PROTECTION AND RESTORATION OF PROPERTY

The Design-Builder shall be responsible for the preservation of all public and private property, trees, monuments, etc., along and adjacent to the roadway not designated on the Plans for repair, removal, or construction. The Design-Builder shall take the precautions necessary to prevent damage to pipes, conduits, and other underground structures, and shall protect from disturbance or damage all land monuments and property markers until authorized by the Project Manager. Any land monument or property markers damaged or disturbed shall be located and reset by Land Surveyors or a Professional Engineer registered in the State of Delaware. The Design-Builder shall not injure or destroy trees or shrubs outside the limits of the graded roadway section, nor remove or cut them without proper authority. Where any direct or indirect damage is done to public or private property on account of any act, omission, neglect, or misconduct in the execution or non-execution of the work on the part of the Design-Builder, such property shall be restored at the Design-Builder's expense to a condition similar or equal to that existing before such damage.

In case of the failure on the part of the Design-Builder to restore such property or make good such damage, the Project Manager may upon giving 48 hours notice proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any monies due to the Design-Builder under the Contract. This responsibility will not end until Final Acceptance.

DB 107-12 EROSION, SEDIMENT CONTROL, AND WATER POLLUTION

DB 107-12.1 Definitions

Clearing. The clearing of trees, brush, shrubs, downed timber, rotten wood, rubbish, and any other vegetation, except where excluded by the definition for grubbing, as well as the removal of fences and structures. *See* the DelDOT Standard Specifications, August, 2001, Subsection 201.01.

Disturbed Area. An area where any activity has been initiated which may result in soil erosion from water or wind or movement of sediments or pollutants into state waters or onto lands in the state, or which may result in accelerated stormwater runoff, including, but not limited to, clearing, grubbing, grading, excavating, transporting, filling, and backfilling of land.

Grubbing. Shall mean the removal from the ground of trees, stumps, roots, brush, root mat, and debris.

Phasing. Staged construction sequencing as shown on the erosion and sediment control plans and the maintenance of traffic plans.

DB 107-12.2 Legal Authority

The Department is a delegated agency of the DNREC as defined in Chapter 40, Title 7 of the Delaware Code and the Delaware Sediment and Stormwater Regulations. Any project built under the Contract documents shall maintain compliance with the aforementioned law and regulations at all times throughout the life of that project. As a delegated agency, the Department may enforce compliance with the law and regulations through the Contract documents or may refer a project to the DNREC for enforcement action.

DB 107-12.3 Sediment and Stormwater Permit Approval.

A signature, date, and seal on the title sheet of the Plans by the Department's Stormwater Engineer indicating the Plans have been reviewed "As To Process" indicates that the Plans were designed in conformance with the applicable State and Federal stormwater regulations and that the Sediment and Stormwater Permit is approved. All Work shall be completed pursuant to the Plans.

Review and approval of the erosion, sediment control, and water pollution control plan or errors and omissions in the Plans shall not relieve the Design-Builder from its responsibilities for compliance with the Delaware Sediment and Stormwater Regulations or other applicable laws or regulations and the more stringent water pollution control requirements shall apply.

DB 107-12.4 Description of Work

Erosion and sediment control measures shall be applied to erodible earth material exposed by any of the Design-Builder's land disturbing activities on the Project. The Work shall consist of the application of temporary and permanent erosion and sediment control items as provided in the Contract or ordered by the Project Manager. The temporary erosion control items shall be coordinated with the permanent erosion control items specified. The items shall include, but are not limited to, the use of berms, dikes, dams, sediment basins, traps, geotextiles, stone check dams, silt fences, phased construction, special land grading methods, mats and nets, aggregates, mulches, grasses, slope drains, chemical binders, tackifiers, and other erosion and sediment control items or approved methods as designated in the Contract documents or as directed by the Project Manager.

See Part 3 – Design Requirements.

DB 107-12.5 Completion of the Work

This Subsection sets forth the methods of construction operations, progress schedules, and construction phasing, staging, and sequencing for the completion of temporary or permanent erosion and sediment control work.

The Design-Builder shall implement the temporary and permanent erosion control items for each phase of construction as detailed in the Contract documents. Additional erosion and sediment control items may be required from time to time during the life of the Project as deemed necessary by the Project Manager in order to provide continuous erosion and sediment control protection.

Before starting each phase of any land-disturbing activity, the Design-Builder shall make certain that all erosion and sediment control items required in that phase are installed and functional.

- A) **Construction Phasing.** For Project sites in excess of 20 acres (8 ha), the construction must be phased in 20 acre (8 ha) increments. Once grading is initiated in one 20 acre (8 ha) increment, a second 20 acre (8 ha) increment may be cleared and grubbed provided the Design-Builder installs and maintains effective erosion and sediment control measures on both sections in such quantities and locations as deemed acceptable by the Project Manager.

When balancing earthwork, such as when borrow from a cut is used as fill at a noncontiguous location distant from the cut, more than a total of 20 acres (8 ha) may be allowed to be grubbed and graded within the overall limits of the Project at any one time with prior written approval from the Project Manager. In such cases, one 20 acre (8 ha) increment in cut and one 20 acre (8 ha) increment in fill may be grubbed and graded at each separate location concurrently. Examples of when this would likely occur would be on interchange construction or on a new alignment.

The Project Manager may further limit the area of clearing, grubbing, stripping, and grading operations to the Design-Builder's capability and actual progress of keeping the finish grading, mulching, seeding, and other temporary or permanent erosion control measures current according to the approved progress schedule and construction sequence.

- B) **Construction Sequence.** The Design-Builder shall sequence the construction to comply with the following constraints unless indicated otherwise on the Plans:
1. Implement temporary erosion and sediment control items prior to any operation that exposes soil to erosion, such as during the clearing portion and prior to the grubbing portion of each phase of construction.
 2. Schedule and perform the clearing and grubbing operations so that grading operations and permanent stabilization can follow immediately thereafter. Once earthwork has begun, the operation shall be continuous from clearing and grubbing through to completion of grading and final stabilization in accordance with DB Subsection 107-12.9 A.2. Any interruption in these operations in excess of 14 calendar days must be approved by the Project Manager and shall require interim stabilization in accordance with DB Subsection 107-12.9 A.1.
 3. Vegetatively stabilize bare soil areas in each phase of construction in accordance with DB Subsection 107-12.9 A.1. prior to advancing the work into the next phase of construction.

4. Vegetatively stabilize all cut and fill slopes of the highway excavation and embankment as the work progresses in height increments not to exceed 10 feet (3 m) measured along the slope surface.
5. Excavate roadside ditches as early in the Project as possible to establish good drainage.
6. Vegetatively stabilize all grass ditches, swales, and medians within seven calendar days after their initial excavation.
7. Remove temporary erosion and sediment controls after final stabilization is complete in accordance with DB Subsection 107-12.9 A.2. Return land contours to original grade or as indicated on the Plans, and vegetatively stabilize any remaining bare soil areas.

DB 107-12.6 Plan Changes

The Design-Builder shall not deviate from the Plans without prior review and approval by the Project Manager and appropriate regulatory authorities. Those portions of the Plans which are normally covered by environmental permits include, but are not limited to, erosion and sediment control, stormwater management, construction sequencing, stream diversions, and site dewatering.

For plan changes initiated by the Design-Builder, revised construction Plans shall be submitted for review and approval by the Project Manager. The revised Plans shall be prepared in accordance with current Department standards for roadway design, traffic control, erosion and sediment control, and stormwater management. Revised Plans shall also conform to all applicable Federal, State, or municipal pollution control laws, rules, or regulations. All supporting design calculations and cost analyses required by the Project Manager shall accompany the submission. The number of copies required to be submitted for review shall be determined by the Project Manager depending on the nature of the proposed revision.

Design-Builder proposed revisions to the Plans, as well as review time by the Department, will not justify a delay in the progress schedule. All costs involved in preparing plan revision documents for changes proposed by the Design-Builder shall be the responsibility of the Design-Builder.

DB 107-12.7 Limits of Construction

The Design-Builder shall not perform any work including, but not limited to, clearing, grubbing, construction phasing, equipment storage, and material stockpiling outside the limits of construction shown on the Plans without prior approval of the Project Manager.

If the Design-Builder chooses to use additional lands that are not within Department rights-of-way or easements, it shall be the Design-Builder's responsibility to make all arrangements with the property owners and to acquire all permits from the appropriate regulatory authorities for the use of these lands.

The Design-Builder shall acquire a statement signed by the property owners that releases the Department from all claims arising from the use of the property being considered. The signed statement from the property owner and copies of all permits acquired by the Design-Builder shall be transmitted by the Design-Builder to the Project Manager for the Project Manager's records prior to initiating any operation on the property being considered for use.

DB 107-12.8 Site Reviewer

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A Site Reviewer shall be a person from the Design-Builder’s staff assigned to erosion and sediment control implementation and maintenance and shall be required on specific projects as noted in the Plans. The name and DNREC certification number of each Site Reviewer so required shall be submitted to the Department prior to construction activities beginning. The Site Reviewer may receive certification directly through the DNREC Division of Soil & Water Conservation. Additional details may be found online at <http://www.dnrec.state.de.us/DNREC2000/Divisions/Soil/Stormwater/StormWater.htm>.

DB 107-12.9 Vegetative Stabilization

- A) *Interim and Final Stabilization.* An area of the work shall be considered vegetatively stabilized for erosion control if it meets the criteria in one of the following two cases:
 - 1) *Interim Stabilization.* The seeding and mulching items, sod, or erosion and sediment control items as noted on the Plans are in place and accepted by the Project Manager.
 - 2) *Final Stabilization.* Meets the requirement for the removal of the temporary erosion controls placed during interim stabilization and complete growth of vegetation has occurred to the satisfaction of the Project Manager. Complete growth of vegetation includes permanent grass reaching a height of 3” (75 mm) over all areas seeded.

- B) *Incremental Stabilization.* Side slopes, and other slopes 1:3 (vertical to horizontal) or steeper require placement of either temporary or permanent seeding and mulching as the work progresses in height increments not to exceed 10 feet (3 m) measured along the slope surface.

- C) *Tracking of Slopes.* During grading operations the Design-Builder shall track all slopes 1:3 (vertical to horizontal) or steeper to prevent gully and sheet erosion. The tracking shall be accomplished by driving cleated equipment such as a bulldozer up and down the slopes so the cleats make horizontally oriented indentations in the soil. All tracking of slopes shall be in accordance with Section 202 of the Standard Specifications. Prior to applying seeding items on slopes 1:3 (vertical to horizontal) or steeper, the Design-Builder shall track the slopes as described above in order to prepare a stable seedbed. All costs associated with tracking of slopes to prepare a seedbed shall be incidental to the seeding item being applied to the slope surface.

- D) *Maximum Soil Exposure Times.* All erodible earth material exposed by the Design-Builder’s activities shall be vegetatively stabilized within the time frames specified below:

<i>Location</i>	<i>Maximum Time to Vegetatively Stabilize</i>
Sediment controls (berms, ditches, traps, basins, etc.)	Seven calendar days from initial construction
Areas meeting final grades	Seven calendar days from completion of grading
Areas not meeting final grades	Fourteen calendar days from ceasing work in that location

DB 107-12.10 Temporarily Stockpiled Material

Erodible earth material designated on the Plans or required by the Project Manager to be excavated and temporarily stockpiled for later use in the Project shall be located away from live streams and wetlands, kept within Department rights-of-way and easements, and placed only in areas deemed appropriate by the Project Manager.

The Design-Builder shall install the erosion and sediment control items designated on the Plans or as directed by the Project Manager about the base of the pile in advance of the actual stockpiling operation. Erodible earth material shall be placed in piles of neat conformations. Side slopes shall be seeded and mulched as the pile is placed in height increments of 10 feet (3 m) measured along the slope surface. All remaining unstabilized surfaces shall be seeded and mulched immediately following completion of the stockpiling operation.

If the Design-Builder proposes to stockpile erodible earth material in areas not designated on the Plans for such use, it shall be the Design-Builder's responsibility to prepare and submit for approval by the Project Manager erosion and sediment control plans for those proposed areas that are located within Department rights-of-way and easements. Materials shall not be stockpiled until an erosion and sediment control plan for the proposed stockpile has been approved by the Project Manager.

If the Design-Builder proposes to stockpile erodible earth material in areas outside of Department rights-of-way and easements, it shall be the Design-Builder's responsibility to prepare and submit for approval a plan for the use of the proposed site to the appropriate agencies having jurisdiction. No stockpiling operation shall commence in areas outside the Department rights-of-way and easements until the Project Manager has received copies of all plans approved by the appropriate regulatory agencies and received copies of statements signed by the property owners, as required under DB Section 107-12.7, which release the Department from any claims arising from the use of the property.

DB 107-12.11 Channel and Ditch Scour Protection

Riprap or other proposed channel lining items designated on the Plans at pipe, culvert, and bridge inlets and outlets and along channel lengths shall be placed before the pipes, culverts, bridges, and channels become operational.

DB 107-12.12 Sediment-Laden Runoff

Stormwater runoff from disturbed areas shall be directed to an approved sediment control measure, such as a trap or basin, prior to release to ditches, storm drain systems, streams, or surface water bodies of any type. All storm drain pipes which convey sediment-laden runoff shall discharge to a sediment trap or sediment basin prior to release from the Project limits of construction as shown on the Plans, or as directed by the Project Manager.

DB 107-12.13 Dewatering Operations

The Design-Builder shall not pump or otherwise withdraw water from below the water table at a rate exceeding 50,000 gallons per day without having first obtained the necessary water allocation and well permits.

The Design-Builder is responsible for obtaining all permits required from the appropriate issuing authority (DNREC) for the withdrawal of groundwater from the Project site. Costs associated with water allocation and water well permit acquisition shall be paid by the Design-Builder. The Design-Builder shall submit copies of all permit approvals to the Project Manager for the Project Manager's records.

Sediment-laden dewatering discharge shall be directed to an approved sediment trapping device such as a dewatering basin, portable sediment tank, sediment trap, or sediment basin, prior to release to ditches, storm drain systems, streams, or surface water bodies of any type.

Prior to initiating a pumping operation to remove water from open excavations or temporary cofferdams, the area to be dewatered shall be allowed to rest undisturbed under quiescent conditions for a period of 12 hours in order to induce physical settling of suspended particles.

The Design-Builder shall attach the suction line of the pumping equipment to a flotation device, immersing the intake end no more than 6” below the water surface. In this manner, water shall be “skimmed” off the surface.

Once the water level has been pumped down, further dewatering shall be accomplished in conjunction with a sump pit constructed in conformance with Department standards or as directed by the Project Manager.

DB 107-12.14 Clean Water Diversions

Stormwater runoff from non-disturbed areas shall be directed away from work areas using any combination of dikes, swales, and slope drains or as shown on the Plans, or as directed by the Project Manager.

DB 107-12.15 Stream Diversions

The Design-Builder shall not conduct work in a stream without having first obtained the appropriate wetland and subaqueous lands permit(s).

When work is to be conducted in the flow line of a stream, whether the stream is perennial or intermittent, the Design-Builder shall use any combination of dikes, swales, ditches, cofferdams, pipes, pumps, and other devices as shown on the Plans, or as directed by the Project Manager to direct the stream flow around the work area.

DB 107-12.16 Temporary Stream Crossings

Equipment shall not be operated in live streams without a stream diversion being installed to the satisfaction of the Project Manager. Temporary bridges or other structures shall be installed if the work requires the crossing of a stream by construction equipment

DB 107-12.17 Wash Water

Water containing sediment from any construction activity on the Project such as saw cutting, milling, aggregate washing, and equipment washing and which is not regulated as waste water under State or Federal statutes shall be discharged to a sediment trapping device and treated by filtration or settling. Sediment-laden wash water shall not be discharged directly to any stream or waterbody of any type.

DB 107-12.18 Waste Water

Water containing pollutants such as raw sewerage, bitumen, fuels, lubricants, paint, or other harmful materials, is strictly regulated under State and Federal statutes and as such shall not be discharged into waters of the State as defined in Chapter 60, Title 7 of the Delaware Code or into natural or manmade channels or storm drain systems leading to waters of the State.

The Design-Builder is responsible for obtaining all permits required from the appropriate issuing authority for the discharge of waste waters from the Project site. Costs associated with waste water permit acquisition shall be paid by the Design-Builder. The Design-Builder shall submit copies of all permit approvals to the Project Manager for the Project Manager's records.

DB 107-12.19 Water Pollution Violations Enforced

If a water pollution control violation exists on the Project which in the Project Manager's judgment poses a public health or safety risk, such as a fuel or chemical spill or release of raw sewerage, the Project Manager may refer the violation to the DNREC for immediate enforcement action. The cost of clean up shall be the sole responsibility of the Design-Builder if the DNREC investigation reveals the Design-Builder's actions caused the violation.

DB 107-12.20 Maintenance

Erosion and sediment control items shall be maintained during the construction season as well as the winter months and other times when the Project is closed down. The Design-Builder shall inspect the Project site immediately after each rain and repair, replace, or maintain any erosion and sediment control item promptly as needed or as directed by the Project Manager. Any eroded surface shall be stabilized, and any accumulated sediment not trapped by a control measure shall be removed and disposed of in an approved stockpile area or hauled off-site. Access shall be maintained to all sediment control devices until construction phasing and stabilization allow the removal of those controls that are no longer required.

Costs associated with repairing, replacing, and maintaining the erosion and sediment control items are incidental to the initial construction of each item

DB 107-12.21 Erosion and Sediment Control Reports

The Department will provide the Design-Builder with erosion and sediment control reports on a regular basis. The reports will itemize work required to maintain compliance with the Contract. The Design-Builder shall complete the items of work listed by the completion dates indicated on the reports.

DB 107-12.22 Failure to Implement and Maintain Erosion and Sediment Control Measures

Controlling erosion and sedimentation is the Design-Builder's responsibility under the Contract. If the Design-Builder fails at any time to implement and maintain the required erosion and sediment control provisions of the Contract, the Project Manager will notify the Design-Builder, orally or in writing, to comply with the required erosion and sediment control provisions. If the Design-Builder fails to perform the work as directed by the Project Manager, the Project Manager may take the following actions in the order listed below to gain compliance with the Contract.

- A) *Stop Work Order.* If the Design-Builder continues to fail to implement and maintain the erosion and sediment controls after oral or written direction to do so by the Project Manager, or continues not to follow the approved construction phasing, sequencing, and progress schedule, the Project Manager may order a "Shut-Down" of all land-disturbing activities except those necessary to bring the site into compliance with the Contract. The Project Manager will establish a time frame for completion of the erosion and sediment control work.

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If the unsatisfactory construction procedures and operations are not corrected promptly after the initial “Shut-Down”, the Project Manager may suspend the performance of other construction until all items of work on the erosion and sediment control reports are complete and accepted.

No claims for additional time or money shall be considered due to “Shut-Downs” resulting from the Design-Builder’s failure to implement and maintain the required erosion and sediment control items or failure to follow the approved construction phasing, staging, sequencing, and progress schedule required by the Contract documents.

- B) *Withhold Progress Payment.* If the Design-Builder fails to bring the erosion and sediment controls into compliance with the Contract documents or fails to proceed in accordance with the approved construction phasing, staging, and sequencing after oral or written direction from the Project Manager to do so and after a “Shut-Down” of all land-disturbing activities, then no monthly estimate or payment will be made. No payment will be made until all items of work on the erosion and sediment control reports are complete and accepted. *See DB Section 102-19 and DB Section 109-12.*
- C) *Deduct Cost of Work Completed By Others.* If the Design-builder fails to remedy unsatisfactory conditions within the time frame established and after all land-disturbing activities have been shut down and payment has been withheld, then the Project Manager may proceed with adequate forces and equipment to implement or maintain the erosion and sediment control items necessary to bring the Project into compliance with the Contract documents. The entire cost of this work for engaging an on-call contractor and administering the on-call contractor will be deducted from monies due the Design-Builder on the Contract.
- D) *Default of Contract.* More than one “Shut-Down” for erosion and sediment control noncompliance may be considered as a failure to perform the terms of the Contract and will be grounds for finding the Design-Builder in default of the Contract in accordance with DB Section 108-8. If the Design-Builder defaults on the erosion and sediment control provisions of the Contract, the Project will be referred to the DNREC for enforcement action.

DB 107-13 AIR NAVIGATION

The Department has obtained a permit (or a determination of no hazard to air navigation) from the Federal Aviation Administration (FAA) for all permanent Structures and temporary Structures (such as, equipment, falsework, construction cranes). The Design-Builder shall obtain new permits if the final design of the bridge or temporary works required to construct the bridge exceed the limits outlined in the existing permit.

If required, the Design-Builder shall complete a separate FAA Notice of Proposed Construction or Alteration (*see* <http://forms.faa.gov/forms/faa7460-1.pdf>) for both the permanent structure and any temporary structures. The Design-Builder shall receive any appropriate approvals or clearances from the FAA pursuant to the Notice of Proposed Construction or Alteration prior to commencing with any construction on the Project in accordance with the notice. The FAA Notice of Proposed Construction or Alteration may be applied for electronically at the FAA’s Web site, <http://oeaaa.faa.gov>, and using the E-filing area.

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The Notice of Proposed Construction or Alteration shall be submitted for review and approval to the FAA, with a copy to the Department's Project Manager. Construction and operations in connection with the Work for protection of aerial navigation shall be in accordance with the approved permit or Notice of Proposed Construction or Alteration and applicable federal regulations. Failure of the Design-Builder to be familiar with applicable rules and regulations of the FAA shall not relieve the Design-Builder of responsibility under this Contract.

DB 107-14 RESPONSIBILITY FOR DAMAGE CLAIMS

The Design-Builder shall assume the responsibility and liability for, and shall indemnify and save harmless the Department, its officers, and employees, from and against all suits, actions, claims, and all damages, direct or indirect, of whatever nature, caused to any person(s) or property or resulting to the work from any act, work, or plan performed or submitted by the Design-Builder or upon its behalf; including but not limited to responsibility of the Design-Builder to provide for the protection and safety of all persons and property. This indemnification and save harmless requirement shall apply, but not be limited to, all suits, actions, claims brought, and all damages resulting from any death, injury, or damage received or sustained by any person(s), third person(s), or property based upon:

- A) Operations of the Design-Builder, including but not limited to work performed; neglect in safeguarding the work; use of unacceptable materials; any act, work, or plan performed or submitted by the Design-Builder on its behalf or resulting from performance, nonperformance of the work, or any omission, neglect, or misconduct occurring during the course of the Contract.
- B) Any claim(s) or amount(s) recovered from any infringement(s) of patent, trademark, or copyright.
- C) Any claim(s) or amount(s) arising or recovered under the "Workers Compensation Act", for any violation or alleged violation of any law, ordinance, rule, regulation, order, or decree.

The Department may withhold as retainage for the use of the State to pay any amount claimed or anticipated, as determined by the Project Manager, except that such money shall not be withheld when the Design-Builder produces satisfactory evidence that it is adequately protected by public liability and property damage insurance. In any event, the surety shall be liable to pay any amount recovered as a result of any suit, action, claim, injuries, or damages sustained and until such time as the matter has been settled or otherwise legally resolved.

DB 107-15 OPENING SECTIONS OF THE PROJECT TO TRAFFIC

The Project Manager may order certain sections of Work to be opened to traffic or other use prior to completion or acceptance of the Work. Opening these sections shall not constitute acceptance of work or waiver of any Contract provisions.

On those sections opened, the cost of establishing maintenance and protection of traffic, maintaining the roadway or other work to accommodate traffic or other use, and repairing damage to the work that occurs after opening will be determined as follows:

- A) If the Contract provided for a total road closure, the opening is not part of a phased or staged construction, and the opening is not due to the fault or inactivity of the Design-Builder, the added costs will be at the Department's expense. Compensation for these added costs will be in accordance with DB Section 109-8.
- B) If the opening was designated as part of the Contract such as phased or staged construction, then the added costs are incidental to the Contract and the Work will be performed at no additional expense to the Department.
- C) If the opening was due to the fault or inactivity of the Design-Builder, then the Work will be performed at no additional expense to the Department. If the Design-Builder is dilatory in completing features of the work according to the Contract or progress schedule, the Project Manager will give written notification establishing a time period for completing these features. If the Design-Builder fails to complete or make a reasonable effort to complete the work according to the written notification, the Project Manager may order all or a portion of the Project opened to traffic. The Design-Builder shall not be relieved of liability or responsibility for maintaining the work and shall conduct the remaining construction operations with minimum interference to traffic at no additional expense to the Department for any added cost of the Work.

DB 107-16 HAZARDOUS MATERIAL REPORTING AND CLEAN-UP OF SPILLS

The Design-Builder shall be responsible for reporting and cleaning up spills associated with construction of the Project, and shall report and respond to spills of Hazardous Materials such as gasoline, diesel fuel, motor oils, solvents, chemicals, toxic and corrosive substances, and other Material that are a threat to public health or the environment. The Design-Builder shall be responsible for reporting past spills encountered during construction and current spills not associated with construction. Reports shall be made immediately to the Department's Project Manager if on state ROW or to the property owner if outside of state ROW. Unreported spills identified after construction and associated with construction of the Project shall be cleaned up by the Design-Builder. Failure to report or respond to a spill shall result in the Design-Builder bearing the full cost of remediation of clean-up of such unreported spills.

The Department shall be responsible for any delay costs and expenses due to it or the Design-Builder making a new discovery of Hazardous Materials that are not identified in the Scope of Services Package or the Contract Documents. The Design-Builder is responsible for all costs and expenses, including delay costs and expenses, for all Hazardous Material spills that are identified in the Scope of Services Package or the Contract Documents or that are caused by the Design-Builder or any of its Subcontractors, employees, or agents.

DB 107-17 DESIGN-BUILDER'S RESPONSIBILITY FOR THE WORK

The Design-Builder is responsible for carrying out the provisions of the Contract at all times, regardless of whether an authorized Department-designated representative is present or not. Any Work or item that is, at any time, found to be out of Specification or not in compliance with the Design Plans shall remain the responsibility of the Design-Builder and shall be subject to such corrective measures that are approved in writing by the Design-Builder's Designer and accepted in writing by the Department's Project Manager.

Until the Design-Builder has achieved substantial completion, the Design-Builder shall have the sole and absolute responsibility for the work and to provide for the protection and safety of employees of the Department, Design-Builder, subcontractors, suppliers, and members of the general public. In no case, including but not limited to, supervisory acts or administration of the Contract by the Project Manager, will the Design-Builder be relieved of the responsibility to indemnify the Department pursuant to the provisions of the Contract.

The Design-Builder shall rebuild, repair, restore, and make good all losses, injuries, or damages to any portion of the work under the control of the Design-Builder or due to his/her fault or inactivity, at no cost to the Department. The Design-Builder shall rebuild, repair, restore, and make good all losses, injuries, or damage to any portion of the work not under the control of the Design-Builder under agreed unit prices or as extra work under DB Section 109-8. "Items not under the control of the Design-Builder" shall be defined for purposes of this Subsection as Acts of God such as earthquakes, tidal waves, tornadoes, or hurricanes; catastrophic conditions such as hazardous waste materials spills, explosions, etc., or acts of the public enemy or of governmental authorities.

In case of the suspension of work the Design-Builder shall be responsible for the Project and shall take such precautions as may be necessary to prevent damage to the Project, provide for normal drainage and normal traffic operations, and to erect any necessary temporary structures, signs, or other facilities. During such period of suspension of work, the Design-Builder shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under the Contract, and shall take adequate precautions to protect new tree growth and other vegetative growth against injury.

DB 107-18 DESIGN-BUILDER'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES

At points where the Design-Builder's operations are adjacent to properties of railway, telegraph, telephone, power companies, or other utilities, or are adjacent to other properties, facilities, or appurtenances, damage to which might result in considerable expense, loss, or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.

In the event of interruption to water or utility services as a result of accidental breakage, or as a result of being exposed or unsupported, the Design-Builder shall promptly notify the proper authority. The Design-Builder shall cooperate with said authority in the restoration of service as promptly as possible. No work shall be undertaken around fire hydrants until appropriate plans for continued service have been approved by the local fire authority.

Fire hydrants on or adjacent to the highway shall be kept accessible to fire apparatus at all times and no material or obstruction shall be placed within 15 feet (4.5 m) of any such hydrant. Work shall be left entirely accessible at all points to fire apparatus at all times.

DB 107-19 ACQUISITION AND CONVEYANCE OF REAL PROPERTY

The Department has identified property to be used for the Project, the boundaries of which are depicted in the Contract Documents.

Any additional ROW required due to design requirements originated by the Design-Builder and deemed necessary by the Department will be acquired by the Department. Additional ROW acquisitions may cause Project delays. The Department will only be responsible for time and cost impacts associated with acquisition of additional ROW in the case of a Necessary Basic Project Configuration Change (*see* DB

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Section 104-8.1.2). If additional ROW is required for the Design-Builder's convenience or if additional ROW is needed for a reason other than a Necessary Basic Project Configuration Change, the Department will conduct the acquisition of the ROW, but the Design-Builder will be responsible for all costs associated with the additional ROW and its acquisition.

The Design-Builder shall cooperate with the Department in the completion of Project design and identification of final ROW requirements and construction impacts. It is expected that the Design-Builder will identify any additional ROW needs no later than the Preliminary Design Review for any affected Project component.

The Design-Builder shall coordinate with the Department regarding any design features that may impact properties, even though no property acquisition is contemplated. The intent is to avoid damages to properties not previously identified and addressed.

DB 107-19.1 Coordination

Within 30 Calendar Days of Contract Award, the Design-Builder will meet with the Department for the following reasons:

- A) Identification and evaluation of the status of all required ROW parcels as being any of the following:
 - 1) Already acquired with all impacts identified (status code A);
 - 2) Not yet acquired, but with all impacts identified (status code B);
 - 3) Not yet acquired and without all impacts identified (status code C); and
 - 4) Not yet acquired with probable need for condemnation (status code D); and
- B) Confirmation of the Design-Builder's preferred priorities for acquisition of outstanding ROW and development of a mutually agreed ROW Acquisition Schedule (Form 107A) that is consistent with the current Baseline Progress Schedule. *See* ITP Appendix C for the appropriate form.

The Design-Builder shall not enter onto parcels until the Delaware Department of Transportation has obtained the legal right to do so.

DB 107-19.2 Change in Project Design

If, after the Contract Award, the Design-Builder identifies additional parcels to be acquired and/or modifications to the ROW limits (fee takings, easements, or other property rights), the Design-Builder shall prepare and submit to the Department new or revised surveys, legal descriptions, ROW maps, and justification of the need for additional ROW. The Department will review the request, determine whether the proposed acquisition is appropriate and necessary, and notify the Design-Builder regarding the minimum time required to complete the acquisition. If the Design-Builder and Department agree to the additional acquisition, the Design-Builder shall prepare any additional documents necessary for the Department to proceed with the acquisition.

If the Department determines that the acquisition is appropriate and required for the Project, the Department will acquire the ROW in accordance with Department procedures, subject to the conditions specified in this DB Section 107-19 regarding allocation of time and cost responsibilities.

DB 107-19.3 Delay in Acquisition

The Design-Builder shall meet with the Department to review ROW acquisition status at progress meetings. In the event that the Design-Builder determines that the Critical Path may be affected, the

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Design-Builder shall notify the Department immediately to determine the best course of action to avoid such delay through alternative design or construction methods or revisions to the Design-Builder's Baseline Progress Schedule or ROW Acquisition Schedule.

If properties are not available by the dates shown in the ROW Acquisition Schedule, the Design-Builder shall exercise good faith efforts to work around any delay and to minimize any time or cost impacts associated with changes in the ROW Acquisition Schedule.

DB 107-19.4 Precedence of Right-of-Way Acquisition Schedule

The Baseline Progress Schedule and the design of the Project furnished by the Design-Builder shall not require the Department to acquire any real property except in accordance with the ROW Acquisition Schedule or as agreed by the Department and the Design-Builder.

DB 107-19.5 Right-Of-Way within Federal or State Lands

Deviations from planned ROW may be allowed within federal government land boundaries. However, acquisition of additional ROW from federal agencies generally requires considerably more time than a private property acquisition.

The Design-Builder is responsible for constructing features, such as fencing and drainage, required by state and federal land management agencies.

DB 107-19.6 Encroachments

The Department will aggressively pursue removal of encroachments located within the existing ROW on or before Contract Award.

The Design-Builder shall notify the Department of any encroachments that are in the way of construction upon their discovery.

Upon written notification by the Department, the Design-Builder will remove any encroachments that are in the way of construction in accordance with the Department's rules, regulations, and procedures.

If the Design-Builder is required to remove encroachments that are not identified in the Contract Documents, such Work will be considered Extra Work under DB Section 104, and the Design-Builder may be entitled to additional compensation and/or time.

DB 107-19.7 Temporary Construction Easements

The Design-Builder shall be responsible to identify, prepare, and submit to the Department new or revised surveys, legal descriptions, ROW maps, and justification of the need for the acquisition of all temporary construction easements not previously obtained by the Department at no change in Contract Time or Price. The Department will acquire the temporary construction easements on behalf of the Design-Builder.

DB 107-20 PERSONAL LIABILITY OF PUBLIC OFFICIALS

The Department, Director, Project Manager, or their authorized agents will incur no personal liability as a result of carrying out any of the provisions of the Contract, as the result of exercising any power or authority granted to them thereby, or as the result of any act by the Design-Builder. In such matters, they act as the agents and representatives of the State.

DB 107-21 NO WAIVER OF LEGAL RIGHTS

Upon completion of the work, the Department will expeditiously make final inspection and notify the Design-Builder of acceptance. Such final acceptance, however, shall not preclude or stop the Department from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Department be precluded or stopped from recovering from the Design-Builder or its surety, or both, such overpayment as it may sustain, or recovering the cost of the failure on the part of the Design-Builder to fulfill its obligations under the Contract. A waiver on the part of the Department of any breach of any part of the Contract shall not be held to be a waiver of any other or subsequent breach.

The Design-Builder, without prejudice to the terms of the Contract, shall be liable to the Department for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Department's rights under any warranty or guaranty.

DB 107-22 THIRD PARTY LIABILITY

It is agreed between the parties executing the Contract that it is not intended by any provisions of the Contract to create in the public nor any member thereof a third-party beneficiary hereunder, nor to authorize anyone not a party to this Contract to maintain a suit for personal injuries or property damage pursuant to the Contract.

DB 107-23 ANTI-TRUST VIOLATIONS

By execution of the Contract, the Design-Builder conveys to the Department all rights, title, and interest in and to all causes of action it may acquire under federal and state anti-trust laws relating to the goods or services purchased by the Department pursuant to the Contract.

DB 107-24 THE DESIGN-BUILDER'S RESPONSIBILITY FOR THE TRAVELING PUBLIC

The Design-Builder shall conduct Work within the construction zone so that there will be minimal hazard to anyone transiting the Work Site on the open lanes of travel. To keep hazards to a minimum, the Design-Builder shall, as far as practical, keep Equipment, Material, and workers from intruding into the travel lanes; remove any hazardous construction debris deposited on those lanes on a continuous and regular basis; inspect and repair the travel lanes; and remove obstacles deposited by the public as they transit the Work site.

Notification that a hazard to the public exists may be received through the Design-Builder's inspections, from the Department's employees, or the public. In any case, corrective action shall be taken to remedy the hazard within a reasonable time after notification is received. The Design-Builder shall have a contact number answerable on a 24 hour basis so that action can be initiated quickly when hazards are identified.

All claims from the public for losses that are alleged to have occurred within the construction zone shall be handled by the Design-Builder, even though a Subcontractor may have introduced the hazard that caused the damage. The Design-Builder shall designate, before the Work commences, the individuals who will be responsible for response to third party claims. The individuals shall provide claimants with a written outline of the Design-Builder's claims procedure, along with a written copy of the Design-Builder's name, address, and telephone number and the name and title of the Design-Builder's individual assigned to damage claim response. The Design-Builder shall maintain a status report of all claims filed and the status of such claims. This report shall contain, at a minimum, the name, address, and telephone number of the claimant; the nature of the claim; pertinent findings regarding the claim; and a statement

regarding the resolution of the claim. This report shall be available to the Department's Project Manager upon request.

The Design-Builder shall establish a local contact number for the purpose of filing claims and post that telephone number conspicuously so that claimants can contact the right person quickly. In addition, the Design-Builder's name, address, and telephone number shall be posted at each approach to the construction zone. All construction vehicles (whether Design-Builder, Subcontractor, or privately owned) working at the construction zone shall have clean and unobstructed license plates and be marked legibly with the appropriate company name.

DB 107-25 DESIGN-BUILDER'S PAYROLLS

See DB Section 102-3.

DB 107-26 ARCHEOLOGICAL AND HISTORICAL FINDINGS

If the Design-Builder encounters cultural artifacts or archaeological or historical sites, operations shall be discontinued. The Department's Project Manager will contact the proper authorities in order that an appropriate assessment may be made to determine the disposition thereof and necessary actions relative to the site. When directed, the Design-Builder shall excavate the site to preserve the artifacts encountered. Such excavation will be paid for as Extra Work, including an appropriate adjustment in Contract Time in accordance with DB Section 109-8. Borrow and muck disposal areas furnished by the Design-Builder shall be subject to such assessment prior to use.

DB 107-27 DISPUTES RESOLUTION

DB 107-27.1 Scope of the Procedure

The dispute resolution procedure outlined in this SB Section 107-27 covers all disputes between the Department and the Design-Builder arising from this Contract. This procedure shall be binding.

DB 107-27.2 Continuation of Performance

At all times during the pendency of a dispute under this procedure, the Design-Builder shall continue Work pursuant to the terms of this Contract and the Department shall continue to pay the Design-Builder. After resolution, the Department shall pay or be credited any amounts due the Design-Builder after conclusion of the dispute resolution procedure.

DB 107-27.3 Claims for Adjustment and Dispute

In any case where the Design-Builder believes that extra compensation is due for work or material not clearly covered in the Contract or not ordered by the Project Manager as an extra, or the Design-Builder feels that it has encountered unusual and unforeseen conditions beyond its control, as defined herein, not discoverable by reasonable inspection and diligence on the Design-Builder's behalf and if all other Contract provisions have been complied with, the Design-Builder shall notify the Project Manager orally or in writing of its intention to make claim for such extra compensation before the Design-Builder begins the work on which the claim is based on. If written notification is not given within five working days and the Project Manager is not afforded proper facilities by the Design-Builder for keeping strict account of actual costs as required, then the Design-Builder waives the claim for extra compensation.

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A. *Design-Builder Written Notification.* The written notification to the Project Manager shall include:

1. The date of occurrence and the nature and circumstances of the occurrence that constitute a change;
2. Name and title of Department representatives knowledgeable of the claimed change; and
3. Particular elements of Contract performance for which additional compensation may be sought under this Section.

Such notice by the Design-Builder, and the fact that the Project Manager has kept account of the cost as aforesaid, shall not in any way be construed as proving the validity of the claim. Nothing contained in this Subsection shall be construed as establishing any claim contrary to any other provision of the Specifications.

B. *Project Manager Response.* Within ten calendar days after receipt of notice, the Project Manager will respond in writing to the Design-Builder to:

1. Confirm that a change occurred and, it shall be allowed and paid as an extra as provided herein; or
2. Deny that a change occurred and, direct the Design-Builder to follow the claims submittal procedure as outlined; or
3. Advise the Design-Builder that adequate information has not been submitted to decide whether B.1. or B.2. above applies, and indicate the need for more information for further review. The Department will respond to such additional information within ten calendar days of receipt from the Design-Builder; or
4. Advise the Design-Builder that the Department will review the claim, after obtaining the claims submittal as described herein.

Any adjustments made to the Contract shall not include increased costs or time extensions for delay resulting from the Design-Builder's failure to provide requested additional information in accordance with this clause.

C. *Claim Submittal.* The Design-Builder must submit a formal claim in writing within 60 calendar days after the item claimed has been completed. The Design-Builder can only recover, and the formal claim shall only consist of those items allowed under Subsection 107-27.4 and must contain:

1. The precise nature and basis for the claim;
2. Each fact upon which the Design-Builder relies, to support the claim;
3. The precise reason the Design-Builder believes the claim should be granted;
4. The language in the Contract upon which the Design-Builder relies, in support of the claim;
5. The amount of money or nature and extent of relief to which the Design-Builder believes it is entitled; and
6. Any other factors which the Design-Builder believes support the claim. In complying with this requirement, the Design-Builder must certify the claim using the following form:

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allowed herein. As described below, A. through G. shall cover all direct and indirect costs allowed and H. identifies all non-allowable costs.

- A. *Labor*. In accordance with DB Section 109-8.2.2.D.1.
- B. *Bond, Insurance, and Tax*. In accordance with DB Section 109-8.2.2.D.2.
- C. *Materials*. In accordance with DB Section 109-8.2.2.D.3.
- D. *Equipment*. In accordance with DB Section 109-8.2.2.D.4.
- E. *Percentage Markups*. In accordance with DB Section 109-8.2.2.D.6 thru 7.
- F. *Subcontractor Claims*. Any claim submitted by the Design-Builder on behalf of a subcontractor shall be submitted according to Subsection 107-27.3 and shall be solely limited to the list of all direct or indirect costs permitted by A. through D. above. For work approved by the Department, the subcontractor will be allowed a percentage markup as permitted by DB Section(s) 109-8.2.2. The Contractor will be allowed an additional percentage markup as permitted by DB Section 109-8.2.2. to be computed on the final sum total of such subcontractor cost claimed under A. through D. above for portions of subcontractor work approved by the Department.
- G. *Waiver of Liquidated Damages*. A claim, not for additional costs, but for a waiver by the Department of an assessment of liquidated damages, in whole or in part, may also be made by the Design-Builder as part of this Subsection.
- H. *Non-allowable Damages or Expenses*. The expenses listed above as A. through G. shall constitute the sole cost(s) and expense(s) to which the Design-Builder shall be entitled on any claim submitted for additional compensation or settlement of any claim made under these Specifications, except as further provided in DeIDOT Standard Specification 105.21. The parties agree that the Department will have no liability for the following items of damage or expense:
 - 1. Profit in excess of that provided herein,
 - 2. Loss of profit,
 - 3. Labor and equipment inefficiencies,
 - 4. Home office overhead in excess of that provided herein,
 - 5. Consequential damages, including but not limited to loss of bonding capacity, loss of bidding opportunities and insolvency,
 - 6. Indirect costs or expenses of any nature,
 - 7. Attorneys fees, claim preparation expenses or costs of litigation, and
 - 8. Interest on any claimed amounts.
- I. Any claim submitted shall not affect in any manner the imposition or waiver of Liquidated Damages, except that any Liquidated Damages shall be waived for any delay for which a time extension is granted in accordance with DB Section 108-6.
- J. The Design-Builder agrees to make its accounting records and cost information available at the time of submission of the claim and such other records as the Department may require, in order to determine the validity and amount of each item claimed. They shall be open to inspection or audit by representatives of the Department during the life of the Contract and for a period of not less than three years after the Design-Builder's acceptance of Final Payment as set forth in DB Section 109-11 and the Contractor shall retain such records for that period. Where payment for materials, equipment, or labor is based on the cost of forces other than the Design-Builder's, the Design-Builder shall make every reasonable effort to ensure that the cost records of such other forces are open to inspection and audit by representatives of the Department on the same terms and conditions as the cost records of the Design-Builder. Payment for the cost of such forces may be deleted if the records of such third parties are not made available to the Department's representatives. If an audit is to be commenced, the Design-Builder is to be provided with a reasonable notice of the time when such audit is to begin. In case all or a part of such records are not made available, the Design-Builder understands and agrees that any items not supported by reason of such unavailability of the records will not be allowed, or if payment therefore has already been made, the Design-Builder shall refund to the Department the amount so disallowed.

DB 107-27.4 Chief Engineer’s Decision

After receiving the written notification from the Design-Builder, appealing the Assistant Director for South Construction’s decision and requesting a hearing by the Disputes Resolution Board as outlined in Subsection 107-27.6, the Chief Engineer will notify the Design-Builder, in writing, within 30 calendar days of the receipt of the notice regarding the claim. The decisions upon all claims by the Chief Engineer shall represent the findings of the Department.

DB 107-27.5 Dispute Resolution Board – Members and Term of Service

A Dispute Resolution Board shall be established to hear disputes between the Department and the Design-Builder. The Dispute Resolution Board shall be established within 90 Calendar Days of the effective date of this Contract by the appointment by the Design-Builder and Department of their respective designated members. The Dispute Resolution Board shall consist of one member selected by the Department (this person may be the Department’s Chief Engineer), one member selected by the Design-Builder, and a third member selected by the first two members. The third member shall be the Chairperson of the Dispute Resolution Board. The qualifications for the members of the Dispute Resolution Board are as follows:

- A) All Dispute Resolution Board members shall have substantial experience in highway or bridge design and construction. The experience may be technical, administrative, or legal. The goal is to have a Dispute Resolution Board with the technical and administrative skills and experience that will promote confidence in its decisions; and
- B) The Chairperson of the Dispute Resolution Board shall not be employed currently and shall not have been employed within the last three years with the Department, the Design-Builder, or any member Design-Builder’s team.

If the two members selected by the Department and the Design-Builder cannot agree on a third member within 30 Calendar Days of their selection, then both members shall withdraw from the Dispute Resolution Board and new members shall be appointed, except the Department’s Chief Engineer may be reappointed by the Department.

The Dispute Resolution Board shall serve for the duration of performance under this Contract. Each party may elect to replace its board member at any time with a showing of reasonable justification. The Chairperson of the Dispute Resolution Board may be replaced at any time with the consent of both parties. If any Dispute Resolution Board member resigns or is replaced, the new member shall be selected in the same manner in which the original appointment had been made.

DB 107-27.6 Hearing Procedure

The party seeking to invoke this dispute resolution procedure shall forward to each member of the Dispute Resolution Board a copy of its claim and all of its supporting documents and shall provide three copies of these materials to the other party. Appropriate notification of Professional Liability Insurance providers will be made at this time. The responding party shall provide its response and all supporting documentation within 20 Working Days of the receipt of the claim. The claimant shall then reply within five Working Days to the response.

The Dispute Resolution Board shall set a hearing on the matter within 30 Calendar Days of the claimant’s reply to the response. The Dispute Resolution Board Chairperson shall direct all meetings and hearings. Presentation of evidence shall be in a manner as directed or permitted by the Dispute Resolution Board in its discretion. The Dispute Resolution Board shall not be bound by judicial rules of evidence. Documents and testimony shall be presented in the order, manner, and degree of detail that the Dispute Resolution

Board deems most efficient and probative. Each party shall be allowed to make a brief initial presentation and to rebut any factual assertion by the other party; however, the Dispute Resolution Board shall determine when enough evidence has been presented and it may limit the presentation of any documentation or testimony that it deems not relevant or redundant. At the Dispute Resolution Board's option, testimony may be required to be given under oath and the oath shall be administered by the Chairperson.

Either party may have legal counsel and insurer representation present at the hearing. Legal counsel may not examine or cross-examine witnesses, object to questions or statements during meetings, or make legal motions or arguments during meetings or hearings.

The Dispute Resolution Board shall have full authority to establish guidelines and procedures for the investigation of a claim. The entire process is intended to be flexible and the Dispute Resolution Board is encouraged to adapt the process to individual circumstances presented by particular disputes.

After the conclusion of the hearing, the Dispute Resolution Board shall issue its written decision within 30 Calendar Days. The written decision shall set forth the reasons for the Dispute Resolution Board's decision.

The Design-Builder or the Department may appeal the Dispute Resolution Board's decision by requesting an Arbitration hearing as outlined in DB Section 107-27.8.

DB 107-27.7 Dispute Resolution Board Expenses

Dispute Resolution Board members shall be paid a reasonable hourly rate for their services subject to civil service regulations, if applicable. Each party shall negotiate the fee arrangements with the member it selects, however, the other party must agree on the rate. Both parties shall agree on the fee arrangement for the Chairperson.

Dispute Resolution Board members shall be reimbursed for out-of-pocket expenses including, but not limited to, travel, copying, telephone, clerical services, and mailings. The Dispute Resolution Board members shall be allowed a reasonable per diem for meals and actual lodging costs provided they stay in hotels. Dispute Resolution Board members must provide documentation for all expenses.

The parties shall share all Dispute Resolution Board members' fees and expenses equally.

DB 107-27.8 Arbitration

Any claim, properly presented pursuant to DB Section 107-27.6, in the absence of agreement by the Design-Builder and the Department as to the resolution thereof, and upon the demand of either party delivered in writing to the other within 30 calendar days from the date of the written decision by the Chairman of the Disputes Resolution Panel, as provided in the aforesaid DB Section 107-27.6; shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect; except as otherwise modified by these Specifications. The arbitration proceeding may involve presentation of facts or such portions thereof as have previously been presented at prior administrative hearings held pursuant to DB Section 107-27.6 herein or may be based entirely upon the record, as established therein. The record established at prior administrative hearings pursuant to DB Section 107-27.6 shall be specifically admissible at such arbitration proceedings and such facts as have been established shall be specifically binding upon the parties; with the exclusion of opinions and conclusions thereon. Such arbitration shall be specifically based upon the claim presented at prior administrative hearings and no material, information, fact, and/or claim not presented at such hearings held pursuant to said DB Section 107-27.6 shall be admissible at any arbitration conducted

pursuant to this Section. The arbitrators, in their final ruling on the claim shall include a summary of the evidence, findings of fact based upon the evidence, conclusions of law, and a concise statement of the relief awarded. This agreement to arbitrate shall be strictly enforceable as provided under Chapter 57, Title 10 of the Delaware Code, as amended.

DB 107-27.9 Design-Builder and Subcontractor/Supplier Disputes

Any dispute arising between the Design-Builder and its subcontractor/supplier concerning payments held in trust, as required by Chapter 8, Title 17 of the Delaware Code, shall be resolved by arbitration. The Department shall not serve as the arbiter of such disputes, but shall, in the absence of agreement between the parties, designate the American Arbitration Association to resolve the matter.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 108

PROSECUTION AND PROGRESS

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APPENDIX 108A - FORMS

DB SECTION 108

PROSECUTION AND PROGRESS

DB 108-1 SUBLETTING OF CONTRACT

The Design-Builder shall not subcontract, sublet, sell, transfer, assign, purchase work or materials from an organization other than its own, or otherwise dispose of the contract or contracts or any portion thereof, or of its right, title or interest therein, without written consent from the Project Manager. The Design-Builder shall perform with its own organization work amounting to not less than 50% of the total Contract Price, except that any items designated in the Contract as “specialty items” may be performed by subcontract and the cost of any such specialty items so performed by subcontract may be deducted from the original Total Lump Sum Contract Price before computing the amount of work required to be performed by the Design-Builder with its own organization. Only the original Contract Price and the value of subcontracted work approved by the Project Manager will be used to compute the percentage of subcontracted work. Adjustments in quantities or additional items of work will not require an adjustment of the percentage computed as described above. The Design-Builder’s organization shall be construed to include only those workers on its payroll, employed and paid directly by the Design-Builder, and equipment owned or rented by the Design-Builder with or without the operator(s) as is consistent with normal industry practice.

If the Design-Builder to whom the Contract is awarded proposes to subcontract any part of Work, the scope and value of the Work to be done by the subcontractor shall be outlined. The cost of materials to be used by the subcontractor shall be outlined. The cost of materials to be used by the subcontractor shall be included in the value of the subcontracted work. A subcontractor shall not subcontract further a portion of the Work intended to be done by the original subcontractor without the express written permission of the Project Manager. In granting such permission, the Project Manager shall ensure that the subcontractor seeking to subcontract the Work to be performed by another shall nonetheless perform with its own organization work amounting to not less than 50% of the total subcontracted price included in the Price Proposal.

All traffic control work and related items shall either be performed entirely by the Design-Builder’s own organization or totally subcontracted. Maintenance of the equipment shall not be subject to this requirement.

When the Design-Builder has sublet a portion of the Contract or a bid item to a subcontractor, the actual payment to the subcontractor shall be applied to fulfill Disadvantaged Business Enterprise (DBE) requirements of the Contract, as specified in DB Section 102-15. The cost of a portion of the Contract or Project Component performed by a DBE shall be applied against the Design-Builder to determine if the Design-Builder is performing at least 50% of the total Contract bid price, as required herein.

The Design-Builder must obtain written permission from the Project Manager for each subcontractor to whom the Design-Builder intends to subcontract or sublet a portion of the Work prior to execution of the subcontract agreement. As a prerequisite to payment for any Work done by a subcontractor or on a subcontractor’s behalf and prior to any Work being done on the Project by the said subcontractor, the Design-Builder shall submit a certified copy of the Design-Builder’s subcontractor agreement and any and all other contracts with suppliers or any other person, firm, or organization for review and approval by the Project Manager. Each subcontract shall be in writing and shall contain and state that all pertinent provisions and requirements of the prime contract are incorporated into the subcontract. It shall be the Design-Builder’s responsibility to determine that all such provisions are included and such provisions shall be implied where not specifically included.

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The Design-Builder may also be required to submit additional information concerning the prospective subcontractor or supplier, including any additional information required by the terms of this Contract, by the Department or FHWA, or other governmental agency, where necessary. Such information may include but may not be necessarily limited to:

- A. The organization that performs the Work is particularly experienced and equipped for such work.
- B. Assurance by the Design-Builder that the Labor Standards Provision set forth in this Contract shall apply to labor performed on all work encompassed by the Contract.
- C. All Civil Rights Provisions and DBE requirements have been satisfied.
- D. The Department is indemnified and saved harmless from the action of the subcontractor or supplier.
- E. Disputes Resolution Clause is included in the subcontract.
- F. Design-Builder saves harmless and indemnifies the Department for omissions in the Design-Builder's subcontractor agreement.

Any review performed or permission or approval granted under these Specifications shall not operate, nor be interpreted as approval of the Work to be performed by the subcontractor or material supplied by a supplier, nor shall it operate to relieve the Design-Builder of the sole responsibility for satisfactory completion of the Contract. No contracts, subcontracts, supplier agreements, sales, transfers, leases, assignments, or any other agreements applicable to this Contract shall in any case release the Design-Builder of its sole responsibility and liability under the Contract and bonds.

The Department, in its discretion, may refuse to pay for all or part of the Work or materials or may refuse to accept any work performed by such unapproved subcontractor or materials supplier and may refuse to consider work performed or materials supplied as part of the subcontracted work.

DB 108-2 START AND PROGRESS OF WORK

DB 108-2.1 Progress Schedules

Sufficient materials, equipment, and labor shall be provided by the Design-Builder to guarantee the completion of the Project within the Contract time.

The Design-Builder shall submit a Critical Path Method (CPM) progress schedule to the Project Manager for review. The Work shall not be started until the progress schedule and methods of construction operations for each phase of construction are acceptable to the Project Manager and are in conformance with all applicable erosion and sediment control requirements. The progress schedule shall be used to establish the critical construction operations and to monitor the progress of the Work.

The schedule shall show the order in which the Design-Builder proposes to carry on the Work and be of sufficient detail to demonstrate a reasonable and workable plan to complete the Project within the Contract Time. The schedule shall be in a suitable scale to indicate graphically the total percentage of Work scheduled to be completed at any time. The schedule submittal shall consist of network diagrams, a bar-chart, and accompanying mathematical analyses. A network diagram shall show the order and interdependence of activities and the sequence in which the Work is to be accomplished. The mathematical analysis of the network diagram shall include a tabulation of each activity shown on the detailed network diagrams. A bar-graph and analysis shall together, show the following information for each activity, as a minimum:

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- (a) Activity ID Number
- (b) Activity description
- (c) Early start date
- (d) Late start date
- (e) Original duration - in working days
- (f) Total Float

The initial update of the Baseline Schedule and all subsequent monthly updates shall be certified by the Design-Builder's Quality Control (QC) Manager and signed and sealed by a Delaware-licensed Professional Engineer. The certification shall state the following:

“This Updated Baseline Schedule hereby submitted correctly represents the Design-Builder's planned and actual progress as of the date of the schedule and contains none of the following:

- 1) Excessive leads or lags; and
- 2) Assigned constraints, except those specified in the Contract Documents.

..

The activity ID number of any activity deleted during a schedule revision shall not be reused in a subsequent version of the schedule when activities are added.

The purpose of this scheduling requirement is to ensure adequate planning and execution of the Work and to evaluate the progress of the Work. Consultation and Written Comment by the Department regarding the Original Baseline Schedule shall not be construed to imply approval of any particular method or sequence of construction or to relieve the Design-Builder of providing sufficient Material, Equipment, and labor to guarantee completion of the Project in accordance with the Contract Documents. The updated Baseline Schedules may be utilized to facilitate the Department's Quality Assurance (QA) activities. Consultation and Written Comment regarding the Original or Updated Baseline Schedules shall not be construed to modify or amend the Contract or the date of completion therein.

The Baseline Progress Schedule and updates will be reviewed by the Department and the Design-Builder at least monthly as part of one of the weekly progress meetings.

The Design-Builder shall employ and supply a sufficient force of workers, Materials, and Equipment and shall prosecute the Work with such diligence so as to maintain the rate of progress indicated on the Baseline Schedule to prevent Work stoppage and ensure completion of the Project within the Contract Time. Any additional or unanticipated costs or expense required to maintain the schedule shall be solely the Design-Builder's obligation and shall not be charged to the Department unless provided for in other provisions of the Contract.

The Design-Builder shall furnish weekly Work schedules indicating the number of personnel, kind of Equipment, and location and nature of the Work to be performed.

See Part 4 - Special Provisions for detailed requirements related to the Baseline and Updated Schedules under “Project Control System Development Plan” and “CPM Schedule Updates and/or Revised Updates”.

DB 108-2.2 Failure to Submit Baseline Progress Schedule or Update

If the Design-Builder fails to submit a Baseline Progress Schedule or any revision or update when required, the Department's Project Manager may suspend payment per DB Section 109.

DB 108-2.3 Monthly Progress Reports

The Design-Builder shall submit a monthly progress report with each payment request, consisting of the following:

- A) A progress narrative;
- B) Quality certifications;
- C) A safety report, using Form SAF (DB Section 107 and Appendix 108A);
- D) A security report (DB Section 107);
- E) A monthly Baseline Schedule update (DB Section 108-1 and Part 4 – Special Provisions);
- F) A Change Order status report;
- G) A monthly subcontract report;
- H) Quantity calculations (DB Section 109-2.7);
- I) An updated Contract Submittals List (CSL);
- J) A summary of hazardous and contaminated substance activities;
- K) Project photographs; and
- L) A statement of Materials and labor used.

DB 108-2.3.1 Progress Narrative

The Design-Builder shall prepare and submit a monthly progress narrative. The progress narrative shall summarize the following information:

- A) Activity and progress for the Contract, including design and construction and identification of the start and completion dates of major phases of Work;
- B) Achievement of any Project Milestones;
- C) Quality Control efforts, including results of any Design Reviews and/or quality audits;
- D) Problems/issues that arose during the period and remaining problems/issues to be resolved;
- E) Resolution of problems/issues raised in previous progress reports or resolved during the period;
- F) Critical schedule issues and proposed resolutions, proposal of actions planned to correct any negative float or other schedule slippage, and explanation of potential delays and/or problems and their estimated impact on performance and the Substantial Completion Date; and
- G) Issues which may need the Department’s Project Manager’s attention or action for the next month, including Design Reviews.

DB 108-2.3.2 Quality Certifications

The Design-Builder shall submit monthly a certificate signed by the Design QC Manager and the Construction QC Manager certifying the following for the previous month:

- A) That all Work, including that of the Designer and all other designers, Subcontractors at all tiers, suppliers, and fabricators has been checked and/or inspected by the Design-Builder’s QC staff and that all Work, except as specifically noted in the certification, conforms to the requirements of the Contract; and

- B) That the Quality Plan and all measures and procedures provided therein are functioning properly and are being followed, except as specifically noted in the certification.

DB 108-2.3.3 Change Order Status Report

The Design-Builder shall provide a report of outstanding Change Order requests containing the following:

- A) The Design-Builder's and the Department's Change Order identification numbers and/or coding;
- B) The issue title;
- C) A brief description of the change;
- D) Any outstanding issues to be resolved;
- E) The estimated cost and time implications; and
- F) The projected resolution date.

DB 108-2.3.4 Subcontract Report

As part of the monthly progress report, the Design-Builder shall submit a subcontract report providing the Department with an updated list of Subcontractors including DBE Subcontractors (design and construction at all tiers). The location where the Subcontractors worked shall be shown

The Design-Builder shall also report the results of all procurements consummated in the previous month, including those procured competitively and by other means. The Design-Builder shall indicate the type of Work or product procured and size of the procurement (in dollars), the names of firms competing for the subcontract, and the name of the successful Subcontractor.

The report shall indicate the total number of Subcontractors and the total dollar value of all subcontracts awarded to date. DBE Subcontractors shall be clearly identified in the report.

The report shall indicate, for each subcontract, the following:

- A) The original subcontract amount;
- B) The value of any modifications to date; and
- C) Payments made to date.

DB 108-2.3.5 Contract Submittals List

Within 30 Calendar Days of Notice to Proceed (NTP), the Design-Builder shall prepare and submit to the Department's Project Manager a Contract Submittals List (CSL) covering all submittals required during the first six months of the Contract. Thereafter, the Design-Builder shall submit monthly updates to Form CSL with the Monthly Progress Report (DB Section 108-2.3). The updated Form CSL shall show the record of submittals made to date and shall show the submittals due over the next three-month period.

DB 108-2.3.6 Summary of Hazardous and Contaminated Substances Activity

The Design-Builder shall submit a monthly summary of activities related to hazardous and contaminated substances. If there is no activity, the report shall indicate such.

DB 108-3 KEY PERSONNEL

DB 108-3.1.1

In addition to the Design-Builder's Principal-in-Charge, Project Manager, Design Manager, and Construction Manager, described below, the positions listed in Part 4 – Special Provisions, Special Provision 108B shall be the Design-Builder's Key Personnel for the Project. The Design-Builder shall provide personnel that meet the minimum requirements specified in Part 4 – Special Provisions, Special Provision 108B.

A. Design-Builder's Principal-in-Charge: Should have a minimum of 20 years experience in construction and management of major bridge or highway projects that included work of a similar scope, nature, and complexity as this project. The Principal-in-Charge should have served in a similar role on a minimum of one prior design-build project of similar scope, nature, and complexity as this project.

 **B. Design-Builder's Project Manager:** Should have a minimum of 15 years experience in construction and management of major bridge structures with demonstrated experience on the design and construction engineering of bridge projects that included work of a similar scope, nature, and complexity as this project. The Project Manager shall have served in a similar role on a minimum of one prior design-build project. The Design-Builder's Project Manager shall be the Design-Builder's representative and single point of contact.

 **C. Design Manager:** Shall be a Delaware-licensed Professional Engineer who is an employee of the Designer or a firm on the design team. The Design Manager shall have a minimum of 15 years experience in design of large bridge design projects with similar type, scope and complexity as this project. The Design Manager should have served in a similar role on a minimum of one prior design-build bridge project.

 **D. Construction Manager:** Should have a minimum of 15 years experience in construction of major bridge structures with demonstrated experience on the construction of bridge projects that included work of a similar scope, nature, and complexity as this project. The Construction Manager should have served in a similar role on a minimum of one prior design-build bridge project.

The Department's Project Manager may designate other positions as Key Personnel or change the designation of some of the positions as needed at any time during the Contract. Additionally, any of the key personnel identified in Part 4 – Special Provisions, Special Provision 108B, may serve in more than one capacity on the Project.

Key Personnel shall be located in the Project vicinity for the duration of the Contract except for the following positions:

A) The Project Principal-in-Charge and QC Manager shall be available and present as necessary to fulfill their Project responsibilities;

 B) The Design Manager and Design QC Manager shall be available and present as necessary through the completion of final design for design changes and other design services during and after construction, including preparation of As-Built Plans; and

C) The Construction Manager and Construction QC Manager shall be present on site whenever construction activities are being actively pursued.

DB 108-3.2 Directory

Within 15 Working Days after NTP, the Design-Builder shall submit to the Department's Project Manager a directory and organizational chart showing all of its Key Personnel. The directory shall be updated throughout the Contract as changes occur. The directory shall include the names, titles, areas of responsibility, office address and location, office telephone and facsimile numbers, and cellular and/or pager numbers of Key Personnel. The Design-Builder shall provide information sufficient for the Department to contact any of the Key Personnel on a 24-hour basis for the duration of the Contract.

The Department's Project Manager shall provide a directory of the Department's Project staff to the Design-Builder.

DB 108-3.3 Temporary Absence of Key Personnel

If any of the Key Personnel plans to be absent from the site for more than 48 hours, the Design-Builder shall inform the Department's Project Manager in writing seven Calendar Days in advance of an "acting" to represent the absent Key Personnel.

DB 108-3.4 Changes in Key Personnel



The Design-Builder shall assign the Key Personnel identified in the Design-Builder's Proposal to this Project. The Design-Builder shall submit the names and qualifications of proposed replacement Key Personnel to the Department's Project Manager 30 Calendar Days in advance of any replacement of any Key Personnel.

The Design-Builder may change Key Personnel only upon receipt of a written consent from the Department's Project Manager. The Department's Project Manager may require written justification from the Design-Builder explaining the replacement of any Key Personnel.

DB 108-4 TRAFFIC REQUIREMENTS AND DESIGN-BUILDER'S OPERATIONS

The Design-Builder shall conduct work at all times in such a manner and in such sequence as will ensure the least interference with traffic. The Design-Builder shall give due regard to the location of detours and to the provisions for handling traffic. The Design-Builder shall not open up work to the prejudice or detriment of work already started, and the Project Manager may require the Design-Builder to finish a section on which the Work is in progress before work is started on any additional sections.

DB 108-5 CHARACTER OF WORKERS AND EQUIPMENT

In the construction of all public works for the State or any political subdivision thereof, or by persons contracting with the State or any political subdivision thereof, preference in employment of laborers, workers, or mechanics shall be given to bonafide legal citizens of the State who have established citizenship by residence of at least 90 days. Each public works contract for the construction of public works for the State or any political subdivision thereof shall contain a stipulation that any person, company, or corporation who violates the provisions of this Section shall pay penalty to the State Treasurer equal to the amount of compensation paid to any person in violation.

The Design-Builder shall employ only competent and efficient persons. Whenever, in the opinion of the Project Manager, any employee is careless or incompetent, obstructs the progress of the Work, acts contrary to instructions of the superintendent or foreman, or conducts themselves improperly, the Design-Builder shall, upon the request of the Project Manager, discharge the employee from the Work and shall not again employ that person on the Contract or any other contract for the Department, except with the written consent of the Project Manager.

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All machinery and equipment owned or controlled by the Design-Builder, that is proposed to be used by the Design-Builder on the Work, shall be of sufficient size and capacity and such mechanical condition as to meet the requirements of the Work and to produce a satisfactory quality of work. Equipment used on any portion of the Project shall be such that no injury to the roadway, adjacent property or other highways results from its use.

When methods and/or equipment to be used by the Design-Builder in accomplishing the construction are not prescribed in the Contract, the Design-Builder is free to use any methods and/or equipment that it demonstrates to the satisfaction of the Project Manager will accomplish the Contract work in conformity with the requirement of the Contract.

When methods and/or equipment to be used by the Design-Builder in accomplishing the construction are not prescribed in the Contract, the Design-Builder is free to use any methods and/or equipment that it demonstrates to the satisfaction of the Project Manager will accomplish the Contract work in conformity with the requirement of the Contract.

When the Contract specifies that the construction be performed by the use of certain methods and/or equipment, such methods and/or equipment shall be used unless others are authorized by the Project Manager. If the Design-Builder desires to use a method and/or type of equipment other than those specified in the Contract, the Design-Builder may request authority from the Project Manager to do so. The request shall be in writing and shall include a full explanation of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Design-Builder will be fully responsible for producing construction work in conformity with Contract requirements. If, after trial use of the substituted methods and/or equipment, the Project Manager determines that the Work produced does not meet the Contract requirements, the Design-Builder shall discontinue the use of the substitute method and/or equipment and shall complete the remaining construction with the specified methods and/or equipment.

The Design-Builder shall remove the deficient work and replace it with work of specified quality, or take such other corrective action as the Project Manager may direct. No change will be made to the Lump Sum Contract Price for the Project Components or items involved, nor in Contract Time as the result of authorizing a change in methods and/or equipment under these provisions unless it is as a credit or a VEP.

DB 108-6 EXTENSION OF CONTRACT TIME

An extension of the Contract Time may be granted by the Department under the following conditions provided documentation has been given to the Project Manager. If the Design-Builder finds that it will be impossible to complete the Work on or before the time allowed by the Contract, the Design-Builder shall, prior to the termination of such time, submit a written request to the Project Manager for an extension of time for completion of the Contract. The Design-Builder shall set forth fully therein the reasons that it considers would justify the request. If requested by the Project Manager, the Design-Builder shall submit a revised detailed progress schedule showing the remaining Work to be completed on or before the requested extended completion date. If the Project Manager finds that the Work was delayed or damage to the Work occurred on account of unusual conditions beyond the control of the Design-Builder to warrant additional time, the Project Manager will grant an extension of time for completion in such amounts as appears to be reasonable and proper. Upon written notice being sent by the Project Manager, the new completion time shall be incorporated into and become part of the Contract and shall be binding upon the Design-Builder and Surety. The Design-Builder shall not be entitled to any additional time as a result of any delay caused by the Design-Builder's failure to prosecute the Work and/or the Design-Builder's failure to work in accordance with the progress schedule without valid reason as permitted by these Specifications.

DB 108-7 FAILURE TO COMPLETE ON TIME

For each Calendar Day or Working Day that work remains uncompleted after the Contract Time has expired or beyond the completion date established by the Contract, the sum specified will be deducted from any money due the Design-Builder. This sum shall not be considered and treated as a penalty but as Liquidated Damages due the Department by reason of inconvenience to the public, added cost of engineering and supervision, and other extra expenditures of public funds due to the Design-Builder's failure to complete the Work on time. Any adjustment of the Contract time for completion of the Work granted under DB Section 108-6 will be considered in the assessment of liquidated damages.

Each and every consecutive calendar day, including Saturdays, Sundays, and holidays, shall be included in the computations for the assessment of Liquidated Damages.

The Design-Builder shall become liable for Liquidated Damages for delays commencing from the date on which the Contract time, as adjusted by DB Section 108-6, shall expire.

If there is a delay in the delivery of critical materials, such as steel, copper, or aluminum, due to defense needs, energy crisis, etc., a time extension shall be allowed for such delays. Each case will be independently evaluated to determine if the delays were, in fact, beyond the control of the Design-Builder or fabricator and delayed the Project completion. Satisfactorily supported time extension requests shall be made concurrently with the delay and not after the fact.

Requests for time extensions shall be subject to review by the Project Manager, and the Project Manager will determine the amount of time extension allowed.

There will be no acceptance of unsupported claims of delays in delivery of Material as a basis for time extensions. The Design-Builder is presumed to have included in its Contract price, allowance for any anticipated delays in procurement of materials, which procurement is its sole responsibility. Unless some unusual market condition such as an industry-wide strike, natural disaster, or area-wide shortage arises after bids are taken and prevents procurement of materials within the allowable time limitations, delays in delivery of such materials do not provide sufficient reason for suspending time charges.

Permission for the Design-Builder or Surety to continue and finish the Work after the Contract Time and approved extensions have elapsed shall not waive the Department's rights under the Contract.

The Department may waive such portions of the Liquidated Damages as may accrue after the Work is substantially complete and is in a condition for safe and convenient use by the traveling public.

Payment of Liquidated Damages will be deducted from payments otherwise due the Design-Builder or be made by direct payment by the Design-Builder in the event the total Liquidated Damages due exceed said deductions.

Liquidated Damages for the period from May 1 through October 30, will be at a rate of **\$15,226.50** per Calendar Day.

DB 108-8 DEFAULT OF CONTRACT

The Project Manager may give notice to the Design-Builder and the Surety, in writing, declaring the Contract to be in default under the following conditions:

- A. If the Design-Builder fails to begin the Work within the time specified in the Notice to Proceed.
- B. If the Design-Builder fails to perform the Work with sufficient labor, equipment, and material resources to ensure the prompt completion of the Work in accordance with the approved schedule.
- C. If the Design-Builder's Work is determined by the Project Manager to be defective or otherwise unacceptable Work, or if the Design-Builder refuses or neglects to remove Materials or replace or repair rejected Work.
- D. If the Design-Builder discontinues the prosecution of the Work or fails to resume the Work that has been discontinued.
- E. If the Design-Builder becomes insolvent, declares bankruptcy, commits any acts of bankruptcy or insolvency, or allows any final judgment to stand unsatisfied for a period of ten days.
- F. Makes an assignment for the benefit of creditors without authorization by the Department.
- G. For any other cause whatsoever, fails to carry on the Work, in the Department's judgment in a manner consistent with Contract requirements.

If the Design-Builder or Surety, within a period of ten days after such notice, does not proceed in accordance therewith, then the Project Manager will declare the Design-Builder to be in default on the Contract, terminate the Design-Builder's right to proceed with the Work, and have full power and authority, without violating the Contract, to take over the prosecution of the Work from the Design-Builder. The Department may appropriate or use the Design-Builder's materials at the site as may be suitable for use in the Project and may enter into an agreement with another contractor or entity for the completion of the Contract according to the terms and provisions thereof, or use other methods as in the opinion of the Project Manager will be required for the completion of the Contract.

All costs and changes incurred by the Department, as a result of the default, including the cost of completing the Work under contract or remedying defective or otherwise unacceptable work, and any applicable Liquidated Damages or disincentives will be deducted from monies due the Design-Builder for completed work. If such cost exceeds the sum which would have been payable under the Contract, then the Design-Builder and the Surety shall be liable and shall pay to the Department the balance of such costs in excess of the Contract Price.

If it is determined, after termination of the Design-Builder's right to proceed, that the Design-Builder was not in default, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Department in accordance with DB Section 108-10. Thus, damages to which the Design-Builder may be entitled as a result of an improper default termination will be limited to amounts as provided for in DB Section 108-10.

DB 108-9 TERMINATION OF DESIGN-BUILDER'S RESPONSIBILITY

The Contract will be considered complete when all Work, including the acceptable submission of all required documents, has been satisfactorily completed, the final inspection made, and the Work accepted by the Department. The Design-Builder will then be released from further obligation except as set forth in the Design-Builder's Payment, Performance and Maintenance Bonds and DB Section 107.

DB 108-10 TERMINATION OF CONTRACT

The Department may, by written order to the Design-Builder, terminate the Contract or any portion of the Contract when such termination would be in the best interest of the Department. In the event such termination occurs without fault and for reasons beyond the control of the Design-Builder, all completed items as of the date of termination will be paid for at the Contract Price, where applicable. Payment for partially completed and eliminated work will be paid for as provided in DB Section 109-9, Eliminated Items.

Acceptable materials, obtained by the Design-Builder for the Work, but which have not been incorporated therein, may, at the option of the Department, be purchased from the Design-Builder at actual cost delivered to a prescribed location, or otherwise disposed of as mutually agreed.

After receipt of notice of termination from the Department, the Design-Builder shall submit, within 60 days of the effective termination date, its claim for additional damages or costs not covered above or elsewhere in these Specifications. Such claim may include such cost items as reasonable idle equipment time, mobilization efforts, uncompensated bidding and project investigation costs, overhead expenses attributable to the Project terminated, legal and accounting charges involved in claim preparation, subcontractor costs not otherwise paid for, actual idle labor costs if work is stopped in advance of the termination date, guaranteed payments for private land usage as part of original Contract, and any other cost or damage item for which the Design-Builder feels reimbursement should be made. The intent of negotiating this claim would be that an adjusted figure be reached with the Design-Builder. In no event, however, will loss of anticipated profits be considered as part of any settlement.

The Design-Builder agrees to make its cost records available to the extent necessary to determine the validity and amount of each item claimed.

Termination of the Contract or portion thereof shall not relieve the Design-Builder of its contractual responsibilities for the Work completed, nor shall it relieve the Surety of its obligation for and concerning any just claim arising out of the Work performed.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

APPENDIX 108A

FORMS

PROGRESS NARRATIVE FORMAT

Design-Builder: _____

Progress Report Number: _____ **Period Covered:** _____
 (Enter inclusive dates)

1. Summary of design activity and progress:

2. Summary of construction activity and progress:

3. Price Components started and/or completed during period:

Price Component Code	Price Component Title	Started This Period (Enter date)	Completed This Period (Enter date)

4. Progress Check Points achieved this period:

Price Component Code	Progress Check Point Number	Description	Planned or Specified Date of Completion	Actual Date of Completion

5. Summary of Quality Control efforts:
 - a) Design (include results of any Design Reviews conducted during period):

 - b) Construction:

Delaware Department of Transportation

6. Summary of problems/issues that arose during the period and remaining issues to be resolved:

7. Summary of resolution of problems/issues raised in previous progress report or resolved during the period:

8. List of accident(s) during period (indicate type, frequency, and severity) and description of corrective actions taken:

9. Summary of critical issues and proposed resolution. Discuss actions planned to correct any negative float. Explain potential delays and/or problems and their estimated impact on performance and the overall completion date:

10. Actions requested and/or required of the Louisiana Department of Transportation and Development, including Design Reviews and visits:

11. Other items:

12. Photographs.

For the Design-Builder: _____ (Signature) _____ (Date)

(Printed or Typed Name)
Design-Builder's Project Manager

Delaware Department of Transportation

FORM SAF

Monthly Safety Report Format

Design-Builder's Name: _____

Period Covered (Month and Year): _____

Name of Design-Builder's Safety Manager: _____

Item	Contract Total This Period	Contract Cumulative Total
Number of Man-Hours Worked (Construction)		
Number of Lost Workday Cases (entire shift lost)		
Number of Restricted Workday Cases (partial shift lost or reassigned to "light" duty)		
Number of Cases Requiring Medical Attention		
Number of Fatalities		
Number of On-Site Safety Meetings		
Number of On-Site Equipment Accidents		
Number of Vehicle Accidents, including off-site accidents by vehicles working on the Contract		
Number of New Workers on the Site During Period		
Number of New Worker Safety Orientations		
Number of Supervisor/Foreman Safety Sessions		
Number of Site Safety Inspections		

1. Describe circumstances surrounding each lost workday and each fatality case.
2. Describe actions taken and/or planned to prevent reoccurrence.

Signed for the Design-Builder:

(Signature)

(Signature)

(Printed or typed name) Board Director

(Printed or typed name) Design-Builder's Project Mgr

(Date)

(Date)

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 109

LUMP SUM PRICE, PROGRESS, AND PAYMENT

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APPENDIX 109A - FORMS

DB SECTION 109

LUMP SUM PRICE, PROGRESS, AND PAYMENT

This DB Section 109 describes and specifies the lump sum pricing concepts, specifies the means of determining the Work progress, and establishes the procedures for requesting and making payment.

109-1 LUMP SUM PRICING CONCEPT

The Schedule of Values concept will be used for all pricing. The price for each Project Component (PC) will be reflected as a Project Component Value (PCV) on Form SV (Schedule of Values) in Appendix C to the Instructions to Proposers (ITP). The sum of all of the PCVs will be the Lump Sum Contract Price.

The pricing concepts are summarized as follows:

- A) The Project is divided into Sections (*see* Form PCD (Project Component Description)) and Form SV in Appendix C to the ITP;
- B) Project Components are identified and defined for Project-wide activities and construction activities within the Sections;
- C) Project Component Values (lump sum prices or the sum of unit priced items) are assigned to each Project Component and to designated activities within each Project Component by the Proposer/Design-Builder per the ITP;
- D) A Contract Periodic Payment Schedule (PPS-C) is prepared by distributing the PCVs over the period of performance of the Work within each PC on a cumulative amount earned basis (a time-price curve). The time-price curve for the Project as a whole is determined by summing the cumulative amounts earned for the PCs;
- E) Milestones (MS) designated by the Department and Design-Builder are identified and defined for each of the PCs;
- F) The date when achievement of the MSs is planned is identified and shown on a Schedule of MSs; and
- G) The sum total of all the Project Components shall be the Lump Sum Contract Price.

Details of the process are described in this DB Section 109.

109-1.1 Project Components

109-1.1.1 General Requirements for Defining Sections and Project Components

Form PCD shows the Department's suggested titles and limits of Sections and PCs. The Proposer/Design-Builder may adjust the PC titles, contents, and limits subject to the requirements noted below, but shall designate Sections and PCs of a similar magnitude and nature to those shown on Form PCD.

The Proposer/Design-Builder shall divide the Project into PCs each representing one or more groups of inter-related Work forming part of the Project. The Proposer/Design-Builder will use the following indicators to create the Sections and PCs:

- A) Use Section "A" for non-construction Project Components, including the following, as applicable:

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- 1) Project Component 1 for preliminaries and general requirements, including activities shown in Form PC1 and Table 109-2;
- 2) Project Component 2 for Project-wide engineering and design activities, including activities shown in Form PC2;
- 3) Project Component 3 for Maintenance of Traffic activities, including those shown on Form PC3;
- 4) Project Component 4 for Project-wide environmental compliance and mitigation activities shown on Form PC4;
- 5) Project Component 5 for public outreach activities, including those activities listed on Form PC5;

Project Components 1 through 5 are reserved for Section “A” for the activities described above;

- B) Use Sections “B,” “C,” and so on for construction Sections and construction PCs. Project Component numbering for Sections subsequent to Section “A” should always begin with PC 6. For example, Section “B” will begin with PC 6, as will Sections “C” and beyond. Thus, there will be only one each of PCs 1 through 5 for any given project. However, there may be multiple PCs 6 and above for a project. For clarity, each PC 6 and above must be identified by Section and PC number (i.e., Project Component B-6 for Section “B,” PC C-6, and so on);
- C) Each construction PC shall represent a series of Work activities comprising a complete Project Component when constructed. *See* Form SV; and
- D) Each Project Component shall have two or more MSs.

See the ITP, Appendix C, for all Pricing Forms.

For all PCs except PCs 1, 2, 3, 4, 5 (Forms PC1, PC2, PC3, PC4, PC5), the Proposer/Design-Builder shall provide a description identifying the scope of Work for each PC in bulleted or narrative form on Form PCD. The Proposer/Design-Builder may include a list of the key components shown on Form SV in each PC description. The Proposer/Design-Builder must generally describe all the Work encompassed within each PC and clearly cross reference items of a similar nature that are included in other PCs.

109-1.1.2 Mobilization

Mobilization shall be an activity in PC 1. Mobilization shall not exceed five percent of the Lump Sum Contract Price.

109-1.1.3 Material Delivered To The Site

If the Proposer/Design-Builder plans to request payment for Material delivered to the site, it must show delivery of the Material as an activity of the associated Project Component(s). *See also* DB Section 109-6.3.

109-1.1.4 Specific Rules For Project Components

The following rules apply for Project Components.

- A) Project Components 1 through 5
The Proposer/Design-Builder may add Project-wide activities to Forms PC1 through PC 5, but shall not delete any of the activities shown on Forms PC1 through PC 5.

B) Other Project Components

- 1) Unless agreed to by the Department, Project Components shall not contain more than one Critical Path; and
- 2) The Design-Builder may find it beneficial to place significant portions of the Project that will be completed by a separate Subcontractor and/or represent significant differences in crafts and/or trades, such as utility relocations, in separate PCs.

109-1.2 Periodic Payment Schedule

The PPS-C shows the planned amount payable to the Design-Builder for each month of Work carried out in the PCs, subject to conditions stated in the Contract. The PPS-C will be the basis for the amounts of periodic payments. However, accelerated payments may be made in accordance with DB Section 109-5.7.

In its Proposal, the Design-Builder submitted a Proposed Periodic Payment Schedule (PPS-P) for the Work. The Design-Builder shall develop and submit the PPS-C to the Department's Project Manger within 45 Working Days of Notice to Proceed (NTP) for review and written acknowledgement. The Design-Builder shall develop the PPS-C in accordance with this DB Section 109-1.3. The PPS-C, upon written approval of the Department's Project Manager, will be incorporated into Part 8 of the Contract.

109-1.2.1 General Requirements for the Periodic Payment Schedule

The Design-Builder shall develop and submit the PPS-C broken down to each Section and PC. The Sections and PCs in the PPS-C shall match those shown on Form PCD. The Design-Builder shall make no changes in PCVs except as authorized by Change Orders.

The PPS-C shall cover the entire period of the Contract in monthly increments, through Final Acceptance, using months and years on the Gregorian calendar, starting at the date of NTP.

The Design-Builder shall make the cumulative payment percentages shown on the PPS-C compatible with the progress of the Work indicated in its proposed Baseline Progress Schedule.

All Project Components, regardless of measurement and payment method, shall be shown on the Periodic Payment Schedule.

109-1.2.2 Developing the Periodic Payment Schedule

The Design-Builder shall distribute the PCV of each PC over the period of the Contract within the limitations described in this DB Section 109-1.3 to indicate the Design-Builder's desired payment schedule.

There will be no advance payment and there will be no separate PC for mobilization. Mobilization costs shall be included in PC 1.

The sum of the Project Component Values shall equal the Lump Sum Contract Price.

The Design-Builder shall determine the monthly cumulative payment distribution of the PCV over the duration of the Contract for each PC. The resulting curve shall be the PPS-C for each PC.

The time-price curve for each PC shall be developed in such a manner that the amount planned to be earned for any month preceding the date of a MS shall not be less than ten percent of the PCV.

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The Design-Builder shall do the following to determine the Periodic Payment Schedule for the Contract:

- A) For each Project Component, list each monthly cumulative payment for each month for that Project Component; and
- B) For each month, sum the planned cumulative payments for the PCs to determine the planned maximum cumulative Contract payment for each month of the Contract.

109-1.2.3 Review of the Periodic Payment Schedule

In addition to the procedure for revision of the PPS-C pursuant to DB Section 109-1.4.4, the Department's Project Manager will carry out a detailed examination and review of the PPS-C, the MSs, and the dates stipulated for their achievement and an assessment of the extent to which the Work has been carried out up to the date of such review, in the following events:

- A) The Department's Project Manager accepts a revised Baseline Progress Schedule containing a change to the sequence or timing of the Work; or
- B) The Department's Project Manager grants an extension of time in accordance with DB Sections 104 and 109; or
- C) The Design-Builder adopts a recovery schedule in accordance with DB Section 108; or
- D) The Department's Project Manager orders a suspension of the Work or any part thereof; or
- E) The Department's Project Manager instructs a change under DB Section 104; or
- F) Following the suspension of payment pursuant to DB Section 109-6.1(C), the relevant MS has not been achieved within three months of the date stipulated in the Schedule of MSs; or
- G) There is a significant change in a PCV by reason of a determination of the Department's Project Manager in accordance with the Contract.

109-1.2.4 Cooperation

The Design-Builder shall cooperate with and, to the best of the Design-Builder's ability, assist the Department's Project Manager in making any such detailed examination pursuant to DB Section 109-1.2.3. The Design-Builder shall provide all such information as may be reasonably required in connection therewith at no increase in Lump Sum Contract Price or extension in time. If, as a result of this detailed examination, the Department's Project Manager is of the opinion that, in relation to any PC, the relationship between periodic payments and progress of the Work and the degree of control over periodic payments envisaged at the date of concurrence of the Design-Builder's Proposal has not been or will not be maintained, then the Department's Project Manager may give 30 Calendar Days written notice to the Design-Builder to prepare a revised PPS-C and/or a revised Schedule of MSs that will, in the Department's Project Manager's opinion, restore, so far as reasonably practicable, said relationship and degree of control. On the expiration of the said notice and after considering any representations the Design-Builder may have made in the meantime, the Department's Project Manager shall, if still of the opinion that revisions ought to be made, revise the PPS-C and/or the Schedule of MSs in any manner that the Department's Project Manager sees fit, based on the rate of progress of the Work which the Department's Project Manager anticipates and with the objective of restoring, so far as is reasonably practicable, said relationship and degree of control.

109-1.3 Milestone Descriptions and Schedule of Milestones

The Design-Builder shall establish and describe MSs that define significant events and/or reflect certain or significant accomplishments towards the completion of Work within each PC that can be readily identified without resorting to measurement of quantities.

For each PC, the Design-Builder shall identify and list the MSs that are reflective of the Baseline Progress Schedule. For each MS identified, the Design-Builder shall provide a detailed description of the Work to be accomplished using Form M.

The Design-Builder shall show its designated Milestones and Department-designated Milestones on Form MS.

The Design-Builder shall develop a numbering system for MSs that readily ties each MS to its specific PC. The Design-Builder will number MSs within the same PC sequentially over time.

If the Design-Builder plans to request payment for Material, products, or components delivered to the site, it must provide for each PC a specific description of the Material, products, or components, including estimated quantities of each. Material, products, or components of a similar type, such as different sizes of Culvert, may be combined in a single MS for a given PC. The Design-Builder shall list similar Material within separate PCs separately for each PC.

The Design-Builder shall complete the Schedule of MSs by selecting events which represent the completion of significant activities, including delivery of Material, products, or components to the site, to be undertaken by the Design-Builder and that are in accordance with the proposed methods and sequence of design and construction.

The Design-Builder shall not describe Milestones in terms of “percent complete.”

The Design-Builder shall enter the scheduled month of completion for each MS in each PC in the column provided. The Design-Builder shall express the months in terms of months after NTP.

Individual Milestones shall meet the following requirements:

- A) There shall be Milestones at the start and completion of Work in a Project Component;
- B) If the duration of the Work on a PC exceeds six months, the Design-Builder shall identify and describe additional interim MSs so that MSs are not more than three months apart;
- C) Milestones shall signify the completion of elements of the Work that can be readily identified as being completed without resorting to conventional measurement of quantities;
- D) The Design-Builder shall relate Milestones to activities on the Critical Path, where practicable;
- E) There shall be no further periodic payments for a Project Component after achieving the last MS in a Project Component;
- F) For PC1, show MSs for each activity in this DB Section 109-1.3(F)(1) through (4) in accordance with due dates established by the Department when such dates are specified in the Contract. Otherwise, the MS dates shall be as designated by the Design-Builder on Form MS for each of the following:

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- 1) Mobilization shall be paid such that 100% of the mobilization costs, not to exceed five percent of the Lump Sum Contract Price, shall be paid out by the time that 50% of the Lump Sum Contract Price has been paid on the Project;
- 2) Submittal (or resubmittal) of and issuance of the Department's Project Manager's written acceptance or approval (if specified) for the following items:
 - a) Safety Plan;
 - b) Quality Plan;
 - c) Baseline Progress Schedule; and
 - d) Other plans to be submitted;
- 3) Provision for the following:
 - a) Facilities and Equipment, if any, for the Department; and
 - b) The Design-Builder's temporary facilities;
- 4) Removal of temporary and Design-Builder provided facilities and site cleanup, landscaping, and restoration. This MS may be scheduled after the Substantial Completion Date; and
- 5) Periodic audits and updates of the Quality Plan and Safety Plan

For PC 1, MSs shall be at three month intervals covering all activities not covered in this DB Section 109-1.4(F)(1) through (4);

- G) For preconstruction engineering and design (Project Component 2), the following particular rules apply:
 - 1) There shall be MSs at the start of design and at the receipt of the Department's Project Manager's written acknowledgement after the Final Design Review as per DB Section 111 for each Design Unit identified by the Design-Builder;
 - 2) The Design-Builder may include additional intermediate Milestones; and
 - 3) The final Milestone shall be the submission and Approval of Record Drawings;
- H) Show the month each Milestone is to be completed on Form M;
- I) For MSs relating to payment for Material delivered to the site, indicate the planned month of delivery of the Materials as described on Form M;
- J) Include Department-designated MSs on Form M;
- K) For PC 3, the submittal of the Maintenance of Traffic Plan and its updates shall be MSs. The Design-Builder shall show major traffic shifts and detour changes as MSs;
- L) For PC 4, environmental compliance and mitigation, the submittal of specified plans shall be MSs. The Design-Builder shall set MSs for on-going activities at no greater than three month intervals; and
- M) For PC 5, Public Outreach activities, the Design-Builder shall set MSs for on-going activities at no greater than three month intervals;

109-1.4 Revisions During the Contract

109-1.4.1 Revisions to Project Components

In the event that revisions to the PCs are required during the Contract, the following procedures shall apply:

- A) Where new PCs are required, the Design-Builder shall revise and submit the following to the Department's Project Manager for written Approval:
 - 1) Form SV;
 - 2) Form PCD;
 - 3) Form M; and
- B) Where revisions to existing PCs are required, the Design-Builder shall revise and submit the following to the Department's Project Manager for written Approval:
 - 1) The appropriate revised Project Component description on Form PCD;
 - 2) Any change to Form SV;
 - 3) Revisions to Form M to reflect new Milestones or changes in Milestones; and
 - 4) Revised Project Components 1, 2, 3, 4, and/or 5 on Forms PC1, PC2, PC3, PC4, PC5.

109-1.4.2 Revisions to Schedule of Values

The Design-Builder shall revise the affected PCVs and Form SV to incorporate any change to the Lump Sum Contract Price. The Design-Builder will update Forms SV and PCD and Forms PC1, PC2, PC3, PC4, and PC5, as appropriate, and submit them to the Department's Project Manager for written Approval.

109-1.4.3 Adjustments to Schedule of Milestones (Form M)

In the event that revisions to the Schedule of MSs (Form M) are required during the Contract, the following procedures shall apply:

- A) In the event that a MS is not achieved, the Department's Project Manager may order the Design-Builder to revise and submit the Baseline Progress Schedule and the Schedule of MSs (Form M) to update the following:
 - 1) The date by which the non-achieved, changed, or added MS(s) will be achieved; and/or
 - 2) The schedule for any affected subsequent MS which may not be achieved by the originally designated date;
- B) The Design-Builder shall revise the Schedule of MSs (Form M) to show changes to affected MSs;
- C) In the event of a revision of the Baseline Progress Schedule, the Design-Builder shall revise dates of the affected MSs;
- D) In the event of changes to Work, the Design-Builder shall make such changes, additions, or deletions to only those affected MSs so identified in the ordered change;
- E) In the event that a MS is changed as result of a time extension the Design-Builder shall change those dates affected by the time extension;

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- F) In the event that a MS is changed as a result of a suspension of Work order the Design-Builder shall change those dates affected by the suspended Work; and
- G) In the event that the Design-Builder’s progress exceeds that shown on the Schedule of MSs, and payment is made at an accelerated rate in accordance with DB Section 109-5.7, the Design-Builder shall revise the Schedule of MSs (Form M), as necessary, to reflect any planned changes to the Schedule of MSs.

109-1.4.4 Revisions to the Periodic Payment Schedule

If the Design-Builder’s progress is such that MS(s) are completed prior to the date(s) shown on the Schedule of MSs (Form M) and payment is made at an accelerated rate in accordance with DB Section 109-5.7, the Design-Builder shall adjust the PPS-C for the affected PC(s) and submit the revised PPS-C to the Department’s Project Manager for written Approval.

The Design-Builder may submit a request to the Department’s Project Manager to allow a change to its PPS-C for a PC to reflect changes in timing of the Work within a given PC. No change in PCVs will be permitted except to reflect changes in Lump Sum Contract Price made through Change Orders. The Design-Builder shall accompany any such request with the following:

- A) Proposed revisions to the Baseline Progress Schedule to reflect the change in schedule; and
- B) Proposed revisions to the MS descriptions and/or Schedule of MSs (Form M) consistent with the requested change in the PPS-C.

The Department, in its sole discretion, may consent to the requested change but will be under no obligation to do so.

Documentation of any changes in the Periodic Payment Schedule will be made as a no-cost Change Order.

When revisions are made to the PPS-C in accordance with the Contract, the Department’s Project Manager may reduce or extend the period over which periodic payments may be made.

109-2 MEASUREMENT/DETERMINING PROGRESS

Unless specified otherwise in the Contract Documents, there will be no measurement of quantities to determine payment due, except for any unit price items.

The Design-Builder shall measure unit price items as specified in DB Sections 109-2.5 and 109-5.2, or per the Project Specifications developed by the Design-Builder and accepted by the Department for items that have unit prices.

For PCs and/or Change Orders paid on a force account basis, the Design-Builder shall substantiate progress with submittal of statements specified in DB Section 109-8.2.2.

For PCs and/or Change Orders paid on a unit price basis, the Design-Builder shall substantiate progress with submittal of invoice documents specified in DB Section 109-8.2.1.

For all Work paid on a lump sum basis, the achievement of Milestones shall be determined as follows.

109-2.1 Project Component 1

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Where a MS requires the submittal of insurance certificates (in addition to the initial submission of the insurance certificates at the time of Contract execution) or similar documents, the MS is met when the document has been delivered to the Department’s Project Manager and content of the document is shown to meet the Contract requirements and the Department’s Project Manager notifies the Design-Builder in writing of that determination.

Where a MS requires the submittal of a specified plan or similar document, the MS is met when the plan has been submitted to the Department’s Project Manager for Consultation and Written Comment and the Department’s Project Manager issues the written comment(s) relative to the plan or document.

Where a MS requires an audit and/or update of a specified plan, the MS is met when the report of the audit and/or plan update is submitted to the Department’s Project Manager for Consultation and Written Comment and the Department’s Project Manager issues the written comment(s).

If Design Plans or documents are returned to the Design-Builder without the Department’s Project Manager’s written acknowledgement, the Design-Builder shall not have met the MS.

Mobilization shall be invoiced at the end of the period following submittal of a Baseline Progress Schedule and the PPS-C that the Department’s Project Manager acknowledges in writing meets the Contract requirements.

For continuing activities listed in Table 109-2, the MSs, which shall be at three month intervals, are met when the specified standards and/or requirements, such as those listed in Table 109-2, are met.

TABLE 109-2

PROJECT COMPONENT 1 CONTINUING ACTIVITIES STANDARDS

ACTIVITY	REQUIREMENT/STANDARD
Project Management and Construction Management	<ul style="list-style-type: none"> • Monthly progress reports prepared and submitted in accordance with DB Section 108; • Key Personnel are on site and meet qualifications requirements of Part 4 – Special Provisions, Special Provision 108C; • Meetings conducted and attended, and minutes prepared in accordance with, DB Section 105; • Baseline Progress Schedule submitted and maintained in accordance with Part 4 – Special Provisions, Special Provision 108A; • Required notices given to the Department’s Project Manager in timely manner; and • Contract submittal list submitted and updated in accordance with DB Section 108. • Maintain coordination and cooperation with adjacent contracts and contractors.
Quality Control of Management and Construction	<ul style="list-style-type: none"> • Quality Plan and updates submitted and received Department’s Project Manager’s written acknowledgement in accordance with DB Section 113. • Management and construction activities conducted in accordance with the Quality Plan; • Sampling and testing conducted in accordance with DB Sections 105 and 106; and

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ACTIVITY	REQUIREMENT/STANDARD
	<ul style="list-style-type: none"> Documentation prepared and maintained in accordance with DB Section 112-9.
Security	<ul style="list-style-type: none"> Site Security Plan and updates submitted and Department's Project Manager's written acknowledgement of Site Security Plan received in accordance with DB Section 107; and Security facilities maintained and security services provided in accordance with the Site Security Plan.
Facilities and Equipment provided for the Department	<ul style="list-style-type: none"> Facilities and Equipment provided, maintained, and cleaned, and utilities provided and paid for.
Safety	<ul style="list-style-type: none"> Safety Plan and updates submitted and received Department's Project Manager's written acknowledgement in accordance with DB Section 107; and Construction Work conducted in accordance with DB Section 107 and the Safety Plan, including submittal of required reports.
Communications	<ul style="list-style-type: none"> Courier service provided.
Design-Builder's Temporary Facilities and Site Maintenance	<ul style="list-style-type: none"> Site and facilities maintained in accordance with DB Section 107.
Insurance	<ul style="list-style-type: none"> Specified levels of insurance maintained in accordance with DB Section 107.

109-2.2 Project Component 2

The MSs are met when the requirements for preconstruction engineering; design and design management; and design QC, including Design Reviews, have been achieved for the applicable Design Unit including the specified reports, the documentation and QC records, the certifications of the Designer and the Design QC Manager, and the Department's Project Manager's written acknowledgement. In the case of design studies and/or reports, the MS is met when the Department's Project Manager issues a written acknowledgement regarding the study or report.

Progress will be determined on a cumulative percent complete basis consistent with the percent complete shown on Form DUS (*see* DB Section 111-3) as agreed between the Design-Builder and the Department's Project Manager.

109-2.3 Project Components 3 through 5

The MSs are met when specified plans, reports, and/or updates are submitted and the Department's Project Manager issues a written acknowledgement that they meet Contract requirements.

Milestones for Maintenance of Traffic are met when Maintenance of Traffic measures, meeting Contract requirements, are implemented and when planned traffic switches are made.

109-2.4 Project Components Associated with Construction

When the MS is identified by the Design-Builder in its Schedule of MSs (Form M) and requires the completion of an entire PC or partial completion of Work associated with a PC, the MS is met only when all components within the MS are constructed in accordance with Contract requirements.

The Design-Builder must comply with the Quality Control requirements before the Milestone is met.

The Milestone will not be considered met until temporary erosion control measures are in place.

Milestones will not be considered met until applicable environmental requirements have been met.

109-2.5 Unit Priced Work

In computing amounts in estimates or Work done under unit prices, all estimates, including the final, will be made for actual quantities of Work performed and Material placed in accordance with the requirements contained in the Project Specifications, Design Plans, and standard sheets (except as provided under DB Section 109-6.3) as determined as per DB Section 109-6.2, and the resulting quantities involved in the Contract shall be accepted as final, conclusive, and binding upon the Design-Builder.

109-3 CHANGES TO LUMP SUM CONTRACT PRICE

The Lump Sum Contract Price shall be increased or decreased only by a Change Order. The Design-Builder shall revise the PCVs in accordance with the terms of a Change Order and submit the revisions to the Department's Project Manager for written Approval.

The Department's Project Manager may decide the applicable PC for the purpose of any revision in accordance with this DB Section 109-3 if and insofar as the same is not identified in the pricing documents, and shall notify the Design-Builder in writing upon making any such decision.

Notwithstanding this DB Section 109-3, the Department's Project Manager may decide not to include a sum payable to the Design-Builder pursuant to the Contract in a PCV, in which case the Department's Project Manager shall notify the Design-Builder of the decision and the Design-Builder may apply for payment of the sum in accordance with DB Section 109-5.

109-4 CONTRACT PAYMENTS

Payments to the Design-Builder for Work satisfactorily performed will be made monthly.

109-4.1 Scope of Payment

The Design-Builder shall receive and accept compensation provided for in the Contract as full payment for furnishing all Material and for performing all Work under the Contract in a complete and acceptable manner and for all risk, loss, damage, or expense of whatever character arising out of the nature of the Work or the prosecution thereof.

109-4.2 Payment Concept

Payment will be calculated using the PPS-C except for Work performed under other specified means, such as unit prices and/or force account (*see* DB Sections 109-5.2 and 109-8.2.2).

The Design-Builder will be paid monthly based on the percentages and amounts shown on the PPS-C for each PC developed in the manner described in DB Section 109-1.2.2 except as provided in DB Section 109-6.1.

If Work defined for a MS in a PC is not completed by the date shown on the Schedule of MSs (Form M), payment may be adjusted to a level commensurate with actual progress made.

Payment will be based on the Price Proposal and the PPS-C. No payment will be made based on the PPS-P and no payment will be made until the PPS-C is incorporated into the Contract.

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Requirements relating to requests for payment for the Work are set forth in DB Section 109-5.

Except for PCs paid on a force account or unit price basis, the PPS-C sets out the maximum accumulative percentage of each PCV (or part thereof) in relation to each month for which the Design-Builder may apply for payment in accordance with this DB Section 109-4.2, subject to the achievement of relevant PCPs. Payment for PCs paid on a force account or unit price basis shall be determined per DB Section 109-8.2.2 and DB Section 109-5.2, respectively.

109-4.3 Progress Payments

No payment will be made for Work until its satisfactory completion in accordance with the Contract and Specifications.

109-4.4 No Payment on Design-Builder's Non-Compliance

No final payment will be made so long as any lawful or proper direction to the Design-Builder by the Department's Project Manager or his/her designee concerning the Work or Material has not been complied with. *See* also DB Section 109-6.1(D).

109-4.5 Claims

The Department will withhold from progress payments and the final payment any amounts claimed due from the Design-Builder.

109-5 REQUESTS FOR PERIODIC PAYMENT

The Design-Builder shall submit all requests for periodic payment to the Department's Project Manager with the monthly progress report (*see* DB Section 108) signed by the Design-Builder's Project Manager, except that the request for final payment must be signed by the Design-Builder's representative or designated Project Principal-in-Charge. The Design-Builder shall submit the request by the fifth day of each month (if a holiday, the next Working Day) or other mutually agreed date.

The Design-Builder's Project Manager, QC Manager, and Design Manager shall execute the certifications on Form RPP (Appendix 109A).

Mobilization will be paid per DB Section 109-2.1.

The Design-Builder shall submit the request for periodic payment using the format illustrated in Form RPP. The Design-Builder will complete the Request for Periodic Payment in accordance with the instructions shown on Form RPP. The maximum cumulative payments at any point in time shall not exceed the sum of planned cumulative payment for each PC as shown on the PPS-C, except when the Design-Builder meets MS's in advance of the dates shown on the Schedule of MS's (Form M). In such case, the Design-Builder shall adjust the maximum payment to incorporate the cumulative payment shown on the PPS-C for MS(s) achieved in advance of the date(s) shown on the Schedule of MSs (Form M). *See also* DB Section 109-5.7.

The Design-Builder shall complete and submit, as part of its request for periodic payment, the certificate of achievement of MSs on Form RPP, listing the MSs the Design-Builder considers to have been achieved in the previous month. The Design-Builder's Project Manager and the Design-Builder's QC Manager shall sign the draft certificate of achievement of MSs. The request for periodic payment will have no effect until countersigned by the Department's Project Manager pursuant to DB Section 109-6.

109-5.1 Payment Requests with the Monthly Progress Report

Each application for periodic payment shall contain the following:

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- A) The amount claimed to be payable using Form RPP, setting out the percentage and amount of each PCV claimed according to the PPS-C, including amounts due under force account PCs and/or Change Orders;
- B) Any other amount claimed to be payable or deducted pursuant to a determination of the Department's Project Manager, identifying the relevant determination; and
- C) A Milestone certificate included on Form RPP indicating the MSs the Design-Builder considers to have been achieved during the preceding month and certifying compliance with Contract requirements. The certification shall be signed by the Design-Builder's Project Manager, QC Manager, and Design Manager.

The Design-Builder shall make payment application for any Work where MSs have been met in advance of the time or date shown on the Schedule of MSs (Form M), subject to meeting all preceding MSs in the applicable PC, in accordance with DB Section 109-5.7.

109-5.2 Unit Price Work

The Design-Builder shall submit a summary table of quantities with the request for periodic payment indicating location, item number and description, quantity, unit price, and total amount due for the period covered by the request for periodic payment. The Design-Builder will attach copies of quantity measurement notes or field book entries stamped and signed by a Delaware-licensed Professional Engineer or Surveyor assigned to the Design-Builder's construction QC organization. The Design-Builder's Project Manager and the Construction QC Manager must sign and date the summary table.

The Design-Builder shall measure quantities as per DB Section 109-2.5.

109-5.3 Payment for Material

Payment for stockpiled or stored Material will be considered only for Materials anticipated to be stored for periods in excess of 90 Calendar Days. When approved by the Department's Project Manager, partial estimates may include an allowance for the value of tested and acceptable materials of a non-perishable or non-contaminative nature which have been produced or furnished in a condition ready for incorporation as a permanent part of work yet to be completed, provided the following terms and conditions are met:

- A. *Request.* The request for payment allowance for properly stored materials must be in writing, accompanied by an itemized inventory statement, written consent of the surety, and documentation of prepayment for the materials.

No payment allowance will be permitted for amounts less than \$25,000.00 for each material of a qualifying Contract item.

- B. *Materials.* An allowance of 100% of the cost to the Design-Builder for materials, not to exceed 90% of the Contract item price, may be made when such material is delivered and stockpiled or stored in accordance with the requirements specified herein.

Prior to such allowance, all such material shall have been tested and found acceptable to the Project Manager.

Payment shall not be allowed in excess of the quantity required for the Contract. The required quantity shall be based on the Contract bid quantities and approved revisions.

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- C. *Excluded Materials.* No allowance shall be made for fuels, form lumber, falsework, temporary structures, or for other materials of any kind that will not become an integral part of the finished construction.

No allowance shall be made for cement, aggregate, sand, seed, plants, fertilizer, or other perishable or contaminative items, nor for materials that, in the opinion of the Project Manager, have an unacceptable shelf life, environmental, or safety restriction.

- D. *Storage.* All materials shall be stored in an approved manner and in areas where damage is not likely to occur. The material stored shall be dedicated to the Project.

When it is determined impractical to store materials within the limits of the Project, the Project Manager may approve the storage of materials on private property or, for structural members, in the manufacturer's or fabricator's yard. Requests for payment for such material stored outside the limits of the Project shall be accompanied by a release from the owner and/or tenant of such property or yard agreeing to permit the removal of the materials from the property without cost to the State.

- E. *Materials Inventory.* Materials shall be available for inspection and inventory at the storage site by the Project Manager or his authorized representative at all times.

- F. *Materials Measurement and Payment.* The method of measurement for materials shall be in units which are easily inventoried and acceptable to the Project Manager.

Payment allowance for Materials shall be included in the progress estimate as a Project Component (PC) and shall be subject to any retainage provisions as outlined in the Contract.

109-5.4 Equipment Used to Construct the Project

The Department shall not pay for direct costs of Equipment used to construct the Project. The Design-Builder shall allocate costs for Equipment, whether new, used, or rented, as part of the activities with which the Equipment is associated.

109-5.5 Bond Premiums

The amount payable to the Design-Builder for bond premiums shall be a dollar-for-dollar pass through of the Design-Builder's costs (not to exceed the amount shown on Form PC1 for such premiums).

109-5.6 Permits

The amount payable to the Design-Builder for permits shall be a dollar-for-dollar pass-through of the Design-Builder's costs (not to exceed amount shown on Form PC1 for permits). The Design-Builder shall provide backup documentation supporting each cost in this category to the Department prior to any payment.

109-5.7 Accelerated Payment

The Design-Builder will be entitled to payment at a rate in excess of that shown on the PPS-C if a MS is completed prior to the date shown on the Schedule of MSs (Form M), provided all MSs preceding the aforementioned MS on the Schedule of MSs (Form M) for that PC have also been completed. Periodic payment will be based on the percentages shown on the PPS-C for the date when the completed MS was anticipated for completion.

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See also DB Sections 109-1.4.3 and 109-1.4.4 for resulting adjustments to the Schedule of MSs (Form M) and PPS-C.

109-5.8 Transportation Tax Exemption

All unit prices shall be based on exemption from any transportation tax for which the State is, by law, exempt on materials entering into and forming a part of the Project.

In order for the Design-Builders to take advantage of the exemption from payment of the tax on transportation and to have the construction materials consigned to the State, in care of itself, the Design-Builder shall furnish the supplier with a statement certifying that the Design-Builder has been authorized to claim the exemption, identifying the Contract in which the authorization was given and instructing the supplier to make the shipment involved free of tax.

109-5.9 Source of Supply and Carrier Rates on Construction Materials

Bidders must fully inform themselves as to the source of supply of acceptable materials needed for the work and in regard to the carrier rates and transportation facilities for these materials before submitting proposals.

Inability to secure satisfactory materials from the source upon which the bid was based, or changes in carrier, or the alteration of transportation facilities for these materials during the life of the Contract, shall not constitute cause for claim for extra compensation.

109-6 REVIEW AND PROCESSING OF REQUESTS FOR PERIODIC PAYMENT

Upon receipt of a request for periodic payment, the Department's Project Manager will proceed in accordance with this DB Section 109-6. At the same time, the Department's Project Manager will countersign the certificate of MSs achieved (Form RPP) for MSs met.

Any adjustments by the Department's Project Manager to a request for periodic payment shall be reasonable and in accordance with the Contract Documents.

Upon resolution of any problems with any draft certificate of MSs that resulted in an adjustment in the amount of a prior request for periodic payment, or upon satisfaction of any conditions that were the basis for such an adjustment, the Design-Builder may include the amount of the adjustment in the next request for periodic payment.

109-6.1 Payment Limitations and Partial Suspension of Payments

There will be no advance payments or payments for mobilization except as specified in DB Section 109-1.2.2 and 109-1.3(F)(1).

The Department will not pay for construction Work, including Work being paid on a force account basis, unless the following conditions are met:

- A) Design Plans and Project Specifications that have been released for construction as per DB Section 111-12.5 are on site for the Work being constructed;
- B) Design Plans and Project Specifications have been checked and reviewed in accordance with DB Section 111-12 and design documentation maintained in accordance with DB Section 111-18;
- C) Construction Work has been inspected and sampling and testing conducted in accordance with DB Section 112-2;

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- D) Items covered by Non-Conformance Reports (NCR) issued by the Department, the Design QC Manager, or Construction QC Manager are corrected and/or resolved to the satisfaction of the Department; and
- E) Construction documentation is completed and records and reports submitted and/or retained in accordance with DB Section 112-9.

If the Design-Builder does not meet the MS by the date indicated on the Schedule of MSs (Form M), the payment for that PC in which the MS appears will be prorated commensurate with the progress of the actual Work satisfactorily completed until the date the MS is met, at which time the payment shall be brought up to the appropriate level through the next request for periodic payment.

As a condition precedent to consideration by the Department's Project Manager of any periodic payment for Work described in PC 1 for the preceding month, the monthly progress report completed in accordance with DB Section 108 must accompany each such application.

As a condition precedent to consideration by the Department's Project Manager of any periodic payment for Work described in PC 1 for the preceding month, all certified payrolls of the Design-Builder and all Construction Subcontractors shall be up to date and submitted to the Department.

The Department may suspend payment for PCs' 1, 3, 4, and/or 5 Work for any period if the Design-Builder's performance of Project Components 1, 3, 4, and/or 5 continuing activities during the period resulted in any of the following:

- 1) Serious disruptions to necessary Maintenance of Traffic and access through the site;
- 2) Serious disruptions to the Department's access to the site or use of facilities provided for the Department's use;
- 3) Unacceptable safety performance as evidenced by the Design-Builder's accident record;
- 4) Non-compliance with environmental requirements that leads to citations, fines, and/or other penalties by environmental authorities;
- 5) Serious disruptions to procedures and documentation required by the Quality Plan and/or specified in the Contract;
- 6) Continued reports of blocked vehicular and/or pedestrian access to properties; or
- 7) Continued report of failure to comply with the requirements of Part 3 – Design Requirements and Performance Specifications, Public Outreach Performance Specification.

The Department's Project Manager may determine that the three month MSs for PCs 1, 3, 4, and/or 5 continuing activities have not been met and may suspend payment for PCs' 1, 3, 4, and/or 5 Work at the end of the three month period covered by the MS if there is a continuing history of non-compliance and failure to correct deficiencies noted in the Department's Project Manager's monthly assessment of the Design-Builder's performance for PCs' 1, 3, 4, and/or 5 continuing activities listed in DB Sections 109-2.1 and 109-2.2.

No payment will be made under PCs or Change Orders being paid on a force account basis for design or construction Work necessitated to correct deficiencies noted on an NCR. The Design-Builder shall

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clearly delineate in its records and on the force account report (*see* DB Section 109-8.2) personnel and Equipment used on any corrective force account Work on such deficiencies.

If the Design-Builder fails to actively prosecute Work within a PC, the Department's Project Manager may suspend payment in that PC at the previous month's level or, as agreed between the Design-Builder and the Department's Project Manager, adjust the payment to a level commensurate with actual progress made.

109-6.2 Certification for Periodic Payment

Within seven Calendar Days of receipt of a request in accordance with DB Section 109-5, the Department's Project Manager shall issue to the Department, with a copy to the Design-Builder, a periodic payment certificate showing the amount of any periodic payment the Department's Project Manager considers payable by the Department to the Design-Builder. Such periodic payment certificate shall be the sum of the following:

- A) The amounts shown to be due by reference to the Contract Periodic Payment Schedule; and
 - B) The amounts determined by the Department's Project Manager to be due in respect of the following:
 - 1) Additional cost incurred and payable in accordance with the Contract;
 - 2) Work executed pursuant to a force account Change Order; and
 - 3) Any other amount or allowance to which the Design-Builder is entitled under the Contract, unless account has been or will be taken of such amount or allowance by way of a revision of a PCV under DB Section 109-1.4.2;
- less:
- a) Any retention monies as provided for in DB Section 109-7;
 - b) Any amounts certified for payment on certificates previously issued; and
 - c) Any amounts recoverable from the Design-Builder in accordance with the Contract, including any amount withheld for PC 1 because the Design-Builder failed to provide the monthly progress report in the form and detail required in the Contract or failed to provide a revised Baseline Progress Schedule that the Department's Project Manager has accepted.

At the same time, the Department's Project Manager shall countersign the certificate of MSs (Form RPP) to be based on the draft submitted by the Design-Builder pursuant to DB Section 109-5, amended as necessary, certifying the MSs the Department's Project Manager considers the Design-Builder to have met. The Department's Project Manager shall have power to omit from any such certificate the value of any Work with which the Department's Project Manager may, for the time being, be dissatisfied. The Department's Project Manager may by any certificate delete, correct, or modify any sum or statement of fact previously certified by him or her.

109-6.3 Cap on Periodic Payment

On some projects, if there is a need, periodic payments may be limited by a cumulative cap set forth on the PPS-C. If a cap on payment is in place on a project, at no time shall the Design-Builder's cumulative total progress payments exceed the cumulative total expenditure shown on the PPS-C except for the Design-Builder's accelerated performance as defined and provided in DB Section 109-5.7. The initial

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PPS-C set forth in DB Section 109-1.3 hereto is subject to revision from time to time as appropriate to account for any changes in the Lump Sum Contract Price as evidenced by Change Orders.

109-6.4 Payment by Department

Within 21 Calendar Days after receipt by the Department of an acceptable request for periodic payment (such acceptability as determined by the Department), the Department will pay the Design-Builder the amount of the request approved for payment by the Department's Project Manager, less any applicable retainage and less any amounts that the Department is otherwise entitled to withhold. If a cap on payment is in place on the Project, in no event shall the Department have any obligation to pay the Design-Builder any amount which would result in payment for any activity in excess of the value of the activity shown on the PPS-C, except as provided in DB Section 109-5.7.

109-6.5 Asphalt Cement Cost Adjustment

For all Sections within Division 400 of the Standard Specifications, payments to the Design-Builder will be adjusted to reflect increases or decreases in the Delaware Posted Asphalt Cement Price when compared to the Project Asphalt Cement Base Price, as defined in the Contract Documents.

The Delaware Posted Asphalt Cement Price will be issued weekly by the Department and will be the industry posted price for Asphalt Cement, F.O.B. Philadelphia, Pennsylvania.

The Project Asphalt Cement Base Price will be the anticipated Delaware Posted Asphalt Cement Price expected to be in effect at the time of receipt of bid.

All deviations of the Delaware Posted Asphalt Cement Price from the Project Asphalt Cement Base Price are eligible for cost adjustment. No minimum increase or decreases or corresponding percentages are required to qualify for cost adjustment.

Actual quantity of asphalt cement qualifying for any Asphalt Cement Cost Adjustment will be computed on the basis of weight tickets and asphalt percentage from the approved job mix formula. For Recycled Hot-Mix the asphalt percentage eligible for cost adjustment shall be only the new asphalt cement added to the mix.

There shall be no separate payment for asphalt cement. That cost shall be included in the various unit prices bid per metric ton for those bid items that contain asphalt cement.

If the Design-Builder exceeds the authorized allotted completion time, the price of asphalt cement on the last authorized allotted work day shall be the price used for cost adjustment during the time Liquidated Damages are assessed.

The Project Asphalt Cement Base Price shall be determined by the Department for each project and shall be set forth in Part 4 - Special Provisions.

109-7 RETAINAGE OF FUNDS

If an election has been made to have retainage withheld from periodic payments due the Design-Builder, the Department will deduct from the periodic payment an amount equal to five percent of the requested periodic payment.

Whenever Liquidated Damages are assessable, such damages shall be deducted from the monthly and final estimate. The payment of any current or final estimate or of any retained percentage shall in no way

affect the obligation of the Design-Builder to repair or renew any defective parts of the construction and to be responsible for all damage due to such defects.

If at any time there is evidence of any lien or claim for which, if established, the Department might become liable, and which is chargeable to the Design-Builder, the Department shall have the right to retain out of any payment then due or to become due an amount sufficient to completely indemnify the Department against such lien or claim. If there should prove to be any such claim after all payments are made, the Design-Builder shall refund to the Department all monies that the Department may be compelled to pay in discharging any lien made obligatory in consequence of the Design-Builder's neglect or default.

Upon Substantial Completion of the Work under the Contract, the Project Manager may release 60% of the amount then retained. The balance of the amount retained will be held until all reports required of the Design-Builder are received and final payment is authorized by the Department. The Department may, at its option, retain temporarily or permanently a smaller amount and may cause the Design-Builder to be paid temporarily or permanently, in accordance with the Contract Documents, such portion of the amount retained as it deems equitable.

No provision contained in these Specifications shall be construed as creating any debt, liability or obligation on the part of the State or Department to any subcontractor, supplier, or materialman.

109-8 EXTRA WORK, FORCE ACCOUNT WORK, AND RECORD KEEPING

109-8.1 Contract Item Charges

The Department reserves the right to order changes in the scope of the Contract Work as is necessary to complete the Project, in accord with the intent of the Contract Documents.

A) *Lump Sum Work*

Lump Sum Contract adjustments shall be based on negotiations between the Design-Builder and the Department.

B) *Unit Priced Work*

Payment shall be made at the Contract Unit Price (if applicable) for all Work less than or equal to twice the original Contract quantity. Once this limit is exceeded, any additional Work shall be considered to be new Work, with payment determined in accordance with DB Section 109-8.2. Negotiated Unit Prices for extra and force account Work shall be paid per unit for the full quantity of extra Work performed.

109-8.2 New Item Charges

109-8.2.1 Agreed Prices

Agreed prices for new items of Work or Material may be incorporated in the Change Order as the Project Manager may deem them to be just and fair and beneficial to the State. These prices must be supported by a complete price analysis in the Change Order, or if approved by the Department's Project Manager, by reference to the weighted average bid or proposal prices for similar types and quantity of Work from other recent contracts. The price analysis will be based on an estimated breakdown of charges listed in DB Section 109-8.2.2. Agreed prices may be lump sum or unit priced Work.

109-8.2.2 Payment for Differing Site Conditions, Major Changes, Extra Work, and Force Account

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Differing site conditions, changes, and extra work performed under Section 104 will be paid for using the following methods as appropriate:

- A) Contract unit prices.
- B) Unit prices agreed upon in the change order authorizing the work.
- C) A lump sum amount agreed upon in the change order authorizing the work.
- D) If directed by the Department, work performed on a force account basis is to be compensated in the following manner except as further provided in Standard Specification Subsection 105.21:

- 1. *Labor.* For all necessary labor and foremen in direct charge of the specific operations, whether the employer is the Design-Builder, subcontractor, or another, the Design-builder shall receive the rate of wage (or scale) actually paid as shown in its certified payrolls for each and every hour that said labor and foremen are actually engaged in such work.

The Design-Builder shall receive the actual costs paid to, or on behalf of, workers by reason of health and welfare benefits or other benefits, when such amounts are required by collective bargaining agreements or other employment contracts generally applicable to the classes of labor employed on the work.

- 2. *Bond, Insurance, and Tax.* For bond premiums, property damage, liability, and workers compensation insurance premiums, unemployment insurance contributions, and social security taxes on the force account work, the Design-Builder shall receive the actual incremental cost thereof, necessarily and directly resulting from the force account work. The Design-Builder shall furnish satisfactory evidence of the rate or rates paid for such bond, insurance, and tax.
- 3. *Materials.* The Department reserves the right to furnish such materials as it deems advisable, and the Design-builder shall have no claims for costs and markup on such materials.

Only materials furnished by the Design-Builder and necessarily used in the performance of the work will be paid for. The cost of such materials shall be the cost to the purchaser, whether Design-Builder, subcontractor, or other forces from the supplier thereof, together with transportation charges actually paid by the purchaser, except as the following are applicable:

- a. If a cash or trade discount by the actual supplier is offered or available to the purchaser, it shall be credited to the State notwithstanding the fact that such discount may not have been taken.
- b. If materials are procured by the purchaser by any method which is not a direct purchase from a direct billing by the actual supplier to such purchaser, the cost of such materials is the price paid to the actual supplier as determined by the Project Manager plus the actual costs, if any, incurred in the handling of such materials.
- c. If the materials are obtained from a supply or source owned wholly or in part by the purchaser, the cost of such materials shall not exceed the price paid by the purchaser for similar materials furnished from said

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- source on items or the current wholesale price for such materials delivered to the job site, whichever price is lower.
- d. If the cost of such materials is, in the opinion of the Project Manager, excessive, then the cost of such material is deemed to be the lowest current wholesale price at which such materials are available in the quantities concerned delivered to the Project site, less any discounts as provided in a. above.
 - e. If the Design-Builder does not furnish satisfactory evidence of the cost of such materials from the actual supplier thereof, the cost will be determined in accordance with d. above.
4. *Equipment and Plant.*
- a. *Design-Builder-Owned Equipment and Plant.* The hourly rates for Design-Builder-owned equipment and plant will be determined from the applicable volume of the Rental Rate Blue Book (referred to hereafter as the "Blue Book"), published by Machinery Information Division of K-III Directory Corporation, 1735 Technology Drive, Suite 410, San Jose, CA 95110.
The Blue Book will be used in the following manner:
 - (1) The hourly rate will be determined by dividing the monthly rate by 176. The weekly, hourly, and daily rates will not be used.
 - (2) The number of hours to be paid will be the number of hours that the equipment or plant is actually used on a specific force account activity.
 - (3) The current revisions will be used in establishing rates. The current revision applicable to specific force account work is as of the first day of work performed on that force account work and that rate applies throughout the period the force account work is being performed.
 - (4) An area adjustment will be made. Equipment life adjustment will be made in accordance with the rate adjustment tables.
 - (5) Overtime shall be charged at the same rate indicated in (1) above.
 - (6) The estimated operating costs per hour will be used for each hour that the equipment or plant is in operation on the force account work. Such costs do not apply to idle time regardless of the cause of the idleness.
 - (7) Idle time for equipment will not be paid for, except where the equipment has been held on the Project site on a standby basis at the request of the Project Manager and, but for this request, would have left the Project site. Such payment will be made at one-half the rate established in (1) and (4) above.
 - (8) The rates established above include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs, overhaul and maintenance of any kind, depreciation, storage, overhead, profits, insurance, all costs (including labor and equipment) of moving equipment or plant on to and away from the site, and all incidentals.
 - (9) Operator costs are not included in this hourly rate for this equipment.

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All equipment shall, in the opinion of the Project Manager, be in good operating condition. Equipment used by the Design-Builder shall be specifically described and be of suitable size and suitable capacity required for the work to be performed. In the event the Design-Builder elects to use equipment of a higher rental value than that suitable for the work, payment will be made at the rate applicable to the suitable equipment. The Project Manager will determine the suitability of the equipment. If there is a differential in the rate of pay of the operator of oversize or higher rate equipment, the rate paid for the operator is to be that for the suitable equipment.

In the event that a rate is not established in the Blue Book for a particular piece of equipment or plant, the Project Manager will establish a rate for that piece of equipment or plant that is consistent with its cost and use in the industry.

The above provisions apply to the equipment and plant owned directly by the Design-Builder or by entities which are divisions, affiliates, subsidiaries, or in any other way related to the Design-Builder or its parent company.

- b. *Rented Equipment and Plant.* In the event that the Design-Builder does not own a specific type of equipment and must obtain it by rental, the Design-Builder shall inform the Project Manager of the need to rent the equipment and of the rental rate for that equipment prior to using it on the work. The Design-Builder will be paid the actual rental rate for the equipment for the time that the equipment is actually used to accomplish the work, provided that rate is reasonable, plus the cost of moving the equipment on to and away from the job. The Design-Builder shall provide a copy of the paid receipt or canceled check for the rental expense incurred.
5. *Miscellaneous.* No allowance will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.
6. *Profit.* Profit shall be computed at 5% of the following:
 - a. Total material cost (bare cost not including FOB).
 - b. Total direct labor cost (actual hours worked multiplied by regular hourly rate) as provided by 109-8.2.2 D.1.
7. *Overhead.* Overhead is defined to include the following:
 - a. All salaries and expenses of executive officers, supervising officers, or supervising employees and all home office expenses;
 - b. All clerical or stenographic employees;
 - c. All charges for minor equipment, such as small tools, including shovels, picks, axes, saws, bars, sledges, lanterns, jacks, cables, pails, wrenches, and other miscellaneous supplies and services; and
 - d. All drafting room accessories such as paper, tracing cloth, and blueprinting.

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Overhead costs for Force Account work shall be computed at 10% of the following:

- a. Total material cost (bare cost FOB).
 - b. Total direct labor cost (actual hours worked multiplied by the regular hourly rate) and benefits as provided by 109-8.2.2 D.1.
 - c. Total Equipment and Plant cost.
 - d. Specific extraordinary overhead expenses, such as hiring of additional supervisory personnel or the use of special type of minor equipment (as defined above), which the Design-Builder has to purchase specifically for the Force Account, may be allowed. In such instances, the Design-Builder will be paid only the reasonable costs of such extraordinary overhead expenses provided the Project Manager has agreed to such costs prior to their being incurred.
8. *Subcontracting.* For administration costs in connection with approved subcontract work, the Design-Builder shall receive an amount equal to 5% of the total of such work completed as set forth in 1. through 4. above.
9. *Records.* The Design-Builder shall maintain force account records in such a manner as to provide a clear distinction between the direct costs of work paid for on a force account basis and the costs of other operations.

From the above records, the Design-Builder shall furnish the Project Manager completed daily force account work reports for each day's work to be paid for on a force account basis. Said daily force account work reports shall be signed by the Design-Builder and submitted daily. The daily force account work reports shall be detailed as follows:

- a. Name, classification, date, daily hours, total hours, rate, and extension for each laborer and foreman.
- b. Designation, dates, daily hours, total hours, rental rate (including a copy of the Blue Book pages used), and extension for each unit of machinery and equipment.
- c. Quantities of materials, prices, and extensions.
- d. Transportation of materials.
- e. Cost of property damage, liability, and workers compensation insurance premiums; unemployment insurance contributions; bonds; and social security tax.

Material charges shall be substantiated by valid copies of vendor's invoices. Such invoices shall be submitted with the daily force account work reports, or if not available, they shall be submitted with subsequent daily force account work reports. Should said vendor's invoices not be submitted within 60 days after the date of delivery of the material, or within 15 days after the completion, whichever occurs first, the Department reserves the right to establish the cost of such materials at the lowest current wholesale prices at which said materials are available, in the quantities concerned delivered to the location of work less any discounts provided in 109-8.2.2 D.3.a

The Project Manager will compare its records with the completed daily force account work reports furnished by the Design-Builder and make any necessary adjustments. When these daily force account work reports are agreed upon and signed by both parties, said reports become the basis of payment for the work performed, but do not preclude subsequent adjustment based on a later audit by the Department.

The Design-Builder's cost records pertaining to work paid for on a force account basis shall be open to inspection or audit by representatives of the Department as provided in Standard Specification Subsections 105.19 and 105.21.

109-9 ELIMINATED ITEMS

Should any items contained in the Contract be found unnecessary for the completion of the work, the Project Manager may, upon written order to the Design-Builder, eliminate the items from the Contract. The elimination of these items shall not invalidate the Contract. When the Design-Builder is notified of the elimination of items, the Design-Builder will be reimbursed for the actual work done and all actual costs incurred. Reimbursement of materials actually purchased prior to notification of the elimination of items will be paid for at the actual cost of the materials plus 15%. Such materials shall become the property of the Department. In no event will reimbursement for an eliminated item exceed the extended amount of the Contract item. Also, in no case will the Design-Builder be reimbursed for the loss of anticipated profit.

109-10 ACCEPTANCE AND SUBSTANTIAL COMPLETION

109-10.1 Project Acceptance

Final Acceptance will not occur until completion of the Project in accordance with this DB Section 109-10. However, at the request of the Design-Builder and at the sole discretion of the Project Manager, the Contract Time may be stopped without all the required documents, certificates, or proofs of compliance.

When the Contract Time is stopped, the Design-Builder is to expeditiously provide the exempted documents, certificates, or proofs of compliance. Final Acceptance and payment will not be made until all documents, certificates, or proofs of compliance have been executed and delivered to the Project Manager.

- A) *Partial Project Acceptance.* When a unit or portion of the Project, such as a structure, interchange, or section of road or pavement is substantially completed, the Design-Builder may request final inspection of that unit or portion. If the unit or portion has been completed in accordance with the Contract, the Project Manager may accept it as completed. The decision to make partial acceptance of a unit is solely at the discretion of the Project Manager. Partial acceptance will not void or alter any of the terms of the Contract.
- B) *Project Acceptance.* Upon receiving notice from the Design-Builder of Project completion, the Project Manager will make a semi-final inspection. During this inspection, the Project Manager will note by stations and in detail all work or conditions requiring correction. The Design-Builder shall immediately prosecute the corrective work. When completion of the noted corrections are completed to the satisfaction of the Project Manager, a final inspection will be arranged. The Project Manager will make a final inspection of the work to certify the Project can be used, occupied, or operated for

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its intended use. The Project Manager will note any further corrective measures as deemed necessary. The Design-Builder shall prosecute corrective measures immediately. When the work is satisfactorily completed, together with receipt of proper documentation as noted herein, the Project Manager will notify the Design-Builder in writing of the date of acceptance of the Project.

The Design-Builder shall prepare and submit Record (as-built) Drawings of the following types in electronic format on Compact Disc – Read Only Memory (CD-ROM) and one reproducible hard copy set:

- Plan and profile sheets;
- Signing and striping;
- Pavement typical sections;
- All Bridge Plans;
- Retaining Structure Plans;
- Utility relocation Plans;
- Lighting Plans;
- Drainage Structure Plans;
- Cross sections in areas with retaining structures and/or cuts and/or fills in excess of ten feet high; and
- Plans of consolidated access points.

If there are no outstanding items to be completed or corrected before Final Acceptance of the Project, the Design-Builder shall, following inspection:

- Submit to the Department's Project Manager special guarantees, warranties, maintenance agreements, maintenance manuals, final certifications, and similar documents required under the Contract;
- Deliver tools, spare parts, instructions, and similar items required to operate and maintain the Work; and
- Make changeover of locks to all Equipment and facilities and deliver keys and/or combinations to the Department's Project Manager.

Final Acceptance shall be final and conclusive except for defects not readily ascertainable by the Department; actual or constructive fraud; gross mistakes amounting to fraud; or other errors which the Design-Builder knew or should have known about as well as the Department's rights under any warranty or guarantee. Final Acceptance may be revoked by the Department at any time prior to the issuance of the final payment upon the Department's discovery of such defects, mistakes, fraud, or errors in the Work.

Damage, theft, or vandalism to the items by the public after Final Acceptance will be repaired or replaced by the Department or by the Design-Builder in conformance with DB Section 104. When the damage to an item is such that only partial repair or replacement is required and the Work is to be done by the Design-Builder, payment shall be made as provided in DB Section 109-8.2. Items damaged due to negligence of the Design-Builder shall be repaired or replaced at no cost to the State.

109-11 FINAL PAYMENT

The Project Manager will, as soon as practicable after the completion of the Contract, make a final estimate of the work done thereunder and the value of such work, and the Department shall pay the entire sum found to be due after deducting from all previous payments all amounts to be kept and all amounts to be retained under the provisions of the Contract. All prior partial estimates and payments shall be subject to correction in the final estimates payment.

The acceptance by the Design-Builder of the last payment, as aforesaid, shall operate as and shall be a release to the State, the Department, the Director, and its agents from all claims of liability under the Contract, or for anything done or furnished or relating to the work under the Contract, or for any act or neglect of the State, the Department, the Director, or its agents relating to or connected with the Contract.

109-12 CHANGED CONDITIONS AND DELAY PROVISIONS

109-12.1 Compensable Delays and Changed Conditions

The provisions of this Contract permit monetary compensation for delays and interference in certain defined instances. The Design-Builder agrees, other than is set forth specifically in Section 109-13, that the only claims it may make for extra compensation caused by delay or interference affecting the performance or the scheduling of Contract Work are for those instances arising out of the following:

- A) Differing site conditions;
- B) Suspension of Work (other than stop orders pursuant to DB Section 109-12.2);
- C) Significant changes in the character of the Work; and
- D) Situations not referenced in DB Section 109-12 and which are not within the contemplation of the parties at the time of entering into the Contract.

In addition, these aforementioned provisions may also form the basis for Extra Work compensation pursuant to DB Section 109-8 and DB Section 109-9. Failure of the Design-Builder to adequately progress the completion of the Work will be considered in determining whether the aforementioned instances are the primary causes of delay. In all such instances, for any claim asserted under this DB Section 109-12.1, the Design-Builder shall keep detailed written records of the costs and agrees to make them available to the Department at any time for purposes of audit and review.

Any dispute relating to such claims shall be promptly submitted to the Department's Project Manager in writing, pursuant to the notice provisions of the Contract. Failure by the Design-Builder to notify the Department's Project Manager in writing pursuant to the provisions of this Contract, or to maintain and furnish cost records of such claims, shall constitute a waiver of the claim.

109-12.2 Suspensions of Work Ordered by the Department

The Project Manager may suspend the work in whole or in part by written order to the Design-Builder, for any reason or condition which would be in the best interest of the Department. The Project Manager may also suspend the work when the Design-Builder fails to perform any provisions of the Contract. The Design-builder shall immediately comply with the written order of the Project Manager to suspend the work wholly or in part. The work shall be resumed when conditions are favorable as determined by the Project Manager or when methods are corrected as approved in writing by the Project Manager.

- A) If the delay resulting from the written suspension order is considered unreasonable, the Design-Builder shall submit a written request to the Project Manager providing the

An adjustment will not be made unless the request has been submitted within the prescribed time.

- B) There will be no adjustment under the provisions of this Subsection if the work performance would have been suspended or delayed by any other cause, under any other terms or conditions of the Contract.
- C) The request for an adjustment will be reviewed by the Project Manager. If there is Agreement that 1) there has been an increase in the Contract performance cost or time as a result of the suspension, and 2) the suspension was caused by conditions beyond the control and not the fault of the Design-Builder or those parties for whom the Design-Builder is responsible, adjustments in the Contract Price, excluding profit, will be made according to DB 109-8.2.2. Any adjustments to Contract Time will be made according to DB 108-06.

109-13 FORCE MAJEURE EVENTS

The Department will be responsible for and agrees to issue Change Orders for the following purposes:

- A) Compensate the Design-Builder for reasonable, verifiable additional costs incurred arising from force majeure events (excluding delay damages except for any force majeure event which is determined to be a Department-caused delay, at the sole discretion of the Department); and



- B) Extend the completion deadlines as the result of any delay in the critical path on Baseline Progress Schedule caused by a force majeure event. It shall be the responsibility of the Design-Builder to demonstrate to the Department that the delay in the critical path is attributable solely to the force majeure event.

"Force Majeure" shall mean an event or circumstance which prevents Design-Builder from performing its obligations under this Contract, which event or circumstance (a) could not reasonably be anticipated as of the date of the Contract, (b) is not within the reasonable control of Design-Builder, (c) does not result from the fault or negligence of the Design-Builder, (d) the Design-Builder is unable to overcome or avoid or cause to be avoided by the exercise of reasonable care, and (e) includes, but is not limited to, the following events:

1. Acts of God (including fires, floods, hurricanes, tornados, earthquakes or other significant and unusual natural catastrophes) occurring at the project site or at the places of manufacture of Project components (so long as such components require greater than sixty (60) days to be manufactured and fabricated) including their transportation routes; *excluding, however,* inclement weather (including rain, significant rainstorms (nor'easter), snow, ice, high winds and extreme heat) experienced from time to time;
2. Any Governmental Authority having jurisdiction over the Work suspends or otherwise prohibits the conduct of the Work, *excluding, however,* (1) any actions by any Governmental Authority resulting from the breach or alleged breach by the Claiming Party of any applicable Law and any Permit); and (2) any delay, rejection or other adverse action (including the imposition of conditions) taken with respect to any Permit for the Work to be acquired by the Claiming Party after the Effective Date;

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3. War, epidemics, or blockades;
 4. Acts of terrorism or sabotage;
 5. Any change in governmental rule or change in the judicial or administrative interpretation of or adoption of any new governmental rules which are materially different with governmental rules in effect on the date the date of the Contract;
 6. Strikes, job actions, work stoppages or slowdowns or labor disputes (“Labor Disputes”) of any type that could not have been avoided by the reasonable action of the Contractor. Contractor shall be responsible for any Labor Disputes among its labor forces that resulted from its own acts or inaction or any acts or inaction of its Subcontractors or suppliers for whom Contractor is responsible;
 7. The discovery at, near, or on the site of any archaeological, paleontological, biological, or cultural resources or hazardous or contaminated substances, provided that the existence of such resources or substances was not disclosed by the Department; and
 8. Civil unrest, other than union activity.
- C) Force majeure shall be limited to the matters listed above and specifically excludes from the definition the following matters which might otherwise be considered force majeure:
1. Except as related to Section 109-13B(2) and 109-13B(3), an explosion or malicious or other acts intended to cause loss or damage or other similar occurrence;
 2. The suspension, termination, interruption, denial or failure to obtain, or non-renewal of any permit, license, consent, authorization, or approval (including all governmental approvals other than environmental approvals) which is necessary for the performance of the Work or the maintenance of the Project;
 3. Any lawsuit relating to any new approval which is the Design-Builder’s risk under the Contract;
 4. The Work or the presence on the Project site of any third party, including, but not limited to, that of other contractors or personnel employed by the State of Delaware; by other public bodies; by railroad, transportation, or utilities; or by private enterprises or any delay in progressing such Work by any third party as indicated or disclosed in the Contract Documents or ordinarily encountered or generally recognized as inherent in the Work;
 5. The existence of any facility or appurtenance owned, operated, or maintained by any third party, as indicated or disclosed in the Contract Documents or ordinarily encountered or generally recognized as inherent in the Work;
 6. The act, or failure to act, of any other public or governmental body or railroad, transportation company or corporation, or utility, including, but not limited to, approvals, permits, restrictions, regulations, or ordinances attributable to the Design-Builder’s design, submission, action or inaction, or means and methods of construction;

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7. Restraining orders, injunctions, or judgments issued by a court which were caused by the Design-Builder's submissions, action or inaction, or means and methods of construction;
8. Any shortages of supplies or Material required by the Contract Work;
9. Variations in soil moisture content from that represented in reports, borings, or tests conducted by the Department and included in the Contract Documents;
10. Any situation which was within the contemplation of the parties at the time of entering into the Contract; and
11. All other matters not caused by the Department or beyond the control of the Department and not listed in Section 109-13B(1) through (8).

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

APPENDIX 109A

FORMS

APPENDIX 109A

FORMS INDEX

Form 109-06	Certificate of Title to Materials Stored, or to be Stored, for Incorporation into Delaware Department of Transportation Project
Form CN-91	General Contractor's Certification of Payment
Form RPP	Request for Periodic Payment and Periodic Certification Summary Sheet
Form M	See Instructions to Proposers, Appendix C
Forms PC1-PC5	See Instructions to Proposers, Appendix C
Form PPS-P	See Instructions to Proposers, Appendix C
Form PPS-C	See Instructions to Proposers, Appendix C
Form SV	See Instructions to Proposers, Appendix C
Form PCD	See Instructions to Proposers, Appendix C

FORM 109-06

**CERTIFICATION OF TITLE
TO MATERIALS STORED, OR TO BE STORED,
FOR INCORPORATION INTO DELAWARE DEPARTMENT OF
TRANSPORTATION PROJECT**

WHEREAS, _____ hereafter referred to as the "Design-Builder," is engaged in the performance of the Contract with the Delaware Department of Transportation, hereafter referred to as the "Department," and

WHEREAS, in accord with the Design Plans and Project Specifications, the Design-Builder has purchased certain Materials for incorporation into the Contract Work from _____, hereafter referred to as the "Vendor," and

WHEREAS, these Materials referred to are as follows:

and,

WHEREAS, to comply with the provisions of the Contract Documents regarding payment of stockpiled Materials requiring certification of the Design-Builder's absolute legal title to the Materials described above and warrant of title to the same Materials to the Department, the Design-Builder and the Vendor have entered into the following agreement.

NOW, THEREFORE, and in consideration of the forgoing premises, the Design-Builder and the Vendor agree, with the intention of being bound hereby, as follows:

1. The Vendor has executed this document for the purpose of acknowledging that: the Vendor has made an outright sale and transfer of title for the above Materials to the Design-Builder free of all restrictions, filings, or liens; the Vendor is the lawful owner of the above Materials and has the right make such transfer of title; and the Vendor will not in the future make any claims whatsoever to such title.
2. The Design-Builder certifies and represents that it is the lawful holder of the absolute legal title to the above Materials and has full legal right, power, and authority to sell and transfer such title without restrictions, filings, or liens of any kind on the part of the Vendor and/or any Subcontractor.
3. The Design-Builder, Vendor, and/or any Subcontractor and their successors and assigns, will and do by these presents warrant title to the above described Materials to the Department.

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4. In the event that the Vendor has sold the above described Materials to a Subcontractor of the Design-Builder, this Certification of Title is hereby amended at all applicable points to reflect this fact. By the execution of this certification, any such Subcontractor is acknowledging that: such Subcontractor has made an outright sale and transfer of title for the above Materials to the Design-Builder free of all restrictions, filings, or liens; such Subcontractor is the lawful owner of the above Materials and has the right to make such transfer of title; and such Subcontractor will not in the future make any claims whatsoever to such title.

IN WITNESS WHEREOF, the parties hereto have caused this Certification of Title to be executed this day of _____, 20____.

ATTEST: DESIGN-BUILDER

By _____
Title _____

ATTEST: SUBCONTRACTOR

By _____
Title _____

ATTEST: VENDOR

By _____
Title _____

***NOTE: FAILURE TO PROVIDE COMPLETE INFORMATION WILL DELAY FUTURE PAYMENTS UNTIL COMPLETE AND ACCURATE INFORMATION IS PROVIDED. IF AUDIT OF PAYMENTS MADE REVEALS INFORMATION IS INCORRECT, INCOMPLETE, OR HAS BEEN FALSIFIED, CONTRACTOR MAY BE BARRED FROM BIDDING FUTURE WORK IN ACCORDANCE WITH STANDARD SPECIFICATION SECTION 102.11, DISQUALIFICATION OF BIDDERS.**

Sealed and dated this _____ day of _____ in the year of our Lord two thousand and _____ (20__).

Corporate _____

Seal

Name of Contractor

Attest _____

By: _____

Authorized Signature

Title

SWORN TO AND SUBSCRIBED BEFORE ME this ____ day of _____, 20__.

Notary _____

Seal

Notary

NOTE: Submitting this document containing information that is not true may constitute additional criminal offenses, in addition to those set out in 17 Del. C. Ch. 8.

Distribution: Project File, Civil Rights (DBE)

FORM RPP

**Request for Periodic Payment and Periodic Certifications
Summary Sheet**

(1) Payment Request No. _____ (4) Date Request Received By Dept's Proj Mgr. _____
 (2) Period of: _____ (5) Contract Price: _____
 (3) Date Request Submitted: _____

(6) Project Component Code	(7) Project Component Value	(8) Cumulative Amount Earned at End of Last Period	(9) Planned Cumulative Payment per PPS-C	(10) Not Used	(11) Actual Cumulative Amount Earned End of This Period
Section A Total					
Section B Total					
Section C Total					
Section D Total					
Section E Total					
Section F Total					
(12) Total Amount Earned to Date					
(14) Total Amount Earned as of Last Period					
(15) Amount Earned This Period					
(16) Less Retention (5%)					
(17) Net Due This Period					

Progress and Quality Certification:

We hereby certify that all Work performed meets Contract requirements, that the indicated Milestone Points have been met and that the cumulative amount earned at end of the period covered by this request and certificate are correct to the best of our knowledge

For the Design-Builder:

Signed: _____
 Printed or Typed Name: _____
 Date: _____
 Design-Builder's Project Manager or Deputy _____ QC Manager

Designer's Certification:

I hereby certify that responsible design staff have examined the site and the Work under construction and have, based on their professional judgment determined that the site conditions appear to be consistent with those represented by the design documents and that the Work is progressing in accordance with the Design Plans and Project Specifications

Signed: _____
 Printed or Typed name: _____
 Date: _____
 Design Manager

Department Endorsement:

I hereby confirm the achievement of the cumulative amount earned to date indicated herei and concur with this request and certificate except as noted below or attached

For Department: _____ (Signature) _____ (Date)
 _____ Project Manager _____ (Date)

FORM RPP

**Request for Periodic Payment and Periodic Completion Certificate
Section A**

(1) Payment Request No. _____
 (2) Period of: _____
 (3) Date Request Submitted: _____

(6) Project Component Code	(7) Project Component Value	(8) Cumulative Amount Earned at End of Last Period	(9) Planned Cumulative Payment per PPS-C	(10) All Scheduled MSs Met Yes or No	(11) Actual Cumulative Amount Earned End of This Period
PC1, Preliminary & General Requirements					
PC2, Engineering & Design					
PC3, Maintenance & Protection of Traffic					
PC4, Environmental Monitoring & Mitigation					
PC5, Public Information/Community Relations					
PC6, Hazardous & Contaminated Materials Remediation					
(12) Total					0

Milestones Met this Period Section A (enter MS Code)(13)

FORM RPP

Instructions

A. All amounts shall be in US\$.

B. Request for Periodic Payment Sheet

- (1) Enter Payment Request Number (numbered sequentially starting with "1")
- (2) Enter month and year covered by this payment request
- (3) Enter date this payment request submitted to Department's Project Manager
- (4) Enter date received by Department's Project Manager
- (5) Enter Contract Price
- (6) Enter Project Component Code from PPS-C for each Project Component in the Section
- (7) Enter Project Component Value from PPS-C for each Project Component
- (8) Enter Amount Earned at End of Previous Period
- (9) Enter Planned Cumulative Amount Earned from PPS-C for each Project Component. Enter "N/A" for any Project Component being paid on a unit price or force account basis
- (10) If "Yes" in Column (10), enter amount shown in Column (9); if "No" in Column (10), enter amount shown in Column (8)
- (11) Total the amounts shown in (11) and enter in (12).
- (12) Enter total of Column (11)
- (13) Enter the MS code of each MS achieved (met) during the period.
- (14) Enter total of column (8)
- (15) Subtract (14) from (12)
- (16) Subtract (16) from (15)

C. Periodic Certifications

The Design-Builder's Representative, QC Manager and Design Manager shall sign and date the Certifications

D. Department's Endorsement

The Department's Project Manager will sign and date the Department endorsement for the Periodic Completion Certificate

D. See Section 109 for documentation required for Unit Priced and Force Account Work.

E. Add additional worksheets for additional project sections as required.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 110

ESCROW OF PROPOSAL DOCUMENTS

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**DB SECTION 110
ESCROWED PROPOSAL DOCUMENTS**

DB 110-1 GENERAL

The purpose of Escrowed Proposal Documents is to preserve all of the Design-Builder's Price Proposal documents for joint use by the Design-Builder and the Department in the resolution of any disputes, claims, arbitration proceeding, or litigation arising from this Contract. The submitted Proposal documentation shall be placed in escrow with a banking institution and preserved by that institution as specified in the following Subsections of this Section. In addition, concurrent with the submission of quotations or revisions to quotations provided in connection with formally proposed Amendments to this Contract and concurrent with approval of each Change Order, if appropriate, one copy of all documentary information used in preparation of the quotation or Change Order shall be added to, and held with the other Escrowed Proposal Documents. The Escrowed Proposal Documents will remain in escrow subject to DB Section 110-2 until all of the following have occurred:

- A) One hundred eighty days have elapsed from Final Acceptance or termination of the Work, as applicable;
- B) All disputes regarding this Contract have been settled; and
- C) Final payment on this Contract has been made by the Department and accepted by the Design-Builder.

DB 110-2 AVAILABILITY FOR REVIEW

The Escrowed Proposal Documents shall be available for joint review by the Design-Builder and the Department in connection with review changes in the Baseline Progress Schedule and/or Contract Periodic Payment Schedule (PPS-C), negotiations of price adjustments and Change Orders, and/or the resolution of disputes. The Department shall be entitled to review all or any part of the Escrowed Proposal Documents in order to determine the applicability of the individual documents to the matter at issue. The Department shall be entitled to make and retain copies of such documents as it deems appropriate in connection with any such matters, provided that the Department has executed and delivered to the Design-Builder a confidentiality agreement specifying that all proprietary information contained in such documents will be kept confidential; that copies of such documents will not be distributed to any third parties other than the Department's agents, attorneys, and experts, and other dispute resolvers hereunder; and that all copies of such documents (other than those delivered for dispute resolvers) will be returned to the depository (or to the Design-Builder, if the Escrowed Proposal Documents have been returned to it) upon final resolution of the negotiations or disputes. The foregoing shall in no way be deemed a limitation on the Department's discovery rights with respect to such documents.

DB 110-3 PROPRIETARY INFORMATION

The Escrowed Proposal Documents are, and shall always remain, the property of the Design-Builder subject to the Department's right to review the Escrowed Proposal Documents as provided herein. The Department acknowledges that the Design-Builder may consider that the Escrowed Proposal Documents constitute trade secrets or proprietary information. The Department further acknowledges that the Design-Builder expended money in developing the information included in the Escrowed Proposal Documents and that it would be difficult for a competitor to replicate the information contained therein. The Department acknowledges that the Escrowed Proposal Documents and the information contained therein are being provided to the Department only because it is an express prerequisite to Award of this Contract. Thus, the Escrowed Proposal Documents will at all times be treated as proprietary and confidential information and will be used

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only for the purposes described in this DB Section 110.

At the Design-Builder's request, confidentiality agreements will be executed and delivered to the Design-Builder by the Department's employees or agents who review or have access to the Escrowed Proposal Documents.

DB 110-4 REPRESENTATION

The Design-Builder represents and warrants that the Escrowed Proposal Documents provided with the Proposal constitute all of the information used in the preparation of its Proposal and agrees that no other Proposal preparation information will be considered in resolving disputes or claims. The Design-Builder also agrees that the Escrowed Proposal Documents are not part of the Contract and that nothing in the Escrowed Proposal Documents shall change or modify the Contract.

DB 110-5 CONTENTS OF ESCROWED PROPOSAL DOCUMENTS

The Escrowed Proposal Documents shall, among other things, clearly itemize the estimated costs of performing each aspect of the Work required by the Contract Documents. All Work shall be separated into sub-items as required to present a complete and detailed estimate of all costs. Crews, Equipment, quantities, and rates of production shall be detailed. Estimates of costs shall be further divided into the Design-Builder's usual cost categories such as direct labor, repair labor, Equipment ownership and operation, expendable Material, permanent Material, and subcontract costs, as appropriate. Plant and Equipment and indirect costs shall also be detailed in the Design-Builder's usual format. The Design-Builder's allocation of plant and Equipment, indirect costs, contingencies, markup, and other items to each direct cost item shall be clearly identified. The Escrowed Proposal Documents shall include all assumptions, quantity takeoffs, rates of production and progress calculations, quotes from Subcontractors and suppliers, memoranda, narratives, and all other information used by the Design-Builder to arrive at the Proposal Price or Change Order price, as applicable.

DB 110-6 FORM OF ESCROWED PROPOSAL DOCUMENTS

The Design-Builder shall submit the Escrowed Proposal Documents in the format actually used by the Design-Builder in preparing its Proposal. It is not intended that the Design-Builder perform any significant extraordinary work in the preparation of these documents prior to the Proposal due date. However, the Design-Builder represents and warrants that the Escrowed Proposal Documents related to the Proposal have been personally examined prior to delivery to escrow by an authorized officer of the Design-Builder and that they meet the requirements of DB Section 110-5 and are adequate to enable a complete understanding and interpretation of how the Design-Builder arrived at its Proposal Price. The Design-Builder further represents, warrants, and covenants that the Escrowed Proposal Documents related to each Change Order will be personally examined prior to delivery to escrow by an authorized officer of the Design-Builder and that they meet the requirements of DB Section 110-5 and will be adequate to enable a complete understanding and interpretation of how the Design-Builder arrived at its Change Order price.

DB 110-7 REVIEW BY THE DELAWARE DEPARTMENT OF TRANSPORTATION

The Department may at any time conduct a review of the Escrowed Proposal Documents to determine whether they are complete. In the event the Department determines that any data is missing, the Design-Builder shall provide such data within three Working Days of the request and at that time it will be date stamped, labeled to identify it as supplementary Escrowed Proposal Documents information, and added to the Escrowed Proposal Documents. The Design-Builder shall have no right to add documents to the Escrowed Proposal Documents except upon the Department's request. At the Department's option, which

Delaware Department of Transportation

may be exercised at any time, the Escrowed Proposal Documents associated with any Change Order or Contract Amendment shall be reviewed, organized, and indexed in the same manner described in the Instructions to Proposers (ITP).

DB 110-8 SUBCONTRACTOR AND SUPPLIER PRICING DOCUMENTS

The Design-Builder shall require each Subcontractor and/or supplier to submit to the Design-Builder a copy of all documentary information used in preparing its sub-bid or sub-proposal immediately prior to executing the subcontract, to be held by the same escrow depository which is holding the Escrowed Proposal Documents and which shall be accessible by the Design-Builder and its successors and assignees (including the Department) and other dispute resolvers on terms substantially similar to those contained herein. Each such subcontract shall include a representation and warranty from the Subcontractor stating that its Escrowed Proposal Documents constitute all the documentary information used in preparation of its sub-bid or sub-proposal.

See DB Section 110-5 for content requirements.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 110

APPENDIX 110A - FORMS

Delaware Department of Transportation

AFFIDAVIT SUBMITTED TO DELAWARE DEPARTMENT OF TRANSPORTATION

The undersigned is duly authorized to certify, on behalf of _____ (Name of Bidder)

I, _____ (Affiant) hereby certify that the following is a true and accurate list of the bid documents used in the preparation of the bid for Contract 25-073-02. I have personally examined all relevant bid documentation used to arrive at the various bid prices specified in the firm's proposal, and all such bid document is list below and included in the container submitted to be held in escrow.

Sealed and dated this _____ day of _____ in the year of our Lord two thousand and (20__).

Name of Bidder (Organization)

Corporate
Seal

By: _____
Authorized Signature

Attest _____

Title _____
(Must be a registered officer authorized to execute bid documents)

SWORN TO AND SUBSCRIBED BEFORE ME this ___ day of _____, 20__.

Notary
Seal

Notary

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 111

**DESIGN MANAGEMENT AND DESIGN
QUALITY CONTROL/QUALITY ASSURANCE**

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DB SECTION 111
DESIGN MANAGEMENT AND
DESIGN QUALITY CONTROL/QUALITY ASSURANCE

DB 111-1 GENERAL DESIGN-BUILDER RESPONSIBILITIES

The Work shall be performed in accordance with the details as shown on the Design Plans, Project Specifications, and Working Drawings prepared by the Design-Builder, subject to the Department's Consultation and Written Comment.

It shall be the Design-Builder's sole responsibility to provide Design Plans, Project Specifications, and Working Drawings of such a nature to develop a finished product in accordance with the Contract requirements. The Design-Builder shall verify pertinent dimensions in the field prior to the design and review of Design Plans, Project Specifications, and Working Drawings. Review of the Design-Builder's Design Plans, Project Specifications, and/or Working Drawings by the Department shall not relieve the Design-Builder of the responsibility for the satisfactory completion of the Work in conformance with the Contract Documents.

Design Plans, Project Specifications, and Working Drawings shall be subject to the Department's Consultation and Written Comments per DB Section 111-12 before beginning construction Work covered by the Plans and the design intent shall not be thereafter amended or altered without the prior approval of the Design-Builder's Designer and subsequent Consultation and Written Comment by the Department.

The Contract Price includes the cost of furnishing all Design Plans and Working Drawings.

The Design-Builder shall perform the following:

- A) Manage the Design and Design Quality Control of the Work;
- B) Obtain new permits and/or permit modifications required by temporary and/or permanent impacts associated with the Work that fall outside the boundaries of the current permit impacts;
- C) Provide information and coordination necessary to assist the Department in providing and/or obtaining the necessary approvals from authorities having jurisdiction for temporary road diversions and detours, shutdowns, Utility Relocations, temporary sidewalk closures, and pedestrian detours; and
- D) Ensure that the Designer properly checks the designs of the Project and that the Design Quality Control (QC) Manager certifies QC procedures in accordance with the Contract.

The procedures outlined in this Section for the checking of design of permanent components shall also apply to design of major temporary components and construction sequences that affect the permanent components of the Project.

Please refer to Part 2 – Design-Build Section 101, Section 101-3, for the definitions of QC and Quality Assurance (QA).

DB 111-2 DESIGN-BUILDER'S DESIGN ORGANIZATION AND OBLIGATIONS

DB 111-2.1 Designer

The Design-Builder shall appoint a suitably qualified and experienced Designer, which may be a consultant or other member(s) of the Design-Build team, to undertake the design of the permanent components and the major temporary components of the Project. The Design-Builder shall require the Designer to be located in the field office and maintain all necessary representation throughout the duration of the Contract to ensure the Designer can meet all its obligations under the Contract and to ensure that the design intent is met by construction.

DB 111-2.2 Location of Design-Builder's Designer



The Designer may perform production design Work in the Project vicinity or elsewhere. ~~However, the~~ Key design personnel shall be available as necessary ~~in the Project vicinity~~ for the duration of the design.

DB 111-2.3 Completeness of Design

At a minimum, the Designer shall determine the following for all temporary and permanent conditions, as applicable:

- A) Effects of all loading requirements;
- B) Dimensions of all elements;
- C) Structural redundancies, where they exist;
- D) Sub-soil interaction to support the loads from above;
- E) Effects of wind loading and vibration;
- F) Effects of seismicity;
- G) Effects of fatigue;
- H) Durability and maintainability requirements, including coastal conditions and the preparation of a maintenance manual;
- I) Details of required Quality Assurance/Quality Control procedures, monitoring, and controls;
- J) Effects of hydrology, design flows, and scour depths; and
- K) Effects on previously or partially constructed facilities adjacent to the bridge site.

Working Drawings will be reviewed by the Department for conformance to Contract requirements. However, design will be considered complete for each Design Unit upon the Department's Design Acceptance that is only to occur following submittal, review, and acceptance of the Record (as-built) Drawings for the specified Design Unit.

DB 111-2.4 Design Manager



The Design-Builder shall designate and assign a Design Manager to manage all Work performed by the Design-Builder's Designer. The Design Manager shall be available ~~in the Project vicinity~~ as required in DB Section 108.

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The Design Manager and/or staff working under the direct supervision of the Design Manager shall conduct an assessment and evaluation of design such that the Design Manager can certify to the Design-Builder and to the Department that the design satisfies the Contract requirements, including the following requirements:

- A) Accuracy;
- B) Adequacy;
- C) Compliance with specified codes, standards, and permits;
- D) Conformance to standards of practice;
- E) Cost effectiveness;
- F) Quality; and
-  G) Fitness for purpose and function as specified in the Contract.

The Design Manager shall include such written certification for all Work being subjected to a Design Review as per DB Section 111-12.

The Design Manager's activities shall include, at a minimum, assessment and evaluation of the following:

- 1) Design reports;
- 2) Design Reviews and conformity to Contract requirements;
- 3) Review of shop drawings;
- 4) Evaluation and mitigation of Non-Conformance Reports;
- 5) Analytical approach;
- 6) Drawing details for conformity to Contract requirements;
- 7) Project Specifications for conformity to Contract requirements;
- 8) Design and Working Drawings;
- 9) Major temporary components' effect on permanent components;
- 10) Field design changes;
- 11) Design approvals for Materials and procedures; and
- 12) Record Drawings for conformity with final design and Contract requirements.

DB 111-2.5 Responsible Engineer

The Designer shall designate and assign a Responsible Engineer for each Design-Builder-designated Design Unit. The Responsible Engineer(s) shall sign and seal design reports, Design and Working Drawings, and Project Specifications for the assigned Design Unit(s). Responsible Engineers shall be Delaware-licensed Professional Engineers.

Responsible Engineers shall be in the Project vicinity as necessary to coordinate the Work on assigned Design Units. The Responsible Engineer shall be present in the Project area for assigned Design Unit(s) and shall attend applicable Design Reviews.

DB 111-2.6 Design Quality Control Manager

The Design-Builder shall assign a Design QC Manager as one of the Key Personnel. The Design-Builder's Design QC Manager shall report to the Design-Builder's QC Manager and shall be a person who is fully independent from the production of the design. Design QC Manager means an independent engineering firm employed by the Design-Builder responsible for administering and managing the design QC specified in the Contract Documents. The Design QC Manager shall not be owned or controlled by any Principal Participant or by any construction subcontractor of the Design-Builder. The Designer or a firm associated with or subsidiary to the Designer may serve as the Design QC Manager, except any Designer that is a Principal Participant or any Designer (or subsidiary of a Designer) that is an Affiliate of any Principal Participant or construction subcontractor shall not serve as the Design QC Manager.

The Design-Builder's Design QC Manager shall be responsible for the QC of all Work conducted by the Designer. The Design-Builder's Design QC Manager shall be in the Project vicinity as required in DB Section 108.

The Design-Builder's Design QC Manager shall assess and evaluate the Design-Builder's design QC activities in order to be able to certify to the Design-Builder and to the Department that the design QC activities comply with the Quality Plan and Contract requirements.

The Design-Builder shall ensure that its Design QC Manager carries out all duties expressed and implied in the Contract.

The Design-Builder's Design Quality Control Manager shall have QC responsibilities related to the following:

- A) Design of permanent and major temporary components;
- B) Changes in design of permanent components; and
- C) Record Drawings.

The Design-Builder's Design Quality Control Manager shall also perform the following activities:

- 1) Identify and report non-conformities/non-compliance;
- 2) Track, monitor, and report on status of outstanding design-related non-conformance reports;
- 3) Supply monthly report (*see* DB Section 111-18.3.1); and
- 4) Submit specified certificates (permanent components and major temporary components).

These responsibilities are further specified in DB Section 111-12.

DB 111-2.7 Check by the Designer

The requirement that the Design-Builder engage and use a Design QC Manager shall not relieve the Designer from carrying out all the checks and reviews that a professional and prudent designer would normally carry out on the type of Work that is actually being designed.

DB 111-3 DESIGN UNITS

The Design-Builder shall package all design and drawings for the Work into separate Design Units. Each

Delaware Department of Transportation

Design Unit shall comprise similar and coherent significant parts of the Project that can be checked and reviewed as a self contained package with due consideration for accommodating interfaces with other Project components.

Within 30 calendar days of Notice to Proceed (NTP), the Design-Builder shall provide a written report updating and identifying each Design Unit. The written report shall include the following:

- A) Design Unit descriptions, including the scope of design Work within each Design Unit, limits, and interface points;
- B) Planned review stages and dates, including specific information to be reviewed, planned review dates (measured from the NTP date), and percent complete represented by each review. *See* Appendix 111A - Forms, Form DUS;
- C) The identity of the Responsible Engineer; and
- D) Locations where design Work will be performed.

The Design-Builder shall submit any revisions to the information provided in response to this DB Section 111-3 in writing to the Department concurrent with the monthly progress report.

DB 111-4 RELATIONSHIP OF CONSTRUCTION STARTS TO DESIGN DEVELOPMENT AND REVIEW

It is the intent of the Department to only allow construction to begin on a Design Unit upon completion of Final Design and Design QA/QC for that Design Unit. Construction may progress in increments determined by the Design-Builder, at the Design-Builder's risk, provided each increment of construction is covered by plans and specifications that have been reviewed and meet the requirements for Readiness for Construction noted in DB Section 111-12.5.

DB 111-5 SCHEDULE FOR DESIGN CHECKS, REVIEWS, AND SUBMISSION OF CHECKED DESIGN

The Design-Builder is responsible for scheduling and conducting Design Reviews to meet design and/or construction needs of the Baseline Progress Schedule. The Design-Builder shall include in its Baseline Progress Schedule submitted with its Proposal a minimum of 4 weeks for the Department's Design Review of each submittal package. It is recognized and anticipated that the Design Review process and frequency, duration, and intensity of Design Reviews may vary with the complexity of the individual Design Units and the associated construction activities. The duration of Design Reviews shall be discussed and mutually agreed between the Department and Design-Builder during the Design Workshop (*see* DB Section 111-16) and verified and modified by mutual agreement during the course of the Project. The Design-Builder shall give written final notice of scheduled Design-Reviews to the Department's designated representative at least one week prior to any review.

The Design-Builder shall include the agreed Design Review schedule for all Design Units (including their components and elements) as part of the Baseline Progress Schedule. The Design Review schedule shall be reviewed monthly until design Work is complete. The Design-Builder shall not schedule more than two concurrent Design Reviews without the Department's written concurrence.

Except for Record Drawings, "submissions" shall be in the form of sufficient copies [to accommodate participants in the Design Review(s)] of Design Plans and Project Specifications and supporting data and reports assembled for review in the Designer's office. For final Design Reviews, "submissions" shall be

in the form of two hard copies and one electronic copy of Design Plans and Project Specifications and supporting data.

The Design-Builder shall make specified submissions of checked designs in accordance with DB Section 111-12. Submissions shall be completed for each Design Unit, but may be combined for multiple Design Units at any one time upon the Department's written concurrence. The Design-Builder shall submit each Design Unit for Consultation and Written Comment (*see* DB Section 105-11) in accordance with the Baseline Progress Schedule.

For each Design Unit designated by the Design-Builder, the Design-Builder shall include design checks and Design Reviews as indicated in Table 111-12 and such additional reviews as may arise as indicated in DB Section 111-12.4.4. The Design-Builder shall allow the time for the Department's participation and input to any Design Review conducted by the Design-Builder's Design QC Manager as agreed as per this DB Section 111-5. The Design-Builder shall incorporate this schedule into the Baseline Progress Schedule and report progress and updates in the monthly updates. The Design-Builder shall keep the Department up-to-date on exact timing of reviews through the weekly progress meetings.

The Design-Builder shall not be entitled to an increase in Contract Price or Time due to any differences between the mutually agreed Design Review schedule and the Design Review schedule assumed in the Design-Builder's Proposal.

DB 111-6 REVISIONS TO DESIGN

The Design-Builder shall deal with any changes to design initiated by the Design-Builder and already checked by the Designer and certified by the Design QC Manager as an entirely new design. The Design-Builder shall not be entitled to any increase in the Contract Price or extension of time pursuant to DB Section 108-6 in such circumstances.

DB 111-7 DESIGN REVIEW PLAN

The Design-Builder shall prepare and submit a written Design Review Plan within 30 calendar days of NTP for Consultation and Written Comment by the Department. The Design Review Plan shall describe the level of design that the Designer will accomplish for each of the planned stages of design development and provide a description and/or checklist for each Design Unit clearly identifying the design product that will be reviewed. The Design Review Plan shall include proposed review time for each Design Review, including the review time for Department and Project stakeholders.

DB 111-8 STAGES OF DESIGN DEVELOPMENT

The Design-Builder shall make a single comprehensive design check and Design Review for each Design Unit at the stages of design development specified herein.

The following are the five stages of design development:

- A) Preliminary Design;
- B) Semi-Final Design;
- C) Final Design;
- D) Working Drawings; and
- E) Record (as-built) Drawings.

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The intent of each stage of design development and Design Review is the following:

- 1) Verify that the design complies with the Contract requirements;
- 2) Allow separate Design Units to be released for construction; and/or
- 3) In the case of reviews of Working Drawings, to allow construction to continue.

Design Reviews or design checks shall be completed as specified in DB Section 111-12 for each Design Unit (and for each component or element within a Design Unit) at each stage of design development.

The Design-Builder shall time the Design Review and submissions (where specified) to be consistent with the Baseline Progress Schedule.

DB 111-9 DESIGN REVIEWS

The Design-Builder shall invite the Department to participate in Preliminary, Semi-final, Final Design; and Working Drawing Reviews. The Department may invite other Project Stakeholders to participate. The Design-Builder shall address and/or resolve the Department's comments in consultation with the Department prior to the Design Review process being considered complete. Any Stakeholder comments will be forwarded to the Design-Builder by the Department and shall be addressed and/or resolved by the Design-Builder.

DB 111-9.1 Preliminary Design Review

The Preliminary Design Review shall be the first Design Review after Award and is intended to verify that the design concepts proposed by the Design-Builder meet Contract requirements. The Preliminary Design Review shall verify the following:

- A) The design concepts governing future design development are defined consistently with Contract requirements;
- B) The final Basic Project Configuration;
- C) The design concepts are substantiated and justified by adequate Site investigation and analysis;
- D) Final Rights-Of-Way requirements;
- E) Permit impacts;
- F) The specific standards applicable to the proposed concepts are identified and appropriate;
- G) The proposed design concepts are constructible;
- H) The availability of required Materials/Equipment; and
- I) The design meets Project quality requirements and required design QC procedures have been followed.

If the Preliminary Design is amended subsequent to the Preliminary Design Review, the Design-Builder shall re-check and re-certify the design at an additional Preliminary Design Review. The Design-Builder will not be entitled to an increase in Contract Price or a time extension for the re-check and re-certification except when the amended design results from a change order requested by the Department.

See also DB Section 111-13 regarding design deviations and exceptions.

DB 111-9.2 Semi-Final Design Review

The Design-Builder shall schedule and conduct a Semi-Final review when the Design Plans and Project Specifications for a Design Unit are at the 60% to 80% stage of completion.

The Design-Builder and the Department shall use the Semi-Final Design Review(s) to verify that the concepts and parameters established and represented by Preliminary Design are being followed and that Contract requirements continue to be met. The Design-Builder shall specifically highlight, check, and bring to the attention of the Department any changes to information presented at Preliminary Design. The Design-Builder shall submit the Semi-Final Design for Consultation and Written Comment by the Department (*See* DB Section 105-11).

DB 111-9.3 Final Design Review

The Design-Builder shall schedule and conduct a Final Design Review when the Design Plans and Project Specifications for a Design Unit are 100% complete. The Design-Builder shall specifically highlight, check, and bring to the attention of the Department any changes to information presented at previous Design Reviews. The Design-Builder shall submit final design for Consultation and Written Comment by the Department (*See* DB Section 105-11).

The Design-Builder shall not construct any permanent components or major temporary components until the design checks, Design Reviews, and Design QC Manager’s certifications have been completed for the relevant Design Unit and the Department’s provided Consultation and Written Comment for the design. The Design-Builder shall not commence any construction until any design-related Non-Conformance Reports (NCR) have been addressed and resolved to the satisfaction of the Department.

The Final Design Review, upon completion of the Department’s Consultation and Written Comment, may be used to satisfy the applicable Readiness for Construction requirements of DB Section 111-12.5.

DB 111-10 WORKING DRAWINGS

Working Drawings shall comprise the development and production of working drawings. The Design-Builder shall check, review, and certify working drawings in accordance with DB Section 111-12.1 through 111-12.3 and DB Section 111-14 prior to their being issued for construction.

The Design-Builder shall invite the Department to participate in the review of Working Drawings. The Department may invite the Stakeholders to participate in reviews of Working Drawings.

Working Drawings include, but are not limited to, the following:

- A) Working drawings;
- B) Material and product data from Manufacturers; and
- C) Calculations.

DB 111-11 RECORD DRAWINGS

The Design-Builder shall submit the Record (as-built) Drawings for each Design Unit in accordance with DB Sections 109-10.1 and 111-12.

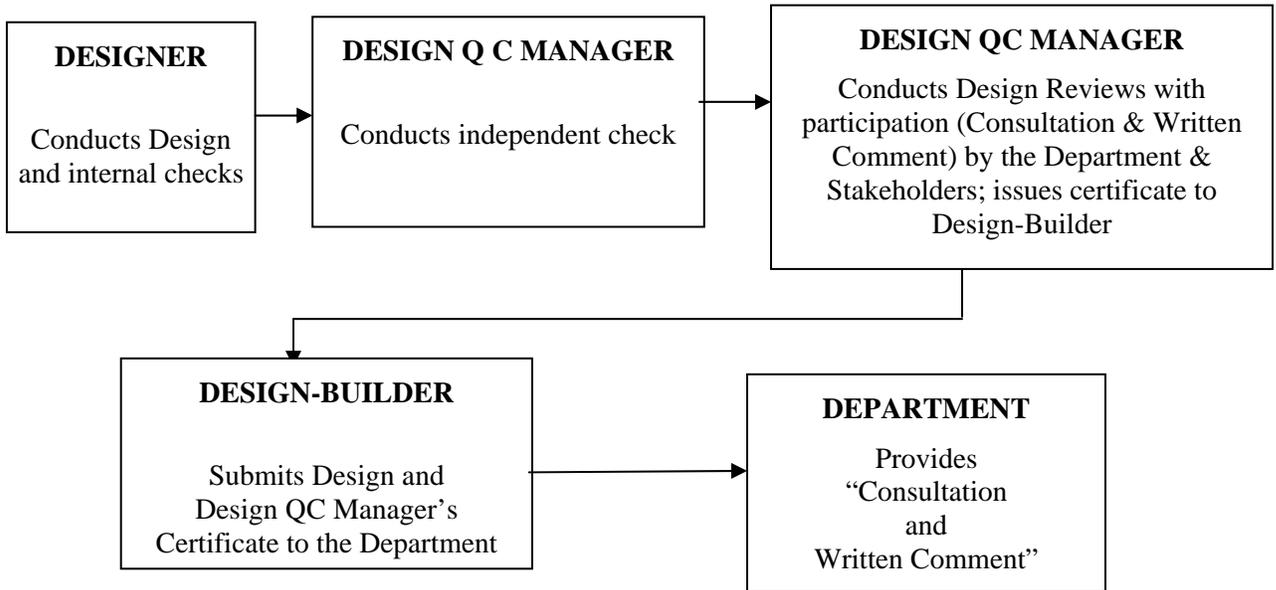
See DB Section 111-12.4.2 for additional requirements and information relating to Record Drawings and information.

DB 111-12 DESIGN CHECKS, CERTIFICATIONS, AND REVIEWS

The Designer's organization shall check all design documents (drawings, plans, specifications, calculations, and reports) produced by the Design-Build Team. The Design-Builder's Design QC Manager will certify that these documents have been checked as per Contract requirements and the Design-Builder's Quality Plan. The Design-Builder's Design QC Manager's written certification shall be provided as specified in DB Section 111-12.5.

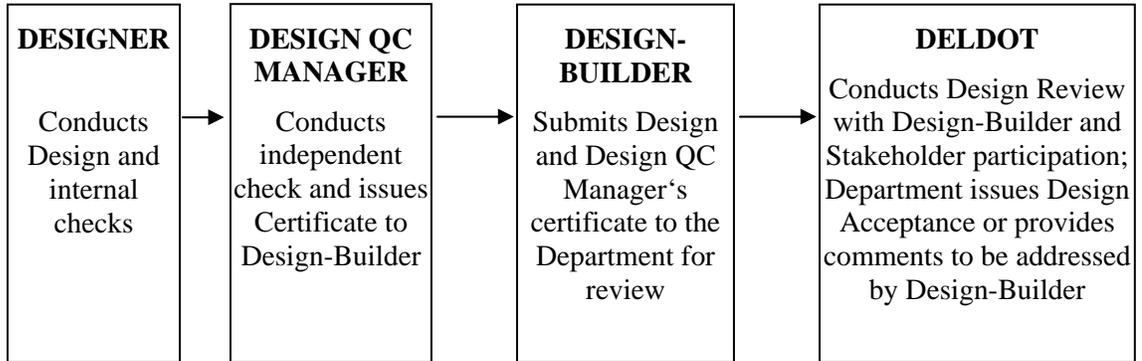
The Design-Builder and the Department shall follow the process shown in Figure 111-12A for Design Reviews conducted by the Design-Builder's Design QC Manager (applies to all Design Reviews except Record Drawing Reviews).

FIGURE 111-12A
DESIGN REVIEW FLOW CHART
(DESIGN-BUILDER'S DESIGN QUALITY CONTROL MANAGER
CONDUCTS DESIGN REVIEW)



The Design-Builder and the Department shall follow the process shown in Figure 111-12B for designs being submitted for the Department's review (applies to review of Record Drawings only).

FIGURE 111-12B
DESIGN REVIEW FLOW CHART
(DELDOT CONDUCTS DESIGN REVIEWS)



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The Design-Builder shall conduct and complete the design checks, certifications, and reviews for each Design Unit by the entity specified in Table 111-12. The Department will provide Consultation and Written Comment for the design(s) prior to the Design-Builder releasing final designs for construction as specified in DB Section 111-12.5. The Department may also issue design NCRs that must be addressed and resolved to the satisfaction of the Department prior to releasing the design(s) for construction.

The Design-Builder shall conduct its Design Review or submit its design for review in accordance with Table 111-12, supported by a written certification issued by the Design-Builder’s Design QC Manager, at the stages of design development shown in Table 111-12 for each Design Unit in accordance with the Design Review schedule in the Baseline Progress Schedule.

**TABLE 111-12
DESIGN CHECKS, CERTIFICATIONS, AND REVIEWS
FOR PERMANENT AND TEMPORARY COMPONENTS**

STAGE OF DESIGN DEVELOPMENT	DESIGN CHECK AND CERTIFICATION TO DESIGN-BUILDER	DESIGN REVIEW
Preliminary Design	Designer and Design QC Manager	Design QC Manager
Semi-Final Design	Designer and Design QC Manager	Design QC Manager
Final Design	Designer and Design QC Manager	Design QC Manager
Working Drawings and related documents	Designer and Design QC Manager	Design QC Manager
Record Drawings	Designer and Design QC Manager	Department’s designated representative
Major temporary components	Designer and Design QC Manager	Design QC Manager
Temporary components	Designer and checker	Not applicable

DB 111-12.1 Design-Builder’s Independent Checks

The Design-Builder shall perform independent checks of permanent components, major temporary components, and effects of temporary components on the permanent components using senior engineers not involved in the production of the design being reviewed who have equal or greater qualifications and experience as the Responsible Engineer for the design being checked.

Independent design checks shall include design assessment and analytical checks as specified in DB Sections 111-12.2 and 111-12.3.

DB 111-12.2 Design Assessment

Design assessment shall be the review of general compliance with the requirements of the Contract, taking into consideration the proposed method of construction, and, as a minimum, shall cover the following areas:

- A) Loads;

- B) Codes and standards;
- C) Methods of analysis;
- D) Computer software and its validation;
- E) Interface requirements;
- F) Maintenance requirements;
- G) Materials and Material properties;
- H) Durability requirements;
- I) Fatigue performance;
- J) Hydrology;
- K) Design flows; and
- L) Scour.

DB 111-12.3 Analytical Check

The independent design check shall include an independent analytical check using separate calculations (and without reference to Designer’s calculations) to establish the structural adequacy and integrity of critical structural members. This shall include, but is not limited to, the following:

- A) The structural geometry and modeling;
- B) Material properties;
- C) Member properties;
- D) Loading intensities; and
- E) Structural boundary conditions.

DB 111-12.4 Design Reviews

Any time or cost impacts for revisions that result from the Department’s and Stakeholders’ participation in Design Reviews and/or caused by Design-Builder’s non-compliance with Contract requirements, including the Department’s and Stakeholders’ time for reviewing revisions, shall be borne by the Design-Builder.

DB 111-12.4.1 Design Reviews Conducted by the Design-Builder’s Design Quality Control Manager

The Design-Builder shall notify and invite the Department to participate in all Design Reviews conducted by the Design-Builder’s Design QC Manager. The Department may also invite Project Stakeholders including affected Utility Owners to participate. The Department will provide Consultation and Written Comment (based on the Department and Stakeholder participation) regarding these Design Reviews.

For Design Reviews conducted by the Design-Builder’s Design QC Manager (*see* Table 111-12), the Design-Builder’s Design QC Manager shall provide a Design Review report for each Design Unit at the conclusion of each Design Review. The Design Review reports will identify any actions arising from the review. The Design Review report shall note items requiring corrective action on the design NCR, Form NCR-D (Appendix 111A). The Design-Builder’s Design QC Manager shall send the design NCR to the Designer and a copy to the Department.

The Design-Builder shall conduct Design Reviews in the offices of the Designer and/or Design-Builder in the Project vicinity. The Responsible Engineer and any specialists with significant input to the design or review shall be present. The Design-Builder shall make available all drawings, copies of calculations, reports, or other items pertinent to the Design Review.

DB 111-12.4.2 Record Drawings Review

Record (as-built) Drawings and Project Specifications shall incorporate complete information that defines the Work as constructed to meet the Contract requirements.

The Design-Builder shall submit complete Record Drawings for each Design Unit to the Department for review and Design Acceptance in accordance with DB Section 111-11. The Department review will verify the Project has been designed and constructed in accordance with Contract requirements and to see if Record Drawings comply with Contract requirements and fully and accurately reflect the Work performed.

The Design-Builder shall make all corrections noted in the review of Record Drawings and resubmit the corrected Record Drawings to the Department for review and Design Acceptance.

Design Acceptance by the Department will not occur until the Record Drawings are submitted, reviewed, and corrected to the satisfaction of the Department.

DB 111-12.4.3 Design Review of Major Temporary Components

The Design-Builder's Design QC Manager shall conduct a Design Review of major temporary components that represent complex structures and that potentially can affect the safety, quality, and durability of the permanent components. The review shall include the effect of the major temporary components on the permanent components.

DB 111-12.4.4 Additional Reviews

The Department (with Stakeholder participation, if invited by the Department) may conduct additional "over-the shoulder" reviews as considered necessary to ensure a continued and uniform consistency in the quality and effective incorporation of revisions to designs. The Design-Builder may also conduct reviews necessary to facilitate early release of designs for construction.

DB 111-12.4.5 Independent Design Review

Prior to the Final Design Review, the Department may choose to conduct an Independent Design Review on the bridge. If performed, this Independent Design Review shall be conducted by an independent design consultant/firm, which is a design consultant/firm that is not owned or controlled in any way by the Design-Builder, one of its Principal Participants, the Designer, or any of the Subcontractors that are performing design for this Project. At the sole discretion of the Department, the Independent Design Review may consist of a 100% analysis of the bridge design, stage-by-stage erection (computer analysis only) and spot-checking of permanent structure components. If the Department chooses to perform the Independent Design Review, the Department shall bear the costs for this review. The Department will share pertinent results of the Independent Design Review with the Design-Builder through Consultation and Written Comment during the Final Design Review.

DB 111-12.5 Readiness for Construction

The Design-Builder may start construction of any element of the permanent components only after all the following items have occurred:

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- A) A Final Design Review has occurred for the items being considered for release to construction;
- B) All Drawings and Documentation prepared by the Responsible Engineer, Manufacturer, Supplier, or other Persons are signed and sealed by a Delaware-licensed Professional Engineer;
- C) The Designer has conducted its design QC checks throughout the design process in compliance with the Quality Plan and certifies in writing that the design is complete to the appropriate level or stage of review, checked, and ready to be released for construction;
- D) The Design-Builder's Design QC Manager has signed the title sheet for the drawings, certifying to the following (the title sheet can be formatted to include the items of certification):
 - 1) Design checks have been completed;
 - 2) Work conforms to Contract requirements;
 - 3) Any deviations or design exceptions have been approved in writing by the Department (DB Section 111-13);
 - 4) Design Quality Control activities are following the Design-Builder's Quality Plan; and
 - 5) All outstanding issues or comments from Design Reviews have been resolved;
- E) The Responsible Engineer has signed all drawings prepared under his/her direction. For those drawings and documents included in the submittal that are prepared by a Manufacturer or Supplier or other Persons not under the Responsible Engineer's direct supervision, the Responsible Engineer will affix a stamp that indicates the design shown on the sheet or document conforms to the overall design and Contract requirements;
- F) The Design Manager has signed the title sheet to the drawings certifying to the items contained in this DB Section 111-2.5. (The title sheet can be formatted to include the items of certification);
- G) The Design-Builder has verified the following:
 - 1) Working Drawings, Project Specifications, and related documents for the portion of the Project to be constructed are complete and checked in accordance with this DB Section 111-12;
 - 2) The design and drawings for Maintenance of Traffic (MOT) and temporary erosion control and environmental measures applicable to the Work are complete; and
 - 3) Adequate stakes, lines, and/or monuments necessary to control the Work have been established on the Site; and
- H) The Department will provide Consultation and Written Comment regarding the design and applicable MOT, temporary erosion control measures, and environmental requirements.
-  I) The Department has reviewed and approved the Design-Builder's Security Plan.

The Department's Consultation and Written Comment will not constitute Approval or Design Acceptance of the design or subsequent construction.

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Any design NCRs issued by the Design-Builder's Design QC Manager or the Department must be addressed and resolved by the Design-Builder to the satisfaction of the Department prior to any design being released for construction.

Upon meeting all of the Readiness for Construction requirements of this DB Section 111-12.5, the Design-Builder may proceed at his own risk with construction of the Work covered by relevant design documents. Prior to construction proceeding on any additional Design Units, the Design-Builder shall first complete the necessary design and meet all Readiness for Construction requirements for each additional Design Unit.

DB 111-12.6 Comment Resolution

The Department's and Stakeholders' comments from Design Reviews will be recorded on Form DR (Appendix 111A) and transmitted to the Design-Builder. The Design-Builder shall record its proposed disposition and response to each comment and meet with the Department to resolve outstanding comments and dispositions. Final disposition and resolution will be documented on Form DR.

If the Design Review reveals non-conformance with Contract requirements, the Department will prepare Form NCR-D (Appendix 111A) and submit it to the Design-Builder for action. The Design-Builder shall complete Form NCR-D when the non-conformance is corrected and return Form NCR-D to the Department.

All Design Reviews shall include a comment and NCR resolution process where unresolved comments and NCRs are discussed and a written action plan and schedule for resolution of unresolved comments and NCRs is developed. The Design-Builder's Design QC Manager will lead the process.

DB 111-13 DESIGN EXCEPTIONS

All deviations (design exceptions) from specified standards must be submitted to the Department for review and Approval. All requests for deviations and exceptions must be submitted with a justification report detailing the reasons to retain a non-standard or substandard feature or for providing an improvement that does not bring the feature up to standard. Requests for design deviations and exceptions must be submitted not later than the Preliminary Design Review and Approved by the Department in writing before the affected Design Units will be released for construction (DB Section 111-12.5). If the Department does not Approve a design exception, it is the Design-Builder's sole responsibility to provide design in accordance with this Contract. The Department will not consider providing the Design-Builder additional time or compensation under this Contract due to the rejection of a design exception request.

DB 111-14 DESIGN CHANGES BEFORE CONSTRUCTION

Design changes may occur prior to construction or after final design and may be initiated by the Design-Builder, through its Designer, or the Department.

For all design changes requiring calculations, the Designer and the Design-Builder's Design QC Manager shall conduct a documented check of all calculations. All design changes requiring alteration of design documents released for construction shall undergo all review procedures included for original design documents in the Design-Builder's Quality Plan and DB Section 111-12.



The Design-Builder shall bear all costs associated with changes initiated by the Design-Build Team. The Department shall be responsible for additional costs when changes requested by the Department are outside the scope of work and the Contract requirements.

DB 111-15 DESIGN SUPPORT DURING CONSTRUCTION

The Designer and Design-Builder's Design QC Manager shall verify during construction that the conditions actually encountered are consistent with the design and related Design Plans, Working Drawings, and Project Specifications. During the course of construction, if Design-Builder has questions, experiences interference / conflict caused by design, or feels errors and omissions may exist in the Design Plans, Working Drawings, and Project Specifications, the Design-Builder's Project Manager shall issue a written RFI (Request For Information) to the Designer for clarification and response. The Designer shall respond to each RFI in writing and shall clearly indicate all necessary design revisions, if applicable. The Design-Builder shall provide a copy of all RFIs and responses to the Department as they are issued. The Designer shall prepare necessary adjustments in the Design Plans, Working Drawings, and Project Specifications and the Design-Builder shall obtain required Department Consultation and Written Comment. The Design-Builder shall be responsible for obtaining Stakeholder permits or approvals. The Designer and Design-Builder's Design QC Manager shall check any such changes in accordance with the Quality Plan. The Design-Builder's Design QC Manager shall certify the change in writing as meeting the Contract requirements. The Design-Builder shall incorporate the adjustments in the Record Drawings. The Design-Builder shall retain copies of its Design QC Manager's written certifications and submit the certifications to the Department.

DB 111-16 DESIGN WORKSHOP

Within 45 working days of NTP, the Design-Builder shall arrange a design workshop to familiarize the Designer's personnel and the Department (and Stakeholders, if invited by the Department) review personnel with the design concepts, issues, status, and review procedures. The agenda shall include developing agreements regarding time allowed for design reviews (*see* DB Section 111-5). The Department and Design-Builder shall jointly develop the agenda of the workshop and how it will be organized (i.e., by Design Unit and engineering discipline). The intent of the workshop is to make the subsequent Design Reviews more effective and efficient for all parties.

All agreements, schedules, and understandings reached during the design workshop shall be documented in writing and signed off by the Design-Builder's Project Manager and the Department.

DB 111-17 QUANTITY ESTIMATES

To facilitate determining sampling and testing requirements, the Design-Builder shall provide quantity estimates for the Work on its Final Plans. The quantity estimates shall be in units that facilitate sampling and testing (i.e., the units shall be consistent with the units used to determine frequency of sampling and testing). For example, if "X" numbers of compaction tests are specified to be taken for every "Y" cubic yards of embankment, the quantity estimate would need to be in cubic yards of embankment.

See also DB Section 111-19.4.

DB 111-18 DESIGN DOCUMENTATION

DB 111-18.1 Progress Tracking

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The Design-Builder shall include engineering and design progress and changes in its Baseline Progress Schedule (including Work on any design change) in the monthly updates.

DB 111-18.2 Design Quality Records

The Design-Builder's Design QC Manager shall prepare and submit monitoring reports to the Department of all design issues and review comments resulting from the scheduled and additional checks and reviews, including spot-check reviews.

The Design-Builder shall also maintain an auditable record of all Quality Plan procedures. An independent auditor shall be able to determine by reviewing documentation if all procedures included in the Quality Plan have been followed.

The Design-Builder shall submit reports of checks and reviews within seven calendar days of the completion of the review.

The Design-Builder shall develop, implement, and maintain a log of design NCRs and/or notices indicating dates issued, reasons, status, or resolution and date of resolution.

The Design-Builder shall prepare and maintain daily records of design activities on forms acceptable to the Department.

DB 111-18.3 The Design-Builder's Design Quality Control Manager Reports

DB 111-18.3.1 Monthly Report to the Delaware Department of Transportation

The Design-Builder's Design QC Manager shall submit a monthly report directly to the Department by the third working day of the following month that includes the following:

- A) A summary of reviews conducted;
- B) Identification of nonconforming Work and current status and/or disposition (based on design non-conformance log, DB Section 111-18.2); and
- C) A listing of submission(s) from the Design-Builder and status.

DB 111-18.3.2 Final Design Report

Upon completion of the Final Design for each Design Unit, including all its components and elements, the Design-Builder's Design QC Manager shall notify the Design-Builder, with a copy to the Department, of any outstanding monitoring report issues or unresolved review comments.

DB 111-19 DESIGN PLANS, WORKING DRAWINGS, AND PROJECT SPECIFICATIONS

The Contract Price will include the cost of furnishing all Design Plans, Project Specifications, Working Drawings, and Record Drawings.

The Contract Documents establish the minimum standards of quality and define requirements that the design and construction must satisfy.

During the design process, the Design-Builder shall develop Project Specifications and Design Plans based on the Contract Documents that are applicable to the specific Materials, products, Equipment, procedures, and methods that the Design-Builder intends to use.

During the Design Reviews, the Design Plans and Project Specifications will be evaluated by the Department to determine if they meet the Contract requirements.

DB 111-19.1 Plans

The Work shall be performed in accordance with the details as shown on the Design Plans prepared by the Designer and those Working Drawings prepared by the Design-Builder. It shall be solely the Design-Builder's responsibility to provide Working Drawings of such a nature as to develop a finished product in accordance with Design Plans, Project Specifications, and Contract requirements. The Design-Builder shall verify pertinent dimensions in the field prior to conducting a Working Drawings review. Participation in the review of the Design-Builder's Design Plans and/or Working Drawings by the Department (or Stakeholders, if invited by the Department) shall not relieve the Design-Builder of the responsibility for the satisfactory completion of the Work.

Working Drawings shall be reviewed and approved in writing by the Designer before beginning the construction Work and shall not thereafter be amended or altered without prior written approval of the Designer and the Department's Consultation and Written Comment.

All Final Design Documents and Record Drawings shall be signed and stamped/sealed by the appropriate Responsible Engineer and shall include, on the title sheet for the plans, certification signatures of the Design Manager and the Design-Builder's Design QC Manager (the title sheet can be formatted to cite the appropriate certification requirements of DB 111-2.4 and 111-12.5).

DB 111-19.2 Format and Organization for Design Plans and Record Drawings

DB 111-19.3 CADD Standards

CADD formatting for Design Plans and Record Drawings shall conform to the Department's CADD manual and drafting standards.

DB 111-19.4 Project Specifications

The Design-Builder shall prepare Project Specifications based on Contract requirements. The Design-Builder may perform the following activities:

- A) Use the Delaware Department of Transportation's Standard Specifications as supplemented by the Design-Builder; and/or
- B) Prepare new Specifications to cover Work.

Project Specifications, including the Department's Standard Specifications, will be reviewed by the Design-Builder and the Department during Design Reviews to verify that the Project Specifications provide a level of quality that meets or exceeds the Contract requirements and are suitable and appropriate to control the Work. The Design-Builder shall be responsible for demonstrating that the Project Specifications meet or exceed the standard of quality established by the Department's Standard Specifications. Any deviation that results in a lesser standard of quality will require Department approval and may require the execution of a change order. The Department shall determine, at its sole discretion, if the Project Specifications meet the Contract requirements. The Methods of Measurement and Basis of

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Payment included in the Department's Standard Specifications shall not apply to the Work included in the Design-Builder's Lump Sum Price Proposal.

Project Specifications shall define the type and frequency of QC sampling and testing to be conducted for the Work covered by a Project Specification. The Design-Builder shall use DB Sections 106 and 112, as well as the Department's Materials Manual, to determine the type and frequency of QC sampling and testing.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 111

APPENDIX 111A - FORMS

FORMS INDEX

Form DR	Design Review Comments
Form DUS	Design Unit Schedule
Form NCR-D	Design Non-Conformance Report

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FORM DUS
Design Unit Schedule

Design Unit Designation/ Code	Design Unit Description	Planned Review Stages ¹	Information/Components to be Reviewed	Planned Review Dates ²	Percent Complete Represented by Review
		Preliminary			
		Final			100%
		Preliminary			
		Final			100%
		Preliminary			
		Final			100%

¹ Provide information as necessary to reflect additional interim and/or readiness for construction reviews planned between Preliminary Design and Final Design Reviews.

² Planned review dates to be provided within 30 days of NTP.

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FORM NCR-D

DESIGN NON-CONFORMANCE REPORT

From: _____ Date: _____
(Name and initials of Design QC Manager or Department's PM or Designee)

To: _____
(Names of Design-Builder and Responsible Engineer)

Project name/Number: _____ Design Unit ID: _____

Copy: **Department's Project Manager**

Transmittal/File No. _____ Applicable Contract Requirement: _____
(Part and Section Number)

The design Work on the referenced Design Unit is not in conformance with the noted Contract requirement for the reasons stated below (Attach additional sheets as necessary):

RESOLUTION: _____ Date: _____

From: _____
(Names and initials of Design-Builder's Project Manager and Responsible Engineer)

To: **Department's Design Compliance Engineer and Project Manager**

The above noted design non-conformance has been corrected and/or resolved as indicated below (attach additional sheets as necessary):

Acknowledgement of Receipt: _____ Date: _____
(Name & initials of Department's PM/Designee)

Send copy of completed, acknowledged form to the Design-Builder's and Department's Project Manager's files.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
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SCOPE OF SERVICES PACKAGE

DB SECTION 112

**CONSTRUCTION QUALITY CONTROL AND
QUALITY ASSURANCE**

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DESIGN-BUILD SECTION 112

CONSTRUCTION QUALITY CONTROL/QUALITY ASSURANCE

DB 112-1 GENERAL

Per Design-Build (DB) Section 113, the Design-Builder shall develop and implement a quality program for all phases of the Project, including design, construction, maintenance, and environmental compliance. The Design-Builder, through its Design-Builder Quality Plan, shall have the primary responsibility for the quality of the Work, including all Work and products of Subcontractors, fabricators, Suppliers, and vendors both on-site and off-site. The Department, in its oversight role through Quality Assurance (QA), reserves the right to and will conduct verification oversight inspections, audits, sampling and testing, and Independent Assurance (IA).

The program shall be capable of ensuring that procurement, shipping, handling, fabrication, installation, cleaning, Inspection, construction, testing, storage, examination, repair, maintenance, and required modifications of all Materials, Equipment, and elements of the Work will comply with the requirements of the Contract Documents and that all Materials incorporated in the Work and all Equipment and all elements of the Work will perform satisfactorily for the purpose intended.

DB 112-1.1 Definitions

See Design-Build Section 101-3 for definitions, including definitions of Quality Control and Quality Assurance.

DB 112-1.2 Construction Quality Control Inspection

All construction processes, procedures, and workmanship shall be inspected by the Design-Builder's Construction Quality Control (QC) Inspectors. The Construction QC inspections shall include the observations, measurements, and documentation specified in DB Section 112-9, Appendix 112A to this DB Section 112 and/or included in the Design-Builder's Quality Plan. Inspection observations, measurements, results, non-conformances, and corrective actions shall be documented on the forms in Appendix 112C to this DB Section 112 or on the Design-Builder's forms acceptable to the Department. Inspection observation and documentation shall include description of construction activity and location by Specification section.

DB 112-2 INSPECTION AND TESTING OF MATERIALS

DB 112-2.1 General

All Materials are subject to Inspection, sampling, and testing at any time before Final Acceptance of the Work.

References in the Contract to a Delaware test method or test designation of the American Association of State Highway and Transportation Officials (AASHTO), the American Society for Testing and Materials (ASTM), or any other recognized national organization shall mean the latest revision of that test method or Specification for the Work in effect on the Proposal due date, unless otherwise noted.

Materials will be sampled and tested by the Design-Builder's construction QC testers and samplers. Copies of all test results will be furnished to the Design-Builder's Project Manager, the QC Manager, and the Department's designated representative. When a test is done for the Design-Builder as process

control assuring that its process and Materials source is producing an acceptable product, test results will also be furnished to the above stated individuals. These process control tests usually occur when an operation is begun and when changes occur in the source of Materials or method of production.

The Department's designated representative may observe any sampling testing performed by the Design-Builder's QC testers and samplers. If the Department's designated representative observes a deviation from the specified sampling or testing procedures, the Department's designated representative shall verbally describe the observed deviation to the Design-Builder's Construction QC Manager, followed by a written Non-Conformance Report (NCR) covering the deviation to the Design-Builder's Construction QC Manager and Project Manager within 24 hours. *See also* DB Section 109-4.4 regarding payment.

DB 112-2.2 Construction Quality Control Testing and Sampling

The Design-Builder's construction QC testers and samplers shall perform sampling and testing for process control. Construction QC testers and samplers shall be certified to the level appropriate for the Work being sampled/tested. The Design-Builder shall maintain a list of construction QC testers and samplers that indicates what test certifications each person currently holds. Testers and samplers will be allowed 90 working days from Award of the Contract to obtain the certifications.

The construction QC testers and samplers will test and sample only those Materials for which they are certified to sample and test. Reports of each test shall be recorded on the form prescribed for that test. All tests that do not pass specified requirements will be added to a log of failed tests. This log of failed tests will be used to assure that the Work is reconciled by a passing test as specified in Appendix 112B to this DB Section 112.

The minimum frequency of QC sampling and testing shall be consistent with Appendix 112B to this DB Section 112 and the individual Project Specifications accepted by the Department's Project Manager, and the Department's Materials Manual. The most stringent of these will determine the sampling and testing frequency.



The Design-Builder shall utilize an electronic system to document and track Material and field test results. The minimum information in the electronic system shall be that required to populate the Department's system. The Design-Builder shall develop a method to transfer the Material and field test result information to the Department's database or, alternatively, may make arrangements with the appropriate sections and/or offices to use the Department's system. In lieu of electronic data entry and/or transfer, the Department reserves the right to request all data be provided on Department-furnished or approved forms at no additional cost.

DB 112-3 QUALITY ASSURANCE INSPECTION

Quality Assurance Inspection will be performed by the Department's designated representative(s) assigned to the Project.

The Department's designated representative(s) will audit sampling and testing results. The review, audit, and subsequent feedback to the Design-Builder's Construction QC Manager are intended to assess the adequacy of the construction QC.



If, in the opinion of the Department, the Design-Builder is not fully complying with the Quality Plan requirements, the Department will advise the Design-Builder in writing of apparent deficiencies. The Design-Builder will have seven Calendar Days to either provide adequate documentation to demonstrate that the alleged violations are unfounded or correct the violations to the satisfaction of the Department. If

after seven Calendar Days neither of the above remedies have been accomplished, the Department may take steps to implement the necessary QC action. All costs associated with this effort by the Department will be documented and these costs will be deducted by Change Order from the Contract Lump Sum Price.

The Design-Builder's Project Manager will provide information to the Department's designated representative regarding verification that Milestones (MS) are met as per the Design-Builder's Schedule of Milestones and quantities of any Unit Priced Work items. A monthly audit of Milestones and quantities of any Unit Priced Work items will be performed and any required correction will be made to the subsequent progress pay estimate. This review and audit will assure that the Milestone achievement and correct quantities are shown. Documents for payment of change orders must also contain sufficient information to satisfy an audit. Documents for the closure of each change order will be reviewed and included in the final pay estimate. Additionally, in accordance with DB Sections 105 and 109, the Department's Project Manager shall have the authority to suspend the Work if at any time he/she determines that the Design-Builder is not in conformance with Contract requirements.

See DB Section 109 regarding payment processing.

Verification Sampling and Testing will be performed by the Department or its designated representative assigned to this Project in accordance with DB Section 106.

DB 112-4 REFEREE LABORATORY

The Department's central Materials and Research laboratory shall serve as a "referee" laboratory for resolution of disputes regarding sampling and testing results reported by the Department's verification samplers and testers and the Design-Builder's construction QC testers and samplers. The services of the "referee" laboratory may be requested by the Department or by the Design-Builder. The sampling and testing results determined by the "referee" laboratory shall be final and binding on both parties and not subject to disputes resolution under DB Section 107-27. The party whose sampling and testing results are not confirmed and/or supported by the "referee" laboratory shall be considered the unsuccessful party. If the Design-Builder is the unsuccessful party, a \$200 surcharge will be assessed for the "referee" laboratory services and will be deducted from payment(s) otherwise due the Design-Builder.

DB 112-5 COMPETENCE

If a concern arises as to the competence of any certified individual, this concern must be documented in writing to the Design-Builder's Project Manager and the Department's Project Manager. The concern will be investigated as deemed necessary by the Department's Project Manager. If this investigation substantiates the concern, corrective action, or decertification will be implemented in accordance with procedures established by the Department and/or the certifying body. *See also* DB Section 108.

DB 112-6 DESIGN-BUILDER QUALITY CONTROL

The Design-Builder shall provide process control measures adequate to produce a constructed product of acceptable quality that conforms to the Contract Documents. The Design-Builder shall perform process control sampling, testing, and Inspection during all phases of the Work at a rate sufficient to assure that the Work conforms to the Contract requirements.

The Design-Builder shall provide personnel and Equipment capable of providing a product that conforms to specified requirements and shall provide personnel and Equipment capable of verifying and documenting this conformance. Continual production of non-conforming Work will not be allowed.

See Appendix 112A for Construction Quality Control Documentation Required.

DB 112-7 DESIGN-BUILDER'S CONSTRUCTION QUALITY CONTROL ORGANIZATION

The Quality Plan shall provide the information regarding the construction Quality Control organization.

DB 112-7.1 Independent Construction Quality Control Firm (Quality Control Engineering Firm)

The Design-Builder shall retain the services of an independent engineering consultant organization (the QC Engineering Firm) to oversee, manage, certify, and perform construction QC activities as specified in this DB Section 112, other Contract Documents, and the Design-Builder's Quality Plan. The QC Engineering Firm (and any firm acting as a subconsultant to the QC Engineering Firm) shall not be owned by or be an Affiliate of the Design-Builder (*see* DB Section 101), any Principal Participant (*see* DB Section 101) or Construction Subcontractor. The QC Engineering Firm shall be responsible for management and scheduling all QC Inspection and QC sampling and testing of all items of construction Work for this Contract. Subject to the limitations stated above, the Designer may serve as the QC Engineering Firm.

The Design-Builder's Construction QC Manager, Construction QC Inspectors and Construction QC testers and samplers and their support staff shall be employees of the QC Engineering Firm or employees of firm(s) acting as subconsultants to the QC Engineering Firm. The QC Engineering Firm shall work directly for the Design-Builder's QC Manager and shall not report to the Design-Builder's Project Manager.

DB 112-7.2 Construction Quality Control Manager

The Design-Builder shall assign an on-site Construction QC Manager. This individual will be considered one of the Project's Key Personnel.

The Design-Builder's Construction QC Manager shall be responsible for overall management and supervision of the Design-Builder's construction QC programs. The Design-Builder's Construction QC Manager shall be a Delaware-licensed Professional Engineer. The Design-Builder's Construction QC Manager shall report directly to the Design-Builder's QC Manager.

The Design-Builder's Construction QC Manager, or his/her designees, shall be delegated the authority to make needed improvements to the quality of Work, including the suspension of the Work if required.

The Design-Builder's Construction QC Manager shall be responsible for coordinating the schedules of the Design-Builder's construction QC Inspectors and construction QC testers and samplers with the Design-Builder's construction activities so as not to delay the Design-Builder's operations due to Construction QC Inspection, sampling, and testing activities.

DB 112-7.3 Staffing Levels

The actual size of the field/site staff shall reflect the complexity, needs, shifts, and composition of QC activities consistent with Work in progress and the requirements outlined in Appendix 112X.

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The Design-Builder's Quality Plan (*see* DB Section 113) shall identify administrative and clerical support for the maintenance and management of records and documents pertinent to QC activities.

The QC staffing schedule shall be updated as necessary throughout the Contract duration to reflect accurate forecasting of QC staffing requirements.

DB 112-7.4 Laboratories

Laboratory QC testing shall be conducted by Department-approved testing laboratories retained by the QC Engineering Firm under subcontract that comply with the requirements for Department certification for applicable tests. Laboratories shall be accredited by the AASHTO Material Reference Laboratory (AMRL), the Concrete Cement Reference Laboratory (CCRL), the National Precast Concrete Association (NPCA) for precasters, or the Prestressed Concrete Institute (PCI), as appropriate, for the Work to be constructed. Department certification shall be obtained for all AASHTO and ASTM test methods to be performed by the testing laboratory. Certification shall also be obtained for AASHTO and ASTM test methods that are modified or referenced by Delaware test methods.

Satellites (field laboratories) of these laboratories may be used where appropriate for the tests being conducted. The Equipment in the satellite laboratories shall be certified at the start of Work and a minimum of once per year thereafter. Certification shall be by an independent party and may be requested by the Department at any time.

The laboratory shall have written policies and procedures to assure portable and satellite laboratories performing testing activities on the Project are capable of providing testing services in compliance with applicable test methods. The policy and procedures shall address Inspection and calibration of testing Equipment as well as a correlation testing program between the accredited laboratory and portable or satellite facilities.

The Department reserves the right to check testing Equipment for compliance with specified standards and to check testing procedures and techniques.

The Department also reserves the right to access the testing facilities of the testing laboratories with no additional cost to the Department to witness the testing and verify compliance of the testing procedures, testing techniques, and test results.

The Department's rights to check Equipment, procedures, and techniques and to access testing facilities will also apply to Project Stakeholders when the Design-Builder is performing Work on their facilities.

DB 112-8 DESIGN-BUILDER SCHEDULING AND NOTICE TO THE DEPARTMENT

The Design-Builder shall notify the Department in writing by Friday noon of each week of planned construction activities, including fabrication, for the following two weeks to allow the Department to schedule its resources. The Design-Builder shall deliver this information at the weekly coordination meeting where related discussion will occur. For activities (such as fabrication) occurring out of the immediate Project area (beyond 100 miles of the Project), the Design-Builder shall give the Department at least 21 Calendar Days notice of planned Work.

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DB 112-9 DOCUMENTATION

The Design-Builder shall collect and preserve each of the following types of data in a computer-generated form concurrently during Design-Builder's performance of the Work, all of which shall be in a format acceptable to the Department:

- A) Inspector Daily Reports (IDR);
- B) Record (as-built) Drawings;
- C) Secure databases, such as spreadsheets, standard database software, and computation books;
- D) Materials acceptance records;
- E) Photographs; and
- F) Field change sheets.

Daily manpower and Equipment reports for the Design-Builder and each Subcontractor for construction-related activities shall be prepared and maintained by the Design-Builder, using the forms in Appendix 112C to this DB Section 112 or other forms with a format acceptable to the Department's Project Manager.

A daily diary for construction-related activities shall be maintained by Design-Builder's Project Manager or his/her designee(s), using a form acceptable to the Department's Project Manager, in which all significant occurrences on the Project shall be recorded daily in a narrative form, including, unusual weather, asserted occurrences, events and conditions causing or threatening to cause any significant delay or disruption or interference with the progress of any of the Work, significant injuries to person or property and a listing of each activity depicted on the current monthly plan update which is being actively prosecuted. Also, traffic accidents in the Project area will be noted as well as lane closures in effect at the time of the accident.

For Utility-related Work such data shall be maintained separately for each Utility facility.

For harmful/Hazardous Material remediation Work, such data shall be maintained separately for each site.

Records shall document all QC operations, Inspections, visitors to the site, activities, and tests performed, including the Work of Subcontractors. The Design-Builder may use the forms provided by the Department or its own forms providing equivalent information. Such records shall include any delays encountered and Work noted that does not conform to the requirements of the Contract and design together with the corrective actions taken regarding such Work.

The Design-Builder shall complete and submit appropriate documentation at the following times and frequencies:

- A) Monthly:
See Design-Build Section 108;

- B) Weekly:

The Design-Builder shall maintain and submit records that include factual evidence that

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required activities or tests have been performed, including the following:

- 1) Type, number, and results of QC and control activities, including, reviews, Inspections, tests, audits, monitoring of Work performance, and Materials analysis;
- 2) Closely-related data, such as, qualifications of personnel, procedures, and Equipment used;
- 3) The identity of the Design-Builder's QC Inspector or data recorder, the type of test or observation employed, the results, and the acceptability of the Work, and action taken in connection with any deficiencies noted;
- 4) Nature of non-conforming Work and causes for rejection;
- 5) Proposed corrective action;
- 6) Corrective actions taken; and
- 7) Results of corrective actions.

DB 112-10 MATERIAL ACCEPTANCE

Documentary evidence that Material and Equipment conform to the procurement requirements shall be available at the job Site no less than 24 hours prior to installation or use of such Material and Equipment. This documentary evidence shall be retained at the job Site and shall be sufficient to identify the specific requirements, such as, Contract Documents, codes, standards, or specifications, met by the purchased Material and Equipment. Additionally, a copy of all documentary evidence that Material and Equipment conform to the procurement requirements shall be provided to the Department, or its representative, at the same time the Design-Builder receives such documentary evidence. The effectiveness of the QC by the Design-Builder's own forces and Subcontractors shall be assessed by the Design-Builder and the QC Engineering Firm at intervals consistent with the importance, complexity, and quantity of the product or services.

The Department reserves the right to inspect and review these documents at any time.

At the completion of the Project, the Design-Builder shall submit with the final invoice a certificate of compliance signed by the Design-Builder's Project Manager and Construction QC Manager indicating that all materials incorporated in the Project conform to the Contract requirements.

See DB Section 106-2 for Materials Certification.

DB 112-11 FINAL ACCEPTANCE

The Department has the responsibility and authority for Final Acceptance of all Work.

The Design-Builder shall complete all Work and provide all documents, certifications, and other information in accordance with the Contract Documents. Final Acceptance will be based on QC testing verified by verification testing and the Final Inspection. Any deviations from the sampling and testing methods and frequencies indicated in Appendix 112B to this DB Section 112 or the individual

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Specifications will require the Department's Approval prior to the start of construction on any affected Work. If there is a discrepancy between the individual Specifications and Appendix 112B to this DB Section 112, the more stringent requirements shall apply unless otherwise agreed in writing by the Department.

Final Materials Acceptance will be based on certificates of compliance and/or Manufacturer's test results where specified in the individual Specification or Appendix 112B to this DB Section 112.

Deficient Materials and products shall be brought into compliance with Specifications or replaced. The method of reconciliation will be noted in the log of failed tests.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

For

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

APPENDIX 112A

CONSTRUCTION QUALITY CONTROL INSPECTION

Delaware Department of Transportation

ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)
All	<ul style="list-style-type: none"> • Location and type of work • Personnel and Equipment • Weather and Site conditions • Checks for compliance with Design Plans and Project Specifications • Extent of Work • Problems encountered 	Inspectors Daily Report (IDR) Daily Construction Diary
Signs and Barricades	<ul style="list-style-type: none"> • Location, stationing and distance from edge of road Visibility, height above road, condition of signs • Daily to ensure condition • Night inspections initial and periodic for reflectivity 	Traffic Control Devices (NDE-6)
Clearing and Grubbing	<ul style="list-style-type: none"> • Clearing and grubbing limits • Disposal • Protection of surroundings from damage • Removal of large roots and stumps • Backfill of areas as required (compaction and material) • Blading the site to ensure drainage • Temporary erosion control <ul style="list-style-type: none"> ~ Mulch ~ Seeding ~ Slope drains ~ Silt Fencing ~ Inlet Protection ~ Check Dams 	

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ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)
Removals	<ul style="list-style-type: none"> • Ensure that only designated structures, facilities or obstructions are removed or relocated • Backfill, compaction and compactive effort • Proper notifications given for removal of under-ground storage tanks and other hazardous materials • Legal Disposal of materials 	Form LB-68 Summary of Field Density Tests
Utility Relocation	<ul style="list-style-type: none"> • Located clear of construction • Backfills adequately compacted 	
Culverts and Storm Drains	<ul style="list-style-type: none"> • Adequate structure • Backfill material, bedding material and fabrics sampled and approved by QC Engineer, accepted by DOT • Damage in transit • Certificate of Delivery • Excavation • Laying pipe • Bedding and Backfill • Joints closed and wrapped • Compaction and compactive effort 	Form LB 68 Summary of Field Density Tests Form LB 92 RCP Report
Earthwork	<ul style="list-style-type: none"> • Area preparation • Soils sampled and approved • Lift thickness • Compaction and compactive effort • Slope and Grade 	Form LB-68 Summary of Field Density Tests
Trench, Culvert and Structural Excavation	<ul style="list-style-type: none"> • Safety • Support and protective system • Legal Disposal of excavated material 	

Delaware Department of Transportation

ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)
Geotextile	<ul style="list-style-type: none"> • Brand name and type • Protection of material • Material acceptance 	
Stone Base	<ul style="list-style-type: none"> • Area preparation • Material sampled, approved (QC Eng.) accepted (DOT) • Compaction and compactive effort • Curing membrane 	LB-68 Summary of Field Density Tests LB-50 Fine Aggregate Report
Asphaltic Concrete	<ul style="list-style-type: none"> • Surface prepared • Materials sampled and approved (QC Eng.), accepted (DOT) • Plant and Equipment calibrated and approved • Temporary traffic tape • Signing and Flagging • Certified technicians • Weather conditions • Mix design submitted and approved • Plant operation • Temperature of mix • Spreading and finishing • Compaction/pavement density • Joints • Surface tolerances 	LB 21 Asphalt Plant Lab Inspection List LB 24 Bituminous Concrete Plant Activity Report LB 26 Gyratory Method LB 29 Box Sample Tag LB 30 Box Sample Worksheet LB 36 Asphalt Sample Tag LB 37 Drilled Core Worksheet LB 65 Hot-mix Request for Compaction Waiver LB 68 Summary of Field Density Tests LB 69 Inspection and Calibration of Batching Equipment Special Provision 401699

Delaware Department of Transportation

ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)
Portland Cement Concrete Paving	<ul style="list-style-type: none"> • Surface prepared • Materials sampled and approved (QC Eng.), accepted (DOT) • Plant and Equipment calibrated and approved • Forms • Dowels and Load transfer devices • Mix design submitted and approved • Placing and spreading concrete • Finishing and texturing • Joints • Surface tolerance • Slump and air • Curing • Removing forms (fixed form paving) • Protection of pavement • Sealing joints 	LB 1 through 12 LB 60 through 65B LB 69 LB 76 through 87 LB 130-135
Incidental Concrete Work – Sidewalks, Curbs, Drives, etc.	<ul style="list-style-type: none"> • Surface prepared • Compaction and Compactive effort for base material • Forms • Mix design submitted and approved • Depth • Cylinders • Curing 	LB 68 Summary of Field Density Tests QA reports
Driven Piles (continued on next page)	<ul style="list-style-type: none"> • Type, size, and length of pile • Materials approved and accepted during fabrication • Test piles driven and loaded • Pile lengths approved • Installation plan and equipment approved • Location of piles • Storing, handling and damage to piles before and during driving 	Pile Driving Record Pile Driving Summary Test Pile Driving Record (CN-59)

Delaware Department of Transportation

ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)
	<ul style="list-style-type: none"> • Adequate bearing capacity achieved 	
Drilled Shafts	<ul style="list-style-type: none"> • Installation plan • Safety • Excavation and material disposal methods • Casings – temporary and/or permanent • Slurry • Location, size and alignment • Reinforcing steel (Storage, handling, sampled and approved, tying, splicing) • Concrete mix design • Concrete placement and finishing • Verification of integrity of shafts 	LB 11 Compression Testing Report LB 62 Air and Slump Report LB 90 Reinforcing Steel Report
Structural Concrete	<ul style="list-style-type: none"> • Forms, re-steel and equipment • Weather • Ambient temperature • Slump and air tests • Placement and vibrating • Cylinders • Surface finish • Curing 	LB 1 through 12 LB 62 Air and Slump Report LB 64 Bridge Deck Survey LB 76 through LB 87 LB 130 through LB 135 QA reports on Slump and Air, cylinders
Reinforcing Steel	<ul style="list-style-type: none"> • Storage and handling • Sampled and approved (QC Eng.), accepted (DOT) at shop • Placement and fastening • Splices 	LB 90

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ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)
Prestressed Concrete Units	<ul style="list-style-type: none"> ● Fabrication <ul style="list-style-type: none"> ~ Equipment approval ~ Concrete mix design ~ Concrete placement and vibration ~ Dimensional tolerance and camber ~ Approved forms ~ Curing ~ Tensioning ~ Storage and transportation ● When receiving units <ul style="list-style-type: none"> ~ Inspector's stamp of approval ~ Certificate of delivery ~ Damage during shipment ~ Dimensional tolerance, camber, etc. ~ Visual defects ● Erection ● Repair of defects 	LB 1 through 12 LB 63 LB 65B LB 69 LB76 through 84 LB 86 and 87 LB 100 QA reports (DOT) for fabrication and upon receipt
Structural Steel	<ul style="list-style-type: none"> ● Fabrication <ul style="list-style-type: none"> ~ Shop drawings ~ Mill test reports ~ Storage of materials and fabricated items ~ Shop Assembly ~ Certified test reports for bolts, nuts, etc. ~ Coating ● Field Erection <ul style="list-style-type: none"> ~ Sequence ~ Falsework ~ Site storage and handling ~ Connections 	QA reports (DOT) for fabrication and upon receipt

Delaware Department of Transportation

ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)
Bridge Bearings	<ul style="list-style-type: none"> • Materials • Fabrication • Protective coatings • Bearing surface preparation • Anchor Bolts • Pad installation 	
Bridge Joint Systems	<ul style="list-style-type: none"> • Materials • Fabrication • Cleaning • Assembly • Installation <ul style="list-style-type: none"> ~ Preparation ~ Handling and Storage 	
Structural Steel Paint System	<ul style="list-style-type: none"> • Materials <ul style="list-style-type: none"> ~ Abrasive ~ Paint ~ Paint Inspection Equipment • Cleaning • Paint application methods • Shop Painting • Field Painting 	
Superstructure Slabs and Approach Slabs (continued on next page)	<ul style="list-style-type: none"> • Forming <ul style="list-style-type: none"> ~ Forms ~ Support Systems ~ Haunch depths ~ Joints ~ Drainage • Placing and fastening reinforcing steel 	LB 1 through 12 LB 60 through 65B LB 68 LB 69 LB 76 through 87 LB 90 LB 130-135
ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)

Delaware Department of Transportation

	<ul style="list-style-type: none"> ● Base (compaction and compactive effort) ● Concrete Operations <ul style="list-style-type: none"> ~ Prior to placing ~ Placing sequence ~ Adequacy of personnel and equipment ~ Concrete supply ~ Curing materials ~ Admixtures <ul style="list-style-type: none"> ○ Weather and Temperature ○ Placing ○ Finishing ○ Curing 	
<p>Permanent Erosion Control</p>	<ul style="list-style-type: none"> ● Final dressing of area ● Area determinations ● Spread rate for seed and fertilizer ● Materials ● Watering 	<p>LB 97 Seed Sample Tag</p>
<p>Maintenance and Protection of Traffic</p>	<ul style="list-style-type: none"> ● Materials ● Surface Condition ● Intersecting Traffic ● Dust Control and Spillages ● Flaggers ● Delineation and Guiding Devices ● Construction signs, temporary barriers, barricades and Lighting ● Pavement markings ● Pavement drop-off protection 	<p>Traffic Control Devices (NDE 6)</p>

Delaware Department of Transportation

ACTIVITY	INSPECTION REQUIREMENT	DOCUMENTATION FORMS(S)
Pavement Markings	<ul style="list-style-type: none">• Atmospheric conditions• General requirements• Materials• Surface cleaning and preparation• Equipment• Application of markings	LB 52 Traffic Markings Report LB 88 Traffic Marking Paint

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

For

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

APPENDIX 112B

**QUALITY CONTROL TESTING FREQUENCY AND
METHODS**

Testing Frequency and Methods:

The testing frequencies required can be found in the Department's Materials and Research Manual at the end of Part B, Minimum Testing and Certification Requirements under the heading "[Quantities List in pdf format](#)".

This list is inclusive of all items that have been used on department projects. The Design Builder is only required to perform the number and types of tests for the items that he is incorporating into the project. The item numbers correlate to those found in the Department's Standard Specifications, August 2001.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

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Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

APPENDIX 112C

CONSTRUCTION MANAGEMENT FORMS

STANDARD CONSTRUCTION MANAGEMENT FORMS

This Appendix shows examples of commonly used forms listed in alphabetical order.

FORM
Checklist for Submission of Final Estimate (CN-28)
Change Order Reason Codes
Contractor's Two Week Schedule (CN-10)
Core Drill Report (LB-75)
Daily Construction Diary
Daily Force Account (CN-42)
Daily Quantity Sheet
Federal-Aid Proper Pay Poster
Federal-Aid Wage Information Poster
Field Change Order Form
Field Inspection Document (CN-78)
Inspector's Daily Report
Piezometer Observations
Pile Driving Record
Pile Driving Summary (CN-60)
Routine Labor Relations Interview (CN-30)
Source Document
Source of Supply Form
Temporary Agreement to Trespass
Test Pile Driving Record (CN-59)
Traffic Control Devices (NDE-6)
Traffic Markings Report (LB-52)

**STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
CONSTRUCTION**

CONTRACT NO. _____

PROJECT NAME _____

DISTRICT _____

SUBMISSION BY _____

DATE _____

CHECK LIST FOR SUBMISSION OF FINAL ESTIMATE

CHECK ONE BLOCK OPPOSITE EACH ITEM

	SUBMITTED HEREWITH	SUBMITTED PREVIOUSLY	NOT REQUIRED
1. Estimate Form (Prepared as Final)			
2. "Clean Up" Change Order			
3. Estimates Book or Books (Prepared as Final)	RETAINED IN DISTRICT		
4. Construction Diary or Diaries	RETAINED IN DISTRICT		
5. "AS BUILT" Plans			
6. CN-91			
7. CN-102			
8. CN-103			
9. FHWA-47*			
10. Bonding Company Release			
11. Contractor & Subcontractors Payroll Submission Up to Date			

RECEIVED AND UP TO DATE

- | | | | | |
|---|--------------------------|-----|--------------------------|----|
| 1. Materials Source Approvals | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |
| 2. Materials Certifications as Required | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |
| 3. Approval of ALL Subcontractors | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |

***Required on all Federal-Aid oversight Contracts OVER \$1,000,000.00 on NHS roadways except Beautification Contracts.**

PLEASE SUBMIT THIS FORM WITH ALL FINAL ESTIMATES

CN-28 6/99

Change Order Reason Codes

- A Requested by Safety Section
- B Requested by Stormwater Management
- C Requested by Legislator
- D Requested by External Affairs
- E Requested by District Maintenance
- F Requested by Property Owner
- G Added new item
- H Added quantity to existing item
- I Added quantity due to erosion
- J Replaced with new item
- K Replaced with another existing item
- L Item eliminated
- M Calculation error by designer
- N Overestimated quantity
- O Overestimated quantity on previous change order
- P Missing quantity- item shown on plans
- Q Additional utilities (Public)
- R Needed for utilities (Public)
- S Additional utilities (Private)
- T Needed for utilities (Private)
- U Value Engineering Proposal
- V Price adjustment
- W Other

**STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
DAILY FORCE ACCOUNT**

Division _____ Date _____
 Sta. _____ Cont. No. & Name _____
 Reason & Description of work _____

LABOR					
Name of Employee	Class	Hrs.	Rate	Amount	
TOTAL LABOR					
MATERIALS		Quantity	Per Unit		
TOTAL MATERIALS					
EQUIPMENT	Make	Size	Hrs.	Rate	
TOTAL EQUIPMENT					
TOTAL FOR DAY					
APPROVED _____			APPROVED _____		
(FOREMAN) CONTRACTOR			INSPECTOR		



Important



U. S. DEPARTMENT
OF LABOR

Wage Rate Information Federal-Aid Highway Project

Construction work on this project is subject to the minimum wage rate provisions of Section 113, Title 28, United States Code and the overtime wage provisions of the Contract Work Hours and Safety Standards Act.

As an employee of the contractor or a subcontractor, you are entitled to be paid not less than the hourly rate for the particular classification of work performed as set forth in the schedule affixed below.

The schedule affixed below contains no minimum wage rates for the following employees:

1. Apprentices properly registered under approved Federal or State apprenticeship programs. Each approved program contains the applicable rates.
2. Persons employed pursuant to apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting equal employment opportunity in connection with Federal-aid highway construction programs. Programs thus certified will set forth the rates applicable.

Call any failure to receive the required rates to the attention of the representative of the contracting agency shown below or the nearest representative of the Federal Highway Administration.

(State highway department representative)

Additional information may be obtained from the Federal Highway Administration, Washington, D.C. 20590.

Any communication should list the name, location, and type of project, the name of the contractor and his address, your name and address, and a statement of what you do, what rate you are paid, and what rate you think you should be paid.

(Attach Secretary of Labor minimum wage rate schedule)

Form FHWA-988 (2-81)

PREVIOUS EDITIONS ARE OBSOLETE

**STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION**

FIELD INSPECTION DOCUMENT
(For Estimated Fixed Quantity Items)

Contract #: _____

Date: _____

This documents to the record that the following inspection was performed in a sound engineering manner to the extent which my judgment deemed necessary:

- Forms for P.C.C. Masonry
- Rebars for P.C. C. Masonry
- _____

(Mark one)

- Estimated fixed quantity item
- _____

Location and/or description of inspected work

(Mark one)

- The work reasonably conformed to the plans, specifications or applicable approved changes.
- _____

Signed _____

Remarks

Sketches

Materials Received

Visitors

Inspector _____

Delaware Department of Transportation

DELAWARE STATE HIGHWAY DEPARTMENT							DATE _____	
BRIDGE SECTION (ENGLISH)								
<u>PILE DRIVING RECORD</u>								
FOUNDATION FOR _____								
CONTRACTOR _____				TYPE OF PILE _____				
FOOTING NO. _____				TIP DIAM. _____		BUTT DIAM. _____		
PILE NO. _____				LENGTH OF PILE AS DRIVEN _____				
DRIVING RIG NO. _____				ELEVATION OF GROUND _____				
TYPE OF HAMMER _____				ELEVATION OF CUT-OFF _____				
ENERGY: _____ LB-F-FT @ _____				BLOWS/MIN _____		ELEVATION OF TIP _____		
AVERAGE BLOWS PER MIN. _____				PAY LENGTH: PILE _____			CUT-OFF _____	
R OF PENETR'N	BLOWS PER ft	R OF PENETR'N	BLOWS PER ft	R OF PENETR'N	BLOWS PER ft	R OF PENETR'N	BLOWS PER ft	REMARKS
1		26		51		76		
2		27		52		77		
3		28		53		78		
4		29		54		79		
5		30		55		80		
6		31		56		81		
7		32		57		82		
8		33		58		83		
9		34		59		84		
10		35		60		85		
11		36		61		86		
12		37		62		87		
13		38		63		88		
14		39		64		89		
15		40		65		90		
16		41		66		91		
17		42		67		92		
18		43		68		93		
19		44		69		94		
20		45		70		95		
21		46		71		96		
22		47		72		97		
23		48		73		98		
24		49		74		99		
25		50		75		100		
PILE DRIVING INSPECTOR _____								
CONSTRUCTION SUPERVISOR _____								

DELAWARE STATE HIGHWAY DEPARTMENT
PILE DRIVING SUMMARY
(ENGLISH)

DATE: _____ SHEET _____ OF _____

PROJECT	Number: _____ Division: _____ Location: _____ Contractor: _____				HAMMER	Type _____ Make/Model _____ Rate Energy _____				PILES	Type: _____ Structural Unit: _____ NOTE: Place Lay-Out sketch on back of sheet - indicate test piles						
	DRIVING DATA *	Calculated Bearing (TONS)														*Usually last 6 in or indicate refusal **For double acting hammer substitute (ft-lbs/blow) for average fall of hammer	
Bearing $\frac{P}{U}$																	
Average Penetration (in/blow)																	
Batter Pile Factor (U)																	
PILE DATA RECORDS	LENGTH (ft)	For Pay												Total this sheet	Total this unit	Average this unit	
		Cut-Off															
		In Leads															
	ELEVATION (ft)	Splice													Inspector in Charge	Recorder:	
		Tip															
		Cut-Off															
		Grade															
	SIZE (in)	Tip												Date Driven	DISTRIBUTION INSTRUCTIONS Original - Bridge Engineer 1 copy - Division Engineer 1 copy - Construction Engineer 2 copies - Project Field Office		
		Butt															
	Pile No.																

CN-60 Revised 3/02

Use additional sheets as required

STATE OF DELAWARE DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS				
ROUTINE LABOR RELATIONS INTERVIEW				
Project Name _____				
1. Contractor or subcontractor (Employer)			2. Contract Number	
Employee Statements				
3. Name		4. Address		
5. Work Classification(s) _____ Wage Rate (s) Received _____ (If apprentice, give period of training)				
6. Have you seen the posted minimum wage rates for this job? <input type="checkbox"/> Yes <input type="checkbox"/> No				
7. Are you paid your full wages regularly each week without any deductions other than social security, income tax, U.S. Savings Bonds, medical or hospitalization insurance, or regular union initiation fees or membership dues? <input type="checkbox"/> Yes <input type="checkbox"/> No				
8. Have you done work which you believe you should have been paid for at a higher rate i.e., have you been misclassified? <input type="checkbox"/> Yes <input type="checkbox"/> No				
9. Additional Comments				
Interviewer's Comments				
10. Work employee was performing when interviewed.				
11. Were minimum wage rates properly posted? <input type="checkbox"/> Yes <input type="checkbox"/> No				
12. Other pertinent comments.				
DATE	TIME	Title of Interviewer	Signature of Interviewer	DISTRICT
For use of Checker				
13. Is above information in agreement with payroll data? <input type="checkbox"/> Yes <input type="checkbox"/> No				
14. Is above information in agreement with requirements? <input type="checkbox"/> Yes <input type="checkbox"/> No				
15. Additional Comments				
Date of Check	Title		Signature	

CN-30-5/74

DOCUMENT NO. 55-81/70/00/05

Delaware Department of Transportation

Contract No.	Field Measurements And	Source Document #	
Item:	Preliminary Calculations of Quantities	By:	Date:
		Entered In:	Date:

CN-11 6/83

Doc. # 55-04/78/05/09

Contract No:
Title of Contract:

Source of Supply
Materials & Research
Delaware Department of Transportation

Contractor: _____
Sub-Contractor: _____
Date: _____

District: _____

Specification #	Item Description	Material	Supplier	Manufacturer	Address & Contact #	Alternate Manufacturer

TEMPORARY AGREEMENT TO TRESPASS

The Division of Highways requests your permission to trespass upon your property in order to perform work that is necessary under Contract No. _____ as described below: _____

This does not imply conveyance of any of your land. All work will be done at the expense of the State unless otherwise specified above.

DelDOT shall cause its Contractor to indemnify, defend and hold harmless owner and its agents from and against any costs or damage of any kind, including attorney fees arising out of the Contractors entry upon lands of owner. DelDOT shall cause its Contractor to leave property in pre-entry condition.

This Agreement shall terminate upon completion of the work. If the foregoing meets with your approval, please signify by signing this agreement.

Property Owner' Name

Recommended By
(Project Engineer/Supervisor)

Date

Owner's Address

Approved (District
Engineer/Assistant
District Engineer)

Date

Signature of Owner

Date

cc: District Office
Right of Way Office
Project Engineer/Supervisor

**DELAWARE DEPARTMENT OF TRANSPORTATION
TEST PILE DRIVING RECORD
(ENGLISH)**

DATE _____ SHEET _____ OF _____

PROJECT		DEPTH OF TIP (ft)	NO. OF BLOWS PER METER	HAMMER INFORMATION	COMPUTED BEARING (US TONS)	REMARK: (Splice, pre-drill auger, obstruction breakdown, jetting, refusal, etc.)
NUMBER _____	DIVISION _____					
LOCATION _____						
Reference Point Elevation: _____						
HAMMER	TYPE _____					
	MAKE & MODEL _____ WEIGHT OF STRIKING PARTS: _____					
	_____ lb RATED ENERGY: _____ lbf-ft @ _____ blows / min					
	_____ lbf-ft per blow @ _____ ft					
PILES	TYPE _____					
	NUMBER _____					
	STRUCTURAL UNIT _____					
	TIP DIA. _____					
	BUTT DIA. _____ in					
	GAGE NO. _____ in					
	REQUIRED BEARING _____ US ton					
	REQUIRED PENETR. _____ ft					
	PLAN LENGTH _____ ft					
	LENGTH IN LEADS 1) _____ ft					
	2) _____ ft					
	TOTAL _____ ft					
	GROUND ELEVATION _____ ft					
	TIP ELEVATION _____ ft					
	CUT-OFF LENGTH _____ ft					
FINAL PILE LENGTH _____ ft						
TOTAL DRIVING TIME _____ min						

Delaware Department of Transportation

INSTRUCTIONS	<p>HAMMER INFORMATION to be with each blow count:</p> <p>1. Single-acting and gravity: Average fall of hammer</p> <p>2. Double-acting and differential-acting: Blows per minute</p> <p>3. Enclosed-ram diesel hammer: record bounce chamber pressure indication under remarks:</p>					
	Inspector in charge: _____					
	Recorder: _____					
	Distribution Instructions: Original - Bridge Engineer 1 copy - Division Engineer 1 copy - Construction Engineer 2 copies - Project Field Office					

CN-59 Revised 3/02

Use additional sheets as required

**STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
MATERIALS & RESEARCH**

Traffic Markings Report

(ENGLISH)

Test No. _____	Contract _____
Sample of _____	Date Sampled _____
Sampled by _____	Date Received _____
Contractor _____	Date Tested _____
Manufacturer _____	Quantity _____
Supply Location _____	Code _____ Batch No. _____

TEST	RESULTS	SPECIFICATION
Wgt of a gal. @ 77 °F	_____	_____ ±0.25
Consistency @ 77 °F, (Krebs Units)	_____	_____ ±5
Drying Time @ _____ mils, (mins.)	_____	_____
Non-Volatile Content, %	_____	_____ ±2%
Pigment Content, %	_____	_____ ±2%
Non-Volatile in Vehicle, %	_____	_____ ±2%

Reference to Pennsylvania Traffic Markings Performance Program.

Remarks:

Material represented by this sample has been _____

Tested by _____

Reported by _____

Laboratory Manager

LB-52

6/99

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

DB SECTION 113

DESIGN-BUILDER'S QUALITY PLAN

Delaware Department of Transportation

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DB SECTION 113

QUALITY PLAN REQUIREMENTS

DB 113-1 GENERAL REQUIREMENTS

The Design-Builder shall submit a Quality Plan, updated as necessary, to the Department for approval.

The Quality Plan shall address the topics contained in this DB Section 113 in the order listed therein and shall meet the specified requirements of this DB Section 113.

The Quality Plan shall set up a “quality system team” which shall be distinct and separate from the design and construction production organization. The quality system team shall report directly to the Design-Builder’s management through the Design-Builder’s Quality Control (QC) Manager. The Quality Plan shall describe the quality system to be implemented at all levels of the Design-Builder’s organization, to include Subcontractors (design and construction) at all levels, including labor only subcontracts.

See Part 2 – Design-Build Section 101, Section 101-3, for the definitions of QC and Quality Assurance (QA).

DB 113-1.1 Quality Plan Submittal

The Design-Builder shall submit its Quality Plan to the Department’s Project Manager within 30 calendar days of Notice to Proceed for review and approval.

DB 113-1.2 Quality Plan Reviews and Updates

The Design-Builder shall conduct management reviews of its quality system as specified in this DB Section 113.

Within 15 calendar days of the receipt of Department’s comments on the initial Quality Plan, the Design-Builder shall make necessary revisions to address Department’s comments and shall submit a conformed copy of the updated Quality Plan with revisions highlighted.

As Work progresses, the Design-Builder shall update the Quality Plan to reflect current conditions. The Design-Builder and/or the Department’s Project Manager may identify the need for revisions to the Quality Plan. The Design-Builder shall submit any revisions or updates to the Quality Plan to the Department’s Project Manager for approval within 30 calendar days of the identification of the need for a revision.

In addition, the Design-Builder shall submit its Quality Plan for review by the Department’s Project Manager annually [within 12 months of Notice to Proceed (NTP) or receipt of the last Approval from the Department’s Project Manager] even if no revisions have occurred during that 12-month period. The Design-Builder shall submit a conformed copy of the updated Quality Plan with revisions highlighted.

Failure to submit a conformed copy of updated Quality Plan in accordance with this D-B Section 113-1.2 shall be considered Non-Conformance with respect to the requirements set forth for Project Component 1 (PC 1) in DB Section 109. The Department may reject Design-Builder’s submittals until the non-conformity is resolved.

DB 113-1.3 Environmental Mitigation

In developing its Quality Plan, the Design-Builder shall establish appropriate controls in its management, design, construction/installation, and documentation procedures to ensure that environmental mitigation requirements are met and documented. This should include having a designated representative that is a DNREC Certified Construction Reviewer.

DB 113-1.4 Organizational Requirements

The Design-Builder shall designate a QC Manager who shall be classified as one of the Key Personnel and be responsible for overseeing the overall quality program and the preparation, implementation, and update of the Quality Plan for the Design-Builder, including management, design, and construction. The Design-Builder's QC Manager shall not report to the Design-Builder's Project Manager, but shall be directly responsible to and report to the Design-Builder's board, senior management, or similar level of the Design-Builder's organization not directly responsible for design or construction. Once the Design-Builder's Design and Construction QC Managers have been submitted and approved they cannot be removed from their respective positions by the Design-Builder without approval of the Department.

The Design-Builder's QC Manager shall be present and available for consultation with the Department's Project Manager and other Department staff on an on-call basis throughout the duration of the Project. The Design-Builder's QC Manager shall attend the weekly progress meetings at a minimum and such other meetings as the Department's Project Manager may request, including individual meetings between the Design-Builder's QC Manager and Department staff.

The Design-Builder's QC Manager shall be the primary point of contact to the Department for all issues relating to the Design-Builder's Quality Plan (preparation, review, implementation, and updates).

The Design-Builder's Design QC Manager and Construction QC Manager and their respective staffs shall report directly to the Design-Builder's QC Manager.

See DB Section 112 for responsibilities and qualification requirements of construction QC staff. *See* DB Section 111 for responsibilities and qualification requirements of design QC staff.

DB 113-1.5 Abbreviations

C/A	Corrective Action
HSPPD	Handling/Storage/Packaging/Preservation/Delivery
P/A	Preventive Action

See DB Section 101-2 for additional abbreviations.

DB 113-2 QUALITY SYSTEM REQUIREMENTS

DB 113-2.1 Management Responsibility

DB 113-2.1.1 Quality Policy

The Design-Builder's executive management shall define and document its policy for quality, including objectives for quality and its commitment to quality. (In the context of this DB Section 113, "executive management" shall mean those persons to whom the Design-Builder's Project Manager reports and who has overall responsibility for the Design-Builder's performance.) The quality policy shall be relevant to

the Design-Builder's organizational goals and the expectations and needs of the Department. The Design-Builder shall ensure that this policy is understood, implemented, and maintained at all levels of the organization.

The Design-Builder shall have a published statement of its commitment to quality and the organization's quality objectives signed by its responsible executive(s). It shall explain the commitment in terms of the services provided to the Department and the responsibilities assumed by the Design-Builder to discharge its contracted accountabilities, relative to the Department's overall responsibility to Stakeholders and the public-at-large for assuring quality in the constructed facility. The statement shall be made known to and understood by all staff and be included in the Quality Plan.

Executive management's commitment to quality could be demonstrated by the quality policy being signed by the responsible executive(s) and management's direct involvement in verifying the implementation and understanding of the quality policy.

All employees shall be made aware of the Design-Builder's quality policy. The indoctrination on quality policy may be formal and can be accomplished by various means depending on the size of the Project, the structure of the Design-Builder's management staff, and the number of employees.

DB 113-2.1.2 Organization

A) Responsibility and Authority

Executive management shall have the responsibility to plan and determine the overall direction of the Design-Builder and its relationship to the quality efforts. Executive management shall ensure the quality policy is documented and understood by all employees and management shall further ensure the implementation of the quality policy by everyone in the organization.

The quality system shall be an integral part of the overall management system and as such shall be supported and implemented from the top down. On a Design-Build (DB) project, most employees are involved in managing, performing, or verifying work that affects quality. It shall not be the sole domain of the design checkers, QC inspectors, or QC personnel. All workers, including design and construction production personnel (including those of Subcontractors), shall be aware of the quality system requirements that govern their respective Work.

A description of the organizational arrangements (such as, a chart) shall be available and maintained. All key roles and persons and lines of communication and authority between the Design-Builder and the Department and their representative(s) and with other organizations involved shall be identified.

The responsibility, authority, and interrelation of personnel who manage, perform, and verify work affecting quality shall be defined and documented, particularly for personnel who need the organizational freedom and authority to do any of the following:

- 1) Initiate action to prevent the occurrence of any nonconformities relating to the product, process, and quality system;
- 2) Identify and record any problems relating to the product, process, and quality system;
- 3) Initiate, recommend, or provide solutions through designated channels. It shall be everyone's responsibility to report any and all quality and safety problems;

- 4) Verify the implementation of solutions. Verifying the implementation of the solutions to quality problems shall be performed in a timely manner. The verification shall also investigate if the solution to the identified problem created another quality problem; and
- 5) Control further processing, delivery, or installation of nonconforming product until the deficiency or unsatisfactory condition has been corrected. Controls shall be established, including stopping work, if necessary, once a significant quality problem is identified until the cause of the problem can be identified and the required corrective action can be implemented.

B) Resources

The Design-Builder shall identify resource requirements and provide adequate resources, including the assignment of trained personnel (*see* DB Section 113-2.18) for management, performance of Work, verification activities, and internal quality audits.

The Design-Builder shall have a system for assuring that projects are adequately staffed and that resources are provided adequate training to perform such activities as design reviews (DB Section 113-2.4), verification activities, receiving, in-process and final inspections (DB Section 113-2.10), and internal quality audits (DB Section 113-2.17).

The Quality Plan shall identify the source of staffing (management, professional, technical, and labor) and shall deal with the integration of resources into the specific Contract requirements.

Other resources shall also be addressed, such as, computers, craft tools, equipment, and facilities.

C) Design-Builder's Quality Control Manager

The Design-Builder's executive management shall appoint a QC Manager who, irrespective of other responsibilities, shall have a defined authority for the following activities:

- 1) Ensuring that a quality system is established, implemented, and maintained; and
- 2) Reporting on the performance of the quality system to the Design-Builder's management for review and as a basis for improvement of the quality system.

The Design-Builder's QC Manager shall have direct access to executive management to report on the performance of the quality system and shall not work under the Design-Builder's Project Manager or anyone else responsible for design or construction production.

DB 113-2.1.3 Management Review

The Design-Builder's executive management shall review the quality system at defined intervals sufficient to ensure its continuing suitability and effectiveness in satisfying the requirements of this standard and the Design-Builder's stated quality policy and objectives (*see* DB Section 113-2.1.1). Management reviews shall be held at least at three-month intervals.

Records of such reviews shall be maintained (*see* DB Section 113-2.16). Minutes shall be taken of the review meetings and these minutes shall be maintained as quality records. Copies of minutes shall be provided to the Department's Project Manager on request.

DB 113-2.2 Quality System

DB 113-2.2.1 General

The Design-Builder shall establish, document, and maintain a quality system as a means of ensuring that product conforms to specified requirements. The Design-Builder shall prepare a Quality Plan covering the requirements of this DB Section 113. The Quality Plan shall include or make reference to the quality system procedures and outline the structure of the documentation used in the quality system.

The Quality Plan shall cover temporary and permanent components; the Design-Builder; all Principal Participants; and all Subcontractors, suppliers, and vendors (design, construction, and materials) at all tiers.

The Quality Plan shall either contain or reference the procedures and documentation structure outline critical to quality.

The Quality Plan shall also establish or reference the procedures that make up the quality system. Should the Quality Plan only reference the procedures, it shall also detail the levels of the documented system, its contents, and the interrelationship of the document types.

There shall be a "road map" within the Quality Plan that is lined up to the applicable element that describes the quality system. This roadmap may be a cross-reference, narrative, chart, index, or some similar method.

The Quality Plan shall detail the role of the Design-Builder, each Principal Participant, the Designer, the Design-Builder's Design and Construction QC Managers, and other team members having a significant quality role.

The Quality Plan shall define policies, goals, and objectives of the organization and organizational interfaces

DB 113-2.2.2 Quality-System Procedures

- A) The Design-Builder shall prepare documented procedures consistent with the requirements of this DB Section 113 and the Design-Builder's stated quality policy.
- B) The Design-Builder shall document standard Work methods in procedures (*see* DB Section 113-2.2.1) and enforce the implementation of these "Best Practices." However, it is inevitable that situations will arise which require a departure from the norm. These conditions shall be anticipated in the procedures and shall allow for control of these activities.
- C) The Quality Plan shall define the liaison and interface between the quality organization and the design and construction arms of the Design-Builder.
- D) The quality procedures shall, as a primary objective, be written with the intent of gaining employee understanding of the system.
- E) It is the Design-Builder's responsibility to describe to the Department the rationale for the procedures selected and, if the procedures do not address every provision of this DB Section 113, to explain why the standard is not applicable in a particular situation. The following common pitfalls should be avoided:
 - 1) Too much emphasis placed on creating multiple tiered documents when a simple

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- Quality Plan will suffice;
- 2) Procedures which are too restrictive;
 - 3) Procedures which are inconsistent;
 - 4) Inordinate emphasis on documentation requirements; and
 - 5) Over-commitment to procedures which provide little or no information to assist employees.
- F) The following list of procedures (1 through 21) shall serve as the starting point for defining the Design-Builder's quality management system.
- 1) A procedure for preparation, control and distribution of Project Quality Plan;
 - 2) Scope;
 - 3) Key Personnel;
 - 4) Organizational/technical interfaces;
 - 5) Design input requirements;
 - 6) Design output requirements (deliverables);
 - 7) Design reviews;
 - 8) Delaware Department of Transportation participation;
 - 9) Levels of responsibility and authority for the following personnel:
 - a) On-site staff;
 - b) Other local office staff;
 - c) Executive management; and
 - d) The Design-Builder's Quality Control Manager;
 - 10) An "Issue Paper" Process – A procedure to substantiate, justify and document the request for Department's approval of deviation from project design criteria, codes, and/or specifications.
 - 11) A procedure to control, verify, and validate the design;
 - 12) A procedure for document issue, approval, and revision;
 - 13) A procedure for verification, storage, and maintenance of Department-supplied Materials or Equipment;
 - 14) A procedure for the identification and traceability of deliverable items, such as, Design Plans, Project Specifications, Working Plans, and As-Built Plans;
 - 15) A procedure for verification and control of computer programs used in design;
 - 16) Procedures for inspecting, testing, and calibrating Equipment;
 - 17) Procedures for handling nonconformance;
 - 18) Procedures for corrective/preventive actions;
 - 19) Procedures for handling, storing, packaging, and delivering Contract deliverables;

- 20) Training processes;
- 21) Procedures for internal quality audits; and
- 22) A procedure for management review.
 - a) The Design-Builder shall identify its standard procedures applicable to the Project. Design-Builder shall develop Project-specific procedures for all elements of the Project that are important to quality for the Project, but are not addressed adequately by its standard procedures. Both types of procedures shall be included in the Project's Quality Plan.
 - b) The Design-Builder shall effectively implement the quality system and its documented procedures. Implementation shall be demonstrated by internal quality audit reports, trending of nonconformances, records of root cause analysis, records of corrective and preventive actions, and/or records of how the Department's complaints were handled.
 - c) For the purposes of this DB Section 113, the range and detail of the procedures that form part of the quality system depend on the complexity of the Work, the methods used, and the skills and training needed by personnel involved in carrying out the activity. The procedures shall accurately reflect the Work that is to be accomplished and shall benefit the organization/Project.
 - d) Documented procedures may make reference to specifications that define how an activity is performed. Procedures shall describe the process steps of "what" needs to be done and Work instructions shall prescribe "how" it is to be done.

DB 113-2.2.3 Quality Planning

A specific Project Quality Plan is required. There shall be evidence of quality planning that ensures specific Contract/Project requirements have been identified and incorporated into the documented quality system. The Department's requirements represent the minimum requirements. The Design-Builder shall develop a fully comprehensive plan.

The Design-Builder shall define and document how the requirements for quality will be met. Quality planning shall be consistent with all other requirements of a Design-Builder's quality system and shall be documented in a format to suit the Design-Builder's methods of operation. The Design-Builder shall give consideration to the following activities, as appropriate, in meeting the specified requirements for the Project:

- A) Preparing the Quality Plan;
- B) If the Design-Builder already has a quality management system, blending the unique Project requirements into the quality system by completing the following for this Project:
 - 1) Stating the Project objectives to be obtained;
 - 2) Identifying responsibilities, authorities, and interfaces (both internal and external);
 - 3) Identifying specific procedures, methods, and instructions to be used (standard and Project specific);
 - 4) Identifying inspections, tests, audits, and surveillances to be used;

- 5) Controlling modifications and change; and
- 6) Incorporating Project requirements into the standard documents;
- C) Identifying and acquiring any controls, processes, Equipment (including inspection and test Equipment), fixtures, resources, and skills that may be needed to achieve the required quality;
- D) Ensuring the compatibility of the design, production process, installation, service, inspection and test procedures, and applicable documentation, the Design-Builder shall have significant interface obligations and shall describe in its Quality Plan how these obligations shall be met;
- E) Updating, as necessary, QC, inspection, and testing techniques, including the development of new instrumentation;
- F) Identifying suitable verification at appropriate stages;
- G) Clarifying standards of acceptability for all features and requirements, including those which contain a subjective element; and
- H) Identifying and preparing quality records. Quality records are comprised of such documents as audit inspection reports, approved designs, Specifications, Plans, calculations, purchase orders, Design Review records, vendor evaluation reports, cumulative progress reports, and audit reports.

DB 113-2.3 Change Order and Amendment Review

DB 113-2.3.1 General

The Design-Builder shall establish and maintain documented procedures for change order and Amendment review and for the coordination of these activities.

The methodology of the review shall be adequately defined and documented in procedure(s). The objective is to ensure that all Contract commitments are reviewed and agreed prior to issue or "execution."

This DB Section 113-2.3 applies to the Contract between the Design-Builder and the Department.

DB 113-2.3.2 Review

The change review is a process that should begin with the request for change and continues during the change order or Amendment preparation. The review process could be "graded" (i.e., different for change orders versus Contract Amendments) and could also be different based on the dollar value and legal framework (i.e., specific to the perceived risk of not doing so).

Change review shall take place for each request for change order or Contract Amendment.

Before submission of a proposal or the acceptance of a change order or Contract Amendment, the proposal shall be reviewed by the Design-Builder to ensure the following:

- A) The requirements are adequately defined and documented. Where no written statement of requirement is available for an order received by verbal means, the Design-Builder shall ensure that the order requirements are agreed before their acceptance. The identification and documentation of the Department's requirements is required;

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- B) The standard also acknowledges that a written statement of requirements may not always be received from the Department. Where verbal orders are received from an authorized representative of the Department, the Design-Builder shall ensure requirements are defined, reviewed, and confirmed in writing. In any case, the Design-Builder shall be responsible to ensure the change requirements are understood and have been agreed to by both parties before acceptance;
- C) Any differences between the Contract or accepted order requirements and those in the proposal are resolved. Differences between a proposal and the requested change shall be reconciled and reviewed for impact and action, clearly and mutually agreed; and
- D) The Design-Builder has the capability to meet the Contract or accepted order requirements. The Design-Builder shall have the capability to fulfill the Project Contract requirements before acceptance of the change order or Amendment. This capability can reside in-house, with Subcontractors, or with subconsultants.

DB 113-2.3.3 Amendment to a Contract

The Design-Builder shall identify how an amendment to a Contract is made and correctly transferred to the functions concerned within the Design-Builder's organization.

The Contract review procedure shall include processing all Amendments to the Contract. Amendments and change order requests should be subject to an appropriate level of review as the initial Contract. The review shall include impact on Work already performed, schedule, and costs.

DB 113-2.3.4 Records

Change order and Amendment reviews correspondence, meeting minutes, signed documents, and records of negotiation shall be maintained as Project records. Records of negotiations shall also be attached to a Change Order.

Channels for communication and interfaces with the Department's organization in these Contract matters shall be established and maintained.

DB 113-2.4 Design Control

DB 113-2.4.1 General

The Design-Builder shall establish and maintain documented procedures to control and verify the design of the product in order to ensure that the specified requirements are met.

Design control shall be applied to computer programs, design tables, and other products that provide analytical results which are used to develop or check designs.

The Quality Plan shall detail the roles of the following Design-Builder personnel:

- A) Designer;
- B) Design Manager;
- C) Design Quality Control Manager; and
- D) Responsible Engineer(s).

DB 113-2.4.2 Design and Development Planning

The Design-Builder shall prepare plans for each design and development activity. The plans shall

describe or reference these activities and define responsibility for their implementation. The design and development activities shall be assigned to qualified personnel equipped with adequate resources. The plans shall be updated as the design evolves.

The Project design control procedures shall define the technical interfaces among the different groups which provide input to the design process or receive output. The necessary information shall be documented, transmitted, and regularly reviewed. If not defined in these procedures, a separate description shall be required.

DB 113-2.4.3 Design Input

Design-input requirements relating to the product, including applicable statutory and regulatory requirements, shall be identified, documented, and reviewed by the Design-Builder for adequacy. Incomplete, ambiguous, or conflicting requirements shall be resolved with those responsible for imposing these requirements.

The essence of this sub-element is that the Design-Builder determines what information is needed and the available sources for information, reviews all pertinent available data, assures itself that there is sufficient information to carry out its assignment, and resolves with the Department and other appropriate authorities any actual or apparent conflicts or inconsistencies in the information so gathered. The information, sources, and decisions shall be documented and treated as a quality record (DB Section 113-2.16).

DB 113-2.4.4 Design Output

The Design-Builder shall document design output and express output in terms that can be verified against design-input requirements and validated (*see* DB Section 113-2.4.8).

Design outputs are usually captured in documents such as Plans, reports and Specifications. The control of these outputs is an integral part of the Design-Builder's document control process.

Output documentation shall be reviewed for compliance with design requirements.

Design output shall comply with the following:

- A) Meet the design-input requirements;
- B) Contain or make reference to acceptance criteria; and
- C) Identify those characteristics of the design that are crucial to the safe and proper functioning of the product (e.g., requirements for operating, storing, handling, maintaining, and disposing).

Design-output documents shall be reviewed before release.

DB 113-2.4.5 Design Review

At appropriate stages of design, documented reviews of the design results shall be planned and conducted. Participants at each Design Review shall include representatives of all functions concerned with the design stage being reviewed, as well as other specialist personnel as required. Records of such reviews shall be maintained (*see* DB Section 113-2.16).

This element reinforces the principle of qualified staff to perform verification functions. The purpose here is to ensure an unbiased look at the Work output being produced, to verify with a "fresh set of eyes" that the Department's contractual requirements and needs are being met fully. Reviews shall include

consideration of the Project's usability, reliability, maintainability, availability, and operability along with safety, cost, and aesthetics. In reviews it is prudent to address environmental impacts, community impacts, and similar concerns. Note that Design Reviews shall be recorded and retained as quality records. Any computer software used to perform alternative calculations or verify clearances through use of scale models or CADD techniques shall be validated before use for the application made and the validation documented in accordance with DB Section 113-2.16.

In addition to conducting Design Reviews, design verification may include the following activities:

- A) Performing alternative calculations;
- B) Comparing the new design with a similar proven design, if available;
- C) Undertaking tests and demonstrations; and
- D) Reviewing the design-stage documents prior to release.

DB 113-2.4.6 Design Verification

Design verification is the process of ensuring specified requirements have been met.

At each stage of design development the Design-Builder shall verify that the design stage output meets the design stage input requirements. The design verification measures shall be recorded (*see* DB Section 113-2.16).

The Design-Builder shall establish and the Quality Plan shall include procedures for verifying and documenting that the design output meets the design input requirements. Verification shall include independent checks, tests, and/or reviews.

Verification shall be performed under the direction of the Design-Builder's Design Quality Control Manager.

Designs provided by subconsultants shall be independently verified and documented under the direction of the Design-Builder's Design QC Manager prior to its acceptance and incorporation into the Work of others.

DB 113-2.4.7 Design Validation

The Design-Builder shall perform design validation to ensure that Project conforms to defined user needs and/or requirements.

Design validation is the process of ensuring "requirements for a specific intended use are fulfilled." In other words, design validation is conformity with the user's needs rather than only specified requirements. In most cases, the Design-Builder cannot determine if the Department's "needs" have been fulfilled until the Project is complete and operational.

Design validation seeks to ensure that the final product conforms to the Department's needs. Design validation follows successful design verification. Validation may only be applicable for electronic, electrical, and/or mechanical components of a Project. Validation is normally performed under defined operating conditions. Validation is normally performed on the final product, but may be necessary in earlier stages prior to Project completion.

Multiple validations may be performed if there are different intended uses.

DB 113-2.4.8 Design Changes

After a design is complete and the Work is ready to be executed, is being executed, or is complete all subsequent design changes and modifications shall be identified, documented, reviewed, and approved by authorized personnel before their implementation.

The Design-Builder shall establish and include in the Quality Plan procedures on how design changes are initiated, reviewed, approved, implemented, and recorded in order to maintain configuration control. Changes may originate at the Department's request, internal and external design organizations, and site or field personnel.

The persons authorized to approve design changes shall be identified in the procedures. The mechanism for changes in the design can be detailed as part of the procedure for the original Work or addressed in a specific design change procedure(s). It is important that any proposed changes should be reviewed and approved by the Responsible Engineer that produced the original Work. The degree and nature of control on design changes shall be at least equivalent to that under which the original Work was accomplished. Changes shall be responsive to the design input and shall be verified and approved. An administrative system shall be in place to ensure that approved changes are documented and provided to holders of the original material in a timely manner. Also, there shall be a documented process that ensures that superseded information is removed from use when the updated document or record is received.

A master list of currently effective documents shall be maintained to reflect design changes approved. A listing of the design changes shall be communicated to the construction site on a timely basis consistent with the progress of construction activities. Under no circumstances shall Work be performed without current knowledge of the approved design changes to be incorporated into the Work product.

DB 113-2.5 Document and Data Control

DB 113-2.5.1 General

The Design-Builder shall establish and maintain documented procedures to control all documents and data that relate to the requirements of this DB Section 113-2.5 including, to the extent applicable, documents of external origin such as standards and the Department's plans.

The Design-Builder shall be responsible for the establishment and implementation of documented procedures for ensuring all documents essential to the quality of the delivered product or service are properly controlled. This shall include, but is not limited to, contracts, Plans, Specifications, master drawing lists or equivalent documents, critical procedures and Work instructions, quality system manuals, Project quality plans, and data (e.g., computer data bases and computer files).

Procedures should recognize that there is a finite life to electronic storage media. Consideration should be made for those "documents" which only exist in the electronic media.

DB 113-2.5.2 Document and Data Approval and Issue

The Design-Builder shall be responsible to see that the documents and data are reviewed and approved for adequacy by authorized personnel prior to issue. A master list or equivalent document control procedure identifying the current revision status of documents shall be established and be readily available to preclude the use of invalid and/or obsolete documents.

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The Design-Builder shall be responsible for establishing, documenting, maintaining, and implementing a procedure which clearly defines the process for document review, resolution of comments, and approval authority.

Quality management system documentation shall also be controlled to ensure its proper authorization and distribution.

No construction Work activities shall be accomplished using unreleased, unauthorized, or outdated design documents.

This control shall ensure the following:

- A) The pertinent issues of appropriate documents are available at all locations where operations essential to the effective functioning of the quality system are performed; and
- B) Invalid and/or obsolete documents are promptly removed from all points of issue or use or otherwise assured against unintended use in the following ways:
 - 1) Superseded, revised, and voided documents shall be removed from all Work areas and the employees whose Work is governed by those documents shall be informed of the changes to ensure compliance to the new or revised requirements;
 - 2) A master document list or equivalent shall be maintained to identify the status and current revision of all controlled documents. The master list or equivalent shall be controlled and be available to all holders of controlled documents; and
 - 3) Any obsolete documents retained for legal and/or knowledge-preservation purposes are suitably identified. Superseded, revised, and voided documents can be maintained for legal and/or historic information. However, the documented procedure must describe the method of identifying and storing these documents in a manner that ensures they are not inadvertently used by an unknowing individual. There shall also be a record retention plan for the Design-Builder.

DB 113-2.5.3 Document and Data Changes

The Design-Builder shall identify and include in the Quality Plan the process for the initiation, review, and approval of all document changes prior to issuance of those changes.

Changes to documents and data shall be reviewed and approved by the same functions/organizations that performed the original review and approval unless specifically designated otherwise. If this is not possible then the designated approval authority shall have adequate background and experience upon which to base the decision. The designated functions/organizations shall have access to pertinent background information upon which to base their review and approval.

Where practical, the nature of the change shall be identified in the document or the appropriate attachments.

DB 113-2.6 Procurement and Purchasing

DB 113-2.6.1 General

The Design-Builder shall establish and maintain documented procedures to ensure that purchased services and products conform to specified requirements.

The Design-Builder shall be responsible for establishing, documenting, and maintaining procedures for the evaluation and selection of suppliers, vendors, and subcontractors. The procedures shall detail the requirements for all important activities, such as, preparation of purchase orders; contracts for services; bid lists; and vendor quality requirements, including, pre-award audits, in-process inspections, and product acceptance.

DB 113-2.6.2 Evaluation of Subcontractors, Suppliers, and Vendors

The Design-Builder shall perform the following functions:

- A) Evaluate and select Subcontractors on the basis of their ability to meet subcontract requirements, including the quality system and any specific QC requirements;
- B) Control the evaluation and selection of suppliers, vendors, and Subcontractors. Procedures, rather than just a statement of policy in the Quality Plan, shall be used;
- C) Describe the evaluation and selection process for suppliers, vendors, and Subcontractors of all tiers and describe the priority of quality in the evaluation and selection criteria in the Quality Plan;
- D) Define the type and extent of control exercised by the Design-Builder over Subcontractors. This shall be dependent upon the type of services or products, the impact of subcontracted Work on the quality of final product, and where applicable on the quality audit reports and/or quality records of the previously demonstrated capability and performance of Subcontractors; and
- E) Establish and maintain quality records of acceptable Subcontractors (*see* DB Section 113-2.16). Records shall be maintained to document the selection, control exercised over, performance, delivery, and quality of all Subcontractors.

The methods the Design-Builder elects to use to control the delivery of the subcontracted service or product may include, but are not limited to the following:

- 1) Design Reviews;
- 2) Shop inspections;
- 3) Receiving inspections;
- 4) Witnessed inspection hold points;
- 5) Issuance of a certificate of compliance or analysis;
- 6) Testing and approval of a prototype or sample;
- 7) Provision and approval of a Quality Plan prior to contract award; and
- 8) Quality system audits.

The procedures shall detail how Subcontractors (including consultants) will be reported to the Department (DB Section 108-1).

DB 113-2.6.3 Procurement and Purchasing Data

- A) Procurement and purchasing documents shall contain data clearly describing the service or product ordered, including where applicable:
- B) The type, class, grade, or other precise identification;

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- C) The title or other positive identification and applicable issues of Specifications; Plans; process requirements; inspection instructions; and other relevant technical data, including requirements for approval or qualification of product, procedures, process Equipment, and personnel; and
- D) The title, number, and issue of the quality system standard to be applied.

The Design-Builder shall review and approve procurement/purchasing documents for adequacy of the specified requirements prior to release.

The documented procedure shall identify how and by whom procurement and purchasing documents are reviewed, how comments are resolved, and who in the organization has the authorization for final approval of the document.

DB 113-2.6.4 Verification of Purchased Service or Product

- A) Design-Builder Verification at Subcontractor's Premises

Where the Design-Builder proposes to verify purchased product or service at the Subcontractor's premises, the Design-Builder shall specify verification arrangements and the method of product release in the procurement/purchasing documents.

The procurement/purchasing document shall include any requirement for the organization performing verification at its Subcontractor's facilities. The method of verification and release of the product or service shall be specified in advance. This may also mean the purchase order or Specifications carry specific instructions on how the process verification will be performed to assure the final product will meet all of the procurement/purchasing requirements.

- B) The Delaware Department of Transportation Verification of Subcontracted Product or Service

Where specified in the Contract, the Design-Builder or the Department's representative shall be afforded the right to verify at the Subcontractor's premises and the Design-Builder's premises that subcontracted product or service conforms to specified requirements. Such verification shall not be used by the Design-Builder as evidence of effective control of quality by the Subcontractor.

When specified in the Contract Documents, the Department shall have the right of access to the Design-Builder and/or Subcontractor facility to inspect, audit, or otherwise verify the specified procurement/purchasing requirements are being fulfilled. The right of access may be extended to authorized personnel and contracted third parties. The Design-Builder is obligated to perform verification actions regardless of what the Department does. The Department's verification may not be substituted for the Design-Builder's actions.

Verification by the Department shall not absolve the Design-Builder of the responsibility to provide acceptable product or service nor shall it preclude subsequent rejection by the Department.

The Subcontractors shall be responsible for fulfilling all of the specified procurement requirements regardless if the Department, Design-Builder, or agent thereof performed any tests or inspections. The Design-Builder shall provide the Department an acceptable product or service regardless of the extent of the Department's verification. Even if the Department has performed verification actions at the Design-Builder's facilities, the

product may still be rejected if it is not acceptable.

DB 113-2.7 Control of Delaware Department of Transportation-Supplied Items

The Design-Builder shall establish and maintain documented procedures for the control of verification, storage, and maintenance of any Department-supplied items provided for incorporation into the supplies or for related activities. Any such item that is lost, damaged, or is otherwise unsuitable for use shall be recorded and reported to the Department (*see* DB Section 113-2.16).

One of the most significant products provided to the Design-Builder by the Department is design information in the form of Plans and Specifications as well as proprietary information, and these items shall be protected with the same vigilance as any hardware items supplied. Any apparent deficiency or ambiguity shall be identified to the Department for its necessary action.

The technical characterizations of the site, such as, the boring log or soil report data supplied by the Department for consideration in designing the structural system for the product are examples of the Department-supplied products for the structural consultant.

When such items are encountered documented procedures shall exist which detail the receipt/ acceptance, storage, and maintenance (preservation) of these items.

When items are considered inadequate for the task required documented procedures shall detail the process used to report such deficiencies to the Department.

DB 113-2.8 Product Identification and Traceability

Where appropriate, the Design-Builder shall establish and maintain documented procedures for identifying the product by suitable means from receipt and during all stages of production, delivery, and installation.

This means that the Design-Builder shall establish and maintain documented procedures whereby items of Work for which records are to be kept shall be identifiable. Examples of this on a construction site include the numbering of concrete pours in a structure or the establishment of a grid matrix for identifying columns.

The Design-Builder shall include the document title, the unique number, the Department's name, the Design-Builder's name, the preparer's name, and the date and revision number on all Project deliverables.

The filing and retrieval of operating manuals, certificates of compliance and/or analysis, heat numbers, inspection status, and nonconforming product shall be traceable to the items. Records shall be kept that identify the installed location of the Equipment.

Where and to the extent that traceability is a specified requirement, the Design-Builder shall establish and maintain documented procedures for unique identification of individual product or batches. This identification shall be recorded (*see* DB Section 113-2.5).

The intent of this DB Section 113-2.8 is to ensure the Design-Builder can effectively identify the root cause of a problem and implement effective corrective and preventive actions to resolve and prevent future occurrences of the problem.

DB 113-2.9 Process Control

The Design-Builder shall plan and control the Work and, when necessary, prepare a documented process plan defining how Work is to be carried out. Documentation may be in the form of a narrative, flow chart, or control points.

The Design-Builder shall identify and plan the production, installation, and servicing processes which directly affect quality and shall ensure that these processes are carried out under controlled conditions. Controlled conditions shall include the following:

- A) Documentation of procedures defining the manner of production, installation, and servicing where the absence of such procedures could adversely affect quality. This requirement deals with the planning and control of all Work processes other than design control processes that are critical to the adequacy of the delivered Project;
- B) Establishment and documentation of the method(s) for scheduling, monitoring, and reporting on the status of each significant aspect of the design or other Project tasks. The methods shall be consistent with the size and complexity of the effort. Such schedules shall identify required inputs from others and submittals to the Department and to relevant government authorities;
- C) An assessment by the Design-Builder of this requirement. The key phrase of this requirement is "where the absence of such procedures could adversely affect quality";
- D) Use of suitable production, installation, and servicing Equipment and a suitable working environment;
- E) Compliance with reference standards/codes, quality plans, and/or documented procedures. Referenced standards shall be available to the people at the location where the Work is to be performed to ensure compliance to the specified requirements;
- F) Monitoring and control of suitable process parameters and product characteristics;
- G) The approval of processes and Equipment, as appropriate. Procedures shall identify who has the responsibility, authority, and expertise for the approval of various processes to ensure their adequacy;
- H) Criteria for workmanship which shall be stipulated in the clearest practical manner (e.g., written standards, representative samples, or illustrations); and
- I) Suitable maintenance of Equipment to ensure continuing process capability.

DB 113-2.10 Inspection and Testing

DB 113-2.10.1 General

The Design-Builder shall establish and maintain documented procedures for inspection and testing activities in order to verify that the specified requirements for the Project are met. The required inspection and testing and the records to be established shall be detailed in the Quality Plan or documented procedures.

This section shall address inspection/testing methodology, methods of control, documentation, acceptance, and distribution of results.

Written procedures are required. In general, QC inspections shall be performed to written criteria with

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specified levels of acceptability based on clearly defined accept/reject criteria. Reports shall be signed and dated by QC inspection personnel and results clearly indicated. Copies of all QC documents shall be provide to the Department within one week from the time they are prepared.

The Design-Builder shall establish, document, and maintain procedures for inspection and testing activities.

Quality Control inspection and testing shall be performed in accordance with written procedures developed by the Design-Builder or the proper issue of test procedures issued by industry, government, and/or code bodies available to test personnel.

Verification of compliance with Specifications and/or requirements by means of inspection and testing is required at the following times:

- A) On receipt of Materials;
- B) At intermediate stages; and
- C) When Work is completed.

The criteria for compliance are defined in the Contract as are appropriate sampling and testing requirements.

Checkpoints and hold points (Work that must be inspected and approved by the assigned QC inspector before Work can proceed) shall be clearly established and identified on the Project Baseline Schedule or other suitable means. Quality Control inspection procedures, logistics, and reporting of results shall be clearly defined, developed, and implemented.

DB 113-2.10.2 Incoming Product Inspection and Testing

The Design-Builder shall ensure that incoming product is not used or processed (except in the circumstances described in DB Section 113-2.10.2.3) until it has been inspected or otherwise verified as conforming to specified requirements. Verification of the specified requirements shall be in accordance with the Quality Plan and/or documented procedures.

The Quality Plan shall include incoming product inspection that shall include, but not be limited to, the following:

- A) Documentation review;
- B) Physical inspection of Materials and/or Equipment:
- C) Identify items per the purchase order and shipping list, tag number, or marking;
- D) Verification of quantity and size;
- E) Dimensional checks, when applicable;
- F) Verification of protective coatings, if applicable; and
- G) Examination of item(s) for condition and shipping damage.

The Design-Builder shall maintain an adequate checking and approving procedure to ensure that all its Work, including, the monitoring, testing, and approving of such Work at the head office and on-site, meets the Department's requirements and the Contract.

In determining the amount and nature of receiving inspection, the Design-Builder shall consider the amount of control exercised at the Subcontractor's premises and the recorded evidence of conformance provided.

DB 113-2.10.3 In-Process Inspection and Testing

The Design-Builder shall provide the following functions:

- A) Inspect and test the product as required by the Quality Plan and/or documented procedures; and
- B) Hold product until the required inspection and tests have been completed or necessary reports have been received and verified.

DB 113-2.10.4 Final Inspection and Testing

The Design-Builder shall jointly conduct all final inspection and testing with the Department in accordance with the Contract requirements and the Quality Plan and/or documented procedures to complete the evidence of conformance of the finished Project to the specified requirements.

The Design-Builder shall have documented procedures to ensure that the final observation and testing where applicable have been completed.

Records of final inspection and tests are required to verify compliance to specified requirements has been achieved (*see* DB Section 113-2.16).

The Quality Plan and/or documented procedures for final inspection and testing shall require that all specified inspection and tests, including those specified either on receipt of product or in-process, have been carried out and that the results meet specified requirements.

DB 113-2.10.5 Inspection and Test Records

The Design-Builder shall establish and maintain records which provide evidence that the product has been inspected and/or tested. These records shall show clearly whether the product has passed or failed the inspections and/or tests according to defined acceptance criteria. Where the product fails to pass any inspection and/or test, the procedures for control of nonconforming product shall apply (*see* DB Section 113-2.13).

Inspection and test records for inspections and tests performed by Design-Builder, the Department, and/or a third party shall show whether the product has passed or failed according to defined acceptance criteria. Product that fails inspection becomes nonconforming product. Also, the records shall identify the inspection authority responsible.

DB 113-2.11 Control of Inspection, Measuring, and Test Equipment

DB 113-2.11.1 General

The Design-Builder shall establish and maintain documented procedures to control, calibrate, and maintain inspection, measuring, and test Equipment (including test software) used by the Design-Builder to demonstrate the conformance of product to the specified requirements. Inspection, measuring, and test Equipment shall be used in a manner which ensures that the measurement uncertainty is known and is consistent with the required measurement capability.

Where test software or comparative references, such as test hardware, are used as suitable forms of inspection they shall be checked to prove that they are capable of verifying the acceptability of product

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prior to release for use during production, installation, or servicing and shall be rechecked at prescribed intervals. The Design-Builder shall establish the extent and frequency of such checks and shall maintain records as evidence of control (*see* DB Section 113-2.16).

Where the availability of technical data pertaining to the measuring Equipment is a specified requirement such data shall be made available when required by the Department for verification that the measuring Equipment is functionally adequate.

Effective test procedures shall contain comprehensive listings of required Equipment, tools, and apparatus to successfully and conclusively perform the test. Matters of "repeatability" and "reproduceability" shall also be addressed, together with precision of measured results and calibration thresholds of measuring devices.

Comprehensive operations, maintenance, setup, and dimensional arrangements for the measuring, testing devices, and Equipment shall also be included in order to allow for their practical layout and installation at the measuring location. The Design-Builder's QC Engineering Firm shall establish, document, and maintain procedures for the control of inspection, measuring, and test equipment. It shall be the Design-Builder's responsibility through its QC Manager to assess the Subcontractor (*see* DB Section 113-2.6.2) to ensure the required procedures exist and are implemented.

The Design-Builder and its QC Engineering Firm shall be responsible for ensuring applicable requirements of this DB Section 113 are addressed.

This DB Section 113-2.11 applies to inspection or testing and surveying Equipment. The Quality Plan shall address the following:

- A) Definition of the responsibility and authority for the inspection, measuring, and test Equipment;
- B) Procedures for selecting measurements, determining accuracy and precision required, and obtaining Equipment which meets those requirements;
- C) Disposition of nonconforming Equipment;
- D) Procedures for identification, maintenance, and storage of measuring Equipment;
- E) Record keeping;
- F) Calibration frequency;
- G) Calibration status including indicators;
- H) Disposition of items checked with Equipment found to be out of calibration; and
- I) Traceability of primary and secondary calibration standards.

DB 113-2.11.2 Control Procedure

The Design-Builder, through its Quality Control Engineering Firm, shall provide the following function:

- A) Determine the measurements to be made and the accuracy required, and select the appropriate inspection, measuring, and test Equipment that is capable of the necessary accuracy and precision;
- B) Identify all inspection, measuring, and test Equipment that can affect product quality and calibrate and adjust them at prescribed intervals or prior to use against certified Equipment having a known valid relationship to internationally or nationally recognized

standards. Where no such standards exist, the Design-Builder shall document the basis used for calibration;

- C) Develop a master calibration listing indicating the inspection and test Equipment that is used. The log shall include at a minimum the identification number, item description, and required frequency of calibration and accuracy requirements. It is not intended that calibration is required for non-precision tools and instruments, such as, measuring tapes, concrete slump cones, rulers, and weld radius gauges;
- D) Define the process employed for the calibration of inspection, measuring and test Equipment, including, details of equipment type, unique identification, location, frequency of checks, check method, acceptance criteria, and the action to be taken when results are unsatisfactory;
- E) Identify inspection, measuring, and test Equipment with a suitable indicator or approved identification record to show the calibration status;
- F) Maintain calibration records for inspection, measuring, and test Equipment (*see* DB Section 113-2.16);
- G) Assess and document the validity of previous inspection and test results when inspection, measuring, or test Equipment is found to be out of calibration;
- H) Ensure that the environmental conditions are suitable for the calibrations, inspections, measurements, and tests being carried out;
- I) Ensure that the handling, preservation, and storage of inspection, measuring, and test Equipment is such that the accuracy and fitness for use are maintained;
- J) Safeguard inspection, measuring, and test facilities, including both test hardware and test software, from adjustments which would invalidate the calibration setting; and
- K) Ensure that geometry controls, including construction layout and surveying, are accurately maintained.

DB 113-2.12 Inspection and Test Status

The inspection and test status of product shall be identified by suitable means which indicate the conformance or nonconformance of product with regard to inspection and test performed. The identification of inspection and test status shall be maintained as defined in the Quality Plan and/or documented procedures throughout production, installation, and servicing of the product to ensure that only product that has passed the required inspections and tests is dispatched, used, or installed.

The Design-Builder shall establish, document, implement, and maintain an effective system for identifying and implementing the inspection and test status of Project products and services. The system shall utilize a method to identify conforming, nonconforming, indeterminate, downgraded, scrap, and rejected Material.

Lack of nonconformance identification shall not be an indication of acceptance.

DB 113-2.13 Control of Nonconforming Product

DB 113-2.13.1 General

The Design-Builder shall establish and maintain documented procedures to ensure that product that does

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not conform to specified requirements is prevented from unintended use or installation. This control shall provide for identification, documentation, evaluation, segregation (when practical), and disposition of nonconforming product and for notification to the functions concerned.

There shall be documented procedures to assess nonconformance in the Design-Builder's Work and in the work provided by other contractors, including the Department. The procedures shall safeguard against use of inaccurate or otherwise inappropriate information or data.

The procedures shall identify the individual(s) responsible for verifying the nonconformance, documenting it, processing the documentation in accordance with the procedures, and determining the effective corrective action/preventive action (*see* DB Section 113-2.14) to resolve the nonconformance.

Procedures shall also cover nonconformances which arise during construction. The procedures shall address the situation where it is discovered that Work does not conform to the requirements after the Work item has previously been subjected to the established checking and approval process. The procedures shall also address Work that is discovered or suspected to contain errors or omissions after delivery to the Department.

Work shall be immediately brought under control to limit the impact it could have on associated Work where it may have been used as input. Procedures shall include methods to inform those to whom the nonconforming Material had been provided as valid information and to retrieve and isolate from use known copies of the Material until a determination can be made about how to proceed. Nonconformances might be manifested as incorrect plans, errors in calculation (numerical or procedural), survey data that might be based on an incorrect benchmark or route, or even a correct design based on superseded Specifications.

DB 113-2.13.2 Review and Disposition of Nonconforming Product

The Design-Builder shall define the responsibility for review and authority for the disposition of nonconforming product.

A nonconformance shall be defined as any condition in Equipment, Materials, or processes which does not comply with required Plans, Specifications, codes, standards, documentation, records, procedures, or Contract requirements which cause the acceptability of Equipment, Materials, or processes to be unacceptable or indeterminate.

Nonconforming product shall be reviewed in accordance with documented procedures. The review may result in the following:

- A) Rework to meet the specified requirements;
- B) Acceptance with or without repair by consent of the Delaware Department of Transportation;
- C) Regard for alternative applications; or
- D) Rejection or scrapping.

The procedures shall also address the disposition of nonconforming items and the steps necessary to verify that the nonconformances have been adequately addressed and that the item then be characterized as conforming.

The proposed use or repair of product which does not conform to specified requirements shall be reported

for consent by the Department. The description of the nonconformity that has been accepted and repairs shall be recorded to denote the actual condition (*see* DB Section 113-2.16).

The Design-Builder shall keep and maintain records of nonconforming findings (*see* DB Section 113-2.16). Also, each nonconformance record shall contain all deliberations, retesting, resolution activities, findings, and decisions.

Repaired and/or reworked product shall be re-inspected in accordance with the Quality Plan and/or documented procedures.

Repair shall require the involvement of the Department, the Designer, and/or an authorized third party to review the condition and determine that although it does not meet the specified requirements, the overall impact is such that the resulting condition is acceptable.

DB 113-2.14 Corrective and Preventive Action

DB 113-2.14.1 General

The Design-Builder shall establish and maintain documented procedures for implementing corrective and preventive action.

This DB Section 113-2.14 encompasses two aspects of dealing with nonconformities. The first is implementation and effectiveness of previously implemented corrective actions.

The second is preventive action, which plays a major role in this requirement. Most procedures addressing corrective action need to include preventive action. The investigation of nonconformances needs to look into three possible causes. They are the product, the process, and the quality system.

These nonconformances may be identified by either internal or external audits or during regular inspections or Design Reviews. The appropriate authority to implement, verify, and review the effectiveness of both preventive and corrective actions shall be identified. Written procedures shall be prepared and implemented to determine the root causes of nonconformances and to revise existing procedures and Work instructions or to establish new ones to prevent the identified situations that cause or allow nonconformances to develop.

Any corrective or preventive action taken to eliminate the causes of actual or potential nonconformities shall be to a degree appropriate to the magnitude of problems and commensurate with the risks encountered.

The Design-Builder shall implement and record any changes to the documented procedures resulting from corrective and preventive action.

DB 113-2.14.2 Corrective Action

The Design-Builder shall maintain and document a procedure for dealing with complaints ensuring the recording, investigating, and determining of the appropriate corrective action, if any, that shall be taken.

The procedures for corrective action shall include the following:

- A) The effective handling of complaints and reports of product, material, process or implementation nonconformities;
- B) Investigation of the cause of nonconformities relating to the product, process, and quality

- system and recording the results of the investigation (*see* DB Section 113-2.16);
- C) Determination of the corrective action needed to eliminate the cause of nonconformities;
- D) Application of controls to ensure that corrective action is taken and that it is effective; and
- E) The tracking of complaints and identified nonconformance and the actions taken to resolve them as an indicator of the effectiveness of the quality system.

Determination and implementation of an effective corrective action requires knowing the root cause of the problem and planning the most effective method of resolving the problem.

Follow-up action shall investigate to see if the corrective action resolved the identified problem and also to ensure the corrective action did not have an undesirable effect on another element of the quality system.

DB 113-2.14.3 Preventive Action

The Design-Builder shall establish, document, and maintain procedures for implementing preventive actions.

The procedures for preventive action shall include the following:

- A) The use of appropriate sources of information, such as processes and Work operations, which affect product quality, concessions, audit results, quality records, service reports, and the complaints to detect, analyze, and eliminate potential causes of nonconformities;
- B) Determination of the steps needed to deal with any problems requiring preventive action;
- C) Initiation of preventive action and application of controls to ensure that it is effective; and
- D) Confirmation that relevant information on actions taken is submitted for management review (*see* DB Section 113-2.1.3).

DB 113-2.15 Handling, Storage, Packaging, Preservation, and Delivery

DB 113-2.15.1 General

The Design-Builder shall establish and maintain documented procedures for handling, storage, packaging, preservation, and delivery of product.

The procedures which shall be developed apply to all parties involved on a Project beginning with the Design-Builder writing the Specifications all the way through to the personnel responsible for the start-up and turn over of the facility to the Department. The specific application of the requirements is determined by the function performed: Design-Builder, manufacturer, distributor, vendor, warehousing, Equipment operator, and installer.

The engineer writing the Specifications shall be responsible for identifying any special handling, storage, packaging, preservation, and delivery requirements and assuring the requirements are identified in the appropriate Project documents. Procurement shall be responsible for assuring the vendor, distributor, and/or Subcontractors are aware of the requirements and are also aware of their responsibilities to identify all requirements to their Subcontractors.

Procedures shall be developed and implemented for designating which items require special handling,

storage, or maintenance. Development of the handling, storage, packaging, preservation, and delivery procedures and Work instructions are affected by the other elements of this DB Section 113 and therefore should be reviewed for applicability and requirement inclusion.

DB 113-2.15.2 Handling

The Design-Builder shall provide methods of handling products that prevent damage or deterioration.

Handling is any physical or electronic movement. Project Materials are usually handled numerous times from producer to installation and start-up. Procedures appropriate to the circumstances shall be developed and implemented to assure handling is done in a manner that prevents damage or deterioration of the material/equipment. There shall be assurances that handling requirements are documented and understood.

The procedures shall cover special handling by people and/or machines.

Special handling clothing and precautions shall be identified for all hazardous materials with assurances that only qualified and trained personnel handle the hazardous material. The handling procedures shall include instructions to follow for decontamination and notification of authorities and responsible parties in the event of an accident.

DB 113-2.15.3 Storage

The Design-Builder shall use designated storage areas or stock rooms to prevent damage or deterioration of product pending use or delivery. Appropriate methods for authorizing receipt to and dispatch from such areas shall be stipulated.

In order to detect deterioration the condition of product in stock shall be assessed at appropriate intervals.

Items requiring protection shall be identified and protected as necessary to prevent loss, damage, deterioration, or loss of identification.

Special storage requirements shall be clearly defined for Materials and Equipment which are received on the Project, including, plans, records and operating manuals. A master list shall be maintained indicating applicable purchase orders, including, quantity, product identification, documentation and records required, receiving inspection requirements, and items requiring special storage or maintenance.

Materials shall be segregated to prevent cross contamination or environmental contamination.

Material with limited shelf life shall be identified and procedures developed and implemented to identify means of assuring usage of Material prior to its expiration date. The procedures shall also identify the disposal of Materials that may be toxic or hazardous or might otherwise have an adverse effect on the environment or on unsuspecting humans.

DB 113-2.15.4 Packaging

The Design-Builder shall control packing, packaging, and marking processes (including materials used) to the extent necessary to ensure conformance to specified requirements.

Engineering or procurement documents shall specify applicable packaging requirements to ensure no damage, contamination, or deterioration occurs in the course of packaging and transporting the Material and Equipment. Procedures/Work instructions shall clearly define all special packing and packaging and marking process requirements (i.e., export crating, moisture barrier, regulatory requirements, climate

control, identification, and all Contract requirements).

Labeling of hazardous materials, special handling instructions, and notification of authorities and the Design-Builder shall be clearly and plainly identified on the packaging.

DB 113-2.15.5 Preservation

The Design-Builder shall apply appropriate methods for preservation and segregation of product when the product is under the Design-Builder's control.

Procedures shall include special unpacking instructions, controlled conditions necessary to prevent or deter deterioration of Material or Equipment, prevention of corrosion and/or contamination, and required servicing.

DB 113-2.15.6 Delivery

The Design-Builder shall arrange for the protection of the quality of product after final inspection and test. This protection shall be extended to include delivery to destination.

When delivery of Equipment and/or Materials to the job site is the responsibility of the Design-Builder, it shall develop procedures or reference appropriate standards to protect the items during delivery.

DB 113-2.16 Control of Quality Records

The Design-Builder shall establish and maintain documented procedures for identification, collection, indexing, access, filing, storage, maintenance, and disposition of quality records.

Quality records shall be maintained to demonstrate conformance to specified requirements and the effective operation of the quality system. Pertinent quality records from the Subcontractor shall be an element of these data.

Records shall be kept of documents which serve as evidence that quality is achieved in Work on the Project. Records shall be adequately identified, filed, and stored. Retention periods and the storage medium of such records shall be established in accordance with Contract requirements.

All quality records shall be legible and shall be stored and retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss. Quality records shall be made available for evaluation by the Department as per Contract requirements.

The Design-Builder shall develop and implement procedures to store, retrieve, and dispose of the documents required by the quality management system, including, but not limited to, correspondence, certifications, design calculations, Plans, reports of Design Reviews, and audit reports. In storage, whether active Project files or long term archives, documents that are designated as records shall be originals or reproducible copies and shall be legible, accurate, identified, and indexed so they can be associated with specific Projects. Documents shall be retrievable in a timely manner. Storage criteria shall be set to specify allowable storage media and ensure physical protection from damage or loss, which could involve duplicate storage facilities for some types of records.

Management shall identify records necessary to provide objective evidence of Contract review, procedure compliance, Design Review (when applicable), training, and completion and acceptance of inspection and testing or to provide traceability of Equipment or items to documentation.

A list of Project-required records shall be developed, retained, and/or turned over to the Department prior to completing the Work.

DB 113-2.17 Internal Quality Audits

The Design-Builder shall establish and maintain documented procedures for planning and implementing internal quality audits to verify whether quality activities and related results comply with planned arrangements and to determine the effectiveness of the quality system.

Internal quality audits shall be conducted in accordance with sound auditing principles. The frequency of the audits shall be appropriate to the importance and complexity of a Project or corporate operation but shall at least be on a quarterly basis. Audits shall be initiated early enough in the life of a Project to assure effective QC during all phases. The audits shall include Project management as well as technical Work activities.

Internal quality audits shall be carried out by personnel independent of those having direct responsibility for the activity being audited.

The internal quality audit program shall provide verification that the quality system is operating and being implemented as planned. Audits should be conducted on a planned and scheduled basis consistent with the importance of the activities being performed.

The results of the audits shall be recorded (*see* DB Section 113-2.16) and brought to the attention of the personnel having responsibility in the area audited. The management personnel responsible for the area shall take timely corrective action on deficiencies found during the audit.

Follow-up audit activities shall verify and record the implementation and effectiveness of the corrective action taken (*see* DB Section 113-2.16).

The results of internal quality audits shall be reviewed in management review meetings. In accomplishing management review the results of internal audits and their attendant corrective action status shall be reviewed for adequacy and effectiveness.

Auditor qualifications shall be established and documented by the Design-Builder. Staff assigned auditing tasks shall be qualified accordingly with qualification records maintained as quality records. Auditing need not be a full time assignment but staff assigned auditing tasks shall have no direct responsibilities for the function or Work they audit.

Audits shall be carefully planned and executed to avoid or minimize disruption of the audited activity. Results shall be provided promptly to personnel responsible for the audited activity and their management. Corrective action shall be developed to identify the root causes and to institute measures to prevent the types of deficiencies identified in the audit. Corrective actions shall be monitored through review of documents, surveillance, or follow-up audits. These actions should be conducted in a timely manner to determine the effectiveness of corrective action that is implemented. Records of corrective actions should be kept together with the respective audit records.

Records of internal audits shall be maintained by the Design-Builder.

DB 113-2.18 Training

The Design-Builder shall establish and maintain documented procedures for identifying training needs and provide for the training of all personnel performing activities affecting quality. Personnel performing specific assigned tasks shall be qualified on the basis of appropriate education, training, and/or experience, as required. Appropriate records of training shall be maintained (*see* DB Section 113-2.16).

The Design-Builder shall establish documented procedures and records to ensure that the skills and professional judgment of their personnel are developed appropriately for their intended roles through training and/or the recorded accumulation of experience, with systematic reviews of their competence at determined levels, and before any deployment of new roles.

Training shall focus on improving competency and skill for those performing activities that materially impact quality.

Procedures established shall include the following:

- A) Position descriptions defining the requirements of the various positions required in conducting activities affecting quality;
- B) Personnel records documenting each person's experience and current education and training accomplished, both formal and informal, relative to current or projected position assignments;
- C) Documented evaluation of that experience and training, including a determination of what training is required to become fully qualified for the activities to which the person is intended to be assigned;
- D) A documented plan to accomplish the training deficiency;
- E) Records documenting accomplishment of that training; and
- F) Education, experience, and licensure used as a basis for qualifications of individuals, which should be verified.

All qualification and training records are quality records and shall be maintained accordingly (DB Section 113-2.16).

Project personnel shall be trained in all the special Project procedures applicable to their Work.

Craft journeymen with special skills need not be trained but their competency shall be verified and a record maintained of the verification.

DB 113-2.19 Servicing

Where servicing is a specified requirement, the Design-Builder shall establish and maintain documented procedures for performing, verifying, and reporting that the servicing meets the specified requirements. The requirement of this DB Section 113-2.19 is applicable only where it is specified in a Contract.

Should such a requirement exist the Design-Builder shall document procedures which detail the methodologies to be used while performing the service, how compliance to these operations and the Department's requirements are verified, and the agreed upon method of reporting compliance of service operations to Contract requirements.

With respect to the design perspective this requirement deals with the service rendered to the Department during the defects liability period, if any.

DB 113-2.20 Statistical Techniques

DB 113-2.20.1 Identification of Need

The Design-Builder shall identify the need for statistical techniques required for establishing, controlling, and verifying process capability and product characteristics.

The Design-Builder shall review its operations for activities which may benefit from the use of statistical techniques as a means of establishing a level of control, the maintenance of an existing level of performance, and the verification of performance. The needs assessment could include determining an activity impact on cost, time management/utilization, and quality of deliverables. It could also identify areas where the application of statistics would provide an indication of variation, activities efficiencies, and deviation control.

DB 113-2.20.2 Procedures

The Design-Builder shall establish and maintain documented procedures to implement and control the application of the statistical techniques identified in DB Section 113-2.20.1. Should the need for statistical programs be established, the Design-Builder shall document procedures detailing the methods to be applied.

DB 113-2.21 Quality System Non-Conformance

If, in the opinion of the Department, the Design-Builder is not complying with these QC requirements, the Department will advise the Design-Builder in writing of apparent deficiencies. The Design-Builder will have seven Calendar Days to either provide adequate documentation to demonstrate that the alleged violations are unfounded or correct the violations to the satisfaction of the Department. If after seven Calendar Days neither of the above remedies have been accomplished, the Department may take steps to implement the necessary QC action. All costs associated with this effort by the Department will be documented and the costs will be deducted from the Contract Lump Sum Price by Change Order.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

PART 3

**DESIGN REQUIREMENTS AND
PERFORMANCE SPECIFICATIONS**

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1.0 GENERAL

1.1 PURPOSE

This Part 3 – Design Requirements and Performance Specifications establishes basic design and performance requirements to be used in the design and construction of the Project. In addition, Directive and Indicative Plans for the Project and Contract Documents and Plans for the adjacent Indian River Inlet Projects (*see* Part 6 – Scope of Services Packages Plans) are provided to the Design-Builder for his information, review, and use in the his design and construction of the Project.

Section 2 provides direction on certain aspects of design applicable throughout the Project and the requirements to be followed for the design in the event a Project element or component is not covered by a Performance Specification.

Section 3 includes both the broad design and performance parameters, usually in the form of recognized standards, under which components and elements of the Project are to be designed and the specifically defined design and performance requirements relative to the Project. More detailed Performance Specifications are included in Appendix A to this Part 3 of the Contract Documents.

2.0 DESIGN REQUIREMENTS

The goal of the Project Design is to minimize design, construction, and maintenance costs while simultaneously minimizing the disruption and impacts to adjacent construction contracts, the Delaware Seashore State Park, marine navigation through the Indian River Inlet, local vehicular and pedestrian access, and communities.

2.1 SCOPE

The design requirements, as defined by standards, references, and project-specific requirements (*see* Section 2.5), are contained in each Performance Specification that governs the design of that Project element. Each Performance Specification lists the precedence of the design requirements.

All Project elements and components directly related to the bridge and all structures and appurtenances that touch, bear, or otherwise, through direct or indirect means, influence the structural response of the bridge or approaches shall be designed utilizing the “AASHTO LRFD Bridge Design Specifications”, Third Edition, 2004 (U.S. Customary Units), with Interims unless specifically modified in Section 2.4 of this Part 3 of the Contract Documents. The order of governing precedence of design codes, manuals, directives, and circulars are defined in Section 2.4 of this Part 3.

See Part 1 – Appendix A of the Contract Documents for more detailed information pertaining to the Project scope.

2.2 PROCEDURES

2.2.1 Format

The Design-Builder shall prepare Design Plans and Project Specifications for the Project to the Department’s standards for general content and format and in accordance with the Contract and Section 2.3.3.

2.2.2 Deviations

Deviations may be made within the framework of these design requirements to meet the requirements and goals of this Section 2.0 and the Performance Specifications, in order to meet the requirements of a particular Project element or component. Deviations from the design requirements or Performance Specifications included in the Contract may be allowed with the approval of the Department's Project Manager prior to incorporation into the design. Determination as to whether the Design-Builder's solution to a Project element is unconventional shall be in the sole opinion of the Department. It is the responsibility of the Design-Builder to identify, explain, and justify any deviation from, discrepancy from, or unconventional solution to the established criteria and to secure approval(s) from the Department's Project Manager.

2.3 SUPPORTING ENGINEERING INFORMATION

2.3.1 Mapping and Surveying

Existing mapping and survey information is contained in the *Reference Documents* Section of the Scope of Services Package.

2.3.2 Geotechnical

Existing geotechnical data, including any supplemental data obtained by the Department during the Proposal phase, is contained within the *Reference Documents* Section of the Scope of Services Package. The Design-Builder shall conduct additional geotechnical investigations, analyses, design, and construction in accordance with the *Geotechnical Requirements* Performance Specification (*see* Appendix A to this Part 3 – Design Requirements and Performance Specifications).

2.3.3 CADD

CADD formatting for Design Plans and Record (as-built) Drawings shall conform to the Department's CADD drafting standards and CADD design standards as defined in the Plan Development Guidelines available from the Department's Project Development Resource Center. Resource Center information can be found at http://www.deldot.net/static/doing_biz.shtml.

2.3.4 Traffic Data

Existing and Design Traffic Data is contained in the *Roadway Geometrics* Performance Specification (*see* Appendix A to this Part 3 – Design Requirements and Performance Specifications).

2.4 DESIGN CODES AND MANUALS

In addition to the requirements listed in this Section 2.0 and the Performance Specifications, the Designer must comply with all other applicable and currently effective engineering codes and standards, including those of the various federal, state, and local jurisdictions.

If codes, standards, and/or manuals are specified herein for the design of an element of the Project, then the edition(s) in effect on the Proposal due date shall be applicable to the Project. Responsibility for design remains with the Design-Builder in accordance with the terms and conditions of the Contract. If a code, manual, or standard is subsequently modified, the Design-Builder shall notify the Department of such modification(s), providing potential cost and schedule impacts to the Project, and request the Department's decision regarding application of the modification(s). If the Department directs the Design-

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Builder to comply with the modifications and any change in the cost or time of performance results, such change shall be processed by a change order.



The governing precedence of Parts 1 through 8 of the Contract Documents is specified in DB Section 102-1. Specific codes and standards include, but are not limited to, the following listed in order of governing precedence for this Part 3 of the Contract Documents:

- A) Performance Specifications for the Project;
- B) “AASHTO LRFD Bridge Construction Specifications,” Second Edition, 2004 (U.S. Customary Units), with Interims;
- C) American Association of State Highway and Transportation Officials (AASHTO) “AASHTO LRFD Bridge Design Specifications,” Third Edition, 2004 (U.S. Customary Units), with Interims through 2006;
- D) Delaware Department of Transportation “Bridge Design Manual” with Revisions;
- E) Delaware Department of Transportation “Road Design Manual” with Revisions;
- F) AASHTO, “A Policy on Geometric Design of Highways and Streets (Green Book),” Fifth Edition, 2004;
- G) AASHTO, “Roadside Design Guide,” Third Edition, 2002;
- H) “Manual of Uniform Traffic Control Devices (MUTCD),” Third Edition, 2003.

2.5 PROJECT-SPECIFIC DESIGN PARAMETERS

Project-specific design parameters are included under their appropriate and respective Performance Specifications. Project-specific design parameters may include, but are not limited to, design parameters specific to the Project, such as, bridge loadings, bridge and structure scour, design life, design speed, forecasted traffic volumes, number of lanes and lane widths, stopping sight distance, horizontal curvature, superelevation, vertical curves, horizontal and vertical alignments, grades, roadside clear zone width, minimum main span bridge navigational clearances, and aesthetic requirements.

See Part 1 – Appendix A of the Contract Documents for additional design parameters.

2.6 ROADWAY GEOMETRICSS

2.6.1 Geometrics

Roadway geometrics shall be in accordance with the codes and standards of Section 2.4 of this Part 3 – Design Requirements and Performance Specifications and the *Roadway Geometrics* Performance Specifications in Appendix A to this Part 3.

2.7 DESIGN EXCEPTIONS AND DEVIATIONS

No design exceptions to the roadway geometric requirements specified in the Roadway Geometrics Performance Specification in Appendix A to this Part 3 shall be permitted. Any requests for deviations from the Contract requirements shall be submitted to the Department for review and approval in accordance with Part 2 – DB Section 111-13.

3.0 PERFORMANCE SPECIFICATIONS

The Performance Specifications included in this Part 3 – Design Requirements and Performance Specifications, establish requirements that the Design-Builder’s Work shall achieve. The Performance Specifications provide clear requirements for how the finished product is to perform while allowing the Design-Builder considerable flexibility in selecting the design, means, materials, components, and construction methods used to achieve the specified performance.

3.1 STANDARDS AND REFERENCES

Standards and references are cited within the Performance Specifications. The following distinction between “standards” and “references” apply. Standards constitute a further elaboration of the requirement. References constitute advisory or informational material provided for the Design-Builder’s benefit. This advisory information need not be followed, but in some cases provide acceptable solutions already used by the Department. In some cases, specific parts of the reference are cited in Performance Specifications as requirements. In case of conflict between the standards and the references, the standards shall govern unless specifically approved in writing by the Department.

3.2 RELATION TO PART 6 – REQUEST FOR PROPOSALS PLANS

The Performance Specifications contained in Appendix A to this Part 3 – Design Requirements and Performance Specifications also govern the applicability of the Plans contained in Part 6 – Scope of Services Packages Plans. Individual Performance Specifications establish which Scope of Services Package Plans apply and the extent to which those Plans apply. Indicative Plans are for reference as described in Section 3.1. The presence or lack of presence of an Indicative or Directive plan relative to an element or component of the Project should not be interpreted as reducing the flexibility or range of choices provided to the Design-Builder under a Performance Specification. Part 6 – Scope of Services Package Plans further address the distinction between Directive and Indicative Plans and the applicability of Directive and Indicative Plans.

3.3 LIST OF PERFORMANCE SPECIFICATIONS

The following is a list of the Performance Specifications contained in Appendix A to this Part 3 – Design Requirements and Performance Specifications:

- A) Aesthetic Requirements;
- B) Bridge Design Requirements;
- C) Bridge Drainage System;
- D) Bridge Hydraulics and Scour Requirements;
- E) Bridge Security Program;
- F) Concrete for Structures;
- G) Engineering Requirements;
- H) Geotechnical Requirements;
- I) Inspection, Maintenance and Construction Requirements;
- J) Mass Concrete;
- K) Public Outreach Requirements;

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- L) Roadway Geometrics;
- M) Temporary Works;
- N) University of Delaware Bridge Monitoring Program;
- O) Warranty Requirements; and
- P) Wind Engineering Requirements.

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STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
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SCOPE OF SERVICES PACKAGE

PART 3 – APPENDIX A

PERFORMANCE SPECIFICATIONS

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**AESTHETIC REQUIREMENTS
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

As part of the original bridge design and overall project development, the Department received considerable input from local residents, community groups, local officials, and other groups regarding aesthetic preferences and design themes to be incorporated into the final designs. This Performance Specification specifies the minimum bridge aesthetic requirements to be considered and addressed by the Design-Builder during the design development of the bridge project.

2.0 STANDARDS AND REFERENCES

The Work shall be in accordance with this *Aesthetic Requirements* Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated herein. Standards and References specifically cited in the body of this Performance Specification establish requirements that shall have precedence over all others. Should the requirements in any standard conflict with those in another, the standard highest on the list shall govern. Listed under References are guidelines that the Design-Builder may use in addressing the requirements as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification of any unresolved ambiguity prior to proceeding with design or construction.

2.1 STANDARDS

- A) None specified.

2.2 REFERENCES

- A) "Summary of the Public Information Workshop #1," Figg Bridge Engineers, Inc., March 2003 (see Scope of Services Package – Reference Documents);
- B) "Summary of the Public Information Workshop #2," Figg Bridge Engineers, Inc., April 2003 (see Scope of Services Package – Reference Documents);
- C) "Summary of the Public Information Workshop #3," Figg Bridge Engineers, Inc., June 2003 (see Scope of Services Package – Reference Documents);
- D) "Summary of the Public Information Workshop #4," Figg Bridge Engineers, Inc., October 2003 (see Scope of Services Package – Reference Documents);
- E) A Guide for Achieving Flexibility in Highway Design, AASHTO, May 2004; and
- F) NCHRP Report 480: A guide to Best Practices for Achieving Context Sensitive Solutions.

3.0 REQUIREMENTS

The Design-Builder should review the referenced summary reports for each previously held public information workshop (also referred to as design charettes) to understand the issues and concerns raised by the public and suggestions that were made to the Department. As part of the design development, the Design-Builder shall address how the design meets or exceeds the following aesthetic requirements and cite examples from the *Public Information Workshop Summary Reports*.

3.1 CONTEXT SENSITIVE DESIGN

The Design-Builder shall strive to achieve a context sensitive bridge design with the following minimum considerations:

- A) Avoid and/or minimize obstructions to the view from the bridge for pedestrians, bicycles, and motorists;
- B) Provide accent or aesthetic lighting. Excessive illumination shall be avoided. Roadway lighting shall not be provided. All proposed bridge lighting shall be approved by the United States Coast Guard;
- C) Provisions for long-lasting, low-maintenance uniform coloration of all exterior finished bridge surfaces;
- D) Provisions for preventing staining of finished bridge surfaces;
- E) Protection from graffiti;
- F) Bridge parapets, railings, and barriers that are consistent with or compliment the roadway approach details;
- G) Substructure finishes that are consistent with or compliment the roadway approach retaining wall details;
- H) A consistent overall architectural theme that is suitable for the surroundings.

3.2 PUBLIC INVOLVEMENT

The Design-Builder may choose, at his option, to include the public in the final selection of architectural and/or aesthetic details as specified in the *Public Outreach Requirements Performance Specification* included in Part 3 of the Contract Documents. Should the Design-Builder propose to involve the public in the selection of aesthetic treatments, the proposed methods of public involvement shall be carried out and the results implemented into the Work at no additional cost to the Department.

**BRIDGE DESIGN REQUIREMENTS
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

The Design-Builder shall design and construct the bridge structure in accordance with the criteria established in this Performance Specification. The bridge structure is defined as all portions of the structure between the north and south roadway approach slabs.

The Design-Builder shall design and construct the bridge for a service life of no less than 100 years, meeting the goals of ease of inspection, maintenance, and durability. The Design-Builder shall also design and construct the bridge to be aesthetically pleasing in accordance with the Aesthetic Requirements Performance Specification (*see* Part 3).

2.0 APPLICABLE STANDARDS AND REFERENCES

Design Criteria shall be in accordance with this Performance Specification and the relevant requirements of the following standards unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of this Performance Specification establish requirements that shall have precedence over all others. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern. Listed under references are guidelines that the Design-Builder may use to address the requirements, as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification of any and all unresolved ambiguity prior to proceeding with any design or construction.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence:

- A) Design Build Performance Specifications (Part 3 of the Contract Documents);
- B) Design-Build Special Provisions (Part 4 of the Contract Documents);
- C) "AASHTO LRFD Bridge Design Specifications," Third Edition, 2004 (U.S. Customary Units), with Interims through 2006. Delete Section 5.14.2.3.9 in its entirety (All Shop and Working Drawings will conform to the requirements of the Contract);
- D) "AASHTO LRFD Bridge Construction Specifications," Second Edition, 2004 (U.S. Customary Units), with Interims through 2006;
- E) "AASHTO Standard Specifications for Highway Bridges, Seventeenth Edition," 2002 (U.S. Customary Units), with Interims through 2006. This Specification shall only apply to design modifications made to the existing sheet pile walls and the design of cofferdams that are to be connected to the existing sheet pile walls;
- F) Delaware Department of Transportation "Bridge Design Manual" with Revisions through May, 2005;
- G) CEB-FIB "Model Code 1990," First Edition, 1993, Chapter 2: Material Properties, for time dependent properties of concrete only;
- H) PTI Guide Specification, "Recommendations for Stay Cable Design, Testing and Installation", Fourth Edition 2001, ("soft" conversion of the Document's metric units is

required);

- I) PTI Guide Specification, “Grouting of Post-Tensioned Structures,” Second Edition, 2003;
- J) Bridge Welding Code: AASHTO/AWS D1.5:2002, An American National Standard, with 2003 and 2005 AASHTO Interims; and
- K) AASHTO Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges, 2003.

2.2 REFERENCES

- A) Directive and Indicative Plans (*See* Contract Documents – Part 6, Scope of Services Package Plans);
- B) Final Environmental Assessment and Nationwide Section 4(f) Evaluation, May 10, 2004;
- C) Department of Transportation, Federal Highway Administration, Finding of No Significant Impact for Bridge 156 Over Indian River Inlet, Sussex County, Delaware, June 22, 2004;
- D) The Boundary Layer Wind Tunnel Laboratory, “A Study of Wind Effects for Indian River Inlet Bridge, Delaware, USA,” May 2005. Only Section 2 – Modeling of the Site and the Wind is applicable to this Project;
- E) FHWA Wind Induced Vibration of Stay Cables, RDT 05-004, Feb 2005;
- F) Delaware Department of Transportation “Standard Specifications for Road and Bridge Construction” Dated 2001;
- G) ACI 207.1 R-96, “Mass Concrete”;
- H) ACI 305 R-99, “Hot Weather Concreting”;
- I) ACI 306 R-02, “Cold Weather Concreting”;
- J) AASHTO, “Guide Specifications for Bridge Temporary Works,” 1995;
- K) AASHTO, “A Policy on Geometric Design of Highways and Streets (Green Book),” Fifth Edition, 2004;
- L) AASHTO, “Roadside Design Guide,” Third Edition, 2002;
- M) AASHTO, “Model Drainage Manual,” 2005 Edition; and
- N) “Manual of Uniform Traffic Control Devices (MUTCD),” Third Edition, 2003.

3.0 REQUIREMENTS



The Project shall be designed and detailed using the customary English units. Plans shall be prepared in accordance with the Department’s Plan Development Guidelines available from DelDOT’s Project Development Resource Center (http://www.deldot.gov/static/business/project_development/index.shtml). A Professional Engineer registered in the State of Delaware shall seal final Plans, Shop Drawings, and Working Drawings. All submittals and submittal requirements shall be as per the Contract Documents.



3.1 LAYOUT

- A) The bridge section shall be designed to carry four 12-foot traffic lanes (two traffic lanes in each direction), two 10-foot outside shoulders, two 4-foot inside shoulders, one 12-

foot combined use recreational bicyclist and pedestrian walkway (on ocean side of structure), a continuous 2-foot wide sand by-pass system utility corridor (on ocean side of structure), and necessary width to accommodate all traffic barriers, end attenuators, and railings required by the AASHTO Code and the Contract Documents.

- B) Traffic barrier(s) having a minimum height of 32 inches shall separate the two opposing directions of traffic (northbound and southbound). Traffic barriers having a minimum height of 54 inches shall be provided at each edge of shoulder and each edge of the combined use recreational bicyclist and pedestrian walkway. No obstructions are permitted within the combined use walkway. All 54-inch barriers shall include an open railing system within the top 24 inches, as a minimum.
- C) The two outside shoulders and the combined use walkway on the bridge shall include bicycle-safe details for barriers, expansion joints, drainage systems, and any other applicable features.
-  D) The bridge shall include the necessary total width to accommodate all traffic barriers, cushions, and railings as per Section 3.1.A of this Specification. All barriers located directly adjacent to SR-1 traffic shall have a minimum TL-4 Test Level rating in accordance with the *AASHTO LRFD Bridge Design Specifications* and shall have been successfully crash-tested in accordance with the Department's policy specified in Section 5.3.7.1 of the *Bridge Design Manual*. All non-traffic barriers located directly adjacent to the combined use walkway shall be designed for TL-2 Test Level loads in accordance with Chapter 13 of the *AASHTO LRFD Bridge Design Specifications*. The crash-testing requirement shall be waived for non-traffic barriers located adjacent to the combined use walkway.
- E) For Navigational Clearance requirements refer to the Coast Guard Permit included in Part 3 – Appendix A of the Contract Documents and the *Directive Plans*.
- F) The minimum horizontal clearance from any stay cables to the back face of traffic barrier shall be 2'-6" measured at all heights normal to the deck ranging from the top of barrier to 20'-0" above the roadway surface. The minimum horizontal clearance from any stay cables to the back face of combined use walkway barrier shall be 1'-6" measured at all heights normal to the deck ranging from the top of barrier to 16'-6" above the combined use walkway surface. At all heights below the top of protective barrier, the minimum horizontal clearance from any stay cable components to the back of all protective barriers, shall be 1'-6".
- G) The sand by-pass system utility corridor shall be adjacent to and accessible from the combined use walkway, but separated by a protective barrier. The limits of the utility corridor may be located directly adjacent to the back face of protective barrier and/or any stay cable components. The utility corridor shall be located above the finished deck level and accessible over the entire bridge length.

3.2 AESTHETIC REQUIREMENTS

Refer to the *Aesthetic Requirements* Performance Specification in Part 3 of the Contract Documents.

3.3 GEOMETRIC DESIGN CRITERIA

Refer to the *Roadway Geometrics* Performance Specification in Part 3 of the Contract Documents.

3.4 GENERAL DESIGN REQUIREMENTS

- A) The bridge structure shall be designed in accordance with all applicable Performance

Specifications and Design-Build Special Provisions included in the Contract Documents.

- B) All reinforced concrete bridge structure members, including the structural characteristics of the supporting foundation elements, shall be designed in accordance with the applicable limit states as defined by the load groups in the *AASHTO LRFD Bridge Design Specifications* and for the additional extreme event limit state specified in Section 3.5.8. Reinforcement of all concrete components shall satisfy the control of cracking provisions in accordance with the *AASHTO LRFD Bridge Design Specifications* for Class 2 exposure conditions.
- C) All prestressed concrete members shall be designed in accordance with the applicable limit states as defined by the load groups in the *AASHTO LRFD Bridge Design Specifications*.
- D) Permanent stay cables shall be designed in accordance with the *PTI Guide Specification, "Recommendations for Stay Cable Design, Testing and Installation"* and per this Performance Specification and the Special Provisions.
- E) Temporary stay cables shall be designed in accordance with the *PTI Guide Specification, "Recommendations for Stay Cable Design, Testing and Installation"* and per this Performance Specification and the Special Provisions. Temporary stay cables shall be limited to an allowable stress of $0.6F'_s$ during construction.
- F) Foundation Elements
 - 1) The structural capacity of all foundation members shall be designed accounting for the soil-structure interaction (load transfer to the soil) parameter recommendations as defined in the Design-Builder's Geotechnical Engineering Report for the Project and the applicable limit states of the *AASHTO LRFD Bridge Design Specifications*;
 - 2) The geotechnical capacity (load transfer to the soil) shall be designed in accordance with the recommendations defined in the Design-Builder's Geotechnical Engineering Report for the Project and applicable limit states of the *AASHTO LRFD Bridge Design Specifications*;
 - 3) Downdrag shall be in accordance with FHWA Guidelines and determined as necessary by the Design-Builder's Geotechnical Engineer in accordance with the *Geotechnical Requirements* Performance Specification;
 - 4) All structural foundation supporting elements shall require load testing in accordance with the *Geotechnical Requirements* Performance Specification; and
 - 5) Additional requirements for foundation elements including acceptable deep foundation types shall be in accordance with the *Geotechnical Requirements* Performance Specification.

3.5 LOADS AND FORCES

3.5.1 Load Modifiers

The Design-Builder will be required to use the following values of load modifiers, η_i , in the *AASHTO LRFD* Strength Load Combinations for the completed structure and construction conditions:

- A) Ductility: $\eta_D \geq 1.00$
- B) Redundancy: $\eta_R \geq 1.00$

- C) Operational Importance: $\eta_I = 1.05$

3.5.2 Load Combinations

- A) All load combinations shall be in accordance with *AASHTO LRFD Bridge Design Specifications*;
- B) The effects of stay cable force adjustments shall be treated as locked-in erection stresses; and
- C) The effect of prestressing shall be considered in all *AASHTO LRFD* combinations with a load factor equal to 1.0. The effect of time dependent concrete creep, shrinkage and elastic shortening shall be included in all the *AASHTO LRFD* load combinations by calculating the redistribution of forces using the dead load factors corresponding to each limit state. Service limit states shall be checked for creep and shrinkage coefficients varying from the mean within the 90% confidence limits defined in the CEB-FIP Model Code 1990. Strength limit states shall be checked considering time dependent effects associated with mean creep and shrinkage coefficients. Inelastic analysis according to Section 4 of *AASHTO LRFD* may be used to determine the effects of time dependent movements, restrain and force redistribution as long as strain compatibility analyses demonstrate the necessary ductility. This replaces the *AASHTO LRFD* load factor range of 0.5/1.2 and 1.0/1.2 for creep and shrinkage..

3.5.3 Permanent Load

The Design-Builder will be responsible for determining and clearly indicating on the plans the magnitudes of the dead load contribution of all traffic barriers, railings, appurtenances, fixtures, equipment, and all other permanent elements that bear, attach, or are otherwise supported by or on the structure with the following additional specific requirements:

- A) Unit weight of the materials shall be in accordance with Section 3.5.1 of the *AASHTO LRFD Bridge Design Specifications* with the following additions:
 - 1) Unit weight of soil Not less than 120 pcf
- B) The dead load contribution for initial and future wearing surfaces, applied uniformly to all traffic lanes, shoulders, and the pedestrian pathway, shall be considered by the Design-Builder. The initial wearing surface shall be a minimum of 1 5/8" inch thick overlay in accordance with Section 4.2 of this Specification. An additional minimum 25 pounds per square foot dead load allowance shall be provided for the application of a future wearing surface. Under no circumstances may the initial wearing surface thickness encroach on or include the minimum required reinforcing concrete cover specified in Section 3.6 of this Specification.



- C) The Design-Builder will be responsible for determining and accounting for the dead load contribution of all utilities to be conveyed and/or supported by the bridge, including, but not limited to, a 200 plf sand by-pass system load allowance. The point of application for the sand by-pass system load allowance shall be centered within the sand by-pass corridor to be provided in accordance with Section 3.1 of this Specification. See Part 5 – Utility and Right-of-Way Statements for additional utilities information.

3.5.4 Live Load

The Design-Builder will be responsible for determining and clearly indicating on the plans the magnitudes of all live loads applied to the structure with the following additional specific requirements:

A) Live load shall be HL-93 with impact (design truck or tandem with design lane load) in accordance with *AASHTO LRFD Bridge Design Specifications* except as modified in Section 3.4.



B) The design shall consider all Delaware legal loads specified in the *DelDOT Bridge Design Manual*, including an additional AASHTO HS20 truck with lane load. All inventory and operating load ratings shall be clearly specified on the on the Plans in accordance with the *DelDOT Bridge Design Manual*. The AASHTO Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges shall be utilized for this Project.



C) The sidewalk will be designed for the worst case of the pedestrian load (PL) or the maintenance inspection vehicle load, not the combined load. The design maintenance inspection vehicle is an Aspen Aerial A-75 Under Bridge Inspection Vehicle (UBIV). The associated wheel loads are:

- 1) Unit in stowed position:

Axle 1:	15,751 LB	
Axle 2:	15,751 LB	(80" behind Axle 1)
Axle 3:	7,000 LB	(133" behind Axle 2)
Axle 4:	14,400 LB	(55" behind Axle 3)
Axle 5:	14,400 LB	(55" behind Axle 4)
Axle 6:	6,000 LB	(103" behind Axle 5)

- 2) Unit in deployed position (non-deployment side wheel/deployment side wheel):

Axle 1:	3,800/11,950 LB
Axle 2:	1,500/14,250 LB
Axle 3:	0/7,000 LB
Axle 4:	1,250/14,390 LB
Axle 5:	1,650/14,000 LB
Axle 6:	0/6,000 LB

- 3) Distance between center of each set of tires:

Axle 1 and 2:	102"
Axle 3 through 6:	98"

D) The placement of the UBIV live load shall be such that no restrictions on the placement of the UBIV are required once the bridge is in service.

E) The bridge shall also be checked for the maximum live load on only one side of the superstructure for the event when the bridge is used as an evacuation route.

F) Stay cables shall be designed for HL-93 live load in accordance with the *PTI "Recommendations for Stay Cable Design, Testing and Installation."*

3.5.5 Longitudinal Forces

Longitudinal forces on the bridge shall be computed in accordance with the *AASHTO LRFD Bridge Design Specifications*.

3.5.6 Water Loads

Water loads shall be determined by the Design-Builder in accordance with the *Bridge Hydraulics and Scour Performance Specifications*. As part of a previous study, overland water depths and current flow velocities were determined and summarized in the report "Scour Analysis Evaluation, Proposed Indian River Inlet Bridge; Sussex County, Delaware," dated January 21, 2005 (*see* Reference Documents,



Hydraulics and Scour). The Design-Builder shall utilize the criteria producing the more conservative result for each design consideration. The following considerations shall be used as the basis for development of the Technical and Price Proposals. Should the actual design water loads exceed the minimums specified, any changes will be considered a result of *Differing Site Conditions* and will be paid for in accordance with Part 2, Section 109-8 of the Contract Documents.

- A) Mean High Water Elevation shall be based upon the epoch data issued by the National Oceanic and atmospheric Administration National Ocean Service on April 21, 2003.
- B) The following minimum overland water depths and current flow velocities are specified for use by the Design-Builder:
 - 1) 100-year return period event:
 - a) Overland water depth: 5.0 feet
 - b) Current flow velocity: 3.7 feet/second
 - 2) 500-year return period event:
 - a) Overland water depth: 7.0 feet
 - b) Current flow velocity: 4.5 feet/second
- C) The magnitude of the forces applied to the structure due to overland current flow shall be determined by the Design-Builder and shall be accounted for in the design of the structure for both the 100-year and 500-year return period events in accordance with the provisions of the *AASHTO LRFD Bridge Design Specification*.
- D) Debris loading shall be included in all current flow load combinations in accordance with the recommendations of NCHRP 445, Debris Forces on Highway Bridges.

3.5.7 Scour

The Design-Builder shall be responsible for designing the structure to account for the effects of scour in accordance with the *AASHTO LRFD Bridge Design Specifications* and the requirements of the *Bridge Hydraulics and Scour Performance Specification*. As part of a previous study, overland water depths and current flow velocities were determined and summarized in the report “Scour Analysis Evaluation, Proposed Indian River Inlet Bridge; Sussex County, Delaware,” dated January 21, 2005 (*see Reference Documents, Hydraulics and Scour*). The Design-Builder shall utilize the criteria producing the more conservative result for each design consideration. Considerations shall include the following:

- A) The design flood for scour shall be the 100-year return period event and the check flood for scour shall be the 500-year return period event as described in Article 2.6.4.4.2 of the *AASHTO LRFD Bridge Design Specifications*.
- B) The Design-Builder shall perform a scour analysis in accordance with FHWA Guidelines for the Design-Builder’s proposed structure and determine the values of total scour at each primary bridge support. The minimum values of total scour are listed below and these values should be used by the Design-Builder in his design, regardless if any scour mitigation measures are employed or if the Design-Builder’s analysis or calculations show a reduction in the total scour values listed. Should the Design-Builder’s analysis and/or calculations indicate an increase in the total scour values, then the Design-Builder shall use the larger total scour values for design. The values below are measured from the native ground elevation at the site and are to be used as the basis for development of the Technical and Price Proposals. Should the actual design scour depths exceed the minimums specified, any changes will be considered a result of *Differing Site Conditions*



and will be paid for in accordance with Part 2, Section 109-8 of the Contract Documents.

- 1) Abutment Foundations:
 - a) 100-year return period event: 30.0 feet
 - b) 500-year return period event: 35.0 feet
- 2) Pier Foundations (Pylons, Arch Bases, Piers, Towers, or other Supports):
 - a) 100-year return period event: 30.0 feet
 - b) 500-year return period event: 35.0 feet
- C) It shall be the responsibility of the Design-Builder to design and install scour mitigation to fortify all bridge abutment foundations and for the transitions and/or tie-ins with the scour mitigation measures installed under DelDOT Contract #23-073-03 (Roadway Approaches Contract). This scour protection shall be provided in addition to the bridge scour depth allowances to be accommodated by the design.
- D) The Design-Builder is not required to design or install scour mitigation measures to fortify the piers, as these (pursuant to Section 3.5.7.A-C) shall be directly designed to account for the occurrence of scour.

3.5.8 Wind Loads

See the *Wind Engineering Requirements* Performance Specification for additional requirements.

- A) Wind on the structure shall be in accordance with the *AASHTO LRFD Bridge Design Specifications* using the resulting load/wind components/component combinations included in the Project Specific Wind Study Report developed by the Design-Builder.
- B) Wind on live load directly per the *AASHTO LRFD Bridge Design Specifications*.
-  C) The minimum design wind for the completed permanent structure shall be the site-specific wind profile corresponding with the 100-year return period event as reported in the *Boundary Layer Wind Tunnel Laboratory, "A Study of Wind Effects for Indian River Inlet Bridge, Delaware, USA,"* report. The bridge shall also be checked for an Extreme Event limit state load combination including wind loads with a 2000-year return period and permanent loads. The load factor for all loads in this load combination shall be equal to 1.0. The structure shall not have any structural instability, such as buckling or brittle failure that could result in catastrophic collapse under this loading
-  D) The design wind for permanent and temporary structures during construction shall be the site-specific wind profile corresponding with, at a minimum, the 25-year return period event as reported in the original Wind Study Report. The *LRFD* Table 5.14.2.3.3-1 Wind Load Factors are to be replaced with 1.0 when using a return period of less than 100 years.
- E) Bridge response and wind loading in the completed and critical staged-construction configurations to wind actions shall be determined from wind tunnel model tests (*See Wind Engineering Requirements* Performance Specification).
- F) The bridge shall not show any aerodynamic instability (flutter, torsional divergence, etc.) for a wind event having a probability consistent with a return period of 10,000 years.
- G) Lift, drag, and moment coefficients determined from the wind tunnel tests and reported in the Design-Builder's Wind Analysis Reports (*see the Wind Engineering Requirements* Performance Specification) shall be used to determine design member forces.

- H) For bicyclist comfort, bridge deck accelerations exceeding 5% of gravity for wind speeds up to 30 mph and 10% of gravity between 30 mph and 50 mph will be considered unacceptable.
- I) For cable-supported bridge types, stay cable vibrations shall be evaluated for the effects of vortex excitation, wake galloping, and rain/wind oscillations. Methods for reducing likelihood of such vibrations shall be implemented as outlined in the Design-Build Performance Specification *Cable-Supported Bridge System Requirements*.
- J) The Design-Builder's Wind Analysis Report, the Final Plans, and the Owner's Manual shall clearly indicate the 3-second gust (in mph) that correlates to the mean hourly deck level wind speed at which the bridge should be closed to traffic.

3.5.9 Earthquake Effects

- A) Earthquake effects shall be in accordance with *AASHTO LRFD Bridge design Specifications*.
- B) The seismic performance category shall be Zone 1 with an acceleration coefficient (A) of 0.05.

3.5.10 Thermal Forces

- A) The uniform temperature ranges shall be calculated using Procedure B as specified in *AASHTO LRFD Bridge Design Specifications*. The base construction temperature shall not be less than 56° F.
- B) Seasonal variation for temperature rise and fall shall be in accordance with *AASHTO LRFD Bridge Design Specifications* for an 80° Fahrenheit temperature range.
- C) Expansion joints shall be in accordance with *AASHTO LRFD Bridge Design Specifications* and the Design-Build Special Provision for *Bridge Expansion Joint Devices* (see Part 4).
- D) Uniform temperature differential between stay cables and concrete bridge elements for the cable-supported bridges shall be $\pm 14^{\circ}$ F.
- E) The temperature differential (linear gradient) between opposite faces of each primary main span supporting elements (such as pylons, arches, towers, piers, etc.) shall be $\pm 10^{\circ}$ F.
- F) Differential temperature load combinations shall be in accordance with *AASHTO LRFD Bridge Design Specifications*, Article 3.4.1.
- G) The temperature gradient for the superstructure shall be as per the *AASHTO LRFD Bridge Design Specifications*.

3.5.11 Creep and Shrinkage

- A) Creep and shrinkage properties for concrete shall be determined by the Design-Builder based on the proposed concrete mixes and materials. Minimum creep and shrinkage coefficients shall be as per the 1990 CEB-FIP Model Code.
- B) The assumed mean humidity shall be not more than 75%.

3.5.12 Differential Settlement

- A) Differential settlement between primary structural supports shall be considered in load combinations that include settlement.
- B) Differential settlement between primary structural supports shall be applied in accordance with recommendations in the Geotechnical Engineering Report for the Project submitted by the Design-Builder. The Geotechnical Engineering Report shall include dimensional values for differential settlement.

3.5.13 Vessel Collision

- A) The vessel collision requirements of the *AASHTO LRFD Bridge Design Specifications* do not apply because no bridge components may be located in the existing or future waters of the Indian River Inlet.

3.5.14 Construction Loads

- A) The Design-Builder shall be responsible for determining the construction loads for the proposed design in accordance with Articles 5.14.2.3.2 through 5.14.2.3.4 of the *AASHTO LRFD Bridge Design Specifications*.

3.5.15 Load Path for Stay Cable Forces

-  A) The load path for all horizontal and vertical force components introduced or carried by permanent stay cables shall be entirely contained within the structural elements of the bridge. Temporary and/or permanent stay cable anchorage locations or structural details that transfer any principal component(s) of stay cable forces under service or strength limit states directly into soil, earth, sand, etc. shall not be used. Use of soil, regardless of type or name, to directly carry, anchor or transfer forces from temporary and/or permanent stay cable(s) is specifically not permitted by these specifications and shall not be considered under any condition for use on this project.
- B) Secondary or incidental forces from stay cable(s) that, by creep, elastic shortening, bearing friction or other means, result in development of forces in foundation(s), pier(s), pylon(s) or other structural member(s) shall be considered as acceptable within the provisions of this specification.

3.6 MATERIALS

All materials shall be as per the *DelDOT Standard Specifications* and the Corrosion Protection Plan referenced in Section 4.8 of this Specification except as modified below.

- A) Concrete:
 - 1) The Design-Builder may develop his own mix designs provided that the materials conform to the *DelDOT Standard Specifications* and with the *Concrete for Structures Performance Specification*.

-  B) Mass concrete shall be in accordance with the Design-Build Special Provisions (*see Part 4 of the Contract Documents*).
- C) Hot weather concreting shall be in accordance with Section 812.05 of the *DelDOT Standard Specifications*.
- D) Reinforcing Steel:

- 1) ASTM A615 Grade 60 (Minimum Yield Stress, $F_y = 60$ ksi).
- 2) All reinforcing steel, regardless of the location in the structure, shall have corrosion-resistant properties or coatings. Epoxy coated reinforcing steel shall conform to either:
 - a) ASTM A775 for reinforcing steel coated prior to fabrication; or
 - b) ASTM A943 for reinforcing steel pre-fabricated before coating is applied.
- 3) All bar bends shall be in accordance with ACI Standard Practice for detailing bar bends.
- 4) Minimum Concrete Cover (unless otherwise specified in the RFP Documents):
 - a) 2" for all exterior above grade precast element surfaces. The minimum finished clear cover to reinforcing bars for precast concrete decks shall be measured after any bridge deck grinding and before application of additional overlays;
 - b) 2" for cast-in-place above grade element surfaces. The minimum finished clear cover to reinforcing bars for cast-in-place concrete decks shall be measured after any bridge deck grinding and before application of additional overlays;
 - c) 1.5" for internal surfaces of voided concrete sections;
 - d) 2" for all substructure concrete surfaces cast against forms; and
 - e) 3" for all substructure concrete surfaces cast against earth.
- E) Post-Tensioning and Grout shall be in accordance with the *Prestressing* Special Provision (see Part 4 of the Contract Documents).
- F) Provisional and Future Prestressing for prestressed structures shall be in accordance with Article 5.14.2.3.8 of the *AASHTO LRFD Bridge Design Specifications*.
- G) Structural Steel and Bolts:
 -  1) Structural steel shall not be directly exposed to the environment. All structural steel, if used, shall be fully enclosed or encapsulated on all sides (including interior void surfaces) and at all locations with low permeability concrete. For encapsulated steel, the concrete shall be connected (i.e., shear connectors or studs, channels, etc.) to the structural steel member. The concrete shall contribute to the capacity of the structural steel member and shall also be included in the analysis of the composite member as dead load. The minimum concrete clear cover to any portion of any structural steel, including connectors or other appurtenances, shall be 2".
 - 2) All structural steel and bolts shall be designed and constructed in accordance with the *DelDOT Standard Specifications*. As a minimum, structural steel shall be AASHTO M270, grade 50 for primary members and grade 36 for secondary members.
 -  3) All non-encapsulated steel shall be painted in accordance with *Delaware Department of Transportation Standard Specifications* Section 820.
 - 4) Miscellaneous steel, including steel for stairways, landings, handrails, ladders,

gratings, hatches, etc., inside void spaces within the structure shall be coated in accordance with the *Inspection, Maintenance and Construction Requirements Performance Specification*. Miscellaneous steel shall not need to meet the requirements of Section G.1 above.

H) Stainless Steel:

- 1) Any bridge component that does not consist of concrete, is not concrete enclosed, or is not fully concrete encapsulated, excluding traffic barriers, end attenuators, railings, ladders and platforms shall be designed and constructed of marine grade, corrosion resistant stainless steel, minimum Grade 316L, unless otherwise specified.
- 2) All bolts, nuts, washers, hinges, backer plates, weld plates, and other miscellaneous items attached to any stainless steel component shall be stainless steel, minimum Grade 316L.
- 3) Stay cable sheathing shall be HDPE or ASTM A312 Type 2205 stainless steel. *See the Cable-Supported Bridge System Requirements Special Provision in Part 4 of the Contract Documents.*
- 4) If welding is required for stainless steel, then all welding material shall be of an equal or better grade than the base metal. Aluminum and/or steel wire brushes and/or abrasives may not be used on any stainless steel part during fabrication. All heat tint and any weld splatter shall be removed.
- 5) All stainless steel shall be finished exclusively utilizing silicon carbide abrasives in accordance with ASME B46.1-2002. Wet 180-grit abrasive shall be used for the final finish resulting in a fine polished finish with a maximum surface roughness of Ra 20 micro-inches. This finish shall continue over field weld splices and connections.
- 6) The direction of the polish grain shall be oriented in the direction of free drainage of the part in its final position on the structure.
- 7) The visible grain of the polished finish of all stainless steel components shall be uniform in appearance and direction.
- 8) The Design-Builder will be responsible for protecting stainless steel bridge components from damage and contamination before final acceptance by the Department.
- 9) Before installation, demonstration samples and full-scale mock-ups, not to exceed 6 feet in length, of all stainless steel components shall be submitted to the Department for approval.

I) Stay cables shall be in accordance with the *Cable-Supported Bridge System Requirements Performance Specification*.

J) Surface Finish:

- 1) All finished exterior surfaces of the bridge structure shall have a uniform coloration in accordance with the *Aesthetic Requirements Performance Specification* and shall have an anti-graffiti coating applied in accessible exterior areas of the bridge in accordance with the *Anti-Graffiti Coating Special Provision (see Part 4 of the Contract Documents)*.

3.7 CONSTRUCTION

- A) Construction shall be in accordance with all applicable Performance Specifications (*see* Part 3) and Design-Build Special Provisions (*see* Part 4).
- B) It is the responsibility of the Design-Builder to prepare a complete construction sequence/erection method and assume responsibility for the detailed design of the structure and erection equipment. The Design-Builder will be responsible for determining and monitoring forces and deflections in the permanent structure at all erection stages caused by his proposed erection method.
- C) The Design-Builder shall provide camber to the structure to achieve the final grades and cross-slopes in accordance with the *Roadway Geometrics* Performance Specification.
-  D) Erection loads and load combinations during construction shall be in accordance with Section 3.5.2 of this Specification.
- E) The Design-Builder shall make provisions for emergency bracing and stabilization of the structure during construction. The structure shall be braced or secured if, during construction, winds in excess of construction design values are to be expected.
- F) Temperature effects shall be considered during construction.
- G) Whenever the construction of a structural component (such as a wall, footing, or other such component) requires excavation that may endanger the public or existing structure that is in use, the Design-Builder must protect the public and the existing facility. If a temporary retaining structure is, therefore, required during the construction stage only, it shall be removed and may be reused after completion of the work. Such systems as steel sheet pilings, soldier beams, and lagging or other similar systems are commonly used. In such cases, the Design-Builder is responsible for designing the retaining structural system in accordance with the DelDOT Bridge Design Manual. The retaining structural system shall be detailed in the Plans for the project and shall be signed and sealed by the Design-Builder's Design Engineer in responsible charge of the design.
- H) The Design-Builder may furnish, erect, operate and utilize an on-site concrete batch plant in accordance with the Section 3.1.5 of the *Concrete for Structures* Performance Specification and Section 812 of the *DelDOT Standard Specifications*.
- I) All concrete construction joints shall be prepared in accordance with Section 602 of the *DelDOT Standard Specifications*.
- J) All concrete chamfers shall be not less than 3/4".
- K) The structure shall be designed prohibiting the drilling of concrete for installation of any appurtenances. All appurtenances (either temporary or permanent) shall be attached to the structure using cast-in-place inserts, unistrut or other hardware approved for use by the Department.

4.0 DESIGN CRITERIA

4.1 GENERAL

- A) The distribution of force effects to the components of cable-supported bridge types shall be determined by either three-dimensional or two-dimensional structural analysis as justified by consideration of the above deck supporting members geometry, number of

- planes of cables, and the torsional stiffness of the deck superstructure.
- B) Non-linear effects shall be considered in both the global and local analyses of the structural bridge system.
 - C) The calculation of forces and deformations shall consider the following:
 - 1) Non-linear response of cables;
 - 2) The p-delta effects (geometric non-linearity) for the girder under axial load and bending and for all other elements with significant axial loads ;
 - 3) The variation of load intensity with loaded length when load superposition is no longer valid;
 - 4) The non-linear effect of live load that includes the moment due to dead load thrust acting on the live load displacement; and
 - 5) The change in stiffness due to concrete cracking under factored loads shall be taken into consideration when the deformation of the structure results in a significant change in force effects.
 - D) The analysis shall include the time dependent effects of creep and shrinkage for the stage-by-stage construction and the completed bridge.
 - E) Live load analysis shall include checkerboard loading to produce maximum torque.
 - F) All other loads including construction loads shall be in accordance with Section 3 “Requirements” of this Performance Specification.

4.2 SUPERSTRUCTURE DESIGN

- A) Stress Limits for Concrete Members
 - 1) Stress limits for concrete members shall be in accordance with the *AASHTO LRFD Bridge Design Specifications* except that no tension shall be allowed at the Service Limit State after losses for effective prestress and permanent loads. The superstructure shall be designed as fully prestressed. Construction load combinations at the service limit state shall be checked as per Section 5.14.2.3.3 of *AASHTO LRFD Bridge Design Specifications*.
 -  2) The term “fully prestressed” as used herein shall be interpreted as defined in Section 5.9 of the *AASHTO LRFD Bridge Design Specification*. The superstructure shall satisfy the allowable stresses for "fully prestressed" components included in the *AASHTO LRFD Bridge Design Specification* for both longitudinal and transverse directions. In addition to the allowable stresses for the AASHTO Service Limit States, the superstructure tensile stress limit after losses shall be “no tension” for an additional Service Limit State Combination consisting of the sum of effective prestress and permanent loads. The “no tension” tensile stress limit shall apply in both the longitudinal and transverse directions of each component.
- B) Bridge Decks
 - 1)  For concrete bridge decks, a minimum 1 5/8 inch thick overlay shall be constructed for the bridge deck wearing surface. Acceptable overlay systems are listed below. Alternative deck wearing surfaces or overlay systems shall be submitted to the Department for review and must be approved by the Department

prior to use.

- a) Latex Modified Concrete Overlay (See Part 4 - Special Provisions, Special Provision 602543);
 - b) Micro-Silica Modified Concrete Overlay (See Part 4 - Special Provisions, Special Provision 602583); and
 - c) Low Permeability Concrete Overlay (See Part 4 - Special Provisions, Special Provision 602697).
- 2) Orthotropic steel deck shall not be used.
- C) Segmental Concrete Box Girders
- 1) For segmental concrete box girders, the effective width of deck slab for analysis and for calculation of section capacity and stresses may be determined by special elastic analysis that considers shear lag effects as per *AASHTO LRFD Bridge Design Specifications*.
 - 2) Influence surfaces or other elastic analysis procedures shall be used to evaluate live load plus impact effects in the top flange.
 - 3) Principle tensile stresses in the girder webs and flanges shall be limited to $3.5\sqrt{f'_c}$ under AASHTO LRFD Service State III.

4.3 PERMANENT STAY CABLES

Refer to the *Cable-Supported Bridge System Requirements* Special Provision for additional requirements.

- A) Stay cables shall be designed in accordance with the strength, service, extreme event and fatigue limit states stipulated herein and in the *PTI "Recommendations for Stay Cable Design, Testing, and Installation."*
- B) The static design of cables shall be made for axial loads and the bending stresses near the anchorages that result from angle changes caused by cable sag changes, geometry changes from joint displacement and change of angle due to rotation of girder and tower.
- C) The Design-Builder's stay cable installation procedure shall specify which is the live (stressing) end anchorage for the cable. The stressing end anchorage shall be detailed to provide for future cable replacement.
- D) The stay cable anchorages shall allow for future force adjustments (increase or decrease) of at least 2.5% of the guaranteed ultimate strength of each stay cable. The Design-Builder's stay cable installation procedure shall include details and procedures for removing/detensioning strands and re-installing strands.
- E) Stay cables shall be designed for HL-93 live load as per the *PTI "Recommendations for Stay Cable Design, Testing, and Installation."* The live load consists of a design truck or design tandem, in combination with a design lane load of 0.64 klf uniformly distributed in the longitudinal direction.
- F) Each traffic lane under consideration shall be occupied by either the design truck or design tandem, in addition to the design lane load. The design lane load occupies 10 ft. transversely within the design lane.
- G) Impact shall be applied to the design truck or tandem. Impact shall not be applied to the design lane load.

- H) The fatigue load shall be a single truck occupying a single lane. The fatigue design truck calculated design value shall be multiplied by the factor 1.4. Impact shall be applied to the calculation of fatigue effects.
- I) Permanent Stay Cable Replacement:
- 1) The design shall provide for the replacement of any individual cable with a reduction of the live load in the area of the cable under exchange. The design shall also be capable of withstanding the loss of any one stay cable without the occurrence of structural instability.
 - 2) Details on final plans shall allow all individual stay cables to be removed by detensioning at the live end anchorage.
 - 3) The following special load factors and combinations shall be used for the following stay cable conditions:
 - a) Stay Cable exchange:
 $1.2DC+1.4DW+1.5(LL^*+IM) + \text{Cable Exchange Forces}$
(* Closest design lanes to the line of stay cable anchorages shall be restricted and/or closed along with the corresponding lane in the opposite direction of travel)

The definitions of the symbols are given in Section 3.3.2 of the *AASHTO LRFD Bridge Design Specifications*. A resistance factor $\Phi=0.80$ shall be used for this strength limit state event.
 - b) Loss of Stay Cable:
 $1.1DC+1.35DW+0.75(LL^{**}+IM) + 1.1 \text{ Cable Loss Dynamic Forces}$
(**Full live load placed in their actual striped lanes)

The definitions of the symbols are given in Section 3.3.2 of the *AASHTO LRFD Bridge Design Specifications*. A resistance factor $\Phi=0.90$ shall be used for this extreme limit state event.

The dynamic force resulting from the sudden fracture of a cable shall be in accordance with Article 5.5 of the *PTI "Recommendations for Stay Cable Design, Testing and Installation."*

4.4 TEMPORARY STAY CABLES

- A) Temporary stay cables, if required for construction, shall be designed in accordance with PTI "Recommendations for Stay Cable Design, Testing, and Installation".
- B) Temporary stay cables shall be limited to an allowable stress of $0.6 F'_s$ during construction.

4.5 BEARINGS

- A) The design friction for structural sliding bearings shall be 3% maximum. The Design-Builder shall be responsible for utilizing the necessary methods and materials defined in the *AASHTO LRFD Bridge Design Specifications* Table 14.7.2.5-1 to achieve friction values less than or equal to this design value.

- B) Each bearing shall be designed and detailed to be replaceable by jacking the superstructure off the permanent bearings. The longitudinal and transverse analysis of superstructure shall consider the redistribution of reactions and forces when jacks are engaged to replace the bearings. The plans shall indicate the required position, size, and type of the jacks.
- C) Bearings shall be in accordance with Part 4 – Special Provisions, *Bridge Bearing Devices*.

4.6 EXPANSION JOINTS

- A) Modular and sliding plate expansion joints shall not be used. Finger joints or strip seal expansion joints shall be used in accordance with Part 4 – Special Provisions, *Bridge Expansion Joint Devices*.
- B) Steel finger joints shall be hot-dipped galvanized.
- C) In the shoulders and the combined use walkway, joints shall accommodate bicyclists.

4.7 SUBSTRUCTURE DESIGN

- A) Towers and Piers
 - 1) Reinforced concrete piers and towers shall be designed in accordance with *AASHTO LRFD Bridge Design Specifications*.
 - 2) The bridge shall be checked for an Extreme Event Limit State load combination including wind loads with a 2000-year return period and permanent loads. The load factor for all loads in this load combination shall be equal to 1.0. The structure shall not have any structural instability, such as buckling or brittle failure that could result in catastrophic collapse under this loading.
 - 3) Precast prestressed hollow-section pier columns constructed segmentally are not permitted for use below the mean high water elevation.
 - 4) Non-linear analysis (large deflection analysis) shall be used for the design of the towers and piers. For the computation of factored load moments and shears, cracked section properties shall be used, if applicable.
 - 5) The use of exposed steel towers shall not be permitted.
- B) Footings
 - 1) Concrete footings shall be designed in accordance with *AASHTO LRFD Bridge Design Specifications*.
 - 2) P-delta effects shall be considered in accordance with Section 4.1 of this Performance Specification.
 - 3) During construction, the following load combinations for foundation supporting elements shall be utilized in addition to all other applicable limits states included in AASHTO (The definitions of the symbols are given in Section 3.3.2 of *AASHTO LRFD Bridge Design Specifications*):
 - a) Service: $1.0[(DL+CR+SH)+(CE+CLL)+W+TR/TF]$
Strength: $\eta_i [1.25(DL+CR+SH)+1.50(CE+CLL)+1.25W+1.0(TR/TF)]$.
- C) Tremie Seals

- 1) Tremie seals, where utilized, shall be designed in accordance with *DelDOT Bridge Design Manual*.
- D) Temporary Retaining Structures
 - 1) Temporary retaining structures, such as cofferdams, sheet pile walls, and other such structures, where utilized, shall be designed in accordance with the *DelDOT Bridge Design Manual*.
 - 2) Temporary retaining structures shall also conform to Section 3.7.G of this Performance Specification.

4.8 CORROSION PROTECTION PLAN

For the Corrosion Protection Plan refer to the Performance Specification for *Inspection, Maintenance and Construction Requirements*.

5.0 INSPECTION AND MAINTENANCE MANUAL

For the Inspection and Maintenance Manual refer to the Performance Specification for *Inspection, Maintenance and Construction Requirements*.

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**BRIDGE DRAINAGE SYSTEM
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

The Design-Builder shall provide a bridge drainage system designed to safely handle storm runoff consistent with the Design-Builder's bridge design and to satisfy all environmental commitments (*see* Part 7 – Permit Requirements) and other Department requirements. The design and construction of all drainage and other bridge drainage facilities shall adequately address runoff control, safety, functionality, erosion mitigation, durability, ease of maintenance and repair, and maintenance access. The Design-Builder shall abide by the specifications and standards in this Performance Specification and in other applicable sections as they pertain to drainage facilities, including NPDES and other permit requirements.

The Design-Builder shall also design the bridge drainage system in a manner that is consistent with the Aesthetic Requirements for the project and all portions of the bridge drainage system shall be camouflaged, concealed, or inconspicuously provided such that the drainage system does not negatively disturb or detract from the aesthetic appearance of the structure in the opinion of the Department.

2.0 STANDARDS AND REFERENCES

The design and construction of bridge drainage system facilities and appurtenances, including those required for environmental purposes, shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Bridge Drainage System Performance Specification establish requirements that have precedence over all others. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern. Listed under references are guidelines that the Design-Builder may use to address the requirements, as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification of any and all unresolved ambiguity prior to proceeding with any design or construction.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence.

2.1.1 Design

- A) Delaware Department of Transportation "Bridge Design Manual" with Revisions through May, 2005;
- B) Federal Highway Administration (FHWA) HTA-22, Hydraulic Engineering Circular 21 (HEC-21) FHWA-SA-92-010, "Design of Bridge Deck Drainage," May, 1993;
- C) FHWA HTA-22, Hydraulic Engineering Circular 22 (HEC-22) FHWA-NHI-01-021, "Urban Drainage Design Manual," Second edition, August, 2001;
- D) AASHTO, "Model Drainage Manual," 2005 Edition;

2.1.2 Specifications

- A) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" Dated 2001;

2.1.3 Coordination with other Design Standards

- A) Delaware Department of Transportation “Road Design Manual” with Revisions through July, 2004;
- B) “AASHTO LRFD Bridge Design Specifications,” Third Edition, 2004 (U.S. Customary Units), with Interims through 2006.

2.2 REFERENCES

- A) Delaware Department of Transportation, Design Guidance Memorandums;
- B) Delaware Department of Transportation, “Standard Construction Details,” Dated 2005;
- C) AASHTO, “A Policy on Geometric Design of Highways and Streets (Green Book),” Fifth Edition, 2004;
- D) AASHTO, “Roadside Design Guide,” Third Edition, 2002;

3.0 REQUIREMENTS

3.1 DESIGN CRITERIA

- A) The Design-Builder shall determine the design storm for the Project subject to approval by the Department.
- B) The minimum allowed design storm recurrence interval shall be the ten-year storm. This value shall be used regardless of any Design-Builder research, analysis or calculations that indicate a lesser design storm recurrence interval. Should the Design-Builder’s research, analysis and/or calculations indicate an increase in the recurrence interval for the design storm, then the Design-Builder shall use the higher recurrence interval for design.

3.1.2 Bridge Deck Drainage

- A) The Design-Builder shall perform a hydraulic analysis in accordance with HEC-21 to determine the required size and number of scuppers. Bridge deck drainage discharge under barriers or curbs by means of slots, weep holes or by other means shall be considered unacceptable and will not be approved by the Department for use on the project.
- B) All scuppers shall be located in a straight line on the low side of the outside shoulders or curbs for pedestrian sidewalks. Scuppers shall not be placed in traffic lanes.
- C) All drainage grates shall be ADA-compliant and shall be bicycle-safe.
- D) The center of scupper inlet pipes shall be parallel to the vertical faces of bridge traffic barriers and curbs for pedestrian sidewalks. Local depressions around scupper inlet pipes shall be provided to promote positive drainage.
- E) Scuppers shall be omitted in areas where free-fall drainage from scupper outlet pipes will be over roadways, permanent paved pedestrian pathways and sidewalks, or immediately over and/or adjacent to bridge supporting elements such as piers, pylons, towers, arch bases, abutment walls and bearing seats. Centers of free-fall scupper outlet pipes may not

be located within 10 feet measured horizontally in plan view within any surface of a bridge-supporting element mentioned above.

- F) Scuppers shall be manufactured from simple sections of PVC piping and shall be installed flush with and normal to the depressed bridge deck riding surface. Outlet pipes shall not introduce runoff discharge within structural void spaces of the bridge.
- G) The minimum allowable pipe schedule shall be schedule 40. Minimum allowable pipe diameters shall be as follows:
 - 1) Scuppers for areas of the bridge deck carrying vehicular traffic: 4 inch dia.
 - 2) Scuppers for areas of the bridge deck carrying pedestrian traffic: 2 inch dia.
- H) The underside surface of the bridge immediately adjacent to free-fall scupper outlet pipes shall receive a 1/2 inch deep “V”-groove around the full perimeter of the outlet pipe to create a drip edge. The “V”-groove shall be located within 4 inches of the outside edge of the outlet pipe. The “V”-groove detail may form either a rectangular or circular perimeter around the scupper outlet pipe.

3.1.3 Bridge Expansion Joint Device Discharge

- A) The Design-Builder shall determine the volume of runoff collected at the bridge expansion joint devices for the design of piping, downspouts, collectors, cleanouts, trench drains, splash blocks, and any other such materials for the proper conveyance of collected discharge from the bridge expansion joint devices.
- B) The Design-Builder shall design piping, downspouts, scuppers, trench drains, and any other such materials for the conveyance of collected discharge from the bridge expansion joint devices with an efficiency of 50% to estimate the condition when the system may be partially clogged by debris and sediment.
- C) All piping, downspouts, cleanouts, floor drains, collectors, connections and other such materials required for the complete assembly of the drainage system for bridge expansion joint device discharge shall be ductile iron conforming to the requirements of *ASTM A746* with asphaltic coating. The asphaltic coating shall be a minimum of 1 mil in thickness after curing.
- D) Minimum allowable pipe size for bridge expansion joint discharge shall be 6 inch DIP size. Minimum allowable diameter for cleanouts and round floor drains shall be 6 inches.
- E) Slopes of pipe laterals shall be determined by the Design-Builder. The minimum allowable slope for piping laterals shall be 3%.
- F) Slopes for trench drains shall be determined by the Design-Builder. The minimum allowable slope for trench drains shall be 1%.
- G) The minimum width and depth of trench drains shall be 6 inches. Trench drains shall be supplied with gratings and shall conform to *ASTM A48*, Class 30.
- H) Drainage outlet pipes shall be placed such that the free-fall discharge height is less than 2 feet above splash blocks.

**BRIDGE HYDRAULICS AND SCOUR REQUIREMENTS
PERFORMANCE SPECIFICATION**

1.0 DESCRIPTION

The specific purpose of this scope is to determine design coastal storm surges, flows, and wave heights to predict expected scour around the proposed Indian River Inlet replacement bridge. Minimum design requirements shall be in accordance with the *Bridge Design Requirements* Performance Specification.

2.0 BACKGROUND

Coastal storms in 2004 and 2005 caused failure of major bridges – primarily through the combination of storm surge and wave action. Failure modes included wave action (uplift, impact, and buoyancy forces), erosion of embankments and abutments, and scour. Lessons learned included a realization that coastal storm factors may require a different hydraulic assessment than normally considered for riverine bridges. The Department shall require that the design of the proposed Indian River Inlet Bridge characterize and consider such factors during the design-build process.

3.0 DESIGN-BUILDER’S QUALIFICATIONS AND EXPERIENCE

Appropriate coastal hydraulic analyses require a multi-disciplinary team qualified in Coastal Engineering, Bridge Hydraulics/Hydrology, Structures, and Geotechnology. The team should demonstrate experience in deriving design storms and/or frequencies in a coastal setting; numerical modeling of both storm surge (e.g. ADCIRC, RMA2, etc), waves (e.g., WAM, SWAN, etc), and understand the need to couple such models as necessary; and be able to perform scour analyses and produce scour countermeasure designs. The key individuals within the team having direct oversight of this work must demonstrate by formal education and or experience the ability to meet these qualifications. An individual may qualify in more than one discipline. The analyses of astronomical tides, waves, and hurricane storm surges should use Coastal Engineering analyses as typified by the practices of the USACE and consistent with current coastal engineering practice¹. The qualifications of the multi-disciplinary Coastal Engineering shall be submitted to the Department for approval.

4.0 TASKS

This scope of work includes several tasks as outlined below. Some of the requirements of the Design-Builder shall include characterizing site conditions, predicting 50, 100 and 500-year return interval storm surge heights and wave parameters at the bridge location, predicting scour depths and extents at structural elements (e.g, piers; abutments, retaining walls), and developing countermeasures and/or shoreline protection.

4.1 TASK 1: DETERMINE DESIGN STORM CHARACTERISTICS

Using accepted coastal engineering approaches and practices, determine the design storm characteristics and/or boundary conditions for the 50, 100, and 500-year events. These may be those surge and wave estimates associated with FEMA Flood Insurance Studies. However, other approaches may be applied to characterize such frequencies. The Department would consider historical, synthetic, or empirical simulation technique (EST) methods (described in “Storm Surge Analyses and Design Water Level

¹ NOTE: These do not include the FHWA document “HEC-25: Tidal Hydrology, Hydraulics, and Scour at Bridges (first edition)” or the tidal waterways section of the FHWA document: “HEC-18: Scour at Bridges (fourth edition).” However, the remainder of HEC-18 SHOULD be used to conduct scour analyses.

Determinations,” USACE, EM 1110-2-1412, April 1986, “Chapter 5 - Water Levels and Long Waves,” USACE, EM 1110-2-1100 (Part II), April 2002, or “Hurricane Climatology for the Atlantic and Gulf Coasts of the United States,” NOAA TR NWS38, April 1987) as describing some accepted procedures to estimate exceedance probability in a coastal environment. Other approaches might apply stochastic analyses of hindcast storm events for the project area.

The resulting design storm characteristics will be applied to the storm surge and wave models developed in Task 2.

4.2 TASK 2: DEVELOP STORM SURGE AND WAVE MODELS

Develop storm surge and wave models for Indian River Inlet. The Department believes that ARCIRC, RMA2, and SWAN represent current state of practice for such studies, but a team may propose application of other, alternative, modeling approaches. The Department must approve use of any proposed models. Submit an interim report for this task for review and comment by the Department and present the methodology and results to the project team.

4.2.1 Gather Available Data

These may include, but are not limited to:

- a) Bathymetry-Topography data
- b) Validation data
- c) Water elevations (tide gages)
- d) Discharge measurements
- e) Water elevation records during past storm events
- f) Aerial photography
- g) NOAA charts
- h) Digital quad maps
- i) FEMA Flood Insurance Studies
- j) Other modeling efforts
- k) Wind data (including purchasing hindcasted wind / pressure data for storms in NOAA database that have impacted the project area).

4.2.2 Reduce, Analyze, Reconcile, and Assess Available Data

Shift and merge data sets as needed. Compare and rectify boundaries for consistency. Evaluate adequacy of coverage and reliability of available survey data. Determine strategy for obtaining additional bathymetry as needed.

4.2.3 Development of Models

- a) Develop Storm Surge Model Mesh. Provide sufficient grid detail to allow acceptable accuracy at bridge substructure units, embankments, and abutments.
- b) Develop Wave Model Meshes. Develop large wave model mesh and higher resolution, nested wave model meshes.
- c) Couple models as needed. This may include developing wind grid to storm surge grid,

storm surge grid to wave grid, and wave grid to storm surge grid.

- d) Validate Storm Surge and Wave Models. Use spring tide elevation and discharge data, and any available hurricane high water marks, to validate the storm surge / wave model.

4.2.4 Prepare Report and Present Results to the Department

Submit a draft final report, make a formal presentation of results, and respond to comments on the report.

4.3 TASK 3: MODEL STORM EVENTS

Using the developed models, determine 50, 100, and 500-year hurricane flow velocities, peak water elevations, and wave heights. Submit an interim report for this task for review and comment by the Department and present the methodology and results to the Project Team. Note: the results of Tasks 1 and 2 will be used to evaluate the potential lateral loadings from wind, waves, and potential buoyancy on the Bridge superstructure. Minimum design requirements shall be in accordance with the *Bridge Design Requirements Performance Specification*.

4.4 TASK 4: PERFORM BRIDGE SCOUR ANALYSES

Using approaches in the FHWA document “HEC-18 – Scour at Bridges (4th edition)”, calculate scour estimates for the following conditions:

- Worst case scour condition up through the 100-year frequency flood event (Design Scour Flood Event).
- Scour condition for the 500-year frequency flood event (Check Scour Flood Event).

Scour Components: Scour estimates for the above events shall consist of the total scour resulting from the following processes described below:

- Natural channel aggradation and degradation anticipated during the life of the structure (including sea level changes).
- Inlet or channel migration anticipated during the life of the structure.
- Contraction scour.
- Local scour, including pier scour² and abutment scour.
- Analyses of surge and wave action on approach embankments and MSE walls.

4.5 TASK 5: DESIGN SCOUR COUNTERMEASURES AND STRUCTURE PROTECTION

Using approaches in the FHWA document “HEC-23 – Scour Countermeasures” and Corps documents, design suitable countermeasures to protect bridge elements from scour and coastal hydraulic forces and effects.

4.6 TASK 6: PREPARE REPORTS

Necessary copies of separate semi-final and final reports shall be submitted and subjected to the Department’s Consultation and Written Comment. The reports shall be compiled in hard cover binders and, at a minimum, shall contain discussions and results of the following:

- CDs of all survey data, aerials, model datasets, the final reports, etc.
- Wave and surge information for the specified return interval events in the form of tables and plots.

² The team should look at both HEC-18 and Sheppard’s methods for estimating pier scour.

**BRIDGE SECURITY PROGRAM
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

This Performance Specification specifies the requirements for the Bridge Security Program and defines the roles and responsibilities for this Work. The purpose of the Bridge Security Program is to ensure a systematic approach to and complete execution of a multi-layer, redundant, and robust program including, but not limited to, controlling access to and the disclosure of sensitive project information, designing and implementing preventative measures and countermeasures for critical Project components, minimizing the consequences of and identifying acceptable levels of damage to the structure, maintaining program initiatives and protective measures during design and construction activities, and developing procedures for the transfer of the Bridge Security Program responsibilities to the Department upon satisfactory acceptance of the Project.

The Bridge Security Program shall include all phases of the Project. The Design-Builder shall be responsible for completing, to the sole satisfaction of the Department, the Bridge Security Program for this Project. The Design-Builder shall develop and submit for approval by the Department specific Bridge Security Program recommendations and Design Criterion, based upon the Design-Builder's project-specific threat-based component level risk analysis and the minimum requirements set forth in this Performance Specification. Upon approval of the recommendations and the Security Criteria, the Design-Builder shall complete final design, furnish, erect, maintain and monitor during construction all Bridge Security Program measures in accordance with this Performance Specification.

2.0 STANDARDS AND REFERENCES

The Work shall be in accordance with this Bridge Security Program Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. If codes, standards, and/or manuals are specified herein for the design of the Bridge Security Program, then the edition(s) in effect on the Proposal due date shall be applicable to the Project. Standards and references specifically cited in the body of the Bridge Security Program Performance Specification establish requirements that shall have precedence over all others. Should the requirements in any standard conflict with those of another; the standard highest on the list shall govern. Listed under references are guidelines that the Design-Builder may use in addressing the requirements as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification of any unresolved ambiguity prior to proceeding with design or construction.

2.1 STANDARDS

- A) Workshop manual on "Risk Management for Terrorist Threats to Bridges and Tunnels," Federal Highway Administration and U.S. Army Engineer Research and Development Center; and
- B) AASHTO, "Recommendations for Bridge and Tunnel Security," September 2003.

2.2 REFERENCES

- A) U.S. Department of Homeland Security, "National Infrastructure Protection Plan," 2006; and
- B) Office of the President, The White House, "The National Strategy for The Physical

Protection of Critical Infrastructures and Key Assets,” February 2003;

- C) Federal Highway Administration sponsored U.S. Army Engineer Research and Development Center, “Bridge and Tunnel Vulnerability Workshop Materials”;
- D) Workshop manual on “Blast Analysis and Design for Highway Structures” developed by the Federal Highway Administration and U.S. Army Engineer Research and Development Center, 2006; and
- E) “Design and Analysis of Hardened Structures to Conventional Weapons Effects”, DTRA DAHSCWEMAN-97, Army TM 5-855-1, Air Force AFJMAN32-1055, Navy NAVFAC P-1080, April 1997.

3.0 PROTECTION OF SECURE INFORMATION

Prior to issuing the Notice to Proceed for the Contract, the Department shall meet with the Design-Builder to establish reasonable protocols for protection of secure information to be developed as part of the Bridge Security Program. Protocols for safeguarding information shall include, but not be limited to, the following:

- A) Establishing appropriate points of contact for the Design-Builder and the Department;
- B) Limiting reproductions and accounting for documents;
- C) Identifying appropriate storage methods;
- D) Means of transmitting and shipping information; and
- E) Means of disposal.

Should it be determined by the Department that a failure to comply with Bridge Security Program requirements resulted from willful misconduct or a lack of good faith, the Contract shall be subject to termination for default.

4.0 REQUIREMENTS

The Bridge Security program, systems and/or bridge components shall be designed and detailed using the customary English units. Plans shall be prepared in accordance with the Department’s Plan Development Guidelines, Standard Specifications for Road and Bridge Construction, the Bridge Design Manual and as changed or amended by the requirements of this Performance Specification. Final Plans shall be sealed by a Professional Engineer registered in the State of Delaware. All submittals and submittal requirements shall be as per the Contract Documents.

4.1 SECURE INFORMATION IN PROJECT RECORDS

Drawings, details, specifications, reports, studies, and any other such records, released for construction shall include information regarding materials to be used and any other information necessary for satisfactory construction of the structure, system, or component. These records shall not indicate that the construction, structure, system, or component shown meets any security standard, or contains any reference to the limits or capabilities of the construction, structure, system, or component.

4.2 BRIDGE SECURITY ANALYSIS AND DESIGN

The Design-Builder shall use all reasonable means to minimize the potential for and consequences of damage to the structure from extreme events. The primary design objectives will be prevention of progressive collapse and to minimize time and cost of repairs. At a minimum, the stability of the

structure shall be maintained after an extreme threat event has occurred. The AASHTO Extreme Event II load combination shall be applied for stability checks with a load factor of 0.75 for live load and 1.00 for extreme events.

Within 30 days of Notice to Proceed, the Design-Builder shall perform a project-specific component level risk analysis of the proposed bridge structure using the Federal Highway Administration's risk management approach equation noted below. (Refer to "Risk Management for Terrorist Threats to Bridges and Tunnels"). Prior to conducting the analysis, the Design-Builder shall participate in a project-specific FHWA Risk Management Workshop and FHWA's Blast Analysis and Design Workshop to be offered by the Department.

$$\text{Risk} = \text{Opportunity} \times \text{Vulnerability} \times \text{Importance}$$

The Design-Builder shall utilize "Opportunity", "Vulnerability", and "Importance" factors that have been mutually agreed to by the Design-Builder and the Department. Structural components having computed risk factors greater than the threshold value established by the Departmental shall be considered critical components and mitigation shall be considered in order to lower their risk.

After reevaluating all components and mitigation measures, no component shall have a mitigated risk above the threshold value established by the Department and the difference between the component with the highest risk and the component with the second highest risk shall be less than 15% of the higher risk value. The span ratio shall be taken equal to 1.00.

Threats to be considered in the Design-Builder's design and analysis include:

- Vehicle-borne explosive improvised devices
- Hand-emplaced explosive improvised devices
- Non-explosive mechanical or exothermic cutting devices
- Vessel and truck collision
- Fire

Each threat event shall be analyzed at all interior and exterior structure locations, as appropriate. Multiple event locations shall be considered to determine the most severe load case and effect for each structural component.

Analysis of structural response shall be for dynamic effects. The effect of localized failure shall be considered when it affects the overall structural response; however, the effects of breach in venting explosive pressure shall not be considered as alleviating the dynamic effects unless intentionally designed to do so.

Additional criteria for the threat analysis and design will be provided separately to the successful Design-Builder. This information shall be controlled and protected in accordance with this *Bridge Security Program Performance Specification*.

4.2.1 Bridge Security Countermeasures

Countermeasures shall be considered and used to mitigate identified vulnerabilities and risks of damage and progressive collapse by applying a combination of the following four strategies:

- A) Deter - Deterrence measures may include clear lines of site to critical components, lighting of critical components, visible closed circuit television cameras, structural protection measures such as barriers and armored protection or other visible protection

measures that send a message actions have been taken to protect the project and critical components.

- B) Deny - Deny measures may include fencing, barriers, berms, fenders, locked hatches and access ways, out-of-reach access ways, plugging holes, barriers to eliminate access from deck to superstructure and substructure components and other means of restricting access to critical components to reduce probability of occurrence and reduce potential physical contact or proximity contact.
- C) Detect - Detection measures may include alarmed doors and hatches, motion activated devices, and manned closed circuit television cameras. Timeliness of response must be considered in evaluating the effectiveness of such measures.
- D) Defend - Defend measures are intended to prevent failure of critical components under extreme events. Such measures may be used to provide more ductility, robustness and redundancy to critical components. Such measures may include:
 - 1) Increasing redundancy by providing alternate load paths. If this defend measure is provided, the structure stability shall be analyzed under different load paths after a failure of a critical component is assumed to have occurred.
 - 2) Structural toughening of vulnerable components to meet ductility and rotation limits,
 - 3) Protection of stay cables and suspender cables in the vicinity of the roadway. Protective sleeves or wraps may be used to effectively protect cables against cutting devices and hand-emplaced improvised explosive devices.
 - 4) Increasing seat widths to allow beams and/or girders to experience large displacements, deflections or rotations without the girder ends slipping off the end supports.

4.2.2 Design-Builder's Bridge Security Summary Report

The Design Builder shall prepare and submit to the Department's Project Manager, or designated representative, six (6) copies of a summary report presenting their risk analysis approach, findings and recommendations. The Design-Builder shall allow 10 Working Days for the Department to review and comment on the report. At a minimum, the report shall:

- A) Include a summary of design and analysis criteria and thresholds considered.
- B) Identify analysis software utilized.
- C) Discuss probable and credible risks to the structure considered including, but not limited to, the following:
 - 1) Resistance to explosives;
 - 2) Internal and external exposure to fire;
 - 3) Resistance to vehicular and vessel impact; and
 - 4) Potential for damage through mechanical and/or exothermic cutting means.
- D) Identify bridge risks and potential impacts on serviceability.
- E) Identify critical structural components potentially affecting the stability of the bridge.
- F) Identify countermeasures proposed to decrease risk to critical structural components.

- G) Discuss how maintenance and public use bridge functions can be maintained without unduly compromising Bridge Security.
- H) Identify anticipated methods of repair for different types of damage associated with specific threats.
- I) Discuss how the proposed bridge type and/or inherent design details will serve to minimize, avoid, and/or prevent risks to the structure.
- J) Proposed costs for all countermeasures considered that were not included in the Design-Builder's Final Technical Proposal.

4.2.3 Design-Builder's Bridge Security Plan

Upon receipt of the Department's written comments on the Bridge Security Summary Report, the Design-Builder shall prepare a formalized Bridge Security Plan. The Bridge Security Plan shall include all countermeasures requested by the Department as part of the Summary Report review. The Design-Builder shall submit six (6) copies of the Bridge Security Plan to the Department's Project Manager and allow up to 5 Working Days for Department approval.

Final approval of the Bridge Security Plan shall be a "Readiness for Construction" requirement in accordance with Part 2 – DB Section 111-12.5. Construction of any permanent bridge component will not be permitted to begin without such approval.

4.3 DESIGN-BUILDER'S RESPONSIBILITIES

- A) The Design-Builder shall comply with the mutually established protocols for protecting secure information.
- B) The Design-Builder shall participate in a project-specific FHWA Risk Management Workshop and FHWA Blast Analysis and Design Workshop to be offered by the Department.
- C) The Design-Builder shall be responsible for performing and completing the bridge design and bridge security analysis in accordance with all design criteria included in the Contract Documents or as otherwise approved by the Department.
- D) The Design-Builder shall be responsible for preparing and distributing a Bridge Security Summary Report as specified in Section 4.2.2 of this Performance Specification.
- E) The Design-Builder shall be responsible for preparing and submitting to the Department a Bridge Security Plan as specified in Section 4.2.3 of this Performance Specification.
- F) The Design-Builder shall be responsible for providing and implementing into the Work all security-specific protective measures, countermeasures, and systems identified in the Design-Builder's Proposal and included in Part 8 of the Contract Documents, unless otherwise agreed to and approved by the Department.
- G) The Design-Builder shall be responsible for providing and implementing into the Work all security-specific protective measures, countermeasures, and systems included in the approved Bridge Security Plan. All costs associated with items and/or activities not included in Design-Builder's original Proposal or required by this *Bridge Security Program* Performance Specification shall be considered "Extra Work" and will be paid for in accordance with Part 2, Section 109-8 of the Contract Documents.
- H) The Design-Builder shall be responsible for security of the Project site during construction and until Final Acceptance by the Department. Means of securing the site

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shall be clearly specified in the Design-Builders Proposal and may include patrol officers, surveillance systems, or other means.

- I) Upon Final Acceptance, the Design-Builder shall be responsible for relinquishing control of any Bridge Security systems and components to the Department.

- J) The Design-Builder's Technical Proposal shall clearly specify all proposed means, methods, systems, design features, and/or approaches to achieving the Bridge Security Program objectives specified in this Performance Specification.

THIS PAGE FOR SEQUENCING PURPOSES ONLY

CONCRETE FOR STRUCTURES 
PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

This Performance Specification specifies the requirements of furnishing, placing, curing and finishing all cast-in-place (CIP) and precast concrete elements proposed by the Design-Builder as part of the Work for the Project. The Design-Builder shall be responsible for designing concrete mixtures that meet all the parameters specified herein and finishing the Work in reasonably close conformity with the lines, grades and dimensions shown on the Design-Builder approved plans.

2.0 REFERENCES AND STANDARDS

The design, furnishing, placement, curing, finishing of all concrete work shall be in accordance with this *Concrete for Structures* Performance Specification and the relevant requirements of the following standards unless otherwise stated in this Performance Specification. Standards and references specifically cited in the body of this Performance Specification establish requirements that shall have precedence over all others. Should the requirements in any standard conflict with those in another, the more conservative standard presented in Section 2.1 of this specification shall govern. References are guidelines that the Design-Builder may use in addressing the requirements as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification from the Department's Project Manager for any unresolved ambiguities prior to proceeding with design or construction. Items listed as standards or references in this Performance Specification shall be the most recent version available on the Proposal due date.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence:

- A) Scope of Services Package Plans (*See Contract Documents*);
- B) Supplemental Specifications to the DeIDOT Standard Specifications;
- C) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" Dated 2001;
- D) Delaware Department of Transportation "Materials and Research Manual" with Revisions through March, 2005;
- E) "AASHTO LRFD Bridge Design Specifications," Third Edition, 2004 (U.S. Customary Units), with Interims through 2006. Delete Section 5.14.2.3.9 in its entirety (All Shop and Working Drawings will conform to the requirements of the Contract);
- F) "AASHTO LRFD Bridge Construction Specifications," Second Edition, 2004 (U.S. Customary Units), with Interims through 2006.

2.2 REFERENCES

- A) ACI 301 R-05, "Specifications for Structural Concrete";
- B) ACI 305 R-99, "Hot Weather Concreting";
- C) CEB-FIB "Model Code 1990," First Edition, 1993, Chapter 2: Material Properties for Time Dependent Properties of Concrete Only;

- D) PTI Guide Specification, “Grouting of Post-Tensioned Structures,” Second Edition, 2003;
- E) ACI 207.1 R-96, “Mass Concrete”; and
- F) Delaware Department of Transportation “Bridge Design Manual” with Revisions through May 2005.

2.3 DEFINITION OF TERMS

- A) ACI American Concrete Institute
- B) (AD) Design Percent Air
- C) ARML AASHTO Reference Materials Laboratory
- D) Arithmetic Mean The value obtained by adding individual values and dividing by the number of values to obtain an average.
- E) CCRL Cement and Concrete Reference Laboratory
- F) Certified Laboratory Either an ARML laboratory with a PCC certification or a CCRL laboratory with a concrete certification.
- G) Defective Material Concrete that is placed but fails to meet specification requirements.
- H) Design Permeability A measurement value of the concrete mixes quality. The value, in Coulombs, which the concrete achieves after 28 days when tested in conformance to AASHTO T 277 and as modified by this specification.
- I) $f'c$ Specified Design Strength at 28 days or specified age (ACI 301 4.2.3.3.a)
- J) $f'cr$ Required average compressive strength at 28 days or specified age (ACI 301 4.2.3.3.a)
- K) Sample Standard deviation (S) The positive square root of the sample variance.
- L) Sample Variance the Square of the difference between a individual sample value and the mean of the sample.
- M) Substructure Concrete Concrete used in the following bridge components: foundation support elements, footings, abutments.
- N) Superstructure Concrete Concrete used in the following bridge components: precast or CIP superstructure, closure pours, pylon, arch.

2.4 MATERIALS

All materials used for Portland Cement Concrete (PCC) and curing shall meet the applicable requirements under Sections 812.02(a), (b), (c), (d), (e), (f), (g), (h), and (i) of the DelDOT Standard Specifications unless otherwise modified herein. Additional material requirements include the following:

- A) Ground granulated blast furnace slag. (Certification by the Manufacturer is required). The one day cube strength results of ASTM C 1073 may be used in lieu of the 7 and 28-day cube strengths required by ASTM C 989.
- B) High molecular weight methacrylate resin sealer shall be in accordance with SS 1054.

- C) Joint filler shall be ¼” thick and be in accordance with DelDOT Standard Specifications Section 808.04(d).
- D) Seals (preformed elastomeric compression joint) shall be in accordance with DelDOT Standard Specifications Section 808.04(a).
- E) Bar Reinforcement shall be in accordance with DelDOT Standard Specifications Section 603.
- F) Epoxy Coated Bar Reinforcement shall be in accordance with Section 604 of the DelDOT Standard Specifications.
- G) Post-Tensioning Steel, Ducts for Post-Tensioning Tendons and Grout for Post-Tensioning Tendons shall be in accordance with Part 4, Special Provisions - *Prestressing*.
- H) Polypropylene Fiber shall be in accordance with DelDOT Standard Specifications Section 824.

3.0 REQUIREMENTS

3.1.1 Concrete Mix Design

The Design Builder shall be responsible for the design, production, documentation, and submittal of concrete mixture designs that will produce structural concrete meeting the required design parameters of this Contract. The Design-Builder’s submitted mixture design shall satisfy the following minimum performance requirements:

Property	Specification Limit	Test Method
f'_c	As specified by the Design-Builder	AASHTO T22 & T23
Permeability ¹	1500 coulombs (maximum)	AASHTO T277 ²
Water/cementitious ratio	0.42 (maximum)	N/A
Air Content	4.0 – 7.0%	AASHTO T152
Slump	4.0 – 8.0”	AASHTO T119

¹ The permeability requirement may be eliminated, at the Design-Builder’s option, for any concrete elements permanently located below finished grade.

² Tests will be run after samples are moist cured for 7 days at 73°F followed by moist curing for 21 days at 100°F.

The specific mixture design submitted by the Design-Builder shall meet all applicable specification requirements and take into consideration the weather conditions, delivery time, and placement operations. All individual concrete constituent materials shall be compatible with the other proposed materials to ensure the concrete satisfies all Contract requirements.

Prior to incorporation of concrete into the Work, the Design-Builder shall produce a 5 cubic yard load of each proposed mixture design for testing by the Department. This shall take place a minimum of 60 Calendar Days prior to placement of this concrete in order for the Department to complete the testing and provide written comment.

Any changes to individual constituent materials for the manufacturing of concrete shall be submitted to the Department’s Project Manager a minimum of 5 Working Days prior to incorporation into the Work.

3.1.2 Alkali-Silica Reactivity Mitigation

Coarse and fine aggregates for use in Portland Cement Concrete shall also be evaluated by the Design-Builder for potential alkali-silica reactivity (ASR) using at least one of the means referenced below along with any field service records available for the materials in question. If a field service record for a particular source includes evidence of deleterious ASR occurring in that source, then that source shall be classified as potentially reactive regardless of any laboratory test result for that source. Test results of the proposed aggregates shall be provided by the Design-Builder to the Department’s Project Manager for review and written comment a minimum of 60 Calendar Days prior to the incorporation of the mixture on the Project.

Tests and Criteria for Proposed Aggregate		
Procedure	Description	Limit
AASHTO T303	Mortar Bar Expansion	≤ 0.08% at 14 days
ASTM C1293	Concrete Prism Expansion	≤ 0.04% at 1 year

If the proposed concrete mixture design exceeds any of the limits referenced above, or the aggregate has demonstrated deleterious ASR in the field, mitigation steps shall be taken. These mitigation steps shall incorporate one or a combination of the following materials:

- **Low Alkali Cement** having an alkali content of 0.40 or less,

And/or the following supplementary cementitious materials:

- **Blended hydraulic cement** meeting the requirements of ASTM C1157,
- **Ground Granulated Blast Furnace Slag** meeting the requirements of AASHTO M302, Grade 100 or 120,
- **Silica Fume** meeting the requirements of AASHTO M307,
- **Fly Ash** meeting the requirements of Section 822, and with a total alkali content less than 3.0%

And/or the following chemical admixture:

- **Lithium Admixture** at a dosage rate based upon the sodium oxide equivalent (AASHTO M 85) of the Portland cement component of the concrete. The standard lithium dosage is 0.55 gal of 30% lithium nitrate solution per 1 lb of sodium oxide equivalent of the Portland cement, with a minimum dosage of 0.60% by weight of the Portland cement. Other lithium compounds may be used if prior approval by the Department’s Project Manager is obtained by the Design-Builder. All lithium salts shall be certified as non-hazardous based on the heavy metal content. Mixing shall be as per manufacturer's recommendation. The amount of lithium admixture used shall be reported as the percent of standard dose.

The exact dosage rates of any of the above referenced products shall be determined by the Design-Builders testing in accordance with the table below, unless otherwise noted. All mixture design testing shall be performed by a laboratory approved by the Department’s Project Manager. Test results of the proposed concrete mixture components shall be provided by the Design-Builder to the Department’s Project Manager for review and written comment at least 60 Calendar Days prior to the incorporation of

the mixture on the project.

Tests and Criteria for Proposed Concrete Components		
Procedure	Description	Limit
ASTM C1260 (modified ^{1,2})	Mortar Bar Expansion	≤ 0.08% at 28 days
ASTM C1293 (modified ²)	Concrete Prism Expansion	≤ 0.04% at 2 years

¹Low alkali cement cannot be evaluated by either of these test methods. If low alkali cement is used with aggregate shown to be potentially reactive as the only measure to minimize the ASR potential of the concrete, then the total alkali loading of the concrete mix design from the Portland cement and other cementitious materials shall not exceed 2.5 lb/yd³.

²The modifications to C1260 and C1293 necessary to meet this table are described in the FHWA publication 'Guidelines for the Use of Lithium to Mitigate or Prevent Alkali-Silica Reaction', publication number FHWA-RD-03-047, July 2003, pages 60-62. An Excel spreadsheet is available from the Department's Project Manager to calculate material amounts for the C1260 modifications. Amounts of components used in modified C1260 tests submitted by the Design-Builder shall match those in this spreadsheet.

3.1.3 Mix Design Documentation

The Design-Builder shall submit to the Department for review and written comment mix design documentation for each Class and Type of concrete proposed for use in the Work. Each mix design submittal shall include certified test data documenting results for air, slump, yield, unit weight, f'_{cr} , and the AASHTO T-277 modified permeability. Submittals shall be made a minimum of 21 Calendar Days prior to the scheduled concrete placement.

The certified test data shall also include:

- A) Weight, source and type of fine aggregate [lb](SSD)
- B) Weight, source, type and size of each coarse aggregate [lb](SSD)
- C) Weight, source and type of Cement [lb] *
- D) Weight, source and class of Fly ash [lb]
- E) Weight, source and grade of Ground Granulated Blast Furnace Slag [lb]
- F) Weight and source of Micro Silica [lb]
- G) Weight of water [lb]
- H) Admixtures including:
 - a) Type
 - b) Brand name
 - c) Dosage during test
- I) Concrete temperature
- J) Water / Cementitious materials ratio
- K) Tested Slump

- L) Tested air content
- M) Unit weight
- N) Yield
- O) Tested f'_{cr} @ 28 days and at other ages as required by the Design-Builder approved plans
- P) Tested design permeability in coulombs @ 28 days

*If blended cement is used, the mix design shall note the components of the blended cement and the proportions of those components along with the proportionate weights.

The submittal shall also include specific gravity for the aggregates, cements, and pozzolanic materials and percent absorption of the aggregates.

The Design-Builder may choose to run trial batches of concrete mixes meeting these specifications to assure workability. If the workability of the trial batch is not acceptable to the Design-Builder, the Design-Builder may modify the mix design or batching sequence and retest. Modifications to aggregate weights, excluding adjustments for specific gravity or absorption changes, by more than 3% or a change in aggregate source will constitute a change to the mix design. Submittal of new certified test data to the Department will be required prior to use of the modified mix.

3.1.4 Quality Control Testing Requirements

The Design-Builder shall be responsible for performing in process quality control sampling and testing of the concrete in accordance with Part 2, DB Section 106 – Control of Materials.

3.1.5 Concrete Production

All concrete shall be produced in accordance with the requirements of Section 812 of the DelDOT Standard Specifications.

3.1.6 Concrete Placement and Curing

The Design-Builder shall be responsible for ensuring the placement and curing of all structural concrete is performed in accordance with the Contract requirements and generally accepted industry standards. Within 24 hours of completing each concrete pour, the Design-Builder shall submit to the Department's Project Manager a report including all concrete test results and documentation associated with the concrete pour. The report must be reviewed and approved by the Design-Builder's Construction QC Manager prior to submission to the Department. Any potential problems identified or concerns raised during or after the concrete pour and planned remedial measures shall be documented in each report.

4.0 CAST-IN-PLACE AND PRECAST CONCRETE

The work specified in this Section shall consist of manufacturing structural cast-in-place (CIP) or precast concrete elements and their incorporation into the completed structure.

4.1.1 Definition of Terms

The following terms apply to cast-in-place segmental bridge construction:

- A) Segment: Refers to a modular section of the superstructure and/or substructure consisting of a certain cross section shape and length as detailed on the Design-Builder approved plans.

- B) Segment Joint: a full width and depth joint between consecutive concrete placements of an individual element shape.
- C) Construction Joint: A joint within an individual section or element, created by consecutive concrete placements.
- D) Cantilever (Erection): A method whereby superstructure segments are sequentially constructed in cantilever to a point where a closure joint is cast-in-place between cantilever segments or ends or end segments.
- E) Balanced Cantilever (Erection): A method whereby the segments are sequentially erected alternately on either side of the pier in cantilever to a point where a closure is cast in place.
- F) Span-by-Span (Erection): A method whereby segments for one complete span are constructed while temporarily supported.
- G) Unidirectional Cantilever (Erection): A method whereby the segments are sequentially erected in one direction by connecting to the previously erected segment in one direction.
- H) Camber: The amount by which the concrete profile at the time of casting must differ from the theoretical geometric profile grade in order to compensate for all structural dead load, post-tensioning, all long-term and time dependent deformations (creep and shrinkage) including all the intermediate erection stages and effects. (The opposite of deflections.) For cast in place construction, these values must include short and long term deflections of the foundations, substructure elements, bearings, formwork, falsework supports and the other superstructure elements.
- I) Match Cast: Refers to a precast concrete fabrication process whereby a segment is cast against the preceding segment producing a matching interface that will permit the reestablishment of the cast geometry at the time of erection. Match casting may be accomplished by either the short line or long line casting method.
- J) Short Line Casting: A method of casting segments one at a time in a casting cell between a bulkhead at one end and a previously cast segment at the other. The first segment is cast between the bulkhead and another temporary bulkhead.
- K) Long Line Casting: A method of casting segments on a casting bed of sufficient length to permit the cumulative casting of segments for the entire length of a span or cantilever between field closure pours without repositioning the segments on the casting bed. With this method, the first segment is cast between bulkheads and successive segments are cast between a movable bulkhead on one end and the previously cast segment on the other.
- L) Casting Cell: Refers to a special formwork arrangement usually consisting of a fixed vertical bulkhead of the cross section shape at one end and adjustable soffit, side and core forms all designed and assembled into a machine for making a single superstructure segment.
- M) Wet Joint System: is a method whereby segments are made in a casting cell between two bulkheads and are not match cast. Subsequently, segments are erected in the superstructure with a narrow cast in place joint between each segment. (During erection, all the segments of a span or multiple spans are supported by falsework, truss or other technique until the joints have reached sufficient strength and the longitudinal post tensioning installed to make them self supporting.)

- N) Casting Curve: Is the curve of casting geometry that has to be followed in the casting cell, bed, or form in order to achieve the theoretical bridge profile and alignment after all the final structural and time dependent (creep and shrinkage) deformations have taken place. The casting curve is a combination of the theoretical bridge geometrical profile grade, alignment, and the camber.
- O) Erection Elevation: The elevation to which a segment or element in the structure is to be set or cast to at the time it is erected or self-supported. (This is not necessarily the profile grade but rather the profile grade corrected by the amount of deflection calculated to occur from that stage onwards.)

4.1.2 Shop / Working Drawing Requirements

Shop drawings shall be in conformance with AASHTO LRFD Bridge Design Specifications and Sections 105.04, 105.05, 105.06 of the DelDOT Standard Specifications, as applicable. The Design-Builder shall submit detailed Shop/Working Drawings that include all details necessary for the successful completion and inspection of all precast and cast-in-place concrete work. Shop/Working Drawings shall clearly identify the methods to be used and identify all items to be cast or formed into each concrete pour. The Design-Builder's detailed Shop/Working Drawings shall include, but not necessarily limited to, the following:

- A) Shop drawings shall be prepared, reviewed, and submitted to the Department in accordance with Part 2, DB Section 111 of the Contract Documents.
- B) Complete details of the proposed segment or element fabrication system, including casting forms, their foundations, operational details, casting layout and geometry control observation and measuring system. The shop drawings shall dimensionally locate all segment joints and construction joint locations.
- C) Complete details for the post-tensioning ducts, anchorage hardware, any additional anchorage reinforcing, inserts or other items to be embedded in the segment or element. A complete geometric layout for each post-tensioning tendon shall also be submitted. This shall include inserts or embedments for temporary items such as climbing forms.
- D) For the casting of Precast Superstructure segments, the Design-Builder must develop a geometry control program and an operating manual for the program for use by the Design-Builder for the duration of the precasting of the superstructure segments. This program must be provided to the Department for verification prior to casting any precast elements.
- E) Theoretical casting curve geometry, in the form of a table of coordinates defining the surface of the superstructure in a phase by phase format compatible with the data input for the Design-Builder's geometry control program will be provided to the Department. Adjustments for camber will be included in these coordinates according to the construction sequence, loads, methods and schedule provided by the Design-Builder. The Design-Builder shall supply to the Department all detailed information requested by the Department including but not limited to the following:
 - 1) Proposed Schedule - including but not limited to all casting dates, erection dates, stressing dates for permanent tendons and temporary stay and load movement (equipment, etc.) dates.
 - 2) All Erection Equipment imposed loads - including but not limited to form travelers, delivery equipment, equipment storage, material storage, cranes,

scaffolding, access platforms, etc.

- 3) Location of all imposed loads - detailed sketches showing all tie down details and locations, loads prior to casting, and after casting.
 - 4) Complete details of forming segments and elements. These details shall include, for each type of segment or element, the method and sequence of concrete placement.
- F) A manual for the geometry control of any segment or element prepared by the Design-Builder, in accordance with the information provided in the Design-Builder Approved Plans and Documents, and as required by this performance specification. This manual shall include a detailed step-by-step casting sequence including all intermediate procedures relating to; any traveler equipment, falsework, stripping of forms, movement of equipment, counterweights, support jacking, stressing of temporary post-tensioning bars, main post-tensioning tendon sequences, stressing forces and elongations, control point erection elevations (and station positions), the field survey and alignment control methods to be employed for setting the initial and subsequent segments, and any other relevant operations.

The detailed step by step procedure for erection of segments shall include the sequence in which these items are to be erected along with a table of theoretical elevations and alignment of the geometry control points as established during casting of each segment and computed at each stage of erection. Stages for which theoretical positions of control points are to be computed shall include the segment in place prior to applying post tensioning and the segment with post tensioning applied.

The theoretical position shall be computed taking into consideration the following, as applicable:

- 1) Effect of formwork/falsework deformations.
- 2) Effects of construction loads, dead load and live loads (including torsion).
- 3) Effects of post-tensioning.
- 4) Effects of creep and shrinkage.
- 5) Effect of the final profile of the roadway as shown in the Design-Builder approved plans.
- 6) Expected foundation settlements.

The procedure shall also include a method for measuring and recording the elevations, positions, and alignment of all control points at each stage of erection.

New casting or erection procedures shall be submitted by the Design-Builder any time it proposes to deviate from the sequence or schedule of operations contained in the casting or erection manual. The proposed deviation(s) shall be approved by the Design-Builder's Design QC Manager and submitted to the Department's Project Manager for review and comment at least 5 Working Days prior to implementing the change.

- G) For precast segments, complete details of handling, storing and transporting of the segments. These details shall include, for each type of segment, the method of lifting (location of any inserts, configuration of lifting devices, etc.) and the method of

supporting segments during storage and transportation, the planned route for transporting the segments and the axle loads for the segment hauler. The details shall be accompanied by calculations prepared under the direction of, and signed and sealed by, a Professional Engineer registered in Delaware demonstrating that the forces imposed on a segment during lifting, storage and transportation will not adversely affect the structural integrity of the segment.

- H) Complete details related to post-tensioning stressing equipment, stressing methods to be used, the sequence of stressing, and all loads to be imposed on any portion of the permanent structure by the erection equipment.
- I) Calculations prepared under the direction of, and signed and sealed by, a Professional Engineer registered in Delaware, which show that the loads imposed on the permanent structure by the erection equipment proposed by the Design-Builder will not adversely affect the structural integrity of the permanent structure, nor exceed nominal resistances during the construction process. These calculations shall include computations of all loads due to the erection equipment.
- J) *See Part 4, Special Provisions - Cable-Supported Bridge System Requirements* for additional shop drawing and submittal requirements for cable-supported bridge structures.

4.2 CONSTRUCTION METHODS

4.2.1 Casting, Placing, and Curing of Concrete

The Design-Builder shall develop and utilize concrete casting, placement, and curing methods that successfully meet the Contract requirements including, but not limited to, the integrity of the in-place concrete, the durability of the in-place concrete, and achievement of the finished lines and grades within specified tolerances. The Design-Builder's means and methods shall be clearly specified on shop drawings and working drawings, as applicable.

The Design-Builder shall satisfy the following requirements for embedded items:

- A) In the plane of the reinforcing steel parallel to the nearest surface of concrete, bars shall not vary from Design-Builder approved plan placement by more than $\pm 1/2$ " , or $1/12$ of the spacing between bars, whichever is less. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from Design-Builder approved plan placement by more than $\pm 1/4$ ". The top and bottom clear cover of reinforcing steel shall be within minus 0" to $+ 1/4$ " of the clear cover limits dimensioned on the Design-Builder approved plans. The end and edge clear cover of the reinforcing steel shall be within minus 0" to $+ 1/2$ " of the concrete cover dimensioned on the Design-Builder approved plans.

In the event of a conflict between post-tensioning ducts and reinforcing bars, the post-tensioning shall generally have priority and the position of the bars shall be adjusted in a manner approved by the Department. All such conflicts shall be brought to the attention of the Department. The Design-Builder's proposed details for its resolution shall be submitted to the Department for review and written comment.

- B) Embedded ducts for tendons shall be positioned accurately (within $\pm 1/4$ ") with respect to their vertical, linear and transverse position within each segment or element. Positive methods shall be utilized to assure that ducts will not be displaced during concrete placement. These methods and their spacing shall be shown on the shop

drawings. Tendon deviation pipes that act to change the alignment of tendons shall be marked so that proper positioning is assured prior to casting and can be verified after casting. The Design-Builder shall submit to the Department, for review and written comment, the method he proposes to use to align deviation pipes and ducts passing between two independently cast segments or elements.

After installation in the forms, the end of the ducts shall at all times be sealed to prevent entry of water and debris. Following each concrete placement, the Design-Builder will be required to demonstrate that all empty ducts are free of water and are unobstructed and undamaged. Immediately prior to installation of the prestressing steel, the Design-Builder shall again demonstrate, to the satisfaction of the Department, that all ducts are unobstructed and that they are free of water and debris.

The anchoring devices for transverse top slab post-tensioning shall be recessed so that the ends of the prestressing steel and all parts of anchoring devices shall be a minimum of 2" inside the end surface of the segment. Following post-tensioning, the recesses shall be filled and protected in accordance with the details noted on the Design-Builder approved plans.

4.2.2 Tolerances

The following tolerances shall apply to the fabrication of superstructure segments or elements (All tolerances shown are maximum deviation):

Width of Web	1/4 in.
Depth of Bottom Slab	3/16 in.
Depth of Top Slab	3/16 in.
Overall Depth of Segment	3/16 in.
Overall Width of Segment	1/4 in.
Length of Segment	3/8 in.
Diaphragm Dimensions	3/8 in.

The following tolerance shall apply to the fabrication of substructure segments or elements:

Height (Individual Element)	1/4 in.
Width and Breadth	1/4 in.
Wall Thickness	1/4 in.

The following shall apply to the fabrication of all Precast segments:

Ends (deviation from a plane per 20 feet width of depth)	+/- 1/4 inch per 20 feet not to exceed 1/2 inch
Flat Surface (deviation from a plane at any location)	+/- 1/4 inch per foot not to exceed a total of 1/4 inch

Dimensions from segment to segment (or element to element) shall be adjusted so as to compensate for any deviations within a single segment (or element) so that the overall dimensions of each completed component will conform to the dimensions shown on the Design-Builder approved plans.

4.2.3 Finishing Concrete

All surfaces of segments and elements shall receive the ordinary surface finish, as specified in Section 602.17(b) of the Department Standard Specifications, unless otherwise specified on the Design-Builder's approved plans. It is further required that all exposed exterior surfaces of the bridge structure, excluding the bridge deck surface, have a long-lasting, low maintenance uniform coloration in accordance with the Part 3, Appendix A – *Aesthetic Requirements Performance Specification*.

The Design-Builder shall also consider the effects of the selected curing compound on the finished concrete appearance so that the uniform coloration requirement is met. Finished concrete surfaces with streaking and/or staining directly related to curing compounds shall be considered unacceptable by the Department. An applied bridge coating system may be utilized by the Design-Builder to satisfy the uniform coloration requirement.

Minor breakage, spalling, or honeycomb (not more than 1" deep) shall be repaired by a method approved by the Department. Major breakage or honeycomb will be subject to review by the Department. These areas may be repaired by a method approved by the Department if it is determined that the structural or other functions of the segment will not be impaired. For cast-in-place construction, breakage, spalling or honeycomb on any mating surface of an in-place segment otherwise found acceptable shall be repaired prior to casting the next segment.

4.2.4 Finished Roadway Surface

The finished roadway surface elevations shall satisfy the requirements of Part 4, Special Provisions – *Overlay Concrete Surface Rideability*.

4.3 DAMAGED OR DEFECTIVE SEGMENTS OR ELEMENTS

Isolated defects are defined as imperfections or damage, which occur randomly and/or infrequently, as determined by the Department.

Recurring defects are defined as imperfections or damage of the same general type and nature that continue to be found in the same general location of the segments at a frequency unacceptable to the Department.

At a minimum, the first five segments or elements cast and erected will be jointly inspected by the Design-Builder and the Department after removal of the forms. All defects shall be identified and categorized during this inspection. The Design-Builder shall examine the defects and propose to the Department, in writing:

- A) Measures that the Design-Builder proposes to take in order to prevent recurring defects in future segments.
- B) The method of repair of all defects discovered as a result of the required inspection.

If recurring defects continue following implementation of the Design-Builder's preventive measures, or new defects are detected at any time during the construction, the Department will instruct the Design-Builder, in writing, to cease operations resulting in defective segments. The Design-Builder shall examine the defects and propose to the Department, in writing: (1) measures the Design-Builder shall take to prevent recurring defects in future segments; and (2) the method of repairing all defects discovered as a result of the inspection as required herein.

The Department will determine what constitutes damage or defect, whether the damage or defect is isolated or recurring, and will categorize the damage or defects. Three categories of defects are recognized by the Department for this purpose:

- A) **Cosmetic:** Cosmetic defects or damages are those that do not affect the ability of the segment or element to resist construction or service loads or reduce the life expectancy of the structure. This category of defect includes a superficial discontinuity such as cracks, small spalls or honeycombed areas, or any defect that does not extend beyond the centerline of any reinforcing steel, or to any elements of the post-tensioning system. Cosmetic defects of other types and causes may also be designated by the Department.

Repair of cosmetic defects shall be made in such a manner that the aesthetics and the structural integrity of the segments are restored.

- B) **Structural:** This category of defect shall include any defect that will impair the ability of the segment or element to adequately resist construction or service loads or reduce the life expectancy of the structure. Any defect or damage, which extends beyond the centerline of any reinforcing steel or into any element of the post-tensioning system or occurs in the deck portion of the segment, is considered a structural defect. Examples of such defects include cracks, large spalls and honeycombed areas, major segregation or breakage of concrete; however, structural defects of other types and causes may be designated by the Department.

The Design-Builder shall be responsible for construction load analysis, service load analyses, and life expectancy determinations.

Repair of structural defects shall be such that the aesthetics and structural integrity of the segment shall be completely restored to a condition to be expected had the defect or damage not occurred.

- C) **Rejectable:** Rejectable defects are any defect or damage, unacceptable to the Department that will impair the ability of the segment or element to adequately resist service loads or construction loads, or will reduce the life expectancy of the structure and cannot be successfully repaired such that the structural integrity is completely restored.

Any segment or element with a rejectable defect, once deemed unacceptable, shall be removed from the work and replaced at no additional cost to the Department.

Damaged or defective segments may also be rejected by the Department for the following reasons:

- 1) Failure of the Design-Builder to submit for approval proposed repair procedures.
- 2) Failure of the Design-Builder to execute the repair according to the Design-Builder's approved procedure.
- 3) Rejection of the proposed repair procedure or repair by the Department.
- 4) Failure of the Design-Builder to provide the required certification or demonstration that the repair was successful and that the defect no longer exists, as required below.

- 5) Failure of the Design-Builder to eliminate recurring defects.
- 6) Determination by the Department that the work or materials used in the work does not meet other requirements of the Contract Documents and is not acceptable.

Segments or elements with cosmetic defects will be paid for upon completion in accordance with the approved Schedule of Values for the Work. However, such payment is subject to review by the Department, and failure of the Design-Builder to prosecute the required repairs properly and in a timely manner shall be cause for withholding of payments sufficient to protect the Departments interests.

Segments or elements with structural defects will not be paid for until the repair procedure is complete and the segment is certified or demonstrated to be free of structural defect or replaced by the Design-Builder, as required.

4.4 REPAIRS

Cosmetic repairs shall only be made following procedures prepared by the Design-Builder, submitted in writing to and approved by the Department. The Design-Builder's repair procedure shall identify those areas required to be repaired prior to post-tensioning, and those that must be repaired after post-tensioning.

Structural repairs shall be made following procedures prepared by the Design-Builder. The repair procedure shall be signed and sealed by a Professional Engineer licensed in the State of Delaware, shall be submitted in writing to the Department, and shall include the following minimum information:

- A) A detailed description and sketch of the defect.
- B) The magnitude and type of the most critical construction loading condition to which the defective area will be subjected.
- C) Detailed reinforcement requirements, material types, surface treatments, curing methods and general repair procedures proposed. The procedure shall clearly indicate those areas required to be repaired before erection, and those areas to be repaired after erection.
- D) Any specific nondestructive testing method and procedure by which the Design-Builder shall demonstrate to the Department that the defect no longer exists and the segment has been restored to a condition to be expected had the defect or damage not occurred.

In lieu of physical demonstration, on a case-by-case basis, the Department may allow the Design-Builder to substitute a written certification by the Design-Builder that the repair has been performed satisfactorily and that the defect no longer exists. This work shall not be the basis for any request for extension of time or additional compensation.

5.0 PRECAST CONCRETE REQUIREMENTS

Work specified in this Section shall govern the storage, transport and erection of structural precast segments into the completed structure. The final structure shall conform to lines, grades and design dimensions shown on the Design-Builder's approved plans and with the provisions of these Performance Specifications.

5.1 PRECAST SEGMENT HANDLING, STORAGE, AND SHIPMENT

It is the Department's intent with this Contract that the Design-Builder provide precast segments that are cast and placed into the structure with zero defects.

Care shall be exercised in the handling of segments to prevent damage to them. Handling shall only be done using the devices shown on the approved shop drawings for this purpose. Lifting devices incorporated into any segment shall be adequate to distribute the handling and erection stresses so as not to damage the segment.

The Design-Builder shall perform visual inspections of each segment for evidence of damage or defect before, during and after critical operations and as often as necessary to ensure adequate quality control. The Design-Builder shall immediately document all such evidence of damage or defect and bring it to the attention of the Department. The extent and frequency of inspection by the Department for quality assurance is the Department's prerogative. Segments may be inspected at any time during construction as deemed necessary by the Department to monitor compliance with this specification.

Superstructure segments shall be stored level in the deck upright position and shall be firmly supported on a symmetrical three point bearing system under the webs at the locations shown on the shop drawings, unless otherwise noted on the Design-Builder approved plans. The storage area of the segments shall be of suitable stability to prevent differential settlement of the segment supports, resulting in any unstable storage condition during the entire period of storage. Segments shall be stored in sequential order so that the uniform appearance of the segments is readily apparent.

Prior to shipment, each segment shall be inspected for damage. The faces of all match cast joints shall be thoroughly cleaned of laitance, bond breaking compound and any other foreign material by wire brushing or light sandblasting. During transport, firm support of the segment shall be provided and the segments shall be fully secured against shifting. Upon arrival at the erection site, each segment shall again be inspected. If any damage has occurred during shipment, the Design-Builder shall immediately notify the Department. Incorporation or utilization of such damaged segments into the structure shall not proceed without prior authorization from the Department.

5.2 ERECTION

An erection scheme for handling and erecting segments shall be shown in the Design-Builder approved plans. The Design-Builder shall be solely responsible for design, fabrication, assembly and operation of all equipment to be used for safe handling and erecting segments.

Erection of segments shall not begin until the required shop drawings and calculations have been reviewed and approved by the Department. No extra payment will be made to the Design-Builder for any cost incurred in modifying the permanent structure due to temporary loadings induced by the Design-Builder's handling and erection equipment or his erection scheme.

Elevations and alignment of segments shall be carefully measured at each stage of erection with instruments capable of providing the degree of accuracy necessary to assure satisfying erection tolerances. Any deviation from the table of elevations and alignment prepared by the Design-Builder shall be corrected so as to prevent accumulation of deviations using a method submitted by the Design-Builder and approved by the Department.

Precast segments shall not be erected until they have cured for a minimum of 14 days and obtained the minimum specified strength in the Design-Builder approved plans.

Erection of segments will be permitted only when the substrate temperatures of the mating surfaces are in

accordance with the manufacturer's requirements. Upon approval of the Department, an artificial environment may be provided to maintain the substrate temperature within the permissible limits by creating an enclosure heated by circulating warm air or by radiant heaters. Localized heating shall be avoided and the heat shall be provided in a manner that prevents surface temperatures greater than 95°F during the epoxy hardening period. Direct flame heating of concrete will not be permitted. The requirements of Part 4, Special Provisions - *Epoxy for Structural Bridge Applications* shall apply to the epoxy joining of all precast segments.

5.2.1 Cantilever Method Requirements

During erection by the cantilever method, the unbalanced load shall not exceed that shown in the erection drawings scheme included in the design-Builder approved plans. Accurate positioning of the initial cantilever segments adjacent to the pier segment is very important, as it will establish the line and grade for cantilever. Initial segments shall be positioned according to the final longitudinal alignment, grade and cross slope. The horizontal and vertical location of the rivet points on the initial segments shall be within +/- 1/8" of the position required by the approved erection plans and the slopes across these segments shall not exceed 0.003 radians of angular deviation from the theoretical values for horizontal and vertical grades.

The alignment and elevations of the cantilevers shall be checked by the Design-Builder and the Department independently each day segments are to be installed. All measurements made by the Department and the Design-Builder shall agree within 1/16". Any discrepancies between the Department's and the Design-Builder's measurements shall be resolved prior to the continuation of segment installation. Note that a temperature differential between the top slab and the remainder of the box sections will cause the superstructure to deflect, resulting in false elevation readings and leading to erroneous elevation adjustment. Even on overcast days it is possible for a temperature differential to develop within the superstructure. To guard against false readings due to temperature differentials, readings should only be taken when all portions of the box section are stabilized at the same temperature. The Design-Builder is expected to use precautions in devising methods to guard against these possible false readings and corresponding adjustments due to temperature differentials. To prevent false measurements, an ideal time for taking readings is within one hour of sunrise.

If measured elevations deviate from the table of elevations, the Department has the right to suspend further erection of superstructure segments until the cause of the deviation is discovered and a corrective action plan, submitted by the Design-Builder, is approved by the Department. No additional payment or time will be made to the Design-Builder as a result of this suspension for unacceptable erection deviation.

5.2.2 Cantilever Closure Pours

- A) The superstructure segment adjacent to the pier segment shall be aligned vertically, and shall be joined to each other by closure joint devices during the construction of the closure pour or closure segment.
- B) Cast in place concrete shall be placed for the closure segment at the time of the minimum daily differential temperature between the top and bottom slabs of the superstructure. The Design-Builder is responsible for monitoring these temperatures and resulting deflections well in advance of the closure pour so that it is known when the minimum differential temperature occurs. The intent is to have the final cast in place concrete placed within one hour of the anticipated time that the minimum thermal differential occurs. This is usually at night or very early in the morning. The Design-Builder will submit a plan of action for the closure pour for approval a minimum of 21 calendar days in advance of the scheduled pour. This plan shall document the Design-Builder's proposed methods for; aligning the cantilevers, forming

the closure, determining the time of minimum thermal differential, placing the concrete, curing the concrete, and timing of subsequent post tensioning operations.

- C) Concrete for closure segments and closure joints shall comply with the same specifications and criteria as the concrete in the precast segments. The same materials and mix will be used to achieve a uniform appearance. The Design-Builder shall submit a plan for the construction of the closure segments and closure joints, which addresses the methods, materials, and sequencing to be used to construct the closures in conformance with the performance specifications.
- D) Formwork shall be adequately supported to take all loads applied and shall not be removed until the concrete in the joints has reached its required strength.

5.2.3 Span By Span Closure Joints

Concrete for closure joints shall comply with the same specifications and criteria as the concrete in the segments. The same materials and mix will be used to achieve a uniform appearance. The Design-Builder shall submit a plan for the construction of the closure segments and closure joints, which addresses the methods, materials, and sequencing to be used to construct the closures in conformance with the specifications. Concrete shall reach the minimum required strength as shown on the Design-Builder approved plans or in the specifications prior to stressing the longitudinal post tensioning. Formwork shall be adequately supported to take all loads applied and shall not be removed until the concrete in the joints has reached its required strength.

5.2.4 Tolerances

The following tolerances shall apply to erection of superstructure segments:

- A) The maximum differential between the outside faces of adjacent segments in the erected position shall not exceed 3/16".
- B) Transversely, the angular deviation from the theoretical slope difference between two successive segment joints shall not exceed 0.001 Radians.
- C) Longitudinally, the angular deviation from the theoretical slope change between two successive segments shall not exceed 0.003 Radians.
- D) The difference in roadway elevation at the connection of two adjacent segments (measured perpendicular to the deck surface) and across closure joints shall be no greater than 1/8". If the Design-Builder fails to meet the tolerance, the Department can require grinding of the bridge deck to meet the tolerances. All corrective work shall be at the Design-Builder's expense.

Dimensions from segment to segment shall be adjusted so as to compensate for any deviations within a single segment so that the overall dimensions of each completed span and the entire structure will conform to the dimensions shown on the Design-Builder approved plans such that the accumulated maximum error should not exceed 1/1000 of the span length for either vertical profile and/or horizontal alignment. Deviations exceeding the erection tolerances listed above which are discovered during the match casting operation shall be identified by after cast surveys at the casting site before the matched castings are separated. Corrections for these deviations shall be submitted to the Department prior to casting the next match cast segment.

5.2.5 Cumulative Erection Tolerances for Superstructure Segments

Vertically, the angular deviation from the theoretical slope change between successive segments shall not exceed 0.002 radians. The maximum overall deviation from the vertical, measured in any direction, shall

not exceed 0.010" per foot of height. The maximum variation from the Design-Builder approved plan location shall not exceed 1" at the bottom and 2" at the top.

THIS PAGE FOR SEQUENCING PURPOSES ONLY

**ENGINEERING REQUIREMENTS
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

This Performance Specification specifies the requirements for Engineering for the project.

The Work performed under this section shall include, without exception, all Engineering required to complete to the satisfaction of the Department, all aspects and all phases of the project, including both temporary and permanent portions thereof. It shall include all labor, travel costs, equipment, computers, other hardware, software, printing and all miscellaneous materials required to conduct, complete, check, document, present and convey the results from each individual aspect of the engineering effort, both to the Department and to all appropriate members of the Design-Builder's team.

2.0 STANDARDS AND REQUIREMENTS

Engineering Work shall be in accordance with all Delaware Professional Engineering ethics standards, regulations and standards of care. All engineering shall be conducted by and/or under the direct supervision of Professional Engineers registered in the State of Delaware.

Each individual aspect of the Engineering Work shall be conducted, prepared and documented in conformance with the provisions of Part 2 - DB Section 111 – Design Management and Design Quality Control.

Each individual aspect of the Engineering Work shall be conducted in conformance with the Project design criteria and design code(s) and shall result in work product/documents that meet all aspects of the specified design codes, construction codes, special provisions, performance specifications and all other Contract requirements.

Qualifications of each "Responsible Engineer" shall be submitted to the Department for approval. Each element and aspect of the design, including calculations, reports, supplemental studies, record drawings and other design drawings, shall be signed and sealed by one of the Design-Builder's Responsible Engineers registered in the State of Delaware.

These standards and requirements apply to all individuals involved in any design activity whether employed directly by the Design-Builder or by the Design-Builder's Designer, Subcontractor(s) or Subconsultant(s).

3.0 RELEASE OF ENGINEERED WORK FOR CONSTRUCTION

It is expected that individual portions of engineered work will be released by the Design-Builder for construction prior to completion of all design and/or construction Engineering Work. Individual groups of working drawings, engineered work methods, plans, specifications or other documents and information presenting engineered work may be "Released for Construction" to the field crews to begin work, provided all aspects of the work have been prepared, reviewed, checked, independently checked, certified and fully coordinated with all other aspects of the works.

This shall include, but not be limited to, for each item to be Released for Construction: Preliminary Design, Semi-Final Design and Final Design submittals and each of the provisions of Part 2 - DB Section 111-12.5.

Each sheet of each document, regardless of type, size, title or nature, which has been authorized by the Design-Builder as “Released for Construction”, shall include a stamp with the words “Released for Construction” and shall be both initialed and dated individually by the Design Manager, the Design QC Manager and signed and sealed by the Responsible Engineer(s).

No documents shall be in use for actual construction of any temporary or permanent aspect of the work that do not include the “Released for Construction” stamp including all appropriate initials and dates.

4.0 ENGINEERING WORK AND ASSOCIATED ACTIVITIES

Engineering Work and associated activities shall include, but are not limited to, the following:

- A) Verification of Pre-Bid Engineering – Immediately after NTP, the Designer-Builder shall prepare design calculations, including all QA/QC requirements, which check, verify and validate the pre-bid engineering design work, including preliminary material quantities. This work shall be prepared, documented and presented in the first engineering review meetings: Design Mobilization Meeting (*See* Part 2 – DB Section 105-12.2); Preliminary Design Review (*See* Part 2 – DB Section 111-9.1); and Design Workshop (*See* Part 2 – DB Section 111-16).
- B) Preparation of Preliminary, Semi-Final and Final Engineering submittals, including QA/QC requirements, for each component of both the temporary and the permanent portions of the work, including falsework, temporary equipment and temporary facilities (including engineering for removal of temporary items).
- C) Preparation for, attendance and participation (including presentations) by the Design Manager (and Responsible Engineers as appropriate) in the design mobilization meeting, each design review meeting, each pre-construction meeting, each value engineering meeting, site mobilization meeting, each progress meeting, each independent assurance meeting, partnering meetings and each special meeting initiated by either the Design-Builder or the Department’s Project Manager. Attendance by the Designer to any (or all) Construction Review Meetings may also be required by the Department’s Project Manager and without additional compensation to the Design-Builder.

In any meeting, the Designer will be required to present design methodologies, design results and other appropriate information relative to each design related topic(s) discussed at the meeting.

- D) Preparation for, attendance and participation (including presentations) by the Designer may be required in public and/or public involvement meetings.
- E) Preparation and presentation/discussion of Designer responses to Department review comments, questions, etc. in support of the comment resolution process. Such review of comments and response preparation by the Designer may include supplemental calculations, engineering analyses, computer modeling, drawings, additional meetings/travel and presentation preparation/materials.
- F) Preparation of drawings, renderings and computer animations of the design related information.
- G) Geotechnical investigations, analyses, reports, review of existing geotechnical information and all related activities. This shall include but not be limited to, temporary

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- and permanent foundation designs, hydraulic/scour evaluations, cofferdams and the development and use of engineering soil-to-structure interaction parameters.
- H) Wind engineering and all related activities. This shall include review of existing wind related information, preparation of project specific wind studies, conducting project specific wind tunnel testing, design/engineering analyses of wind-to-structure interaction (both during construction and under permanent conditions) and presentation/justification of all such information to the Department and Department's representatives (*See the Wind Engineering Requirements Performance Specification for additional requirements*).
 - I) Security engineering, related engineering analyses and presentation/justification of all such information to the Department and Department's representatives.
 - J) Roadway related engineering, including roadway geometry and all surveying.
 - K) Maintenance of traffic (MOT) plan development, including engineering analyses and presentation/justification of all such information to the Department and Department's representatives.
 - L) Design, plan preparation and specification preparation for electrical systems, maintenance, navigational and safety lighting systems, aesthetic lighting systems, and lightening protection systems.
 - M) Utility system design, plan preparation, specification preparation and coordination with utility companies and/or owners and the Department and/or Department representatives.
 - N) Development and justification of each proposed design exception and/or non-standard feature (as may be identified or classified as such by either the Design-Builder or the Department). Design exceptions will be required to be part of a Value Engineering submittal after selection of the successful Design-Builder.
 - O) Environmental related permits and environmental control plan(s) development.
 - P) Designer participation in dispute resolution meetings as may be requested by either the Design-Builder or the Department.
 - Q) Designer participation in arbitration meetings as may be requested by either the Design-Builder or the Department.
 - R) Design scheduling, progress tracking and reporting.
 - S) Design quality records development and documentation.
 - T) Evaluation of equipment interaction(s) with temporary works and permanent portions of the structure.
 - U) Construction engineering and development of supporting engineering information. This shall include, but not be limited to: structural camber, erection elevations/geometry, rigging design (for lifting, dragging, tie-down, securing, etc.), monitoring as-built conditions (including Designer site visits), as-built geometry, evaluation of stability during construction, geometry control manual and detailed erection manual.
 - V) Engineering analyses, drawings, procedures and other support, relevant to corrective actions and/or repairs to non-conforming element(s).
 - W) Engineering analyses, drawings, procedures and other support, relevant to changed or differing site conditions.
 - X) All required critical path schedule (CPM) development, monitoring, updates and reports

(See the *Project Control System Development Plan* and *CPM Schedule Updates and/or Revised Updates Special Provisions* in Part 4 of the Contract Documents).

- Y) Engineering analysis and/or review of project related test data.
- Z) Load rating and drawings of as-built bridge condition.

5.0 ENGINEERING SOFTWARE



All computer based engineering calculations, checks and studies shall be performed with ~~commercially available and~~ fully documented engineering software. Proprietary software of the Designer (or others) may be used for checking if commercially available software is used for original calculations. The Designer shall be required to validate all computer software (before use of the application is made by the Design-Builder/Designer) and document each validation in accordance with Part 2 - DB Section 113-2.16.

6.0 APPROVAL OF AS-BUILT CONDITIONS

The Design-Builder (including the Design Manager, Construction Manager, and Quality Control Manager) shall be required to provide written acceptance of the as-built conditions after conducting final field reviews, completing Record Drawings (and other such documents) and resolving all Non-Conformance Reports.

The written as-built acceptance by each party shall clearly state that all aspects of the structure were found to comply with all aspects identified in the Contract relative to the design criteria, standards of construction and all project Performance Specifications and Special Provisions. Disclaimers, exceptions, or other such terms, shall not be included or considered acceptable in any written as-built acceptance.

**GEOTECHNICAL REQUIREMENTS
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

The Design-Builder shall conduct geotechnical investigations, analyses, design, construction, and quality control in accordance with all applicable criteria and standards cited herein and in accordance with this *Geotechnical Requirements Performance Specification* and the Contract Documents.

2.0 APPLICABLE STANDARDS AND REFERENCES

The geotechnical investigation, design, construction, and construction monitoring shall be in accordance with this *Geotechnical Requirements Performance Specification* and the relevant requirements of the following standards unless otherwise stated in this Performance Specification. Standards and references specifically cited in the body of this Performance Specification establish requirements that shall have precedence over all others. Should the requirements in any standard conflict with those in another, the more conservative standard presented in Section 2.1 of this specification shall govern. References are guidelines that the Design-Builder may use in addressing the requirements as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification from the Department's Project Manager for any unresolved ambiguities prior to proceeding with design or construction. Items listed as standards or references in this Performance Specification shall be the most recent version available on the Proposal due date.

2.1 STANDARDS

Cited publications refer to the most recent issue, including interim publications, in effect on the Proposal due date, unless otherwise specified.

- A) AASHTO LRFD Bridge Design Specifications, Third Edition, 2004, with Interims;
- B) DelDOT Bridge Design Manual, May 2005.
- C) DelDOT Design-Build Special Provisions (Contract Documents – Part 4);
- D) Supplemental Specifications to the DelDOT Standard Specifications; and
- E) DelDOT Standard Specifications, August 2001.

2.2 REFERENCES

- A) Training Course in Geotechnical and Foundation Engineering: Subsurface Investigations, FHWA-HI-97-021, 1997;
- B) Drilled Shafts: Construction Procedures and Design Methods Manual, FHWA IF-99-025, 1999;
- C) Design and Construction of Driven Pile Foundations, Volumes 1 and 2, FHWA HI-97-013 & -014, 1998;
- D) Training Course in Geotechnical and Foundation Engineering: Earth Retaining Structures – Participants Manual, FHWA-NHI-99-025, 1999;
- E) AASHTO Manual on Subsurface Investigations, 1988;
- F) Standard Classification of Soils for Engineering Purposes (Unified Soil Classification

- System) ASTM D2487-00;
- G) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) ASTM D2488-00;
 - H) Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines, FHWA NHI-00-043, 2001;
 - I) Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, FHWA NHI-00-044, September 2000;
 - J) Geosynthetic Design and Construction guidelines, FHWA HI-95-038, current edition;
 - K) Geotechnical Instrumentation, FHWA HI-98-034, 1998;
 - L) Advanced Technology for Soil Slope Stability, Volume 1: Slope Stability Manual FHWA-SA-94-005, 1994;
 - M) Ground Improvement Methods – Reference Manual, FHWA NHI-04-001, September 2005.
 - N) Geotechnical Engineering Circular No. 6: Shallow Foundations, FHWA-IF-02-054, 2002;
 - O) Soils and Foundations Workshop Manual, FHWA NHI-00-045, 2000;
 - P) DelDOT Construction Manual, January 2004; and
 - Q) Geotechnical Summary Reports included in the Reference Documents to the Scope of Services Package.

Additional geotechnical reference documents may be found in the Federal Highway Administration’s publications library (http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm). When further references to these Standards and References are made within this Performance Specification, the edition and date will not be repeated, but are understood to cite the complete reference included in this Section 2.0.

3.0 REQUIREMENTS

3.1 GEOTECHNICAL PLANNING REPORT

The Design-Builder shall prepare a Geotechnical Planning Report for the Project and submit the Geotechnical Planning Report prior to the Preliminary Design Review for review and written comment from the Department. The Geotechnical Planning Report shall include a method statement describing the general philosophy and anticipated methods of investigation, design, construction, and construction monitoring. The report shall include a discussion of the rationale for selection of the proposed construction methods for all geotechnical and foundation aspects of the Project. The method statement shall indicate how material and design details are chosen to match selected construction and monitoring methods, construction details, soils, and the groundwater environment for the site.

The Design-Builder shall provide a summary of equipment and methods proposed for foundation and earthwork construction and demonstrate how they are consistent with the design approach and assumptions. The details presented shall demonstrate compliance with the *Geotechnical Requirements* Performance Specification and shall demonstrate an understanding of the ground conditions and Project constraints as defined within this Contract. The Geotechnical Planning Report shall be prepared, checked, submitted, and reviewed in accordance with the Preliminary Design Submission requirements

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specified in the Contract Documents - Part 2, DB Section 111.

The Design-Builder shall submit the following technical information with the Geotechnical Planning Report:

- A) Description of geology and various ground types expected to be encountered within the project limits;
- B) A description of the geotechnical information that was collected and/or analyzed in developing the interpretation used to develop the Design-Builder's Proposal and pricing for the Project;
- C) Assessment of the engineering properties of all soil types known to exist within the proposed Project Limits, including the expected average and range of soil strengths and deformation properties;
- D) Recommended design parameters (preliminary) for all soil types;
- E) Anticipated ground behavior and categorization of ground during excavation, filling, and foundation and retaining structure construction;
- F) Support of excavation and groundwater control considerations;
- G) A narrative describing how any interpretation was derived from available geotechnical data;
- H) Consideration for, discussion of, and rationale for protection of existing structures, bodies of water, utilities, and environmentally or historically sensitive areas; and
- I) Any pertinent geotechnical data used as a basis for selection, design, and installation of the proposed foundation elements.

The Geotechnical Planning Report shall define the engineering and design approach that will be followed in order to develop technically and environmentally acceptable and durable foundations, cut and fill slopes, retaining structures, geotechnical aspects of pavements sub-grade drainage, geosynthetics and geotechnical designs for the Project. The Geotechnical Planning Report shall discuss all aspects of the required geotechnical effort, including design and analysis, for the following:

- 1) Proposed subsurface investigations;
- 2) Determination of geotechnical and foundation design parameters;
- 3) Erosion control measures anticipated;
- 4) Embankment and fill settlement and slope stability analysis, if modifications to the approach roadway embankment are proposed;
- 5) Effects of the proposed bridge and retaining wall structures on the approach embankment;
- 6) Retaining wall design and analysis methods already completed or to be performed;
- 7) Planned field testing programs, including pile and drilled shaft integrity and load testing and ground improvement testing;
- 8) Ground improvement or treatment of in-situ soils;
- 9) Selection, design, and analysis of foundation systems;

- 10) Lateral and vertical earth pressures;
- 11) Instrumentation and monitoring programs; and
- 12) Expected serviceability and durability of proposed solutions.

The Geotechnical Planning Report shall be prepared, signed and sealed by a Professional Engineer registered in the State of Delaware meeting the qualification requirements in Special Provision 108C Key Personnel.

3.2 SUBSURFACE INVESTIGATION AND DATA ANALYSIS

3.2.1 General

The Department has performed a systematic subsurface investigation of the Project site. Information generated from previously completed investigations is included in the Reference Documents to the Scope of Services Package.

During the proposal development process, the Department will consider requests from each Proposer to provide up to two (2) additional soil borings within the Project Limits. Each boring will include split spoon soil samples with standard penetration testing taken at five-foot intervals for the first twenty-five feet, and every ten feet, thereafter. Undisturbed soil samples will be taken in each unique cohesive soil deposits, as well. Requests for additional subsurface information must be made to the Department within one (1) week of the pre-proposal meeting and shall include horizontal locations, requested depths, and requested laboratory testing. Typical testing procedures performed by the Department's Materials & Research Section are listed in Section 6.1.3 of the *DelDOT Bridge Design Manual*. The results of any additional pre-proposal subsurface investigation information gathered by the Department will be furnished to all Proposers simultaneously once all field work and lab analysis has been completed.

The Design-Builder shall conduct additional post-award investigations in accordance with the minimum scope specified herein and any additional investigations the Design-Builder deems necessary to establish the geotechnical conditions and to perform all geotechnical and foundation design and analyses. These additional investigations shall be completed prior to, and the findings included with, the Semi-Final Design Review submission.

These additional investigations and testing shall be conducted in accordance with the reference items identified in Section 2.2 and shall include proper coordinates, stations, offsets, and elevations based off of the horizontal and vertical survey control systems established for the Project.

The Design-Builder shall form its own interpretation of the existing geotechnical data and satisfy itself as to the nature of the ground and sub-soil, the form and nature of the site, and nature of the Work that may affect its detailed design, construction method, and tools. The Department neither assumes nor implies any other warranty regarding the data provided, other than that the information was obtained at locations and depths indicated and to the accuracy of the data at the time of testing.

The Design-Builder shall determine the number and location of additional investigations required for the proposed design in accordance with the requirements presented in Table 3.2.1. Existing investigation borings furnished by the Department may be used by the Design-Builder to satisfy the minimum requirements presented in Table 3.2.1. For borings with depths in excess of 50 feet, split spoon soil samples with Standard Penetration Testing (SPT) shall be taken at five-foot intervals for the first twenty-five feet and every ten feet thereafter, as a minimum, with undisturbed soil samples taken in each unique cohesive soil deposits. For borings with total depths less than or equal to 50 feet, SPT split spoon soil

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samples shall be taken at five-foot intervals throughout, as a minimum, with undisturbed soil samples being taken in each unique cohesive soil deposits. Cone Penetration Test (CPT) soundings may be considered as an alternative to the SPT borings where the Design-Builder considers it appropriate provided that a sufficient number of borings are performed at CPT sounding locations to develop reliable correlation between the SPT and CPT results. The Design-Builder shall provide the results of investigations to the Department in a memo as follows:

- A) The logs of all SPT borings, CPT soundings, and the field records of any field investigations; and
- B) Laboratory test results for all soil samples obtained.

The Design-Builder shall classify soils in accordance with *Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System) ASTM D2487-00*, and, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) ASTM D2488-00*.

Except as specified herein, the Department and AASHTO standards shall be followed with respect to planning and performing subsurface exploration programs.

Table 3.2.1 Minimum Requirements for Additional Investigations

Geotechnical Feature	Minimum Investigation Locations
Bridge Foundations	For piers and abutments, representative pre-construction SPT and/or CPT investigations shall be performed within 50 feet (horizontally) of each proposed foundation unit with a minimum of two representative tests being performed at each foundation unit. At a minimum, all investigations shall extend 20 feet below anticipated tip elevations for the portions of the foundation they are to represent. Additional investigations shall be provided at foundations areas showing erratic subsurface conditions. Existing boring information of adequate depth and proximity to the proposed bridge foundations may be considered to meet this criterion.
Geotechnical Feature	Minimum Investigation Locations
Retaining Walls	A minimum of two SPT borings or CPT soundings shall be performed for each retaining wall to be constructed and/or modified by the Design-Builder. For retaining walls more than 100 feet in length, the spacing between SPT or CPT soundings shall be no greater than 100 feet and shall be of adequate depth to properly design for bearing, settlement, and stability.
Roadways	The spacing of SPT borings or CPT soundings along the roadway alignment shall not exceed 200 feet. The spacing and location of the borings shall be selected considering the geologic complexity within the Project area with the objective of defining the vertical and horizontal boundaries of distinct soil units within the Project limits.
Embankments and Cuts	The spacing between borings shall be no greater than 200 feet. At critical locations, provide a minimum of three borings in the transverse direction to define the existing geological conditions for stability analysis. Borings shall be of adequate depth to

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Geotechnical Feature	Minimum Investigation Locations
	properly design for settlement and stability.

Note: Except as specified herein, the Department and AASHTO standards shall be followed with respect to planning and performing subsurface exploration programs.

3.3 FOUNDATION DESIGN

Foundation embedment, layout, and geotechnical design for all permanent Project structures shall conform to the *AASHTO LRFD Bridge Design Specifications*. Maximum horizontal and vertical pile loads, settlement, lateral deformations, downdrag, pile group action and all other foundation design considerations shall be based on the worst case factored load combinations specified by AASHTO. Temporary structures shall meet the requirements set forth in Part 4 – Special Provisions, *Temporary Works*.

Foundations for bridge structures shall be deep foundations consisting of either driven piles or drilled shafts. The Design-Builder shall not use auger cast piles, screw piles, timber piles or existing foundations. Spread footing foundations shall not be used for bridge foundations, but may be considered for support of retaining walls in accordance with Section 3.4 of this Performance Specification. Pile bent structures, if used, shall utilize pre-cast, pre-stressed concrete piles or drilled shafts.

3.3.1 Wave Equation Analyses

For driven pile foundations, the Design-Builder shall perform wave equation analyses during the semi-final design development in order to confirm the feasibility of driving the proposed pile size(s) and type(s) to the anticipated tip elevations. Wave equation analyses shall be performed using a wave equation analysis program (WEAP) in accordance with Section 619.09 of the *DelDOT Standard Specifications*. During the semi-final design development, the WEAP shall be used on a minimum of one representative driven pile per foundation unit. The Design-Builder shall submit the WEAP analyses and results to the Department for review and comment as part of the Semi-Final Design Review submission.

A minimum of 30 Calendar Days prior to the driving of each test pile, the Design-Builder shall prepare and submit to the Department for review and comment test pile WEAP analyses and results in accordance with Section 619.09 of the *DelDOT Standard Specifications*. Each test pile WEAP analysis shall consider the actual driving system to be utilized during the initial driving and restrikes; the actual pile type, size, and diameter; and the anticipated pile tip elevation.

The use of dynamic pile driving formulae will not be an acceptable method for developing driving criteria or performing drivability studies to determine hammer energy requirements.

3.3.2 Deep Foundation Testing and Monitoring

The Design-Builder shall perform field testing and monitoring for all deep foundation types to evaluate nominal resistances, integrity, accuracy of design assumptions, pile driving system performance (if applicable), installation characteristics, and to establish production foundation depths. At a minimum, the foundation testing and monitoring shall include test piles, monitor piles, technique shafts, load test shafts, dynamic testing; static load testing; non-destructive integrity testing; and Quality Control (QC) testing, as applicable. The Design-Builder’s testing and monitoring program shall satisfy the following minimum requirements:

- A) For each pile-supported foundation, a minimum of 5% but no less than two (2) of all the piles to be installed within that foundation unit or pile group shall be driven as test piles and dynamically tested during the entire initial drive and all restrikes. Test piles for each

pile group shall be driven, tested, analyzed and the results used by the Design-Builder to develop driving criteria prior to the driving of monitoring and production piles within the associated pile group. Test piles may serve as production piles if accepted by the Department;

- B) For each pile-supported foundation, a minimum of 5% but no less than two (2) of all the production piles to be installed within that foundation unit or pile group shall be driven as monitoring piles and dynamically tested during the end of initial drive and all restrikes. Monitoring piles are to be used in addition to the test piles and are intended to serve as a Quality Control measure during the Design-Builder's pile driving program. Monitoring piles may serve as production piles if accepted by the Department;
- C) If pile-supported foundations are to be used, a minimum of two (2) static load tests shall be performed on sacrificial test piles with at least one (1) load test being performed on each side of the inlet. Static load tests shall be performed in accordance with the *Quick Pile Load Test* Special Provision;
- D) If drilled shafts are utilized, a minimum of two (2) Technique Shafts shall be installed and integrity tested in accordance with the *Drilled Shafts* Special Provision. A minimum of one (1) Technique Shaft shall be installed and integrity tested on each side of the inlet;
- E) If drilled shafts are utilized, a minimum of two (2) Load Test Shafts shall be installed and tested in accordance with the *Drilled Shafts* Special Provision. A minimum of one (1) Load Test Shaft shall be installed and tested on each side of the inlet; and
- F) Non-destructive Integrity Tests and QC testing shall be performed on all drilled shafts in accordance with this Performance Specification and the *Drilled Shaft* Special Provision.

All foundation monitoring and testing shall be performed by the Design-Builder, using testing personnel or Subconsultants, qualified with a minimum of 5 years experience in performing and interpreting the results of the required foundation testing. Documentation of such experience shall be submitted to the Project Manager for approval at least 30 Calendar Days prior to beginning work.

The Design-Builder shall prepare and submit a detailed description of the proposed Foundation Testing and Monitoring Program. The description shall include specifications and plans presenting the type, purpose, number, location, and procedures for each test and the recording and reporting procedures. Testing and monitoring of deep foundations shall be in accordance with the applicable DelDOT, ASTM, and AASHTO specifications. The Foundation Testing and Monitoring Program shall include a Working Plan and Response Plan as specified in Section 3.9 of this specification. The entire Foundation Testing and Monitoring Program shall be submitted to the Department for review and comment a minimum of 30 Calendar Days prior to the implementation of the program. The Design-Builder shall allow 21 Calendar Days for the Department's review.

3.3.2.2 Driven Piles

For driven piles, a pile driving analyzer (PDA) shall be used to determine if each hammer is delivering the energy required by the design. Dynamic pile testing and static load testing shall be performed in accordance with the *DelDOT Bridge Design Manual* and the *DelDOT Standard Specifications*, except as specified herein. PDA monitoring shall be performed by the Design-Builder on all test piles and monitoring piles.

Each foundation unit may be comprised of multiple pile groups. The Design-Builder shall clearly identify all pile groups and test piles on the Plans. Locations for monitoring piles may be specified by the

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Design-Builder's Geotechnical Engineer during construction. Each pile group shall include the minimum number of test piles and monitoring piles specified in this Performance Specification. In no case, shall the limits of a pile group extend more than 50 feet from one of its representative test piles. Test piles may be considered acceptable for use as production piles, if the PDA test results demonstrate the required nominal resistance shown on the Design-Builder's Plans has been safely achieved without pile damage.

The Design-Builder shall perform dynamic testing during the initial drives and restrikes of all test and monitor piles. The PDA measurements shall be recorded and the data analyzed using the Case Pile Wave Analysis Program (CAPWAP) to determine any time-related gains or losses in soil resistance. The Design-Builder shall apply PDA and CAPWAP results and revise driving criteria only for piles within the related pile group. The Design-Builder shall ensure that all test and monitor piles are re-struck and that such restrikes occur no sooner than 48-hours after initial installation. Additional pile restrikes with dynamic testing may be performed at the Design-Builder's option to quantify longer-term gains (or losses) in soil resistance. Without additional verification of gains in soil resistance with time, PDA measurements and CAPWAP computations at the time of restrike must indicate the nominal resistance requirements for the piles have been met in order for the piles within the group to be considered acceptable.

The Design-Builder shall require that all pile driving monitoring be performed by a Design Professional with at least five (5) years experience using PDA and in performing analyses with the CAPWAP in similar soil conditions. Documentation of such experience shall be submitted to the Project Manager for approval at least 30 Calendar Days prior to beginning work.

The Design-Builder shall ensure the geotechnical engineer evaluates the data obtained through the test pile program to establish driving criteria and pile lengths for production pile installation. The Design-Builder shall provide the Department's Project Manager all information obtained from the test piles driven for each group at least 48 hours prior to the beginning of production pile driving for the group.

The Design-Builder shall provide pile driving records on the standard Pile Driving Record Forms H-47, H-49, and H-51 included in the *DelDOT Construction Manual*. The Design-Builder shall provide all information required for the Department's Pile Driving Records, including the hammer stroke, final pile tip elevations, load achieved and pile lengths used. The Design-Builder shall provide completed Pile Record Forms to the Department within 48 hours of driving the piles. The Design-Builder shall assign separate inspectors to each active pile driving hammer.

The Design-Builder shall conduct static load tests to allow for increased resistance factors as specified in the *AASHTO LRFD Bridge Design Specifications*. Each static load test shall be performed in accordance with ASTM D-1143 and the requirements of the *Quick Pile Load Test Special Provision*. Sacrificial test piles to be used for static load testing shall be located as close as possible to the pile groups they are intended to represent. In such cases, the Design-Builder shall verify that the nominal resistance for the pile meets or exceeds the design values. The Design-Builder shall furnish all Equipment to perform the load test(s), including load frames, reaction piles, structural connections, dial gauges, an independent reference beam for the support of the dial gauges, methods of protection from weather, and any other means and methods specified in the Geotechnical Planning Report. The Design-Builder shall ensure that the load test pile, test pile and monitoring pile installations all be monitored with PDA and that initial drive and re-strikes are analyzed using CAPWAP, in order to allow the static load test results to be correlated with PDA results, CAPWAP results, and blowcounts recorded during pile installation. Load test piles shall not be accepted for use as production piles.

In addition, to the axial compression test requirements specified herein, the Design-Builder shall develop

appropriate testing procedures for demonstrating that adequate uplift and lateral load resistances are provided by the foundation system. Testing procedures shall be submitted to the Department for review and comment at least 30 Calendar Days prior to any uplift and/or lateral load testing being performed. No production pile driving shall be performed until all tests have been reviewed and approved by the Construction QC Manager. Results of the testing shall be furnished to the Department a minimum of 48 hours prior to production pile driving commencing.

3.3.2.3 Drilled Shafts

All drilled shafts shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications and constructed in accordance with Part 4 – Special Provisions, *Drilled Shafts*. The Design-Builder shall provide the minimum testing and monitoring of all drilled shafts and techniques shafts as specified in Section 3.3.2 of this specification.

Minimum integrity testing requirements shall include Crosshole Sonic Logging (CSL) and shall be performed on all drilled shafts. The testing shall be performed in accordance with Part 4 – Special Provisions, *Drilled Shafts*.

Technique Shafts and Load Test Shafts shall be in accordance with Part 4 – Special Provisions, *Drilled Shafts*. Additional Gamma-Gamma testing shall be performed by the Design-Builder on all Technique and Load Test Shafts to investigate the integrity of the cover concrete and the shaft perimeter behavior.

The Design-Builder shall perform each required integrity test with Design Professionals having at least five (5) years of similar experience for the tests they will be performing. Documentation of such experience shall be submitted to the Project Manager for approval at least 30 Calendar Days prior to beginning work.

A report of CSL results shall be furnished to the Department’s Project Manager within 7 days of each test. Reports shall include all anomalies and suspected defects identified by the CSL and any remedial measures and repairs required by the Design-Builder’s Geotechnical Engineer. The Design-Builder shall consider anomalies as any discontinuity in the drilled shaft construction that might affect the durability of the shaft. Defects shall be considered variations or discontinuities that might affect the structural integrity or nominal resistance of the shaft. At a minimum, all anomalies and defects shall be further investigated through alternative non-destructive testing means or through coring as specified in Part 4 – Special Provisions, *Drilled Shafts*.

The Department shall have the right to perform additional integrity testing in accordance with Part 4 – Special Provision, *Drilled Shafts* to confirm the findings included in the CSL reports and/or assumptions made. Should discrepancies be found through the Department’s testing, the Department will issue a Non-Conformance Report (NCR) for each drilled shaft questioned. Final acceptance of the drilled shafts shall be in accordance with the *Drilled Shafts* Special Provision.

3.4 RETAINING WALL DESIGN

The following criteria shall apply to all permanent retaining wall structures proposed by the Design-Builder and shall apply to new structures and/or modifications to existing structures. The Design-Builder shall ensure proper performance and safety of temporary retaining structures in accordance with the *Temporary Works* Special Provision.

3.4.1 Wall Types

All permanent walls shall be conventional cast-in-place concrete or Mechanically Stabilized Earth (MSE) wall systems and shall be consistent with the Indicative Plans included in Part 6 of the Scope of Services

Package. The wall type utilized in the approach roadway retaining walls, including materials and construction methods, shall be maintained for any additional retaining walls and or modifications to the work being performed under Contract #23-073-03. See Reference Documents in Scope of Services Package for specifications used for Contract #23-073-03.

3.4.2 Design Criteria

All permanent retaining structures shall be designed in accordance with the *AASHTO LRFD Bridge Design Specifications* and the *Bridge Design Requirements Performance Specification*. Additional wall design considerations shall include the following:

- A) Internal and External Stability and Settlements of Walls
The Design-Builder shall provide retaining wall designs to address internal and external stability and settlements (i.e., total and differential) of the walls in accordance with the *AASHTO LRFD Bridge Design Specifications*.
- B) MSE Walls (Including Modular Block MSE Walls)
The Design-Builder shall provide MSE Wall designs in accordance with the *AASHTO LRFD Bridge Design Specifications*. Additional reference information pertaining to MSE Wall design considerations may be found in *FHWA's Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines, Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes*, and the *Geosynthetic Design and Construction Guidelines*.

3.4.3 Geometry

The Design-Builder shall provide retaining wall layout to address slope maintenance above and below the wall and provide returns into the retained fill or cut at retaining wall ends, where possible. The Design-Builder shall provide walls that have minimum final tolerances of 0.05-feet in 10-feet for level and plumb. The design shall reserve a minimum of 5-ft of terrain from the ROW line for wall maintenance and inspection. The Design-Builder shall include surface and subsurface drainage provisions in the design and construction of the wall. The Design-Builder shall provide a system to intercept or prevent surface water from entering behind the wall and drainage shall be provided along the retaining wall and into a drain during all stages of construction. The coping and barrier shall be consistent with the Indicative Plans for the Roadway Approach Contract.

3.4.4 Plans and Calculations

The Design-Builder shall provide Plans and design calculations meeting *AASHTO LRFD Bridge Design Specifications*, including a global stability and seismic analysis, as applicable, while taking into consideration drainage, vertical and lateral deformations at and below the ground surface. Plans and calculations shall be signed and sealed by a Professional Engineer registered in the State of Delaware.

3.4.5 Aesthetics

All retaining walls shall be of the same surface finish and appearance as the Directive Plans for the Roadway Approach Contract.

3.5 FILL/EMBANKMENT DESIGN

3.5.1 Excavation and Embankment

Excavations and embankment construction shall be in accordance with the requirements of Section 202 of the *DelDOT Standard Specifications*. Embankment cross sections shall be in accordance with the requirements of the *Roadway Geometrics Performance Specification*.

3.5.2 Slope Stability

The Design-Builder shall design slopes in accordance with *FHWA's Soil Slope and Embankment Designs*. Embankment slopes shall be no steeper than 2:1 (horizontal:vertical). The analyses shall consider the effects of deterioration and loss of soil resistance due to local climatic and construction conditions. All slopes shall be designed to minimize erosion by rainfall and runoff. Adequate drainage and erosion control provisions should be incorporated in the design and construction of the embankments in accordance with Subsection 3.7 of this Special Provision.

Slope stability analyses shall consider circular and wedge type failures for potential occurrence for each embankment configuration and slope. The evaluation of global slope stability shall consider potential seepage forces and any weak deposits and seams that are adversely impacted by water flow. The minimum factors of safety for static load conditions shall be 1.3 for non-critical slopes and 1.5 for critical slopes (at bridge abutments, wingwalls and existing structures) for permanent embankment slopes. The minimum factor of safety for a rapid drawdown condition shall be 1.1. For non-permanent embankment and earthwork slopes, the minimum safety factor shall be 1.3 under static load conditions.

3.5.3 Settlement

The Design-Builder shall conduct an analysis to estimate the soil settlement induced by additional embankment loads, including immediate settlement in granular soils, and both immediate and consolidation settlements in cohesive soils. The Design-Builder shall design embankments in order to limit total long-term settlements to 2 inches during a period of 50 years after completion of the pavement construction for that portion of the Project. Differential settlement within new fill sections, between new and previously placed fill sections, and across fill/Structure interfaces shall be limited to 0.5 inches between sections or supports of a span. Embankment settlement shall be monitored and assessed during the duration of the Contract to verify that the specified settlement criteria will be achieved.

3.6 SOIL IMPROVEMENT

The use of soil improvement to increase soil strength and reduce compressibility in order to increase the safety factors for external and internal stability and reduce settlements to the allowable range specified herein will be allowed in the design. It shall be necessary to demonstrate their suitability of the improvement methods for local conditions and means of installation. Techniques such as vertical drains, surcharge, stone columns, vibro-compaction, lime columns, cement columns, deep-soil mixing, rammed aggregate pier, grouting, and the use of lightweight fill may be included in the design in order to expedite consolidation of the subsoils, where it is required to increase bearing capacity or reduce post-construction settlements.

All soil improvement systems shall be designed using current practice and procedures as specified in *FHWA's Ground Improvement Methods*. The performance of all ground improvement techniques shall be verified with a pre-production field testing program developed to demonstrate that the proposed methods and design will provide the ground improvement level required to satisfy the performance requirements specified herein.

3.7 EROSION CONTROL AND DRAINAGE

Slopes in both cut and fill areas are subject to erosion and deterioration through the action of water, wind and freeze/thaw cycles. Erosion control and drainage measures shall be evaluated, considered and designed for all new and existing slopes within the Project Limits. Erosion of slopes presents a significant maintenance issue and stability problem on slopes. Each cut and fill slope that requires erosion control and drainage measures shall be evaluated for the following:

- A) Reduction of Water Flow across Slope;
- B) Slope Revegetation;

- C) Slope Armor;
- D) Subsurface Water Control.

Erosion and sediment control measures shall be in accordance with the DelDOT's *Standard Construction Details* and *Standard Specifications*.

3.8 MISCELLANEOUS CONSTRUCTION CONSIDERATIONS

The Design-Builder shall design temporary excavation support required for construction, and such design will consider short-term loading due to earth pressures, groundwater pressures, surcharge pressures, and construction equipment loading. Design Builder shall ensure Working Plans for temporary decking, sheeting, and bracing are signed and sealed by a Delaware-licensed Professional Engineer. Special attention is drawn to the as-built information for the adjacent sheet pile wall and approach roadway MSE Walls included in the Scope of Services Package – Reference Documents.

The Design-Builder shall include surcharge pressures due to Structures, point, line and area loads in lateral earth pressure diagrams. Construction Materials and Equipment loads shall be estimated using a minimum 600 pounds/square foot distributed area load.

Design Builder shall indicate special requirements on the Working Plans for the installation and removal of temporary bracing systems that relate to the designs of underpinning and protection walls, such as levels of bracing tiers, the maximum distances of excavation below an installed brace, and the amount of preloading.

See Part 4 – Special Provisions, Temporary Works

3.9 CONSTRUCTION INSTRUMENTATION MONITORING PROGRAM

The Design-Builder shall prepare a geotechnical instrumentation program to monitor vibration, accelerations, vertical settlement, and lateral movement of temporary support structures and adjacent ground, and permanent Structures during and after construction, according to accepted industry standards referenced in Sections 2.1 and 2.2 of this Special Provision. The Design-Builder shall prepare a Working Plan that details the proposed program of instrumentation and monitoring, shall establish threshold values of the monitored parameters, and shall describe the Response Plan that will be implemented when threshold parameters are exceeded. Consideration shall be given to extending instrumentation monitoring for a period after completion of construction when long-term performance issues are a concern. The design and distribution of instrumentation within the Working Plan shall demonstrate an understanding of the need, purpose and application of each proposed type. The Design-Builder shall provide, install and monitor the instrumentation during and after construction and shall interpret the data. The Working Plan and Response Plan shall be part of the Foundation Testing and Monitoring Program as specified in Section 3.3.2 of this Specification. The Design-Builder shall provide weekly Construction Instrumentation Monitoring Reports to the Department's Project Manager. The Design-Builder shall take corrective action in accordance with the Response Plan where the instrumentation data indicate adverse conditions.

3.10 SUBMITTALS

- Geotechnical Planning Report (*See* Section 3.1) to the Department's Project Manager for Consultation and Written Comment;
- Revised Geotechnical Planning Report to the Department's Project Manager, as required for conformity with the Contract Documents;

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- Provide initial drivability analysis (WEAP) to the Department as part of the Semi-Final Design Review (*See* Section 3.3.1);
- Foundation Testing and Monitoring Program (*See* Section 3.3.2) to the Department's Project Manager for Consultation and Written Comment;
- Qualifying Experience of testing personnel (*See* 3.3.2.1) to the Department's Project Manager for approval prior to foundation work beginning;
- Provide drivability analysis (WEAP) to the Department's Project Manager for Consultation and Written Comment at least 30 Calendar Days prior to driving each test pile (*See* Section 3.3.1);
- Qualifying Experience of pile driving monitoring personnel (*See* 3.3.2.2) to the Department's Project Manager prior to the foundation work beginning;
- Test Pile Results, including load tests, to the Department's Project Manager review and comment prior to the start of production pile driving (*See* Section 3.3.2.2);
- Provide Pile Driving Record Forms (*See* Section 3.3.2.2) upon completion of pile installation;
- Provide CSL Reports to the Department's Project Manager (*See* Section 3.3.2.3); and
- Provide Construction Instrumentation and Monitoring Reports to the Department's Project Manager on a weekly basis (*See* Section 3.9).

INSPECTION, MAINTENANCE AND CONSTRUCTION REQUIREMENTS

PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

The Design-Builder shall design and construct the Project so as to meet ease of inspection and maintenance goals for the Project in accordance with all applicable Criteria and Standards cited herein and in accordance with this specification.

2.0 APPLICABLE STANDARDS AND REFERENCES

2.1 STANDARDS

- A) International Testing Association (NETA), Maintenance Testing Specifications.
- B) National Electric Code (NEC), NFPA-70.
- C) Standard for the Installation of Lightning Protection Systems, NFPA-780.
- D) Illuminating Engineering Society of North America, IES-RP-8-00.
- E) American Society of Mechanical Engineers (ASME), A17.1 Safety Code for Elevators and Escalators.
- F) ASME, A17.2 Guide for Inspection of Elevators.
- G) ASME, A17.3 Safety Code for Existing Elevators and Escalators.
- H) DelDOT Bridge Design Manual, May 2005.
- I) FHWA Bridge Inspector's Reference Manual, October 2002.
- J) AASHTO Manual for Condition Evaluation of Bridges 2nd Edition (2000).
- K) AASHTO Revisions to the Manual for Condition Evaluation of Bridges, 2nd Edition (2003).
- L) AASHTO Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges (2003).
- M) Occupational Safety and Health Association (OSHA) Standards, Part 1910.
- N) United States Coast Guard (USCG) 33 CFR 118.
- O) Post-Tensioning Manual, Sixth Edition, Post-Tensioning Institute (PTI)
- P) DelDOT Standard Specifications, August 2001.

2.2 REFERENCES

- A) DelDOT Bridge Inspection and Maintenance Procedures.
- B) Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges, FHWA-PD-96-001, December 1995.
- C) Pontis Bridge Management System (BMS), Release 4, AASHTO/FHWA.
- D) DelDOT Standard Specifications, dated August 2001.

3.0 REQUIREMENTS

The Design-Builder is to design and build permanent structures in accordance with the requirements outlined in Performance Specifications for Structures. Structures so designed are expected to perform for periods as follows:

Bridge Structure	100 years
Stay Cables	75 years
Stay Cable Vibration Suppression System	25 years
Multi-Rotational Bearings	20 years
Elastomeric Bearings	30 years
Expansion Joints (Excluding Finger Joints)	10 years
Finger Joints	30 years
Coating Systems	20 years

During the above service life of the structures, inspection and maintenance activities will need to be performed. The Design-Builder is required to take the activities into consideration during the design and construction.

3.1 INSPECTION AND MAINTENANCE MANUAL

3.1.1 Inspection Requirements

The Design-Builder shall perform a detailed “inventory” inspection upon Final Acceptance of the Work. This detailed inspection shall be in accordance with NBI, Pontis, and Department guidelines. Any special or unique NBI and Pontis ratings or requirements shall be defined by the Design-Builder for use by the Department on future bridge inspections and shall be discussed in the Maintenance Manual.

3.1.2 Maintenance Manual

The Design-Builder shall develop a project specific Inspection and Maintenance Manual (Manual) for the Project. The Manual shall provide guidelines and suggested procedures for inspecting and maintaining the bridge structure and shall identify any new Pontis elements to be created in the Department’s database. At a minimum, the Manual shall cover the following:

- A) Chapter 1: Introduction:
 - 1) Purpose of the Manual; and
 - 2) Description of Bridge.
- B) Chapter 2: Bridge Design Considerations:
 - 1) Overall Concept of Design; and
 - 2) Descriptions of Design Loadings.
- C) Chapter 3: Structural Role of Major Bridge Elements:
 - 1) Substructure Elements;
 - 2) Superstructure Elements; and
 - 3) Identification of Critical Inspection and Maintenance Elements.
- D) Chapter 4: Construction:

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- 1) General;
 - 2) Unique Construction Techniques (Superstructure and Substructure)
 - 3) Design Modifications During Construction
 - 4) Repairs Made During Construction
 - 5) Permanent Record of Stay Cable Installation, if applicable
- E) Chapter 5: Inspection Personnel and Equipment
- 1) Inspection Personnel
 - 2) Inspection Access
 - 3) Special Inspection Equipment
- F) Chapter 6: Inspection Program and Schedule
- 1) Inspection Program
 - 2) Inspection Schedule
- G) Chapter 7: Inspection Procedures
- 1) General
 - 2) Deficiencies (Common, Superstructure, Substructure)
 - 3) Other Considerations
 - 4) Detailed Inspection Procedures for all Components and Materials
 - 5) Checklist – Forms to Record Observations
 - 6) Survey of Bridge
 - 7) Waterway
 - 8) Post-Event Inspection (e.g. Hurricanes, Storm Surges, Floods, Earthquakes, etc.)
- H) Chapter 8: Maintenance and Repair Procedures
- 1) General
 - 2) Deficiencies in Concrete
 - 3) Corrosion and Deterioration Prevention
 - 4) Concrete Box Girder
 - 5) Bearings
 - 6) Expansion Joint Assemblies
 - 7) Post-Tensioning Systems
 - 8) Stay Cable System
 - 9) Stay Cable Vibration Suppression System
 - 10) Mechanical / Electrical System (Including access elevators)
 - 11) Lightning Protection System
 - 12) Bridge Lighting System Checks and Procedures

- 13) Vermin Protection/Deterrent System
- 14) Differential Settlements
- 15) Deck Rehabilitation Procedures
- 16) Bearing Replacement Procedures/Details
- 17) Stay Cable Replacement Procedures/Details
- 18) Expansion Joint Replacement Procedure/Details
- 19) Stay Cable Vibration Suppression System - Dampers Replacement Procedure/Details
- 20) Innovative Material Replacement Procedures/Details

3.2 LOAD RATING ANALYSIS AND SPECIALIZED TRAINING

The Design-Builder shall provide load rating analysis of the bridge in accordance with *AASHTO Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges* for the as-built condition. The results of the analysis including all back-up calculations shall be included as an appendix in the Manual. The Design-Builder shall be required to provide a specialized training seminar to select Department staff on the load rating analysis of the bridge. The Design-Builder shall provide a minimum of 2 seminars of 8 hours for 25 attendees for the load rating analysis.

3.3 CORROSION PROTECTION PLAN

The Design-Builder shall provide to the Department, for review and approval, a detailed Corrosion Control Plan including material selection modeling process and estimates of life-cycle costs, to assure the stated service lives for any structural steel components of the bridge. Cathodic protection is not required. Any permanent steel bridge components directly affecting the structural integrity and load carrying capability of the bridge shall not be exposed to atmospheric conditions.

For post-tensioned bridges, the Corrosion Protection Plan shall include specific detailed provisions for post-tensioning tendon corrosion protection. The plan shall specify corrosion allowances and outline detailed provisions with regards to reinforcing steel and structural steel protection. In regards to concrete performance, the plan shall assess the effects on concrete permeability, corrosion thresholds, corrosion rate, impacts on cracked concrete, time-to-repair and provide recommendations on the use of calcium nitrate, silica fume, sealers, membranes, reinforcing coatings, increased cover, corrosion inhibitors, etc.

3.4 SECURITY

Access to the bridge shall be limited to authorized personnel only. The bridge shall be detailed to deny access to voided areas/components of the bridge, such as box girders and voided towers, ladders, platforms, walkways, and/or travelers. Access shall be detailed as required within this Performance Specification.

See the Bridge Security Program Performance Specification in this Part 3 for additional requirements.

4.0 BRIDGE STRUCTURE

This section includes requirements applicable to cable-stayed bridge types. Similar provisions shall be made by the Design-Builder for other structure types.

4.1 TOWERS

4.1.1 Inspection and Maintenance Access

All superstructure and substructure components of the bridge structure shall be accessible by way of normal and customary inspection and maintenance access equipment. Design-Builder shall provide suitable access into any enclosed areas for inspection.



4.1.1.1 Voided Towers



For voided towers, inspection and maintenance access for the full height of each tower leg, including access to the exterior top of each tower leg shall be provided. Permanently mounted interior access ladders and platforms shall be provided from the bottom to the top of each voided tower leg. A supplemental elevator system, equipped with emergency egress capability and access to the ladder system, shall also be provided and shall be capable of transporting a minimum of two (2) workers and associated equipment with a total combined live load of at least 1500 pounds. The access limits for the elevator system shall extend from the bottom of each voided tower leg to the top of each tower leg or within 25 feet of any cable anchorage zones. Where elevator access is not provided, the Design-Builder shall provide an automated lift system capable of lifting at least 1000 pounds of equipment and/or materials at one time.

Access doors for voided tower access shall be readily accessible by maintenance personnel, vehicles and equipment. The access doors shall be hinged vertically to open horizontally and shall be provided with locks to prevent unauthorized entry. An inspection/maintenance platform or landing shall be provided at critical points, such as cable anchorages, and at each access door. Access doors shall be made with minimum ½ inch thick aluminum alloy, a minimum of 3ft. - 0in. in width by 4ft. - 0in. in height.



4.1.1.2 Solid Towers

In order to enhance bridge aesthetics and minimize potential corrosion issues, the use of external platforms and ladders shall not be permitted unless specifically required by this Specification. Accordingly, the use of solid towers shall not be permitted.



4.1.1.3 Safety Railing and Anchor System

A safety railing system shall be provided at the top of each tower leg. Additionally, an anchor system will be provided at the top of each tower leg to provide attachment of maintenance and inspection platforms that will support a minimum load of 1500 lbs. The safety railing system and anchor system components shall be steel painted in accordance with Section 826 of the DeIDOT Standard Specifications, or other corrosion resistant material.

4.1.2 Critical Maintenance and Inspection Components

The following items are representative items that have been identified which require special design and/or detailing in the interest of inspections and maintenance. This is not an all inclusive listing and may not be completely applicable to the proposed bridge structure type. The Design-Builder shall be responsible for identifying and discussing all critical components in the Inspection and Maintenance Manual for the actual bridge type utilized.



4.1.2.1 Tower/Stay Cable Anchorage Connection

The anchorage connection/assembly must be fully protected internally within the tower and accessible for inspection. The connection assembly shall be detailed to shed water and sealed to prevent water and moisture intrusion.

4.1.2.2 Composite Steel Member Stay Cable Attachment

Composite steel member to stay cable attachments shall be detailed to shed water and sealed to prevent water and moisture intrusion to the steel/concrete interface.

4.1.2.3 Elevator System (Electrical/Mechanical)

All elevator machinery, cables, and electrical components shall be readily accessible with work platforms, hatches, and ladders necessary to perform routine inspections and maintenance. The elevator shall be provided with emergency lighting. All electrical components shall be UL-listed for the application, and comply with *NEC* workspace clearances. Cables and raceways shall comply with *NEC* requirements for the application. The installation shall include all structures, clamps, bolts, hangers, drive mechanisms, control devices and safety devices as required for the operation of the elevators and shall be in compliance with *ASME A17.1, A17.2, and A17.3* and all local codes and ordinances. Megger test all cables before putting them into service. Test results shall become part of the Inspection and Maintenance Manual for reference.



During construction through Final Acceptance, the elevators shall be inspected and maintained by qualified service personnel. Maintenance shall be performed per the manufacturer's recommendations and inspections shall be at durations as required by the permitting authority. These same requirements shall be outlined in the Inspection and Maintenance Manual.

4.1.3 Moisture Control and Interior Drainage System

4.1.3.1 Ventilation

The design and detailing of voided towers shall promote natural ventilation to aid in preventing in the accumulation of moisture within the towers and stagnant air. Openings to promote ventilation shall be provided with appropriate screening to prevent entry of birds, pests, or other vermin.

4.1.3.2 Access Doors

All horizontal access doors shall be provided with appropriate seals to prevent moisture from entering the towers.

4.1.3.3 Drainage Details

Floors of voided towers shall be contoured and weep holes provided to promote the drainage of water and prevent moisture accumulation. Any holes shall be screened to prevent the entry of birds, pests, or other vermin.

4.1.3.4 Attachments

Any attachments to towers shall be waterproofed.



4.1.4 Painting and Coating of Steel Elements

As a minimum means of protection, all interior steel elements and steel surfaces of voided towers shall be painted in accordance with Section 820 of the *DelDOT Standard Specifications*. The top coat shall consist of a light color that is easily visible within the tower.

4.2 STAY CABLES

4.2.1 Permanent Record of Stay Cable Installation

Permanent records shall be established for each cable installation. Such records shall include survey records, date, time and ambient temperature; cable forces; cable elongation measurements; shim pack or lock nut settings; and all other special notations necessary and sufficient to establish the conditions under which the cable was installed.

4.2.2 Stay Cable Vibration Suppression System

All connections and openings for the stay cable vibration suppression system shall be sealed to prevent water and moisture intrusion. The system shall be detailed to allow for easy inspection and replacement.

4.2.3 Stay Cable Vibration Testing and Structural Damping Evaluation

The Design-Builder shall provide a full vibration testing and structural damping evaluation of the Stay Cable system at the completion of construction.

4.2.4 Duct Coupler and Connection System

The duct coupler and connection system shall be designed and detailed to ensure a minimum of two nested qualified (per Post-Tensioning Institute) barriers are provided to prevent corrosion of the main tensile element and provide for the stated service life of the stay cable. Duct couplers and splices shall be minimized.

4.3 SUPERSTRUCTURE

4.3.1 Inspection and Maintenance Access

The Design-Builder shall demonstrate the full underside and all fascia areas of the superstructure is fully accessible with a readily available under bridge inspection vehicle (UBIV). For areas not accessible from a UBIV, the Design-Builder shall provide the necessary platforms, walkways, travelers and/or other means of ensuring full access is possible for inspection and maintenance in the future. Suitable means shall be provided to access bearings, expansion joints, navigation lights and other components.

Regardless of the complete inspection and maintenance means provided by the Design-Builder for the bridge type, the combined use walkway shall be fully traverse-able by the UBIV. The design live loads for the bridge shall be in accordance with the *Bridge Design Requirements* Performance Specification and shall include provisions for UBIV loadings in accordance with the *Bridge Design Requirements* Performance Specification.

4.3.1.1 Inspection and Maintenance Platform/Traveler

The Design-Builder shall design, furnish, and install maintenance and inspection self-propelled travelers, where UBIV access is not possible, to provide for future inspection and maintenance access to the full underside of the superstructure of the bridge. The inspection and maintenance self-propelled travelers shall be designed in detail to provide easy connection and implementation when needed. The travelers shall provide “hands on” accessibility to all areas of the underside not accessible from a UBIV or permanent platforms, ladders, and walkways. The travelers shall be able to accommodate up to three (3) workers and associated equipment. The total minimum load requirement, including three workers and associated equipment is 1500 lbs. The travelers shall provide full access between abutments.

If used, the work shall include designing and fabricating structural, mechanical, hydraulic and electrical components, assembling of components, erecting the assembled platforms and or travelers and testing.

Travelers shall not be used for construction of the bridge. The travelers shall ride on an independent rail system and shall not ride directly on bridge girders. The primary structural components of the traveler and the support rails shall consist of stainless steel or other corrosion resistant materials. Galvanized steel and painted steel will not be permitted for primary traveler components. Secondary components must be readily replaceable from the traveler and shall not compromise or reduce the load carrying capacity of the traveler. Secondary components might include decking and protective railings. Materials and coatings for secondary components shall be appropriate for use in a marine environment.

The Design-Builder shall provide operations and maintenance information on the system within the Inspection and Maintenance Manual.

4.3.1.2 Underdeck Inspection Access

Any permanent underdeck inspection access systems shall be located outside the clearance envelope specified in the Part 6 Directive Plans.

4.3.1.3 Interior Access Considerations

The interior of all box girder sections, regardless of construction material or methods, shall provide a minimum vertical clearance of 6'-0". Access openings for box sections shall be a minimum of 3'-0" horizontally by 4'-0" high. Access doors should be located at or near each foundation unit. Entrances to all box girders shall be made with in-swinging, hinged, solid doors. Doors in diaphragms shall be in-swinging, hinged, 0.25-inch mesh screen doors. Equip all doors at abutments and entrances with a lock and hasp. All locks on the bridge shall be keyed alike.

Provide an access opening through all interior diaphragms of any box sections. If the bottom of the diaphragm access opening is not flush with the bottom flange, provide ramps to facilitate equipment movement. Indicate on plans that diaphragm access openings are to remain clear and are not to be used for utilities or other attachments.

If utilities are required, provide additional areas or openings. Analyze access opening sizes and bottom flange locations for structural effects on the girder. Avoid entrance locations over traffic lanes and locations that will require extensive maintenance of traffic operations or that would otherwise impact the safety of inspectors or the traveling public.

4.3.2 Critical Inspection and Maintenance Components

4.3.2.1 Stay Cable/Superstructure Anchorage Connection

Any anchorage connections/assemblies must be fully and easily accessible for inspection. The connection assemblies shall be detailed to shed water and sealed to prevent water and moisture intrusion.

4.3.2.2 Composite Steel Member Stay Cable Attachment

Any composite steel member to stay cable attachments shall be detailed to shed water and sealed to prevent water and moisture intrusion to the steel/concrete interface.

4.3.3 Moisture Control and Interior Drainage System

See Section 4.1.3 of this Performance Specification for requirements.

4.4 SUBSTRUCTURE

4.4.1 Maintenance and Inspection Access

Interior safety platforms and ladder systems, including a fall protection system, shall be provided for inspection and maintenance access for all voided substructure units.

4.4.2 Moisture Control and Interior Drainage System

4.4.2.1 Ventilation

The design and detailing of voided columns/piers shall be done to promote natural ventilation to aid in preventing in the accumulation of moisture and stagnant air within the components. Openings to promote ventilation shall be provided with appropriate screening to prevent entry of birds, pests, or other vermin.

4.4.2.2 Access Doors

All horizontal access doors shall be provided with appropriate seals to prevent moisture from entering the substructure components and shall be provided with locks in order to prevent unauthorized entry. An access hole shall be located in the pier cap with minimum access hole dimension of 2'-6" diameter.

4.4.2.3 Drainage Details



Floors of voided columns and other enclosed substructure components shall be contoured and weep holes provided to promote the drainage of water and prevent moisture accumulation. Any holes shall be screened to prevent the entry of birds, pests, or other vermin. If voided columns substructure units are utilized, the voids shall not extend below a height that is 15'-0" above the established high water elevation.

4.4.2.4 Attachments

Any attachments to substructure components shall be waterproofed.

4.4.2.5 Post-Tension Pourbacks

Post-Tension pourback areas at the top of columns shall be a two-barrier system and shall be detailed to shed water and to prevent water and moisture intrusion. Barrier system shall be qualified per PTI.

4.5 BEARINGS AND EXPANSION JOINTS

4.5.1 Bearings

Any exposed areas of steel components shall be hot-dipped galvanized or metallized. Bearing placement and details shall provide for ease of inspection and maintenance. Provisions shall be made to facilitate jacking of the superstructure for bearing replacement. Provisions for jacking, including jacking location, sequence and load shall be clearly shown on the final plans.

4.5.2 Expansion Joints

All expansion joints shall provide a watertight seal and finger joints shall be provided with a neoprene trough drainage system. Modular and Sliding Plate joints are not permitted. Expansion Joint systems shall be designed and detailed to promote ease of inspection and maintenance and to provide for replacement with minimum interruption of traffic. A minimum of one lane in each direction shall be able to remain in use during replacement operations. Steel components of expansion joint assemblies shall be hot-dipped galvanized in accordance with *AASHTO M-111 (ASTM A123)*.

4.6 LIGHTNING PROTECTION SYSTEM, GPS, AND NAVIGATION LIGHTS

4.6.1 Lightning Protection System

The Design-Builder shall provide a UL master labeled lightning protection system. The installation shall comply with NFPA-780. All connections and components of the system shall be accessible for inspection and maintenance.

For cable-stayed bridge structure types, lightning protection of concrete pylons and stay cables shall consist of the following:

- A) Installation of collector lines from each stay cable anchorage to a transition line. Installation of a collector line from the reinforcement near the top of the pylon to the transition line. Collector lines should be made of copper and have a cross section of at least 0.08 inches;
- B) Installation of a transition line, in direct contact with the reinforcement cage, from the pylon tip down to the foundation. The transition line should have a cross section of at least 0.3 square inches and may consist of specifically designated reinforcing steel bars properly welded together to assure adequate electrical conductivity. The transition line should be connected to the foundation earth which typically consists of a horizontal closed loop of reinforcing steel bars (min 0.3 inches cross section) placed low in the foundation, inside the concrete.

The concrete deck does not need any specific protection in general. In case electrically isolated bearings

are used, they need to be electrically connected to earth with cables (min. cross section of 0.08 square inches or copper bar with a minimum diameter of ¼ inches). Composite structures are suggested to be protected similarly to concrete structures.

For alternate bridge structure types, lightning protection provisions comparable to those listed in this Section 4.6.1 shall be made as appropriate.

4.6.2 GPS Installation

The Design-Builder shall provide a Global Positioning System (GPS) for monitoring bridge movement. The antennas, electronics cabinets and other major system components shall be accessible by way of normal and customary inspection and maintenance access equipment

4.6.3 Navigation Lights & Aviation Beacons

The Design-Builder shall design, furnish and install navigation and aviation lighting systems for the bridge and any temporary erection towers. The system shall be suitable for marine environment.

The installations, equipment, materials and workmanship shall be in accordance with the applicable provisions of the National Electrical Code, the United States Coast Guard and the Federal Aviation Administration.

Marine navigation red and green lanterns shall be provided on each side of the span over the navigable channel in accordance with 33 CFR 118. Two suspended duplex red channel margin marker lights (180 degrees) and one suspended duplex center channel green lantern (360 degrees) shall be displayed below the superstructure on each side of the bridge. A mounting bracket with a system allowing bulb replacement shall be provided to hold the lantern in proper operating position. The mounting bracket shall be hot-dip galvanized steel with stainless steel hardware complete with all required accessories.

The navigational lights shall be placed so as to mark the navigation channel.

Temporary and permanent aviation beacons lights shall be in accordance with Federal Aviation Administration requirements. All housings shall be constructed of non-corrosive material.

Temporary navigation lights and other navigation signals shall be installed during construction as required by the United States Coast Guard (USCG).

Permanent lighting shall not be solar powered.

4.7 INTERIOR INSPECTION LIGHTING

4.7.1 Towers & Superstructure

All enclosed areas subject to inspection and maintenance shall be provided with a low voltage (120 Va.c.) inspection and maintenance lighting system, and electrical outlets. The lighting levels shall be 30 foot candles horizontal. Bulbs for interior lighting system shall be high-endurance bulbs. The system wiring shall be sized so that voltage drop shall not be more than 5%. Megger test all system conductors before putting them into service. Test results shall become part of the Inspection and Maintenance Manual for reference. Installation shall meet all requirements of the latest edition of the National Electric Code (NEC) and local ordinances.

Electrical receptacles shall be provided and be 120V duplex receptacles, in non-metallic outlet boxes at 50' maximum on centers. Each receptacle shall have a weather-protective gasketed outdoor plate.

Switches shall be mounted at each end of each span and at each access door. Provisions for automatically tuning off interior lighting systems shall be made if left unattended for extended periods of time.

4.8 AESTHETIC LIGHTING

The Design-Builder shall be responsible for providing aesthetic bridge lighting features within the Primary Project Limits. The bridge lighting Work shall include design, furnishing and installation of all conduits, junction boxes, pull boxes, pole bases, supports, anchor bolts, cabling, wiring, poles, luminaries, and other light fixtures and assemblies as required by the Contract Documents.

Any aesthetic lighting fixtures used shall be accessible by way of normal and customary inspection and maintenance access equipment. Aesthetic lighting fixtures shall be water tight, and marine grade. Aesthetic lighting shall pose no veiling luminance to roadway or navigable channel users.

No roadway lighting is required as part of the Project.

5.0 ROADWAY

5.1 DRAINAGE SYSTEM

Design-Builder shall provide drainage structures at all drainage channels and equalizers as needed to prevent backwater flooding. Bends in drain pipes should be <45 degrees. *See Part 4 – Special Provisions, Item 605524 – Bridge Drainage System* for additional requirements.

5.2 GUARDRAIL / BARRIER RAIL

Details utilized in Approach Roadway Contract #23-073-03 shall be maintained throughout the Secondary Project Limits. *See Part 6 – Scope of Services Package Plans, Directive Plans* for guardrail and barrier details.

5.3 SLOPE PROTECTION (EROSION CONTROL)

Design-Builder shall provide a construction erosion control plan. Paved ditches and revetments will be provided by the Design-Builder where needed for erosion control and slope protection.

6.0 CONSTRUCTION REQUIREMENTS

6.1 WORK OVER AND IN THE INLET

Navigable waters shall be maintained in accordance with the USCG Bridge Permit. The Design-Builder shall provide for temporary protection against falling objects when working over the inlet. The use of cofferdams, temporary piling, temporary caissons, or any other methods that might alter the existing scour behavior within the existing inlet limits shall not be permitted.

Approval for use of barges within the navigable channel must be obtained from the USCG. Should the Design-Builder elect to deliver materials via barge directly to the work zone, appropriate approvals from the USACE and USCG must first be obtained. The Design-Builder shall be aware of the turbulence and rapid changes in flow through the inlet.

See Part 3 – Design Requirements and Performance Specifications, Environmental Documents for permit information.

6.2 WORK OVER EXISTING ROADWAY

The Design-Builder shall maintain a temporary protective shield over pathways and emergency access

routes north and south of the inlet. If temporary closures of these areas are required during construction, the Design-Builder shall coordinate with the Department, and the DNREC Division of Parks and Recreation. Law enforcement and emergency personnel must also be notified of such closures.

See Part 6 – Scope of Services Package Plans, Directive Plans for temporary protective shield limits.

See Part 4 – Special Provisions, Temporary Protective Shield for additional requirements.

6.3 NO WORK AREAS

No Work Areas are delineated in the referenced Environmental Assessment and on the Indicative Plans for the Roadway Approaches and previous Bridge Plans. The Design-Builder shall take all necessary precautions to avoid these areas as stipulated in the Environmental Assessment.

See Part 3 – Design Requirements and Performance Specifications, Environmental Documents and Part 6 – Scope of Services Package Plans for additional information.

6.4 MAINTENANCE DURING CONSTRUCTION

The Design-Builder shall comply with the maintenance requirements specified in Part 2 – DB Section 105-8.

7.0 SUBMITTAL REQUIREMENTS

7.1 CORROSION CONTROL PLAN

With the submission of the applicable structural design packages, the Design-Builder shall provide to the Department for review and approval a detailed Corrosion Control Plan, which is to include discussion of the following:

- A) Estimates of life-cycle costs and assurance of stated service lives.
- B) Post-tensioning tendon corrosion protection methods.
- C) Corrosion allowances/thresholds.
- D) Concrete permeability, corrosion rate, time-to-repair, etc.
- E) Inhibitors, sealers and coatings, etc.

7.2 INVENTORY INSPECTION

- A) Detailed bridge inspection report to be submitted within six months of Final Acceptance of the Work.

7.3 MAINTENANCE MANUAL

- A) To be submitted within two months after substantial completion of construction.
- B) Cable Installation records in accordance with Section 4.2.1 of this Performance Specification.

7.4 LOAD RATING / SEMINAR

- A) Minimum of two seminars of 8 hours for 25 attendees.
- B) Load rating shall reflect as-built conditions.
- C) Rating shall follow *AASHTO LRFR*.

**MASS CONCRETE
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

This item covers the procedures for the control of the curing of mass concrete by monitoring of internal temperatures.

It is the Design-Builder's responsibility to determine which elements will be considered as Mass Concrete based on the temperature requirements of this specification and to ensure that elements do not crack as a result of temperature differentials. The Design-Builder shall submit to the Department his procedure and list of elements that will be considered Mass Concrete prior to the placement of any concrete elements. The Department shall have 20 calendar days to review and comment on this submittal.

2.0 CONSTRUCTION METHODS

The Design-Builder shall provide his Plan for the mass concrete mix design, analysis, monitoring and control, including insulation and methods to the Department for review and comment a minimum of 45 days prior to the placement of any Mass Concrete. This Plan shall include a minimum of one level of redundancy for all equipment and materials to maintain continuous placement as per the Design-Builder's proposal.

- A) Mix Design: Ground granulated blast furnace slag or fly ash may be used in the mix to reduce the heat of hydration. Slag or fly ash may be used as a cementitious replacement material for cement up to a maximum limit of 75% by weight of total cementitious material in the mix. Slag and/or fly ash shall be from single sources approved by the Department, shall be compatible with the type of cement used and thoroughly blended in the mix. Other precautions for reducing the heat of hydration may be taken, such as the addition of controlled quantities of ice in lieu of equal quantities of mixing water or cooling tubes. However, the mix shall contain no frozen pieces of ice after blending and mixing components. The use of liquid nitrogen to cool the concrete will be permitted if included in the Design-Builder's Plan.

All concrete constituent materials shall be compatible with the proposed cements, workability enhancing additives and water reducing agents as necessary to provide concrete satisfying all requirements of the Contract Documents.

- B) Analysis and Monitoring: The Design-Builder's Plan shall provide an analysis of the anticipated thermal developments within the mass concrete elements for the anticipated project temperature ranges, along with the proposed mix design, casting procedures and materials. A copy of any software model input and output (such as the Schmidt model) with the site and element specific data shall be transmitted to the Department for review and comment. This submittal shall include electronic files and complete documentation defining the theory, means and methods used by any software models. Additionally, the Plan shall describe the measures and procedures intended to maintain, monitor and control the temperature differential between the interior and exterior of the mass concrete elements, with a maximum temperature of 160°F during curing. During curing, the maximum differential temperatures shall not exceed:

First 24 hours	30° F
24 to 48 hours	40° F

2 to 7 days	50° F
7 to 14 days	60° F

- C) Monitoring Devices: The Design-Builder shall provide temperature monitoring devices to record temperature development between the interior and the exterior of the element at various points approved by the Design-Builder's Engineer. A minimum of two independent sets of interior and exterior points shall be monitored for each element to provide redundancy in case of failure of a device. The monitoring points shall be located at the geometric center of the element for the interior point and 2" from the surface along the shortest line from the geometric center to the nearest surface of the element for the exterior point.

Monitoring devices shall be automatic sensing and recording instruments that record information at a maximum interval of one hour. These devices shall operate for a range of 0 to 200° F with an accuracy of $\pm 2^\circ$ F. In addition, the Design-Builder shall take manual readings and record data at intervals not greater than 6 hours to ensure that the automatic devices are working properly and that the temperatures are within allowable limits. The intervals of one and six hours shall begin immediately before casting concrete and shall continue until the maximum temperature differential and maximum temperature are reached and begin to drop. These readings shall be transmitted to the Department within 2 days of the time the readings were taken.

Prior to the first pour of mass concrete, the Design-Builder shall perform a demonstration placement to verify accuracy of the predicted temperature and methods of controlling temperature, and to test the automatic and manual thermal sensing and recording equipment.

- D) Construction: The Design-Builder shall take measures to control differential and absolute temperatures by appropriate use of insulated forms, curing blankets or internal cooling.

If, during the first 14 days after the concrete pour, the internal concrete temperature differential nears the maximum differential limits, corrective measures shall be taken by the Design-Builder to immediately retard further growth in the temperature differential such that the differential ultimately remains within the above limits. Furthermore, the Design-Builder shall make revisions to the Plan to maintain the required limits on differential temperature on any remaining placements of Mass Concrete. The Design-Builder shall obtain the Department's review and comment on revisions to the Plan prior to implementation.

The Design-Builder's attention is drawn to the fact that strength gain and cooling of the Mass Concrete pours can take a long time. The Design-Builder shall take all such time and strength considerations into account when planning construction activities.

- E) Grout Inlets and Outlets: All inlets and outlets for grouting of post-tensioning tendons (or bars) that are embedded in mass concrete elements shall be Schedule 10 Rigid Steel Pipe (galvanized).
- F) Portion of tendons embedded in mass concrete elements not required to use Type A ducts based on the Tendon Bending Radius shall use Type B ducts. For duct type descriptions, see Part 4 - Special Provisions, *Prestressing*.
- G) Any cracking or damage due to exceeding maximum temperature and/or temperature

differential, as determined by the Department, shall be repaired by the Design-Builder to the satisfaction of the Department at no cost to the Department. These repair procedures may include, but are not limited to, epoxy injection of cracks or removal and replacement of the damaged element.

**PUBLIC OUTREACH REQUIREMENTS
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

This Performance Specification specifies the minimum requirements for the Design-Builder's Public Outreach Plan, establishes responsibilities for the Design-Builder and the Department, identifies content requirements for informational materials, and establishes communication protocols for the implementation of the Public Outreach Plan.

The Public Outreach Program consists of both Department and Design-Builder activities, including the following:

- A) Public Update meetings (semi-annual);
- B) Public Advisory Group meetings (monthly);
- C) Response to inquiries and comments (as needed);
- D) Site tours (weekly);
- E) Newsletters (quarterly);
- F) Public notices (as needed);
- G) Media relations (as needed);
- H) Photographs and video documentation (continuous); and
- I) Other activities included in Part 8 - The Design-Builder's Proposal.

Awareness and support of highway users, residents, and communities within the area are critical to the successful completion of the Project. The initial bridge design was developed and evolved in large part from the continuous involvement of local residents, community groups, local officials, and other groups. It is important that the Design-Builder continues this cooperative approach in handling community participation.

2.0 STANDARDS AND REFERENCES

The Work shall be in accordance with this Public Outreach Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated herein. Standards and References specifically cited in the body of this Performance Specification establish requirements that shall have precedence over all others. Should the requirements in any standard conflict with those in another, the standard highest on the list shall govern. Listed under References are guidelines that the Design-Builder may use in addressing the requirements as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification of any unresolved ambiguity prior to proceeding with design or construction.

2.1 STANDARDS

- A) Design-Builder's Public Outreach Plan.

2.2 REFERENCES

- A) A Guide for Achieving Flexibility in Highway Design, AASHTO, May 2004; and

- B) NCHRP Report 480: A guide to Best Practices for Achieving Context Sensitive Solutions.

3.0 REQUIREMENTS

The community involvement and participation element is intended to continue the close working relationships with residents, landowners, community groups, local officials, and other like groups that were initiated during the initial design phase. This effort shall include activities such as, but not limited to, periodic meetings, site tours, job progress documentation, and response to informational requests. In addition, the Design-Build team shall assist in identifying and responding to public issues or activities that might affect the safe, efficient completion of the Project.

Public Outreach is intended to keep the public and media informed of major activities, decisions, and project changes through design and construction. This element will involve the preparation and distribution of Project information to the assigned Department representative for further dissemination to the public and media.

The Design-Builder shall make a good faith effort to address any concerns the public may have, and take under consideration any suggestions or wishes they express if those suggestions are reasonable in regard to cost, time, and construction effort. Documentation shall be in the form of meeting minutes and correspondence, including e-mails. The Design-builder shall respond to these requests through the Department. All design or construction modifications are subject to written acceptance by the Department in consultation with the Design-Builder.

3.1 DEPARTMENT RESPONSIBILITIES

The Department and the Design-Builder both have responsibility for the Public Outreach Program. The Department's Project Manager and Office of Public Relations will be the lead on the Public Outreach effort. The Design-Builder shall have primary responsibility for performing the activities specified in this Performance Specification as well as in the Contract Documents.

The Department's responsibilities shall include the following activities:

- A) Maintain QA/QC of any approved Design-Builder communication efforts;
- B) Monitor the Design-Builder's performance for compliance with the Contract's Public Outreach requirements and the Design-Builder's Public Outreach Plan;
- C) Secure facilities for meetings;
- D) Review and distribute meeting minutes;
- E) Compile information provided by the Design-Builder for use in printed materials;
- F) Coordinate all printed materials including, but not limited to, newsletters, informational maps, press releases, public notices, advertising and correspondence;
- G) Review, approve, and distribute responses to inquiries and comments;
- H) Issue and advertise Public Meeting Notices;
- I) Provide official spokespersons for the Project. The Department-designated representatives will be the first point of contact for all media inquiries including, but not limited to, newspaper, magazine, radio, Internet, and television reporters and others as required in the Public Outreach Plan; and
- J) Host and maintain the Project Website and Web-cams.

3.2 DESIGN-BUILDER RESPONSIBILITIES AND REQUIREMENTS

3.2.1 Public Outreach Program

Within 30 Calendar Days of Notice to Proceed, the Design-Builder shall submit to the Department's Project Manager any request to modify or append the Public Outreach Plan originally included in the Design-Builder's Technical Proposal and included in Part 8 of the Contract Documents. The Department's Project Manager shall have the sole responsibility of determining the acceptability of any proposed changes to the Plan. The approved Public Outreach Plan and the Department's responsibilities specified in Section 3.1 of this Performance Specification shall comprise the overall Public Outreach Program.

3.2.2 Public Update Meetings

The Department intends to hold periodic Public Update Meetings for the duration of the Project. The Design-Builder shall coordinate and prepare for each meeting through its designated Public Outreach Specialist and in close cooperation with the Department.

The Design-Builder shall provide the necessary staff, displays, renderings, models, and hand-outs to adequately portray the bridge concept and the Project's status at the time of each meeting. The Design Builder shall identify the number and types of materials to be used for Public Update Meetings as part of the Public Outreach Plan. Major design and construction update information shall be presented to the public. All materials to be used and/or distributed must be reviewed and approved for use by the Department prior to the Update Meeting.

The initial Public Update Meeting is to be held within 45 Calendar Days of the Notice to Proceed for the Project and will be held approximately every six months thereafter. Each meeting is to be held at facilities obtained by the Department.

The Design-Builder shall submit a meeting summary within 2 Working Days of each Update Meeting. As a minimum, the summary shall include a list of attendees, comments received, issues or concerns raised, copies of hand-outs, displays, or other presentation materials.

The Design-Builder shall provide electronic versions (in Adobe Acrobat .pdf format) of display boards and other materials presented at Public Meetings to the Department's Project Manager and Office of Information Technology Web Team for posting to the project Website.

3.2.3 Advisory Group Meetings

As part of the overall Project, the Department holds a monthly Advisory Group Meeting with members of local Homeowner Associations, Chambers of Commerce, elected officials, members of the media, and other interested parties to discuss on-going design and construction activities associated with the Project. The purpose of this meeting is to provide a forum for increasing the public's awareness regarding the Project, identifying public activities and events that might be affected by proposed construction activities, and identifying potential safety concerns. These meetings are informal, approximately 1 hour long, and are held in the Department's field office. The Design-Builder will be expected to provide a verbal update and to answer questions at each meeting. Typical items for discussion might include the following:

- A) Anticipated impacts to traffic, including pedestrians and bicyclists;
- B) Anticipated impacts to Delaware Seashore State Park;
- C) Construction access areas;
- D) Site security and safety concerns;

- E) Proposed hauling routes;
- F) Noise and dust control; and
- G) Schedule and duration of activities.

Information regarding Project design and construction schedules shall be offered in a form that can be easily understood by the public and shall be consistent with information contained in the Baseline Progress Schedule and schedule updates.

The Design-Builder shall be aware of the recreational and seasonal tourism issues associated with the project location. It is essential that the Design-Builder cooperates with the Department and remains proactive in attempting to minimize disruption to other activities in the area.

3.2.4 Response to Inquiries and Comments

- A) The Design-Builder will have direct contact with the community in meetings and as otherwise required by this Public Outreach Performance Specification.
- B) If a resident, business, or other member of the public has a question or comment on the Project outside of a public meeting forum, the first and preferred point of contact should be the Department's Public Relations Office or the Department's Project Manager. The Design-Builder shall take necessary steps to facilitate such contact.
- C) If Design-Builder receives a complaint regarding Design-Builder's conduct of Work on the Project, the Design-Builder shall notify the Department's Project Manager within 24 hours. The Design-Builder shall provide necessary information, staff support, and representation to assist in resolving the issue.
- D) The Design-Builder shall provide a commitment of the Design-Builder's Project Manager to serve as a spokesperson for the Project, at the Department's request, for technical and Project safety issues.

The Design-Builder shall maintain a consistent system for documenting all contact with business owners, residents, media and property owner. The Design-Builder shall provide the Department's Project Manager, an electronic copy of all public contact records. The electronic file should be received by the 1st of each month and should include all contacts made prior to the 25th of the previous month.

3.2.5 Site Tours

It is the Department's goal to fully utilize the educational opportunities this Project might offer. The Design-Builder shall assist the Department in achieving this goal by organizing and leading periodic tours of the construction project site. Knowledgeable guides shall be made available by the Design-Builder to explain the Work progress, ensure visitor safety, and answer questions related to the Design-Build portions of the project. The Design-Builder shall have appropriate safety devices (e.g. hard hats, safety vests, personal flotation devices, gloves, glasses, etc.) available for use by visitors.

The Design-Builder shall allow for approximately one tour group per week on average for the duration of the construction activities. Group sizes are expected to include up to 30 visitors at any given time. Each group may be divided into smaller groups as deemed appropriate by the Design-Builder. Anticipated visitors might include the following:

- A) Professional Societies;
- B) Industry Representatives;

Delaware Department of Transportation

- C) University Organizations;
- D) Department Personnel;
- E) Community Groups;
- F) Local Schools; and
- G) Elected Officials.

A portion of the anticipated tours may be conducted and led by Department personnel. The Design-Builder shall assist the Department, as necessary, by furnishing safety devices, identifying reasonable visitation times and schedules, and determining which areas are safe for visitors.

3.2.6 Newsletters

As part of the overall Project, the Department will prepare and distribute a newsletter approximately once every three (3) months for the duration of the Project. As directed by the Department's Project Manager and Office of Public Relations, the Design-Builder shall provide information and relevant digital photographs in a format to be specified by the Department for inclusion in the newsletter.

Newsletter information shall be provided to the Department's Project Manager and Office of Public Relations fifteen (15) Working Days in advance of the planned distribution date for each newsletter.

3.2.7 Public Notices

The Design-Builder's planned construction activities may periodically result in temporary impacts to utility services, driveway entrances, and vehicular, pedestrian, and bicycle traffic. In such cases, the Design-Builder shall immediately notify the Department's Office of Public Relations and Project Manager. The Design-Builder and the Department will coordinate contacting the affected parties or general public of anticipated impacts or disruptions of services. Utility shut-off/diversion announcements shall be made in the form of a personal contact by the Design-Builder that shall include a written notice to the affected parties. Copies of the notice shall be provided to the Department's Project Manager and Public Relations Office. The Design-Builder shall provide the specific notifications listed in Table 3.2.7-1.

Table 3.2.7-1 - Notifications

Notice	Requirement
Closure	Written notices posted at least 7 days in advance of planned traffic lane or pedestrian walkway closures. Notice provided to the Department's Traffic Management Center (TMC) and Public Relations Office 7 days in advance. Lane closures to be signed using Variable Message Signs (VMS) in addition to standard signage.
Critical Utility Shut-off/Diversion	Written notice at least 72 hours in advance of, but not more than 96 hours before, shut-off and/or diversions. Copy of notice to Department's Project Manager and Public Relations Office.
72-hour Business/Commercial Utility Shutdown	Written notification of Utility shutdown or diversion for businesses and commercial property. Copy of notice to Department's Project Manager and Public Relations Office.

Table 3.2.7-1 - Notifications

Notice	Requirement
48-hour Residential Utility Shutdown	Written notification of Utility shutdown or diversion for residential property. Copy of notice to Department's Project Manager and Public Relations Office.
Weekly Construction Updates	A construction update will be provided to the Department.
Emergency Unforeseen Utility Disruptions, Hazardous Conditions, Traffic Emergencies, Security, and Loss of Access	See Section 3.2.11.
Road and Driveway Closures	Written notice and personal contact at least 72-hours in advance of, but no sooner than seven calendar days prior to, closure. Copy of notice to Department's Project Manager and Public Relations Office.

3.2.8 Media Relations

An ongoing media relations campaign will occur and be managed by the Department. The Design-Builder's Public Relations Specialist shall assist in giving timely information to the Department regarding construction activities and situations that may have the potential for unplanned public focus or media coverage.

Neither the Design-Builder nor any Subcontractor nor their employees shall conduct or participate in media events or radio or television broadcasts without the written consent of the Department. In emergencies, the Design-Builder shall immediately notify the Department's Project Manager and Office of Public Relations to coordinate responses.

3.2.9 Photographs and Video Documentation

The Design-Builder shall provide to the Department's Project Manager high-resolution construction progress photographs in electronic format at least bi-weekly or at any time that a new significant activity commences. Bi-weekly submission should include a minimum of 20 (twenty) new progress photos. In addition, the Design-Builder will accommodate requests for specific photographs and make arrangements for the Department to take additional photos on an as-requested basis

The Design-Builder shall coordinate with and accommodate the Department by allowing video camera stations to be set up and maintained by the Department within the established limits of disturbance for the Project. Cameras may be positioned within the work zone and/or within staging areas as required by the Department. The Department anticipates a minimum of two camera set-ups within the Project Limits for the purpose of transmitting continuous video feeds through the Department-maintained Project Website.

3.2.10 Other Activities

The Design-Builder is encouraged to provide additional, cost-effective services to enhance the overall Public Outreach Program. Additional public involvement activities might include soliciting feedback on multiple aesthetic treatment options and/or lighting schemes developed by the Design-Builder and implementing designs consistent with indicated preferences. Additional services are to be consistent with other requirements specified in this Performance Specification. Any such Public Outreach Program enhancements may be implemented at any time during the Project, subject to the Department's written acceptance.

3.2.11 Emergency, Unforeseen Utility Disruptions, Hazardous Conditions, Traffic Emergencies, Security, and Loss of Access Notifications

The Design-Builder shall provide immediate response to emergencies by trained personnel from an incident response team within 30 minutes of receiving notification from the Department, law enforcement or fire suppression agencies, federal land management agencies, Utility Owners, and/or affected businesses and/or residents. The Design-Builder shall notify the Department's Project Manager or designated alternative contact person immediately of such occurrences.

The Design-Builder shall establish and manage an emergency response telephone tree. All appropriate emergency response agencies, including federal land management agencies, shall be included on this telephone tree for immediate response in the event of an emergency. The telephone tree shall be divided into areas of expertise so the proper people are called for specific emergency situations.

All emergency and/or unforeseen disruptions shall be explained to affected residents or businesses immediately. The person making the contact shall provide to the affected parties the following information:

- A) Cause of disruption (i.e., whether it is construction oriented or not);
- B) Actions being taken to alleviate the problem
- C) Responsible party for the actions; and
- D) Anticipated duration of the disruption.

3.2.12 Changes to Access

Any proposed changes in access shall be submitted to the Department's Project Manager, along with an access map, at least five Working Days prior to start of construction for the Department's Project Manager's written acceptance.

**ROADWAY GEOMETRICS
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

The Design-Builder shall design and construct any roadway related Work in accordance with these requirements and these specifications. Included in this Project is the design, construction or reconstruction of all bridge approach roadways as required within the Design-Builder's proposed Project Limits. This Roadway Geometrics Performance Specification specifies the requirements for the design and construction of the roadway, bicycle and pedestrian facilities including bridge geometry.).

Part 6 – Scope of Services Packages Plans contains geometric elements (such as, horizontal alignments, vertical alignments, superelevation, and typical sections) that have evolved through the project development phases needed for environmental approval. The final Right-of-Way (ROW) Plans have been established in compliance with Department policy to provide for an ultimate four lane divided roadway section as depicted in the Scope of Services Package Plans. The design of this Project shall be performed in a manner that maintains the specified roadway geometrics and properly ties to the adjacent Roadway Approach (Contract #23-073-03) Work.

The current design provides a workable solution to the corridor's needs and the roadway geometry meets the established design criteria. The Design-Builder may, however, find ways to improve this geometry. Any innovative alternatives that increase benefits or savings to the Department or the Contractor are encouraged and will be accepted if they do not deviate from these Performance Specifications.

2.0 STANDARDS AND REFERENCES

The design of roadway geometrics shall be in accordance with this Roadway Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of the Roadway Performance Specification establish requirements that shall have precedence over all others. Standards list are placed in the descending order of precedence. In case of conflict between or among standards listed, the order of precedence established by the Department shall govern. Listed under references are guidelines that the Design-Builder may use in addressing the requirements as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification of any unresolved ambiguity prior to proceeding with design or construction.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence:

- A) Performance Specifications for the Project;
- B) Delaware Department of Transportation "Road Design Manual," July 2004 with Revisions (including all Design Guidance Memoranda);
- C) Part 4 - Supplemental Specifications;
- D) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction," dated 2001;
- E) AASHTO, "A Policy on Geometric Design of Highways and Streets (Green Book)," Fifth Edition, 2004;

- F) “Manual of Uniform Traffic Control Devices (MUTCD),” Third Edition, 2003; and
- G) Delaware Department of Transportation “Traffic Controls for Street & Highway Construction, Maintenance, Utility & Emergency Operations,” dated July 2001.

2.2 REFERENCES

The following design standards shall be used as reference materials that contain requirements that, by way of their application, may directly affect the designs of the roadways.

- A) AASHTO, “Roadside Design Guide,” Third Edition, 2002;
- B) AASHTO, “Model Drainage Manual,” 2005 Edition;
- C) DelDOT ES2M Design Guide (Erosion & Sediment Control, Stormwater Management);
- D) Delaware Erosion & Sediment Control Handbook;
- E) Highway Capacity Manual, Special Report 209. Third Edition. Transportation Research Board, National Research Council, Washington, D.C.;
- F) Delaware Department of Transportation “Bridge Design Manual,” May 2005, with Revisions;
- G) Delaware Department of Transportation “Materials and Research Manual” with Revisions.

3.0 REQUIREMENTS

3.1 PERFORMANCE

The Design-Builder shall design all roadway geometrics including, but not limited to, horizontal alignments, superelevation, typical sections, bicycle and pedestrian facilities, and all other required features not specifically defined in other performance specifications. The roadway designs required by this section shall be performed and completed such that the bridge approach roadways and other features are designed and constructed in a manner that is equal to a standard of care which is practiced by engineers performing successful designs for the Department. All roadway geometrics shall be designed in accordance with the Standards listed and referenced in this Roadway Performance Specification.

The objective of this design work is to result in constructed Project facilities within specified criteria while allowing the Design-Builder the flexibility to make changes that produce benefits or savings to the Department or the Design-Builder without impairing essential functions and characteristics of the Project, including, safety, traffic operations, desired appearance, and maintainability.

Any significant Basic Project Configuration Changes to the Scope of Services Package Plans may require a review in relation to the Finding of No Significant Impact (FONSI) and other environmental approvals. If it is determined by the Department that the Environmental Assessment (EA) must be supplemented, the Design-Builder, in coordination with the Department, will be responsible for conducting the supplemental process.

The Department has or will acquire the necessary rights-of-way to perform the Work as designated on the ROW Directive Plans included in Part 6 – Scope of Services Packages Plans. No additional ROW will be acquired by the Department beyond that which is shown on the Directive Plans.

3.2 DESIGN CRITERIA

The Department has developed design traffic data for the overall project. The following traffic data and design criteria shall be maintained for this Contract:

	A) Functional Classification:	Principal Arterial
	B) Current A.A.D.T. (Year 2002):	13,137
	C) Projected A.A.D.T. (Year 2025):	20,000
	D) Projected D.H.V. (Year 2025):	4,255
	E) Percent Trucks:	8.0%
	F) Directional Distribution:	60%
	G) Design Speed:	60 mph
	H) Width of Clear Zone	30 feet
	I) Minimum Stopping Sight Distance	580 feet
	J) Minimum Horizontal Curve Radius	1348 feet (assumes e=0.06)
	K) Minimum K (crest)	156
	L) Minimum K (sag)	120
	M) Maximum % of Grade	4.00%
	N) Maximum Front Slope (Unprotected)	6:1 (Minimum)
	O) Maximum Back Slope	4:1
	P) Barrier Offset (Roadway Approaches only)	2 feet

The profile grade line included in the Directive Plans shall be maintained. Adequate bridge camber shall be included to provide proper finished grades on both the approach roadways and the bridge.

3.3 TYPICAL SECTION

The Department has established the required number and minimum widths for travel lanes, shoulders, and sidewalks. These requirements are depicted in the Directive Plans included in Part 6 – Scope of Services Packages Plans and are summarized as follows:

3.3.1 Northbound Roadway

- A) Provide a minimum 12-foot pedestrian sidewalk on the outside edge (ocean side) of the bridge;
- B) Provide two minimum 12-foot travel lanes;
- C) Provide a minimum 10-foot outside shoulder to be located and between the travel lanes and the pedestrian sidewalk;
- D) Provide a minimum 4-foot inside median shoulder; and
- E) Provide traffic barriers in the median area, between the outside shoulder and the pedestrian sidewalk, and on the outside edge of the bridge.

See the Bridge Design Requirements Performance Specification for additional traffic barrier requirements.

3.3.2 Southbound Roadway

- A) Provide two minimum 12-foot travel lanes;
- B) Provide a minimum 10-foot outside shoulder;
- C) Provide a minimum 4-foot inside median shoulder; and
- D) Provide traffic barriers in the median area and on the outside edge of the bridge.

See the Bridge Design Requirements Performance Specification for additional traffic barrier requirements.

3.4 PRELIMINARY DESIGN REVIEW

The concept design shall be submitted to the Department for Preliminary Design Review in a format based on the plan preparation guidelines and shall contain at a minimum the following design layouts on plan sheets:

- A) Accurate topographic mapping;
- B) Typical cross sections with finish slopes, side ditches, and grades;
- C) Horizontal alignment geometry data, lanes, shoulders, directional arrows, traffic barriers and railings, retaining walls, slope limits, and bridge limits;
- D) Profile grades, original ground, and bridge profiles;
- E) Anticipated drainage inlet locations;
- F) Unforeseen environmental constraints to roadway designs;
- G) Unforeseen existing utilities and proposed relocations;
- H) Limits of disturbance and Right-of-Way; and
- I) Cross sections cut at 100 foot intervals along centerline with existing Right-of-Way shown.

3.4.2 Review and Comment of Roadway Configuration

The Design-Builder shall not submit any subsequent roadway design for reviews after the Preliminary Design Review until after comments made during the definitive design review have been resolved by the Design-Builder and incorporated, if necessary, into the design.

Deviations from any roadway designs from designs depicted in the Readiness for Construction review shall not be allowed without written approval by the Department.

3.5 QUALIFICATIONS OF THE ROADWAY DESIGN ENGINEER

The Design-Builder's roadway design Engineer of Record shall be a registered professional engineer in civil engineering in the State of Delaware and have a minimum of ten (10) years of professional practice in roadway design engineering for the Department. Engineering intern experience will not be counted.

**TEMPORARY WORKS
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

The Design-Builder shall be responsible for furnishing all design, construction, installation, monitoring, supervision, and quality control reviews for all Temporary Works associated with the Work. Temporary Works shall be considered any non-permanent structure that provides support of any materials and/or excavations used to complete the Work.

2.0 STANDARDS AND REFERENCES

The design and construction of all Temporary Works shall be in accordance with this Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this Performance Specification. Standards and references specifically cited in the body of this *Temporary Works* Performance Specification establish requirements that have precedence over all others. Should the requirements in one standard conflict with those in another, the standard highest on the list shall govern. Listed under references are guidelines that the Design-Builder may use to address the requirements, as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification of any and all unresolved ambiguity prior to proceeding with any design or construction.

2.1 STANDARDS

Specific codes and standards include, but are not limited to, the following listed in order of governing precedence:

- A) "AASHTO LRFD Bridge Construction Specifications," Second Edition, 2004 (U.S. Customary Units), with Interims through 2006;
- B) "AASHTO LRFD Bridge Design Specifications," Third Edition, 2004 (U.S. Customary Units), with Interims through 2006. Delete Section 5.14.2.3.9 in its entirety (All Shop and Working Drawings will conform to the requirements of the Contract); and
- C) Delaware Department of Transportation "Standard Specifications for Road and Bridge Construction" Dated 2001.

2.2 REFERENCES

- A) Delaware Department of Transportation "Bridge Design Manual" with Revisions through May, 2005; and
- B) AASHTO, "Guide Design Specifications for Temporary Works," 1995.

3.0 REQUIREMENTS

3.1 DESIGN AND CONSTRUCTION

3.1.1 Retaining Structures

The following specifications shall govern for design and construction of retaining structures as indicated:

- A) Cofferdams and Shoring shall be in accordance with Section 3.3 of the *AASHTO LRFD Bridge Construction Specifications*.

- B) Temporary Water Control Systems for excavations shall be in accordance with Section 3.4 of the *AASHTO LRFD Bridge Construction Specifications*.
- C) Sheet Pile and Soldier Pile Walls shall be in accordance with Section 7.6.2 of the *AASHTO LRFD Bridge Construction Specifications*.
- D) Cantilevered Walls and Anchored Walls shall be in accordance with Section 11 of the *AASHTO LRFD Bridge Design Specifications*.
- E) Ground Anchors shall be in accordance with the applicable *2004 Post Tensioning Institute* (PTI) provisions.
- F) Earth Pressures used in the design of all retaining structures shall be in accordance with Section 3 of the *AASHTO LRFD Bridge Design Specifications*.

3.1.2 Falsework

All falsework shall be designed and constructed in accordance with Section 602.09 of the *DelDOT Standard Specifications*.

3.2 MONITORING

The Design-Builder shall develop and submit to the Department for review and written comment a Monitoring and Contingency Plan for all work related to excavations or other activities that might cause ground movements. This plan shall be signed and sealed by a Delaware-licensed Professional Engineer having at similar monitoring experience on at least 5 similar projects in the past 10 years. The Design-Builder shall submit the Qualifying Experience for this Work to the Department for approval.

The purpose and objectives of the Monitoring Program are to:

- A) Establish pre-construction baseline data for comparison with construction and post-construction data.
- B) Provide early information on the interaction of the construction process with, and its effect on the ground and adjacent structures.
- C) Detect and provide warning of unforeseen conditions that may require remedial or precautionary measures.
- D) Permit timely implementation of the proper procedures, changes in excavation methods, additional support to prevent damage to structures, equipment, utilities.
- E) Document ground movement and any structure movement that may occur as a result of construction.

The Design-Builder's monitoring Work shall consist of furnishing all necessary engineering and design services, supervision, labor, materials, and equipment needed to furnish, install, and monitor geotechnical instrumentation, including extensometers, inclinometers, monitoring and reference targets, readings, and reporting and interpretation of collected data.

3.2.1 Instrumentation Requirements

Where global instability of the excavation is possible or where there are adjacent structures, roadways,

utilities, etc, that may be impacted by failure of any excavation, the Design-Builder shall install inclinometers behind the excavation face at a distance no greater than one third the height of the excavation. The depth and spacing of inclinometers shall be determined by the Design-Builder's Geotechnical Engineer and shall be subject to review and comment by the Department; however, the inclinometers shall extend a minimum of one half the excavation height below the bottom of the excavation. The Design-Builder shall be independently responsible for determining whether additional instrumentation such as extensometers, etc, are needed to protect property and to ensure the safe performance of all Work.

When the instrumentation data indicate potentially damaging ground or structure movements, the Design-Builder shall adjust the excavation and support procedures as per the Contingency Plan requirements specified in the "Submittals" section of this Performance Specification, to reduce the ground and structure displacements.

At a minimum, instrumentation shall remain in place and monitoring shall be performed from the time excavation begins until all associated structure work and backfilling is completed. Additional monitoring may continue to be performed upon completion of the related Work as deemed necessary by the Design-Builder's Geotechnical Engineer or the Department's Project Manager.

3.2.2 Permissible Movements

The maximum allowable deflection of each excavation support or cofferdam shall be established by the Design-Builder based on specific analyses of the system and previous documented experience, and shall consider the existence of any nearby structures or utilities susceptible to settlement or lateral movement. However, the deflection of any point on the face of the cofferdam or temporary excavation support system shall not exceed 0.2 percent of the excavation or cofferdam height or 3 inches, whichever is less. Allowable vertical deflections will be established by the Design-Builder based on the excavation support or cofferdam system used and subject to review and comment by the Department.

For excavations or cofferdams higher than 12 feet, the deflection shall be measured or surveyed, at a minimum, by means of survey targets established within the top 7 feet, within 5 feet of midheight, and within 7 feet of the bottom of the excavation support or cofferdam. For excavations or cofferdams less than 12 feet in height, the targets at midheight may be omitted. The horizontal spacing between the targets shall not exceed 30 feet. The targets shall allow monitoring of horizontal and vertical deflections.

3.2.3 Pre-Existing Survey

The Design-Builder shall perform a survey of all structures and utilities existing within a 100-foot of the perimeter of the excavation. The Design-Builder shall submit the survey report to the Department for record purposes at least 7 days before the start of excavation support work.

4.0 SUBMITTALS

For all Temporary Works, the Design-Builder shall develop Working Drawings and design calculations that have been signed and sealed by a Professional Engineer licensed in the State of Delaware and reviewed and approved by the Design QC Manager. All Working Drawings shall reflect the Final Design Plans Issued for Construction and shall be resubmitted to reflect any revisions to the Final Design Plans. Working Drawings and supporting calculations shall be submitted to the Department for review and written comment at least 15 Calendar Days prior to the Temporary Works being constructed. Note that any additional time required by the Design-Builder to address and resolve comments shall not be cause for delay or impact claims. All costs associated submittals not conforming to the Contract requirements shall be the responsibility of the Design-Builder.

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At least 30 Calendar Days prior to installation, the Design-Builder shall submit to the Department for review and written comment an Instrumentation and Monitoring plan. The plan shall include the following minimum information:

- 1) Detailed description of each instrument type to be used, including company name, model number, sensitivity, accuracy, and power requirements.
- 2) Detailed plan for installation and commissioning of each instrument type, and the plan for interim recalibration.
- 3) Detailed description of how and how often the instruments are to be read, the data processed, and the results calculated, displayed, archived, reported, and interpreted.
- 4) Details of permissible threshold values and movements.
- 5) Detailed Contingency Plan for reasonably conceivable events and for movement approaching or exceeding threshold values. The first action item in the Contingency Plan shall be to cease all excavation operations in the affected areas and notify the Department's Project Manager followed by the Engineer of Record. The subsequent steps shall include implementation of the planned actions.
- 6) Quality Control procedures.
- 7) Present the experience of the Design-Builder's subconsultant and/or subcontractor in monitoring of similar work in the past 5 years.
- 8) Working Drawings showing the layout of the monitoring system, system components, component material, and details of connections.
 - a) Provide plan and elevation drawings showing the types, locations, and layout of the monitoring targets, inclinometers, extensometers, and any other instrumentations.
 - b) Provide identification numbers for each device and target.
 - c) Provide elevation, station, and offset for each device and target.

**UNIVERSITY OF DELAWARE BRIDGE MONITORING PROGRAM
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

A permanent bridge instrumentation system will be installed on the New Indian River Inlet Bridge. The purpose of the system is to enable the Department to effectively manage and maintain the bridge by better understanding its performance under a variety of loading conditions including construction loads, dead loads, traffic loads, and environmental loads.

2.0 DESCRIPTION

The bridge instrumentation system (BIS) will be developed by the University of Delaware (UD), working cooperatively with the Design-Builder. A monitoring program manual will be developed that describes in detail the monitoring program, all associated instrumentation, the responsibilities of all parties with regards to system installation, and the reporting protocols. The manual developed as part of the original bridge design concept is included in the *Reference Documents* Section of the Scope of Services Package for reference purposes.

 Additional information regarding the instrumentation system and monitoring program was presented at the pre-proposal meeting.

3.0 RESPONSIBILITIES

 UD will install internal and external sensors on the bridge (both on site and at fabrication yards) and possibly on temporary structures in order to quantify bridge behavior during and after construction. The University will be responsible for supplying all sensors and installing the vast majority of the sensors.

The Design-Builder will be responsible for installing sensors, such as heavy load cells, that require exceptional means of installation. The Design-Builder shall provide UD with access to the bridge construction site and to on-site power, as well as the means to physically reach the locations where the sensors will be installed to perform readings during the appropriate construction phases. Means of access might include lifts, ladders, or other devices. The Design-Builder shall also be responsible for the movement of bulky equipment to required locations.

 The Design-Builder shall be responsible for working with UD to incorporate into the design plans necessary details such as through holes, block outs, and communication conduit for the BIS. The Design-Builder shall be responsible for installing communication conduits that run throughout the bridge and connect to a data acquisition cabinet located at a site to be determined that is close to the bridge. The Design-Builder shall provide the necessary utility hook-ups and ensure that the communication cabinet sits on an appropriate pad. Utility services anticipated for this work include electric and telephone services.

All UD staff working on and off site shall be independently safety certified and insured at no cost to the Design-Builder.

 **4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

The Design-Builder shall include a Project Component titled “University of Delaware Bridge Monitoring Program Activities” on the submitted Schedule of Values (Form SV) included in Appendix C to the

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Instructions to Proposers. This activity shall have a fixed Project Component Value of One Hundred Thousand Dollars (\$100,000.00) and shall be included in the Total Lump Sum Proposal Price included on the Schedule of Values.

All Design-Builder costs associated with coordination and the incorporation of details such as through holes, block outs, and communication conduit into the Design Plans and/or Working Drawings shall be incidental to the Contract.

All construction related activities including, but not limited to, the furnishing and/or installation of labor, materials, and equipment for the installation of the Bridge Instrumentation System shall be performed by the Design-Builder on a force account basis in accordance with Part 2 – DB Section 109-8.2.2 of the Contract Documents. Requests for Periodic Payment shall be made on Form RPP for the specified Project Component in accordance with DB Section 109. The actual value of the force account(s) will be divided by the \$100,000 value to establish the percentage of the Total Lump Sum that will be paid when the work occurs. The contractor will only be paid for the value of the work established by the force account(s).

**WARRANTY REQUIREMENTS
PERFORMANCE SPECIFICATION**

1.0 INTRODUCTION

The Design-Builder shall be required to meet minimum warranty requirements associated with the contract Work. This Performance Specification identifies items and systems to be warranted by the Design-Builder and the minimum terms associated with those items.

2.0 REQUIREMENTS

The Design-Builder shall unconditionally warrant to the Department all items specified within this Performance Specification, for the minimum period specified, to be free of defects and deficiencies in the design, manufacture or workmanship that would result in the loss of an essential quality or function. The minimum warranty periods specified shall be from the date of Final Acceptance by the Department.

With respect to any portion of the Work that is repaired or replaced, the remaining warranty period shall be the longer of one year from repair or replacement of the Work or the remainder of the original warranty period.

Nothing in these warranty requirements is intended to limit any manufacturer's warranty nor any warranty implied by Delaware law. The Design-Builder will provide the Department with all manufacturer's warranties prior to Final Acceptance of the Work.

See Part 2 – DB Section 104-6 of the Contract Documents for additional requirements.

 **2.1 CABLE SYSTEM**

The Design-Builder shall guarantee the installed stay cable system performs within the cable vibration performance requirements established for the Work for a minimum period of two (2) years. The Design-Builder shall be responsible for modifying and/or replacing damping system(s), cable surface treatments and cable stiffening ropes, as required, to achieve the established performance requirements for cable vibration at no additional cost to the Department. The Design-Builder will replace or repair to like-new condition all cable elements, appurtenances, or bridge components damaged by cable vibration or damaged by other environmental loading conditions in combination with cable vibration for the duration of the warranty period at no cost to the Department.

2.2 EXPANSION JOINTS

The Design-Builder shall guarantee the performance of all expansion joint systems, including drainage troughs, for a minimum period of five (5) years. If any expansion joint fails to perform properly for any reason, including but not limited to normal wear and tear, then the Design-Builder shall replace the expansion joint system at no cost to the Department.

2.3 BRIDGE BEARINGS

The Design-Builder shall guarantee the performance of all bridge bearings for a minimum period of five (5) years. If any bridge bearing fails to perform properly for any reason, including but not limited to normal wear and tear, then the Design-Builder shall replace the bridge bearing at no cost to the Department.

2.4 DECK OVERLAY

The Design-Builder shall guarantee the performance of the entire bridge deck overlay system for a

minimum period of two (2) years. If any portion of the deck overlay system fails to perform properly for any reason, including but not limited to normal wear and tear, cracking, or delamination, then the Design-Builder shall replace the failed portion of the bridge deck overlay at no cost to the Department.

2.5 COATINGS

The Design-Builder shall guarantee the performance of all bridge coating systems for a minimum period of five (5) years. If any portion of the bridge coating system fails to perform properly for any reason including, but not limited to, blistering, cracking, peeling, or discoloration then the Design-Builder shall replace the failed bridge coatings at no cost to the Department.

2.6 LIGHTING FIXTURES

The Design-Builder shall guarantee the performance of all lighting fixtures for a minimum period of two (2) years. If any internal or external lighting fixture fails to perform properly for any reason, including but not limited normal wear and tear or improper grounding then the Design-Builder shall replace the failed lighting fixture at no cost to the Department. Additionally, the Design-Builder shall furnish to the Department adequate replacements bulbs and parts for unique lighting fixtures. Replacement bulbs and fixtures shall be sufficient to meet the anticipated maintenance schedule included in the Design-Builder's Maintenance Manual. See Part 3 – Performance Specifications, *Inspection, Maintenance and Construction Requirements* for additional Maintenance Manual Requirements.

2.7 MECHANICAL AND ELECTRICAL SYSTEMS

The Design-Builder shall guarantee the performance of all mechanical and electrical equipment, apparatus, materials, and workmanship provided under the Contract for a minimum period of one (1) year. During the warranty period, any repairs or replacement needed to maintain satisfactory operation of the mechanical and electrical systems furnished shall be made by the Design-Builder at no cost to the Department.

2.8 ADDITIONAL ITEMS

Other items included in the Design-Builder's warranty proposal shall be guaranteed for the period and terms specified in the Technical Proposal included in Part 8 of the Contract Documents.

2.9 EXTENDED WARRANTY PERIODS

Any extended warranty periods beyond the minimum requirements specified in this Performance Specification shall be in accordance with the terms of the Design-Builder's warranty proposal included in Part 8 of the Contract Documents.

2.10 MAINTENANCE BOND

A Maintenance Bond shall be submitted to the Department per DB Section 103-2 for all guaranteed and warranted items.

WIND ENGINEERING REQUIREMENTS

PERFORMANCE SPECIFICATION

1.0 PRELIMINARY DESIGN SERVICES

During the preliminary design phase, the Design-Builder shall undertake the following wind related activities:

- A) Review of the Meteorological Site Analysis (see Reference Documents – Wind Effects);
- B) Preliminary Wind Design of the Bridge Structure;
- C) Preliminary Sectional Model Tests; and
- D) Select Cable-Stay Vibration Evaluation and Control Methods.

1.1 INITIAL DESIGN REVIEW

In the preliminary design stage, the Design-Builder shall review the Meteorological Site Analysis and provide aerodynamic input on how alternative deck cross-sections and above deck supporting member(s) details (such as towers, pylons, arches, and other such supporting elements) will perform in the wind.

The conclusion of this effort shall determine what deck cross-section shall be initially tested.

1.1.1 Preliminary Sectional Model Tests

This phase of the study shall include preliminary wind tunnel sectional model tests to examine the vertical and torsional motions of the bridge deck. Three configurations shall be tested, as follows:

- A) The deck without railings and barriers representing construction stages;
- B) The deck with railings and barriers for the completed bridge; and
- C) The deck with railings, barriers and a typical traffic pattern.

The tests shall be conducted in smooth flow conditions representative of those at the bridge site in order to determine the aerodynamic characteristics and any tendency to instability. Smooth flow tests shall be used to investigate the potential for vortex shedding induced response as well as lower bound estimate of the onset of any aeroelastic instability. Smooth flow tests shall be used to estimate the wind force coefficients on the completed structure as well as the sensitivity to turbulence of any instability identified in the smooth flow tests. Critical wind speeds for instability shall be established.

Should the stability and/or response characteristics prove not to be satisfactory, modifications to the aerodynamic cross-sections should be made. Naturally occurring turbulence in the wind shall not be relied upon to meet the stability and vortex induced motion criteria.

1.1.2 Cable Vibrations

Using the latest available research, testing, and analytical techniques, the preliminary wind studies shall include an evaluation for wind-induced cable-stay vibrations caused by coupled wind and rain effects, vortex shedding and wake galloping. The study shall include recommended methods to suppress or mitigate vibrations. Additional requirements for suppressing cable-stay vibrations, if applicable, are outlined in the Cable-Supported Bridge System Requirements Special Provision.

2.0 FINAL DESIGN SERVICES

During the final design phase, the Design-Builder shall undertake the following wind studies:

- A) Static and Dynamic Sectional Model Tests;
- B) Buffeting Analysis;
- C) Aeroelastic Model Tests - Construction Stages; and
- D) Aeroelastic Model Tests - Completed Bridge.

ALTERNATE ANALYTICAL PROCEDURES

(in lieu of tasks identified in 2.1.3, 2.1.4, 2.1.4.1 (not 2.1.4.2), and 2.1.5)

- A) Buffeting Analyses - Completed Bridge
- B) Stability Analyses - Completed Bridge
- C) Buffeting Analyses - Construction Services
- D) Stability Analyses - Construction Services

The Design-Builder's wind engineering laboratory must declare whether they wish to use the small-scale, full-bridge, aeroelastic model approach in their analyses, or the alternate analytical procedure. They laboratory must have used the chosen procedure in the wind engineering studies for at least three comparable bridges. The laboratory must provide a list of the three most recent bridge wind engineering studies using the selected procedure, and the appropriate contact information for the owners and clients for those projects. The Department shall approve the laboratory and the analytical and testing procedures to be used.

2.1 STATIC AND DYNAMIC SECTIONAL MODEL TESTS

2.1.1 Detailed Sectional Model Tests

This phase of the study shall include a comprehensive series of sectional model tests on the final design of the deck. The sectional model shall have the section of the deck corresponding to the final design. The detailed sectional model tests shall be conducted to examine the vertical and torsional dynamic motions of the bridge. The models shall not be constructed to a scale of less than 1:60. A single test series will involve testing at a minimum of 5 angles of inclination, -5 to 5 degrees in 2.5 degree increments. In the primary test series, the damping shall be set at a conservative value and smooth flow simulated. These parameters shall be referred to as the benchmark conditions. Several test series shall be performed to examine the influence of damping, and the torsional to vertical frequency ratio. Then the effect of turbulence on the stability of the section shall be measured.

The test program shall provide as a minimum the following:

- A) Test the section for the benchmark conditions for 5 angles of attack;
- B) Adjust the benchmark conditions by increasing the damping to the probable maximum value and test for 5 angles of attack;
- C) Adjust the benchmark conditions by lowering the frequency ratio and test for 3 angles (from -2.5 to 2.5 degrees in 2.5 degree increments) of attack;
- D) For benchmark conditions, introduce turbulence into the wind flow and test for horizontal winds;
- E) If unacceptable levels of vortex shedding are found at this point, additional tests to examine refinements to the deck cross-section shall be carried out; and
- F) Turbulence should not be relied upon to meet the design criteria.

2.1.2 Measurement of Time-Averaged Force Coefficients

After the stability of the section has been confirmed, measurements shall be carried out for the time averaged vertical and horizontal wind forces and pitching moments on the bridge deck model in order to determine the mean wind load coefficients. The tests shall be conducted in smooth flow wind for 11 angles of inclination, -10 degrees to +10 degrees in 2 degrees increments. Three configurations shall be tested, as follows:

- A) The deck without railings and barriers representing construction stages;
- B) The deck with railings and barriers for the completed bridge; and
- C) The deck with railings, barriers and a typical traffic pattern. Some measurements shall be included in turbulent flow.

2.1.3 Buffeting Analysis

The following tasks shall be undertaken in order to determine the wind loads acting on the bridge deck and above deck supporting member(s):

- A) Based on buffeting theory and using the static force coefficients determined from the sectional model tests, wind loads acting on the bridge shall be estimated for construction stages as well as in its completed configuration. Two construction stages shall be examined. Typically, the stage prior to connecting to the temporary tie-down (if used or required by the Design-Builder's design) and the stage prior to building the closures shall be evaluated. Effective wind load distributions shall be provided for the design wind speeds for each of the two construction stages, the completed bridge with and without traffic and for any other critical conditions that are identified. Approximately the ten lowest modes of vibration shall be considered. Aeroelastic effects (motion dependent aerodynamic loads) shall be included in the buffeting analysis.
- B) Review the design of the above deck supporting member(s) to assess their susceptibility to unstable aerodynamic behavior and also to provide estimated wind loads.

2.1.4 Aeroelastic Model Study-Construction Stages

In order to investigate the wind loads on the partial structure during construction, the aeroelastic model study shall include two parts:

- A) Partially completed bridge deck; and
- B) Free-standing above deck supporting member.

2.1.4.1 Partially Completed Bridge

- A) Examine the aeroelastic stability and measure the responses of the bridge during erection at the two most critical construction stages. The critical stages will be selected on the basis of the dynamic analysis, sectional model results and the buffeting analysis described above.
- B) An aeroelastic model of the bridge shall be designed and constructed with a scale of 1:200 or greater. The model shall be capable of representing two erection stages including any temporary supports or construction equipment that might be used.
- C) A section model shall be made to the scale as the full-bridge aeroelastic model and tested at the same Reynolds Number at which the full-bridge model will be tested. Tests shall be performed in horizontal winds in smooth flow, and are to be performed to validate the use of a small-scale model. If the ratio of small-scale model critical flutter wind speed to large-scale critical flutter wind speed is less than unity, then the full-bridge critical flutter

wind speeds must be scaled by the same ratio. Similarly, if the ratio of the small-scale section model buffeting response to the large-scale buffeting response is less than unity, then the full-bridge buffeting results must be scaled by the inverse of this ratio. Beneficial results from the small-scale section model tests (relative to the large-scale section model results) shall not be allowed.

- D) The pertinent elastic properties of the deck and the above deck supporting member(s) shall be scaled down and incorporated in the structural components (spines) of the model. The correct mass and geometry of the deck and above deck supporting member(s) shall be represented by segmented sections attached to the spines. The geometric portions of the model shall be constructed of wood, plastic and/or metal, bearing in mind durability, weight and maintenance of model accuracy. Initially, the sources of damping shall be minimized in the model, and if necessary, damping could be later increased to represent full scale. The main cable stiffnesses shall be correctly scaled and the cable ends, cable drag and mass be brought up to the properly scaled values by attaching specially proportioned weights at intervals along their length.
- E) The aeroelastic model shall be instrumented with strain gages at the base and deck levels of the above deck supporting member(s) and accelerometers at the top of the above deck supporting member(s). Displacement transducers shall be used to measure the horizontal, vertical and torsional deflections of the deck.
- F) The model shall be tested in a properly scaled simulation of the natural turbulent wind. Critical wind speeds, vortex shedding and turbulent response shall be measured for the construction stages. The mean wind tunnel wind speed shall have a full-scale equivalent averaging time that is long with respect to the longest bridge natural period, but not greater than the period of the longest gust that can modeled in the wind tunnel with accuracy. The turbulence intensity modeled must be consistent with the upwind exposures and the mean wind speed averaging time.
- G) Each model configuration shall be tested for a series of wind speeds covering the design range and beyond. The effects of the wind normal to the span and from other directions shall be investigated. Tests shall be carried out to assess the impact of changes in the turbulence levels.
- H) The mean, root mean square, and peak vertical and horizontal deflections of the deck shall be measured for each test direction and the corresponding bending and torsional moments of the above deck supporting member(s) obtained.
- I) The meteorological wind data shall be combined with the wind tunnel data to derive the effective design wind loads and distributions. These effective wind loads and distributions shall incorporate the effects of the dynamic excitation of the bridge in its various modes of vibration.
- J) Turbulence shall not be relied upon to meet the design criteria.

2.1.4.2 Tests on a Free Standing Above Deck Supporting Member

One of the above deck supporting member models constructed for the Construction Stages tests shall be modified and used for these tests by removing the deck.

- A) During the tests, the base shears normal and parallel to the span and corresponding moments shall be measured in each leg of the supporting member. In addition, motions at the top accelerations at the top of the above deck supporting member shall be measured normal and parallel to the span. The tests shall be performed for wind azimuths from 0 degrees through 90 degrees with 0 degrees being normal to the span. The tests shall be

carried out on the completed above deck supporting member as well as on the above deck supporting member modeled in its most critical interim stage.

- B) Supplementary tests shall be carried out in low turbulence flow to check the vortex shedding response. Again, turbulence shall not be relied upon to meet the design criteria.
- C) The test data shall be used to derive the recommended wind forces for structural design and to provide predictions of the above deck supporting member's dynamic response.

2.1.5 Aeroelastic Model Tests - Completed Bridge

In order to confirm the response of the bridge in its completed form, confirm and refine the findings of the sectional model tests and assess three-dimensional and topographic effects, the following tasks shall be undertaken:

- A) The test model assembled for the investigation of the construction stages shall be expanded to represent the completed bridge.
- B) The force and displacement measurements on above deck supporting member(s) and deck outlined for the construction stages shall also be carried out with the complete center span modeled.
- C) The test program in terms of wind speeds, wind direction and turbulence levels shall be as outlined for the tests on the construction stages.

2.2 ALTERNATE ANALYTICAL PROCEDURE

This alternative analytical procedure may be used in lieu of the tasks outlined in 2.1.3, 2.1.4, 2.1.4.1, and 2.1.5 - not 2.1.4.2).

As outlined in previous sections, the section model studies are assumed to simulate the fundamentals vertical and torsional modal responses of the bridge under a number of conditions. These are approximate results, and should they be used as such, then small-scale full-bridge aeroelastic model studies must be performed.

The large-scale section model studies can, however, be used to obtain static and dynamic aerodynamic characteristics of the bridge deck section (static drag, lift, and moment coefficients, and aeroelastic flutter derivatives). These can be used with an analytical description of the wind environment and a detailed finite element model of the bridge structure to predict the behavior of the full bridge in strong winds, in its final configuration and in its various construction configurations.

2.2.1 Buffeting Analyses - Completed Bridge

The buffeting analysis of the full bridge using the analytical procedures defined in Section 2.2 shall be performed for the 5 angles of incidence, for the bridge with and without the traffic pattern. Included in the analyses shall be a minimum of the lowest 3 sway, 3 vertical, and 3 torsional modes of vibration, and the fundamental modes of vibration that define the motion of the above deck supporting members. Aeroelastic effects and aerodynamic coupling amongst all the modes shall be included.

If any buffeting analysis produces unacceptable results, then the bridge deck shall be modified until the buffeting results are acceptable.

2.2.2 Stability Analyses - Completed Bridge

Stability analyses shall be performed using the analytical procedures described previously in smooth flow for the 5 angles of incidence using the modes of vibration identified in Section 2.2.1, with and without the traffic pattern. Effects of turbulence (on the aeroelastic flutter derivatives) on the analytically generated critical flutter wind speeds shall be identified.

If any analysis produces results that do not meet the design criteria, the bridge design shall be modified

until all stability analyses meet the design criteria. The design criteria shall apply to all 5 angles of incidence without reduction unless it can be shown that the mean deck rotation, at the critical flutter wind speed, is less than 5 degrees.

2.2.3 Buffeting Analyses - Construction Services

The analyses defined in Section 2.2.1 shall be repeated for the two most critical construction configurations identified in Section 2.1.4.1 (A). From the peak modal responses identified in this analyses, the internal actions in the deck and above deck supporting member(s) can be computed. The static and dynamic aerodynamic coefficients used shall be those obtained without the deck furniture.

If any response is unacceptable, construction procedures shall be changed to make all responses (and resulting internal actions) acceptable.

2.2.4 2.2.4 Stability Analyses - Construction Services

The analyses defined in Section 2.2.2 shall be repeated for the two most critical construction configurations identified in Section 2.1.4.1.(A). Aerodynamic coefficients for the bridge deck shall be those obtained for the bridge deck without deck furniture.

If any critical flutter wind speeds do not meet the design criteria, the construction procedures must be changed, or the bridge deck section must be temporarily changed, until the design criteria are met for all cases considered. Again, turbulence in the natural wind shall not be relied upon to meet the design criteria.

3.0 AVAILABILITY OF INFORMATION

Interim information shall be made available to the Department as the preliminary and final design wind studies evolve. This will include, as a minimum, a summary report following the completion of the following

- A) Meteorological /Site Analysis (if different from the Department-furnished report)
- B) Initial Design Review;
- C) Preliminary Section Model Tests;
- D) Final Static and Dynamic Sectional Model Tests;
- E) Buffeting Analyses (completed bridge and construction stages);
- F) Stability Analyses (completed bridge and construction stages)

Items E) and F) shall describe results from the full-bridge aeroelastic model studies, or from the alternate analytical studies.

Two final reports shall also be prepared, one at the completion of the preliminary design phase wind studies and the other at the completion of the final design phase wind studies. The final preliminary design phase and final design phase wind reports shall provide a complete review of the studies performed at the respective phase, including modeling principles, test methods, test results, analysis and recommendations.

To assist in describing the wind tunnel tests and test results, video tape recordings of the key aspects of the preliminary design and final design tests shall be produced during these activities. At the completion of the final design phase wind studies, the video shall be edited and be of professional quality to be used in presentations.

The Design-Builder shall maintain a close contact with the Department throughout the course of the wind

Delaware Department of Transportation

studies via telephone and fax and make provisions for a minimum of four or five (4 or 5) design review meetings as outlined below:

- 1) **Meeting #1:** At the Department's Administration Building in Dover, Delaware upon completion of the Initial Design Review to discuss the initial assessments on the deck cross-section and above deck supporting member(s) and discuss design modifications, if necessary.
- 2) **Meeting #2:** At the wind laboratories during the preliminary sectional model tests to review the initial results and discuss design modifications, if necessary.
- 3) **Meeting #3:** At the wind laboratories during the final sectional model tests to review the model and its instrumentation, and confirm the test program.
- 4) **Meeting #4:** At the wind laboratories during the full-bridge aeroelastic test to review the model and its instrumentation and confirm the test program (if the full-bridge aeroelastic model option is chosen).
- 5) **Meeting #5:** At the Department's Administration Building in Dover, Delaware to make a presentation of the complete test program and its results.

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STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

PART 4

SPECIAL PROVISIONS

Delaware Department of Transportation

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- H) **Safety Manager:** Shall be a Work Zone Safety Supervisor as certified by any agency or firm approved by the Department. The Safety Manager should have a minimum of 10 years experience in a work zone safety technician or supervisor capacity on construction projects for major bridges over navigable waters and new roadway facilities. The Safety Manager shall be knowledgeable of OSHA standards and shall be present as necessary to ensure the safety of the workers and the job site.

- I) **Environmental Coordinator:** Shall have at least a Bachelor of Science (B.S.) or Bachelor of Arts (B.A.) degree and demonstrated experience related to the areas of responsibility outlined in the Contract Documents. The Environmental Coordinator should have experience in managing others in environmental activities and experience with major Bridge projects. The Environmental Coordinator should have experience with Bridge and Highway engineering drawings and concepts and working cooperatively and effectively with design engineers and construction staff.

- J) **Lead Geotechnical Engineer:** Shall be a Delaware-licensed Professional Engineer who is an employee of the Designer or a firm on the design team. The Lead Geotechnical Engineer shall have demonstrated experience in geotechnical investigation and design with demonstrated expertise in deep river foundation design and construction including drilled shafts and caisson type foundations.

- K) **Public Outreach Specialist:** Shall have at least a B.S. or B.A. degree and demonstrated experience related to the areas of responsibility outlined in the Contract Documents. The Public Outreach Specialist should have experience in managing others in community involvement activities and experience with major Bridge projects. The Public Outreach Specialist should have experience with Bridge and Highway engineering drawings and concepts and working cooperatively and effectively with design engineers and construction staff.

- L) **Traffic Control Supervisor:** Shall have demonstrated experience in traffic and Highway engineering with contractor, consultant, city, county, or state transportation agencies and possess certification from the American Traffic Safety Services Association (ATSSA).

SECTION 108C - KEY PERSONNEL QUALIFICATIONS AND REQUIREMENTS

In the qualifications specified below, the word “shall” indicates a required minimum qualification. The word “should” indicates the Delaware Department of Transportation’s preferred qualifications, but such qualification is not a mandatory requirement.



A) **Design-Builder’s Project Manager:** Should have a minimum of 15 years experience in construction and management of major bridge structures with demonstrated experience on the design and construction engineering of bridge projects that included work of a similar scope, nature, and complexity as this project. The Project Manager shall have served in a similar role on a minimum of one prior design-build project. The Design-Builder’s Project Manager shall be the Design-Builder’s representative and single point of contact.

B) **Principal-in-Charge:** Should have a minimum of 20 years experience in construction and management of major bridge or highway projects that included work of a similar scope, nature, and complexity as this project. The Principal-in-Charge should have served in a similar role on a minimum of one prior design-build project of similar scope, nature, and complexity as this project.



C) **Design Manager:** Shall be a Delaware-licensed Professional Engineer who is an employee of the Designer or a firm on the design team. The Design Manager shall have a minimum of 15 years experience in design of large bridge design projects with similar type, scope and complexity as this project. The Design Manager should have served in a similar role on a minimum of one prior design-build bridge project.



D) **Construction Manager:** Should have a minimum of 15 years experience in construction of major bridge structures with demonstrated experience on the construction of bridge projects that included work of a similar scope, nature, and complexity as this project. The Construction Manager should have served in a similar role on a minimum of one prior design-build bridge project.

E) **Quality Control Manager:** Should have a minimum of 20 years experience in major bridge structure design and/or construction with at least 10 years experience in Quality Assurance (QA)/Quality Control (QC) activities, including preparation and implementation of Quality Plans and procedures for design and/or construction.

F) **Design Quality Control Manager:** Shall be a Delaware-licensed Professional Engineer who is an employee of the Designer or a firm on the design team. The Design QC Manager should have a minimum of 5 years experience in QC/QA activities on large bridge design projects with similar scope and complexity of the New Indian River Inlet Bridge Project.

G) **Construction Quality Control Manager:** Shall be a Delaware-licensed Professional Engineer who is an employee of the independent firm responsible for construction QC. Should have a minimum of 15 years experience in QC/QA activities (including management of construction QC programs) on large bridge construction projects that have incorporated the type of construction included in the New Indian River Inlet Bridge Project. The Construction QC Manager should have demonstrated experience in Materials management, specifications, and testing procedures.

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401502 - ASPHALT CEMENT COST ADJUSTMENT

For Sections 304, 401, 402, 403, 404, and 405, payments to the Contractor shall be adjusted to reflect increases or decreases in the Delaware Posted Asphalt Cement Price when compared to the Project Asphalt Cement Base Price, as defined in these Special Provisions.

The Delaware Posted Asphalt Cement Price will be issued monthly by the Department and will be the industry posted price for Asphalt Cement, F.O.B. Philadelphia, Pennsylvania.

The Project Asphalt Cement Base Price will be the anticipated Delaware Posted Asphalt Cement Price expected to be in effect at the time of receipt of bids.

All deviations of the Delaware Posted Asphalt Cement Price from the Project Asphalt Cement Base Price are eligible for cost adjustment. No minimum increases or decreases or corresponding percentages are required to qualify for cost adjustment.

Actual quantity of asphalt cement qualifying for any Asphalt Cement Cost Adjustment will be computed on the basis of weight tickets and asphalt percentage from the approved job mix formula.

For Recycled Hot-Mix the asphalt percentage eligible for cost adjustment shall be only the new asphalt cement added to the mix.

There shall be no separate payment per ton (metric ton) cost of asphalt cement. That cost shall be included in the various unit prices bid per ton (metric ton) for those bid items that contain asphalt cement (mentioned above).

The Asphalt cement cost adjustment will be calculated on grade PG 64-22 asphalt regardless of the actual grade of asphalt used. The Project Asphalt Cement Base Price for the project will be \$388.33 per ton (\$428.07 per metric ton).

If the Contractor exceeds the authorized allotted completion time, the price of asphalt cement on the last authorized allotted work day, shall be the prices used for cost adjustment during the time liquidated damages are assessed. However, if the industry posted price for asphalt cement goes down, the asphalt-cement cost shall be adjusted downward accordingly.

NOTE

Application of Asphalt Cement Cost Adjustment requirements as indicated above shall apply only to those contracts involving items related to bituminous base and pavements, and with bitumen, having a total of 1,000 tons (1,000 metric tons) or more of hot-mix bid quantity in case of Sections 401, 402 and 403; and 15,000 gallons (60 000 liters) or more in case of Sections 304, 404 and 405.

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302500 - DEL. NO. 3 STONE
302501 - DEL. NO. 8 STONE
302502 - DEL. NO. 2 STONE
302503 - DEL. NO. 57 STONE
302504 - DEL. NO. 67 STONE
302505 - DEL. NO. 10 STONE
302509 - DEL. NO. 1 STONE

Description:

This work consists of furnishing, hauling, placing, and compacting stone, in accordance with the details and notes shown on the Plans and/or as directed by the Engineer.

Materials and Construction Methods:

The stone for Del. No(s). 1, 2, 3, 57, 67, 8 and 10 shall comply with quality and gradation requirements of respective Sections 805, and 813 of the Standard Specifications.

Construction methods shall conform to the requirements of notes on the Plans and/or as directed by the Engineer.

When used in a temporary situation, the stone shall be removed and disposed of by the Contractor as directed by the Engineer.

Method of Measurement:

~~———— The quantity of stone will be measured as the actual number of tons (metric tons) for stone placed and accepted. The weight will be determined according to Subsection 109.01.~~

Basis of Payment:

~~———— The quantity of stone will be paid for at the Contract unit price per ton (metric ton). Price and payment will constitute full compensation for furnishing, hauling, and placing all materials, and for all labor, equipment, tools, and incidentals required to complete the work.~~

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401644 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 64-22
401645 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 64-22
401646 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 64-22

401647 - SUPERPAVE, TYPE B HOT-MIX, 115 GYRATIONS, PG 64-22
401648 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 64-22
401649 - SUPERPAVE, TYPE B HOT-MIX, 205 GYRATIONS, PG 64-22

401650 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 70-22
401651 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 70-22
401652 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 70-22

401653 - SUPERPAVE, TYPE B HOT-MIX, 115 GYRATIONS, PG 70-22
401654 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 70-22
401655 - SUPERPAVE, TYPE B HOT-MIX, 205 GYRATIONS, PG 70-22

401656 - SUPERPAVE, TYPE C HOT-MIX, 115 GYRATIONS, PG 76-22
401657 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 76-22
401658 - SUPERPAVE, TYPE C HOT-MIX, 205 GYRATIONS, PG 76-22

401659 - SUPERPAVE, TYPE B HOT-MIX, 115 GYRATIONS, PG 76-22
401660 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 76-22
401661 - SUPERPAVE, TYPE B HOT-MIX, 205 GYRATIONS, PG 76-22

401662 - SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 115 GYRATIONS, PG 64-22

401663 - SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 160 GYRATIONS, PG 64-22

401664 - SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 205 GYRATIONS, PG 64-22

401665 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG 64-22, PATCHING

401666 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG 64-22, PATCHING

401667 - SUPERPAVE, BITUMINOUS CONCRETE BASE COURSE, 160 GYRATIONS, PG-64-22, PATCHING

401668 - SUPERPAVE, TYPE C HOT-MIX, 160 GYRATIONS, PG-64-22, WEDGE

401669 - SUPERPAVE, TYPE B HOT-MIX, 160 GYRATIONS, PG-64-22, WEDGE

Description:

The following Subsections of the Standard Specifications shall be applicable: 401.01, 401.03 - 401.10, 401.12, and 401.13. All other subsections have been modified herein.

The Contractor shall read and thoroughly understand the requirements of the QA/QC specification as defined in item 401699. It is the responsibility of the Contractor to determine all costs associated with meeting these requirements and to include them in the per ton bids for the various Superpave bituminous concrete items. The Contractor shall also be aware that the pay adjustment factors in item 401699 will be applied to the Superpave bituminous concrete payments to determine the bonus or penalty for the item.

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Materials:

Materials for hot-mix, hot-laid bituminous concrete shall conform to the requirements of Subsections 823.01, 823.05- 823.17, and 823.25 - 823.28 of the Standard Specifications and the following.

Asphalt Binder:

The asphalt binder shall meet the requirements of Superpave PG 64-22, PG 70-22, or PG 76-22 performance grade asphalt, as referenced in the Plans, according to M-320, Table 1 and tested according to AASHTO PP6 with the following test ranges:

TEST PROCEDURE	AASHTO REFERENCE	SPECIFICATION LIMITS
Temperature, °C	M-320	Per Grade
Original DSR, $G^*/\sin(\delta)$	T-315	1.00 - 2.00 kPa
RTFO DSR, $G^*/\sin(\delta)$	T-315	2.20 - 5.00 kPa
PAV DSR, $G^*/\sin(\delta)$	T-315	1400 - 5000 kPa
BBR Creep Stiffness	T-313	90.0 - 300.0 kPa
BBR — value	T-313	0.300 - 0.440

Substitution of a higher temperature grade will require prior approval by the Engineer. If PG 76-22 is the specified binder, recycled asphalt pavement (RAP) and natural sand shall not be allowed in the mixture. If a producer would like to submit a mixture with natural sand, the Engineer will perform a deformation test using the Asphalt Pavement Analyzer (APA). The sample will be tested per AASHTO TP xxx “Determining Rutting Susceptibility of Asphalt Paving Mixtures Using the Asphalt Pavement Analyzer (APA)”. If the depth of measured permanent deformation is 2 mm or less after 8000 strokes and a fatigue criteria of less than 1.0 mm/stroke after at least 50000 strokes, the mixture may be approved for use.

Shingles:

Only shingles reclaimed from shingle manufacturers such as tabs, punch-outs, and damaged new shingles shall be allowed in the mixture. Post-consumer shingles or used shingles shall not be permitted in the mixture and all shingles shall be free of all foreign material and moisture. Fiberglass-backed and organic felt-backed shingles shall be kept separately and both materials shall not be used in the same mixture at the same time. The shingles shall be broken down in the mixing process with 100% passing the ½ in (12.5 mm) sieve. Shipping, handling, and shredding cost are incidental to the price of Superpave bituminous concrete.

The overall percentage of RAP and recycled shingles (5% maximum) shall not exceed 20% of the mixture. The RAP and recycled shingles mixture are not permitted on wearing course.

Mineral Aggregate:

The mineral aggregate employed in the target gradation of the job mix formula (JMF) shall conform to Section 805 and the following criteria. These criteria apply to the combined aggregate blend.

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DESIGN ESAL'S (MILLIONS)	COARSE AGGREGATE ANGULARITY ¹ (% MIN)		FINE AGGREGATE ANGULARITY ² (% MIN)		CLAY CONTENT ³ (% - MIN)	FLAT AND ELONGATED ⁴ (% - MAX)
	≤ 100 MM	> 100 MM	≤ 100 MM	> 100 MM		
< 0.3	55/-	-/-	-	-	40	-
0.3 to < 3	75/-	50/-	40	40	40	10
3 to <10	85/80 ⁵	60/-	45	40	45	
10 < 30	95/90	80/75	45	40	45	
≥30	100/100	100/100	45	45	50	

¹Coarse Aggregate Angularity is tested according to ASTM D5821.

²Fine Aggregate Angularity is tested according to AASHTO TP-33.

³Clay Content is tested according to AASHTO T176.

⁴Flat and Elongated is tested according to ASTM 4791 with a 5:1 aspect ratio.

⁵ 85/80 denotes that 85% of the coarse aggregate has one fractured face and 80% has two or more fractured faces.

The following source properties apply to the individual aggregates in the aggregate blend for the proposed JMF.

TEST METHOD	SPECIFICATION LIMITS
Toughness , AASHTO T96 Percent Loss, Maximum	40
Soundness , AASHTO T104 Percent Loss, Maximum for five cycles	20
Deleterious Materials , AASHTO T112 Percent, Maximum	10
Moisture Sensitivity , AASHTO T283 Percent, Minimum	80

For any roadway with a minimum average daily traffic volume (ADT) of 8000 vehicles and a posted speed of 35 mph (60 kph) or greater, the polish value of the composite aggregate blend shall be greater than 8.0 when tested according to Maryland State Highway Administration MSMT 411 – “Laboratory Method of Predicting Frictional Resistance of Polished Aggregates and Pavement Surfaces.” RAP shall be assigned a value of 4.0. The contractor shall supply all polish values to the Engineer upon request.

Mineral Filler:

The mineral filler shall conform to AASHTO M17.

Mixture Requirements:

Gradation: The FHWA Superpave 0.45 Power Chart with the recommended restricted zone shall be used to define permissible gradations for the specified mixture. Type C shall be either a No.4 (4.75 mm), 3/8” (9.5 mm), or 1/2” (12.5 mm) Nominal Maximum Aggregate Size Hot-Mix. Unless otherwise noted in the Plans, the Type C shall meet the 3/8” (9.5 mm) Nominal Maximum Aggregate Size. Type B Hot-Mix shall be the 3/4” (19.0 mm) Nominal Maximum Aggregate Size and the Bituminous Concrete Base

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Course (BCBC) shall be the 1" (25.0 mm) Nominal Maximum Aggregate Size. Target values for percent passing each standard sieve for the design aggregate structure shall comply with the Superpave control points and should avoid the restricted zone. Percentages shall be based on the washed gradation of the aggregate according to AASHTO T11.

In addition to the results of the material requirements specified above, the following material properties shall be provided by the contractor: bulk specific gravity G_{sb} , apparent specific gravity G_{sa} , and the absorption of the individual aggregate stockpiles to be used, tested according to AASHTO T84 and AASHTO T85 and reported to three decimal places along with the specific gravity of the mineral filler to be used, tested according to AASHTO T100 and reported to three decimal places.

Superpave Gyratory Compactive (SGC) Effort:

The Superpave Gyratory Compaction effort employed throughout mixture design, field quality control, or field quality assurance shall be as indicated below. All mixture specimens tested in the SGC shall be compacted to N_M Height data provided by the SGC shall be employed to calculate volumetric properties at N_I , N_D , and N_M

Superpave Gyratory Compactive (SGC) Effort:

DESIGN TRAFFIC LEVEL (MILLION ESAL'S)	$N_{INITIAL}$	N_{DESIGN}	$N_{MAXIMUM}$
0.3 to < 3	7	75	115
3 to < 30	8	100	160
≥ 30	9	125	205

Volumetric Design Parameters. The design aggregate structure at the target asphalt cement content shall satisfy the volumetric criteria below:

DESIGN ESAL'S (MILLION)	REQUIRED DENSITY (% OF THEORETICAL MAXIMUM SPECIFIC GRAVITY)			VOIDS-IN-MINERAL AGGREGATE (% - MINIMUM) NOMINAL MAX. AGGREGATE (MM)					VOIDS FILLED WITH ASPHALT (% - MINIMUM)
	$N_{INITIAL}$	N_{DESIGN}	N_{MAX}	25.0	19.0	9.5	12.5	4.75	
0.3 to < 3	≤ 90.5								65.0 - 78.0
3 to < 10	≤ 89.0	96.0	≤ 98.0	12.0	13.0	15.0	14.0	16.0	65.0 - 75.0 ¹
10 < 30									
≥ 30									

Air voids (V_a) at N_{design} shall be 4.0% for all ESAL designs. Air voids (V_a) at N_{max} shall be a minimum of 2.0% for all ESAL designs

The dust to binder ratio for the mix having aggregate gradations above the PCS Control Points shall be 0.6-1.2. For aggregate gradations below the PCS Control Points, the dust to binder ratio shall be 0.8-1.6. For the No. 4 (4.75 mm) mix, the dust to binder ratio shall be 0.9-2.0 whether above or below the PCS Control Points.

For 3/8" (9.5 mm) Nominal Maximum Aggregate Size mixtures, the specified VFA range shall be 73.0% to 76.0% and for 4.75 mm Nominal Maximum Size mixtures, the range shall be 75 % to 78% for design traffic levels ≥ 3 million ESALs.

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Gradation Control Points:

The combined aggregates shall conform to the gradation requirement specified in the follow table when tested according to T-11 and T-27.

Nominal Maximum Aggregates Size Control Points, Percent Passing										
	25.0 MM		19.0 MM		12.5 MM		9.5 MM		4.75 MM	
SIEVE SIZE	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
37.5 MM	100	-	-	-	-	-	-	-	-	-
25.0 MM	90	100	100	-	-	-	-	-	-	-
19.0 MM	-	90	90	100	100	-	-	-	-	-
12.5 MM	-	-	-	90	90	100	100	-	100	-
9.5 MM	-	-	-	-	-	90	90	100	95	100
4.75 MM	-	-	-	-	-	-	-	90	90	100
2.36 MM	19	45	23	49	28	58	32	67	-	-
1.18 MM	-	-	-	-	-	-	-	-	30	60
0.075 MM	1	7	2	8	2	10	2	10	6	12

Note: The aggregates gradation for each sieve must fall within the minimum and maximum limits.

Gradation Classification:

The Primary Control Sieve (PCS) defines the break point of fine and coarse mixtures. The combined aggregates shall be classified as coarse graded when it passes below the Primary Control Sieve (PCS) control point as defined below. All other gradations shall be classified as fine graded.

PCS CONTROL POINT FOR MIXTURE NOMINAL MAXIMUM AGGREGATES SIZE (% PASSING)					
Nominal maximum Aggregates Size	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.5 mm
Primary Control Sieve	4.75 mm	4.75 mm	2.36 mm	2.36 mm	1.18 mm
PCS Control Point	40	47	39	47	30-60

Plant Production Tolerances:

Volumeric Property	Superpave Criteria
Air Voids (V_a) at (%) N_m	2.0 (min)
Air Voids (V_a) at N_{design} (%)	5.5 (max)

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Volumetric Property	Superpave Criteria
Voids in Mineral Aggregate (VMA) at N_{design}	
25.0 mm Bituminous Concrete Base Course	-1.2
19.0 mm Type B Hot-Mix	+2.0
12.5 mm Type C Hot-Mix	
9.5 mm Type C Hot-Mix	
4.5 mm Type C Hot-Mix	

Design Evaluation:

The contractor shall furnish a Job Mix Formula (JMF) for review and approval. The Engineer may elect to evaluate the proposed JMF and suitability of all materials. All materials requested by the Engineer shall be provided at the contractor's expense to the Central Laboratory in Dover in a timely manner upon request. To verify the complete mixture design and evaluate the suitability of all materials, the following approximate quantities are required:

- 5.25 gal (20 liters) of the asphalt binder,
- 0.13 gal (0.5 liter) sample of liquid heat-stable anti-strip additive,
- 254 lb (115 kg) of each coarse aggregate,
- 154 lb (70 kg) of each intermediate and fine aggregate,
- 22 lb (10 kg) of mineral filler, and
- 254 lb (115 kg) of RAP, when applicable.

The proposed JMF shall include the following:

Plot of the design aggregate structure on the FHWA Superpave 0.45 power chart showing the maximum density line, Superpave control points, and recommended restricted zone.

Plot of the three trial asphalt binder contents at +/- 0.5% gyratory compaction curves where the percent of maximum specific gravity (% of G_{mm}) is plotted against the log base ten of the number of gyrations (log (N)) showing the applicable criteria for N_i , N_d , and N_m .

Plot of the percent asphalt binder by total weight of the mix (P_b) versus the following:

% of G_{mm} at N_d , VMA at N_d , VFA at N_d , Fines to effective asphalt binder (P_{be}) ratio, and unit weight (kg/m^3) at both N_d and N_m .

Summary of the consensus property standards test results for the design aggregate structure, summary of the source property standards test results for the individual aggregates in the design aggregate structure, target value of the asphalt binder content, and a table of G_{mm} of the asphalt mixture for the four trial asphalt binder contents determined according to AASHTO T209.

The JMF shall also include the NCAT Ignition Oven calibration for the specific materials utilized for this mix.

Compaction:

Compaction shall be tested and paid per Item 401699 - Quality Control/Quality Assurance of Bituminous Concrete .05 (b) Pavement Construction - Tests and Evaluations.

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Method of Measurement and Basis of Payment:

~~Method of Measurement and Basis of Payment will be in accordance with Subsections 401.14 and 401.15 of the Standard Specifications.~~

~~The item 401699, will define adjustment factor to be applied to the bituminous concrete payments for bonus or penalty.~~

NE - 12/4/03

501530 - OVERLAY CONCRETE SURFACE RIDEABILITY

Description:

This work shall consist of furnishing diamond grinding equipment and grinding the overlaid concrete deck surface in accordance with these Specifications, notes and details in the Plans, and as directed by the Engineer. Application of this Specification on the overlaid deck surface involves identifying and correcting unacceptable riding surface qualities, and involves providing payment adjustment values based on the tested quality of the riding surface smoothness.

The Contractor shall employ construction and grinding procedures that will produce a maximum average profile ride index (PRI) per 328' segment of 8.0" per mile or less on the final riding surface to receive full compensation.

Equipment Requirements

Measurement Equipment: The Contractor shall furnish, calibrate, and operate equipment capable of producing an accurate profilograph ride index in accordance to test procedures outlined in DeIDOT Test Method 13. Prior to use, the Engineer will verify that the equipment selected is capable of producing an accurate, repeatable trace of the roadway. The equipment shall be equipped with a computer-based system capable of calculating the PRI and locating excessive deviations (must-corrects).

Grinding Equipment: Equipment used to perform grinding operations for the correction of excessive deviations shall be self-propelled and contain diamond blades mounted on a multi-blade arbor that has a minimum cutting head width of 36" and that has been designed and approved for grinding pavements. The equipment shall be such that it does not cause strain or damage to the underlying surface of the surface. All slurry or residue resulting from the grinding operations shall be immediately discharged into tank trucks, or other suitable holding tanks, and shall be removed from the project for proper disposal by the Contractor. Grinding equipment that causes excessive raveling, aggregate fractures, spalls, or disturbance of the joints shall not be permitted. Equipment used to perform any grinding operations must have demonstrated previous successful use in grinding similar surfaces.

Construction Methods:

Initial Testing: The Engineer will determine the station counts for the limits of the test segments for all areas subjected to this specification using DeIDOT Test Method 13. Each segment will consist of a 328' section. The Contractor shall mark the locations of these limits with approved permanent markings on or in the overlay concrete. This identification may be a scribe mark made at the time of paving into the top surface of the plastic concrete near the side of the slab and shall remain visible until the project is accepted.

Upon completion of the superstructure erection, overlay, and any patching and similar work that may change the smoothness of the riding surface, but before any grinding or similar surface altering work, the Contractor shall test the riding surface of the deck and approach slabs (each wheelpath, in each lane) using equipment meeting the specifications established in this Specification in the presence of the Engineer. The Contractor shall provide 5-business days notice to the Engineer prior to testing.

Results of this initial testing shall be provided to the Engineer within 1 hour of completion of testing. The Engineer will then process the information and provide a summary of test segments indicating areas in need of PRI correction and must-corrects within 7 business days of test completion.

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Smoothness Requirements: In addition, the surface shall not have, in the transverse direction, any deviations greater than 0.125" as measured using a 10' straightedge.

Each area having a deviation of more than 0.28" above a reference line between two points that are up to 25 feet apart is defined as a "must-correct" area. The Engineer will report deviations located from testing by station count where the approximate greatest measured deviation exists. Complete removal of all excessive deviations, whether identified by initial testing or later testing, is required before the area will be considered acceptable.

Before being considered acceptable, each area having an unacceptable PRI must be corrected.

Correction of Excessive Deviations: Any corrective grinding that is to occur shall be performed prior to final grooving of the overlay.

The Contractor shall furnish and use equipment capable of determining the limits of the proposed corrective work. For the precast concrete superstructure deck, the Contractor shall furnish and use a pachometer to locate the top of the embedded steel prior to starting any corrective work. The Contractor shall ensure that minimum cover above the steel (2") and minimum overlay thickness (1") is met after the corrective work has occurred.

Correction Procedures - PRI Improvement: When the Initial PRI is found to be less than 10"/mile (although a negative pay adjustment may be assessed, see Table 1), the Contractor is not to perform any grinding for PRI improvement, and no final testing is required other than that applicable to must-corrects. When the Initial PRI is within the limits requiring additional corrective work (PRI >10"/mile), the contractor must improve the PRI and request final testing.

The Contractor may proceed with PRI correction only after the following steps have been completed:

- a. The Contractor has acceptably corrected all "must-correct" areas in the section and presented an acceptable profilograph trace of the full length of the test section verifying this condition to the Engineer for review and approval.
- b. The Contractor shall submit to and receive approval from the Engineer for the proposed individual locations of corrective work (limits of work) for the test segment. The Contractor, in attempting to improve the PRI to an acceptable level, shall address the roughest areas within and immediately next to the segment so that an evenly smooth travel way results.

The texture and cross-slope of the surface after PRI improvement work shall conform to the same requirements stated for work at "must-correct" areas. The Engineer reserves the right to reject any area where the Contractor did not conform to the approved improvement plan.

Final Testing: After the Contractor completes PRI improvement work and requests another PRI determination from the Engineer, the Engineer will evaluate the smoothness of the test segment riding surface (but not necessarily before the Engineer has completed outstanding work in determining Initial PRI and validating "must-correct" correction work of other test segments). The result of this evaluation will be a Final PRI. This result will be available to the Contractor within one week (7 business days) of the test being performed. After the Final PRI is requested for a test segment, the Initial PRI cannot be used for payment adjustment for that test segment.

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After the Engineer has determined the Final PRI, the Contractor shall request another PRI test when the surface alteration work exceeds a total of 50 ft² within the test segment. This requirement does not apply to surface alteration work that is approved work at “must correct” areas. However, other surface alteration work such as full depth patching, partial depth patching, and attempts at PRI improvement require another PRI determination. Whatever the previous value of the PRI for the segment, the Contractor shall request another PRI determination when surface alterations require another PRI test. If any “must-correct” deviations are discovered during Final PRI determination, the Contractor shall correct them before that segment will be accepted for payment. To receive acceptance of any such segment after correction, the Contractor shall request additional testing by the Engineer. The results of the Final PRI testing performed before this correction work will be used to determine the payment adjustment unless the Contractor requests another PRI determination.

Payment Adjustments: Payment adjustments will be made for the deck and approaches containing areas subject to the riding specification.

Values, as calculated from the Payment Adjustment Schedule (Table 1) for a segment’s Initial PRI, will be used as a basis for payment adjustment only when the Contractor does not request or require a Final PRI determination.

When the Contractor requests a Final PRI determination after an Initial PRI was determined, or after the Contractor has attempted a correction of the segment’s PRI following the initial construction of the test segment, values as calculated from the Payment Adjustment Schedule for a segment’s Final PRI will be used.

There may be a negative or a positive adjustment value for each of the test segments (Table 1). The final total adjustment will be the addition of all the individual adjustment values calculated for all of the test segments.

Table 1 - Payment for Tested Surfaces

		Contract Unit Price Adjustment (per yd ²)
Initial Test PRI	Less than 4.0	\$1.20
	4.0 to 10.0	(\$0.30) * (8-Initial PRI)
	Greater than 10	Additional Corrective Work Required
Final Test PRI	Less than 4.0	\$1.00
	4.0 to 10.0	(\$0.30) * (6-Final PRI)
	Greater than 10	Additional Corrective Work Required

Other than through the above described payment adjustment, there will be no additional payment for any work for any attempted corrections of “must-correct” areas, or for the attempted PRI improvement work.

Damage to joint sealant, stripping, etc. caused by corrective work performed on the riding surface shall be acceptably repaired by the Contractor at no additional cost to the Department.

Areas containing spalls, aggregate fractures, disturbed joints, cross-slope discontinuities, or

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raveling surfaces shall be repaired by the Contractor at no additional cost to the Department. Corrections to obtain acceptable final surface texture for cross-slope drainage, skid resistance, and appearance shall be performed by the Contractor at no additional cost to the Department.

If the option to perform a blanket grind is selected by the Engineer based on the condition of the roadway after corrective action has taken place, the bonus payment will be calculated using the PRI test results measured after blanket grinding has occurred.

3/11/05

Modified DelDOT Test Method 13: Measuring Pavement Ride Roughness with a Profilograph

This test method matches ASTM 1274, “Standard Test Method for Measuring Pavement Roughness Using a Profilograph”, except for the following additions and modifications:

Background - Overview

The profilograph is a mobile testing instrument designed to register and record deviations of a pavement surface. The profilograph shall be capable of tracing a representation of the pavement profile onto strip-chart paper for permanent record and evaluation. The profile trace shall be drawn automatically by sensing the vertical movement, relative to the 25-foot long frame of the instrument, made by a wheel traveling on the pavement. The sensing wheel shall be a bicycle-type wheel with a 5-foot circumference located at the midpoint of the profilograph frame.

A group of 6 wheels shall support each end of the frame. These wheels shall have no common axle and shall be arranged in a staggered pattern such that no two wheels cross the same bump at the same time. Each wheel group shall be connected to the frame at points 25 feet apart.

Strip-chart paper shall be advanced through the recording device as the profilograph advances over the surface being evaluated. The profile trace shall be drawn in ink as a line with a horizontal scale of 1 inch equaling 25 feet and a vertical scale of one-to-one, i.e., the full amount of deflection is shown along a length that is scaled down by a factor of 300 on the trace. The trace shall be marked to allow distance correlation to the pavement of the test segment.

Unless otherwise directed, the pavement shall be evaluated by guiding the profilograph straight along each outside wheel path of the pavement; for the PCC pavement with multiple lanes, an additional interior pass will be made approximately one foot to the left side of each longitudinal joint (left being relative to the direction of the paving operation); for HMA pavements and rehabilitation work, all other wheel paths shall also be evaluated. The wheel path is located 3 feet from the centerline of the lane being tested.

Changes for ASTM E1274

Scope

- 1.1 Add: The supported reference frame shall be 25 feet long; the equipment shall be a California-type profilograph similar to those manufactured by James Cox and Sons, Inc., of Colfax, CA., having a group of six wheels at each end that averages the elevations in the area near each end.

Terminology

- 3.1.1 Add: The blanking band length will match the length of the test segment. The width of the blanking band is 0.20 inches for new PCC pavement construction and rehabilitation. The blanking band width for new Hot-Mix Asphalt pavement is zero.

Apparatus

- 5.3 Replace with the following: *Excessive deviation template (optional)* - Clear plastic piece marked with 4 parallel lines of a length of 1.00 inches (plus or minus 0.02 inches) (24.5 to 25.5 mm), spaced at 0.1 inches (2.5mm) on center, all beginning and ending at an imaginary line that is oriented 90 degrees to the ends of the lines.

Calculations

Note 1. Replace with the following: The profilograph trace reduction shall be computerized; the computer's result shall match the results gotten by manually determining the deviations and calculating the roughness index as described herein.

- 10.1 Apply the blanking band to the test segment represented by the profilograph trace (the record of the surface as produced by the profilograph) so that the maximum number of deviations are covered by the blanking band. With the blanking band in place for each segment, determine the distance that each scallop along the trace extends either above or below the blanking band - representing bumps and dips. Divide the total distance of all deviations determined within the test segment by the total non-exempted length of the test segment, to determine the Profilograph Ride Index (PRI) represented by that trace. Average the values of both wheel paths to determine the PRI for the test segment.
- 10.2 Apply the excessive deviation template such that the bottom line on the template extends to or beyond the trace line. By comparing points on the profilograph trace to the parallel lines above the bottom line, identify all possible deviations from that line that exceed the tolerance established for excessive deviations.

Report

- 11.1.2 Replace with the following: Excessive deviation tolerance to the nearest 0.05 inches (1 mm), for example, 0.3 inch.
- 11.1.3 Replace with the following: Length of each test segment,
- 11.1.4 Replace with the following: Profilograph Ride Index (PRI) for each wheel path and for the test segment, and
- 11.1.5 Add the following: Total number of excessive deviations located within each test segment (use the count from both wheel paths).

501531 - BLANKET GRINDING OF OVERLAY CONCRETE

Description:

This work shall consist of furnishing diamond grinding equipment to perform a “blanket” grind of the overlaid concrete deck surface and approach slabs in accordance with these special provisions, notes and details in the Plans, and as directed by the Engineer.

The Contractor shall employ grinding methods that will produce a visually consistent deck surface while maintaining or improving rideability criteria established in Special Provision 501530.

Material Requirements:

Measurement Equipment: The Contractor shall furnish, calibrate, and operate equipment capable of producing an accurate profilograph ride index (PRI) in accordance to test procedures outlined in DelDOT Test Method 13 (Modified). Prior to use, the Engineer will verify that the equipment selected is capable of producing an accurate, repeatable trace of the deck surface. The equipment must be equipped with a computer based system capable of calculating the PRI and locating excessive deviations

Grinding Equipment: Grinding shall be done using self-propelled machinery containing diamond blades, mounted on a multi-blade arbor with a minimum cutting head width of 36" that has been designed and approved for grinding pavements. The equipment shall be such that it does not cause strain or damage to the underlying surface of the deck. Grinding equipment that causes excessive raveling, aggregate fractures, spalls, or disturbance of the joints shall not be permitted. All slurry or residue resulting from the grinding operations shall be immediately discharged into tank trucks, or other suitable holding tanks, and shall be removed from the project for proper disposal by the Contractor. Equipment used to perform any grinding operations must have demonstrated previous successful use in grinding similar surfaces.

Construction Methods:

Blanket Grinding: The Contractor shall ensure, prior to transverse grooving operations that all areas of overlaid surface consist of a uniform texture. This shall be accomplished by performing a blanket grind of the overlay concrete.

After the blanket grinding operations, the overlaid deck surface shall again be tested in accordance to Special Provision 501530.

Basis of Payment:

~~The payment for item “Blanket Grinding of Overlay Concrete” shall be made for at the Contract Unit Price which price and payment shall be full compensation for furnishing and operating the grinding/scarification equipment; all testing equipment and personnel necessary to operate the equipment; and the removal and disposal of slurry or residue from the operations; and for all labor, equipment, tools, and incidentals necessary to complete the work.~~

~~Final adjustments to the payment will be executed by change order.~~

3/11/05

600501 - BRIDGE CONSTRUCTION REQUIREMENTS

1.0 GENERAL

The following provisions shall apply to the bridge erection, temporary supports and falsework, cable installation, and geometric controls. The cable-stay references shall apply to all cable-supported structures as appropriate.

- A) The erection of the structure and the field workmanship shall be in accordance with the best practice and shall conform to the Performance Specifications and Special Provisions.
- B) The safe erection of the structure is the sole responsibility of the Design-Builder.
- C) The Design-Builder shall submit complete, detailed and checked shop and erection drawings of his proposed erection sequence, including complete and checked erection design calculations to the Department for review and comment. The review and comment by the Department of the Design-Builder's erection sequence and Plans shall not relieve the Design-Builder from his responsibility for performing the work required by this Special Provision and the Contract Documents.
- D) The following items shall be performed by the Design-Builder and submitted to the Department for review:
 - 1) Complete, detailed erection sequence drawings are required. Erection and erection wind stresses in permanent and temporary members including temporary piers and false work reactions shall be determined for each stage. Moments, shears, axial loads and other forces shall be computed and tabulated for all pertinent members at a sufficient number of points to demonstrate that the load demand will not exceed the capacity or allowable stresses for each stage of the erection. Details of contemplated elevations, cable-stay lengths, adjustments etc. required shall also be shown for each stage. If final cable-stay adjustments are required after superimposed dead loads are placed, the Design-Builder shall take proper steps to prevent unintended stiffness created by superimposed dead loads (e.g. parapets and barriers) from affecting the accuracy of stay cable adjustment.
 - 2) The Design-Builder shall prepare, check and then submit detailed shop and erection drawings to the Department for review and comment.
 - 3) All submittals by the Design-Builder shall be submitted sufficiently in advance of the start of construction as to allow for review and resubmission if required. The review shall be conducted in accordance with Part 2 – DB Section 111 of the Contract Documents.
- E) The Design-Builder shall meet with the Department to discuss the proposed erection procedure, erection design criteria, and structure capabilities to support the proposed erection scheme. The Department will review the preliminary erection procedure proposal for general compliance with the contract requirements.
- F) The Design-Builder shall develop and submit to the Department a complete description and stress calculations of the proposed process and sequence of erection including positions and weights of equipment at each position and at each stage in sufficient details to allow review of the effects of the erection procedure on the structure.
- G) The Design-Builder shall submit to the Department for review and comment the detailed design of all erection equipment, falsework, temporary bracing and other items required

for erection.

- H) The Design-Builder shall ensure the intermediate static and dynamic stability of the structure is adequate for the various stages of the construction. To fulfill this requirement, the Design-Builder may have to construct temporary support bents or install auxiliary cables to stabilize the bridge. Such cables or other means shall not be permitted within the waters of the Indian River Inlet or within the clearance envelope required over the navigable waterway.

Should stabilization be required, the Design-Builder shall develop a scheme for stabilizing the cable-stayed structure against wind loads at all construction stages. All details and layouts of any tie down assembly including all connections, foundation elements, and material properties shall also be submitted to the Department for review and comment.

- I) All computations shall be prepared, signed and sealed by a Professional Engineer registered in the State of Delaware who is experienced in the design and construction of the proposed bridge type. Calculations shall be submitted in a neat organized manner that is easy to follow.
- J) The Design-Builder will be responsible for determining and monitoring forces and deflections in the permanent structure at all erection stages as are caused by his proposed erection process.
- K) No construction work shall be performed until the Design-Builder's erection sequence is totally reviewed and approved in writing by the Quality Control Manager and any related Non-Conformance Report items have been resolved with the Department. The erection sequence must be consistent with the design.
- L) Any subsequent modifications to the structure for erection purposes shall be submitted to the Department for review. The Design-Builder shall demonstrate that such modifications will have no adverse effect on the completed structure. Any additional materials required shall be provided at no cost to the Project. Completed details and stress computations will be required for all revisions to the Plans. The Design-Builder shall submit for Department review all proposed modifications to details shown on the Plans. No such work shall be performed until it is also reviewed and approved in writing by the Quality Control Manager and any related Non-Conformance Report items have been resolved with the Department.

1.1 CABLE-STAY INSTALLATION

Cable-stay installation shall conform to the Performance Specification for *Cable-Supported Bridge System Requirements* and the provisions below.

- A) Cable-stays shall be installed in accordance with an engineered cable installation procedure prepared by the Design-Builder that shall prescribe cable force and elongation for the installation of each cable-stay. The engineered procedure shall include consideration of actual construction loads and static conditions at the time of cable-stay installation.
- B) Changes to construction and erection sequence or procedure from those assumed in the development of the cable-stay procedure shall be incorporated in revisions to the cable-stay installation program.
- C) Jacks and gauges for cable-stay installation shall be calibrated using a load cell or calibrated static load machine within one month prior to the beginning of the cable-stay installation, and every 6 months thereafter, for the duration of cable-stay installation. The

6-month recalibration may be performed using a master gauge, provided that the master gauge is calibrated with the field gauges at the time of initial jack calibration.

- D) The cable-stay installation program shall prescribe both force and cable elongation, for each jacking operation, and shall establish the priority of force over elongation for control of the jacking operation. This program shall stipulate the permissible variance between force and elongation for each cable to be installed.
- E) A strand and cable force verification method shall be utilized. The verification procedure shall be performed by an independent Subcontractor (i.e., independent of the Design-Builder and stay cable system supplier). A laser-based force measurement system shall be used for this purpose. The forces in individual strands shall also be measured in the laboratory on the cable-stay systems to be tested for fatigue and strength. This will verify the uniformity of strand forces. The forces in all cable-stays shall be measured after completion of stay erection iterations for comparison with the Designer's predicted and erection tabulated forces. The Design-Builder shall develop procedures to ensure that the initial stressing is equalized for all tensile elements in a given cable-stay within a range of 2.5%.
- F) The cable-stay installation procedure shall include provisions for monitoring the installation of each cable.
- G) Permanent records shall be established for each cable installation. Such records shall include survey records, date, time and ambient temperature; cable forces; cable elongation measurements; lock nut setting; and all other special notations necessary and sufficient to establish the conditions under which the cable was installed.

1.2 FALSEWORK

Temporary supports and/or falsework may be required to erect the structure. Falsework shall be properly designed for all anticipated loads obtained from stage-by-stage erection analyses. The Design-Builder shall submit detailed Plans for all falsework to be used showing all loadings assumed by the Design-Builder's design. Review of the Plans by the Department shall not relieve the Design-Builder of his responsibility for the Work.

1.3 GEOMETRIC CONTROLS AND LOADS

- A) The Design-Builder shall be responsible for geometric control of construction so that the completed structure will conform to the lines, grades, and dimensions and cable stresses on the Plans. The Design-Builder shall furnish, on-site, competent engineering and surveying personnel and equipment to establish and verify elevations and alignment of the structure and cable-stays at every stage of construction. The Design-Builder shall be responsible to determine the need for the amount of adjustments that may be required in the erection stages. The Department shall be provided the opportunity to review and comment on each such use of adjustments in advance of its implementation.
- B) At the reference temperature (e.g. 70° F) shown on the Plans, the structure shall have a geometric configuration that is in general conformance with the dimensions shown on the Plans for the dead load conditions. The target elevations and loads during each erection stage shall be adjusted to account for the actual temperature at the time of construction. The Design-Builder shall provide sufficient computations and analyze the structure with sufficient detail to reasonably assure that final adjustments can be made to also obtain the target dead load cable stress and deck elevations defined in the Plans with the following tolerances:
 - 1) Absolute tolerance in deck elevation at the centerline of bridge at center span

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shall be $\pm 5.5"$, provided that the deck elevation at cable attachment points follows, within a tolerance of $\pm 1"$ (unless a tighter tolerance is required to satisfy drainage) the elevation based on the bridge cross-slope. A smooth parabolic curve shall pass through the final deck elevation at the centerline of the bridge and the deck elevation at the end of the cable-stayed span and be within 1" at all other points along the bridge. In no case, shall the bridge deck elevation tolerance allow for the low chord of the bridge, or any of its attachments, to extend within the clearance envelope over the navigable waters of the Indian River Inlet.

- 2) Cable-stays shall be adjusted for the dead load condition such that each individual cable shall not exceed values of \pm five percent (5%) of the cable dead load computed and shown on approved Working Drawings. It is possible that one individual cable may have to be adjusted to lesser tolerances to prevent stress in other cables from exceeding the \pm five percent (5%) tolerance.
- 3) Final fabrication lengths for the cable-stays shall be calculated by the Design-Builder after erection loads and methods are known and detailed erection stress calculations have been completed. The tolerance in the fabrication length of the cable in the unstressed condition shall be as follows:

<u>Length between bearing faces (ft)</u>	<u>Permissible tolerance (inches)</u>
150	plus 1.0, minus 0.0
300	plus 1.5, minus 0.0
500 and over	plus 2.0, minus 0.0

- C) The Design-Builder shall prepare and furnish to the Department complete detailed erection sequence drawings.
- D) Based on the Design-Builder's construction equipment and procedures, the Design-Builder shall compute and prepare tables of anticipated cable tensions in each cable at corresponding stages of erection of the bridge including, but not limited to the stages immediately:
 - 1) Before and after erection of precast segments or completion of in-situ casting of segments;
 - 2) Before and after each cable-stay stressing operation;
 - 3) After full dead load including concrete parapets and concrete overlay; and
 - 4) After completion of all time dependent behavior (i.e. day 10,000).
- E) The tables of anticipated cable tensions and computations shall be submitted to the Department for review and comment.
- F) If as-built cable forces exceed the design forces as shown in the Plans, the Design-Builder shall investigate adequacy of all cable components and anchorages. Cost for all and any additional engineering, field work and material required shall be borne by the Design-Builder.
- G) As part of the Design-Builder's Quality Control requirements, the tension in each cable shall be checked at intermediate stages of the superstructure erection to ensure that it is within the anticipated range. Any cable requiring adjustment at these intermediate stages shall be properly adjusted.

- H) Each cable-stay anchoring at the same segment (and/or station) of deck shall be installed and stressed simultaneously. The difference in force in the cable-stays at any time shall not exceed five percent (5%) of the corresponding design cable forces.
- I) Promptly after erection of each cable, the tension in the cable shall be checked to ascertain that it is within the range of anticipated tension for the corresponding stage of superstructure erection. Maximum cable tension during construction shall not exceed fifty-six percent (56%) of the cable's guaranteed ultimate tensile strength.
- J) Cable-stays shall be erected at the appropriate times to suit the Design-Builder's erection scheme.
- K) The Design-Builder's cable installation procedure shall specify which is the live (stressing) end anchorage of the cable, i.e. at the tower anchorage or deck girder anchorage, and the live end anchorage shall be detailed to provide for future cable replacement.
- L) Cable-stay anchorages shall allow for future force adjustments (increase or decrease) of 2.5% of the guaranteed ultimate strength of the cable-stay without the use of shims. The Design-Builder shall include in the cable-stay installation plan fully developed details and procedures for removing/detensioning strands and re-installing strands.
- M) Care shall be exercised during cable erection to prevent damage to the sheathing and to prevent damage to the other components of the cable-stay. All damage to the sheathing or cable components shall be immediately repaired to the satisfaction of the Department. Damaged sheathing and components shall be replaced, at the Design-Builder's expense.
- N) Cable-stays shall be installed so that there are no wedge marks within the stressed portion of any strand. Any strand that results with wedge marks on the permanently stressed portion of the strand shall be replaced.

1.4 SPAN CLOSURES

- A) To make up the closure pours, the ends of the bridge shall be brought into vertical, horizontal and cross-slope alignment by jacking, counterweighing or adjusting selected cable-stays. This shall be included in the Design-Builder's erection scheme submitted to the Department for review and comment.
- B) After the closure concrete has attained the required strength and other construction operations have been completed as necessary, certain selected cable-stays shall be adjusted to produce the required stresses in the structure.
- C) Upon completion of final post-tensioning, closure concrete and the placement of the concrete parapets and overlay, the cable-stays shall be adjusted as required to their planned tension.
- D) After all final adjustments have been made, wedges shall be post-blocked.
- E) Fully developed details for side span and central span closures, including placement of alignment devices as required, jacking, and counterweighing and stay cable adjustments shall be included in the Design-Builder's erection scheme submittal to the Department.

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602543 - FURNISHING LATEX MODIFIED CONCRETE
602544 - CONSTRUCTING LATEX MODIFIED CONCRETE OVERLAY

Description:

The item "Furnishing Latex Modified Concrete" shall consist of furnishing latex modified Portland cement concrete (hereafter referred to as overlay concrete) at the site of construction; and the item "Constructing Latex Modified Concrete Overlay" shall consist of preparing, placing, consolidating, curing, and texturing the latex modified concrete on the bridge deck and/or other specified areas in accordance with these specifications, applicable requirements of Section 602 of the Standard Specifications, and notes on the Plans and as directed by the Engineer.

The overlay shall be constructed as a single monolithic element of the structure with respect to depth. Any joints between placements shall be placed to not be within the wheel paths of the traffic. The overlay shall be uniform, strong, dense, and well-bonded to the existing deck, and shall have a smooth, free-draining, crack-free surface.

Materials:

Cement shall be either Type I or II, non-air entraining Portland cement conforming to Section 801. It shall be stored in a suitable weatherproof enclosure which will protect the cement from dampness.

Fine Aggregates shall conform to Section 804.

Coarse Aggregate shall conform to Section 805 of the Standard Specifications, except that only non-carbonate rock shall be used, and that its percentage of wear (Los Angeles Test - AASHTO T96) shall be not more than 30%. Non-carbonate rock shall be understood to be rock from any one of the following geological classifications: trap rock, granite, gneiss, quartzite or argillite. The use of serpentine aggregate shall not be permitted. The coarse aggregate grading conform to the requirements of Section 813, Delaware Number 8.

Coarse and fine aggregate shall be stored separately in such a manner as to avoid contamination with each other or with foreign matters and also avoid frequent variation in its moisture content.

Water shall conform to the requirements of Section 803.

Latex Modifier for Concrete shall be non-toxic, film forming, polymeric emulsion to which all stabilizers have been added at the point of manufacture, and shall be homogeneous and uniform in composition.

Mix Design

Latex concrete shall be composed of Portland Cement Type I, coarse and fine aggregates, and a non-toxic polymer emulsion prepared in accordance with these Special Provisions.

After the materials furnished by the Contractor have been submitted for the project, the actual batch weights will be designed by the Contractor based on tests in accordance with the limits shown in Table 1 of these Special Provisions. The design shall be submitted to the Engineer for approval. The proportions will be stated in terms of aggregates in a saturated surface-dry condition, and the batch weights will have to be adjusted periodically to take into account the actual moisture of the aggregates at

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the time of use.

The proportions and the slump for the latex concrete as submitted to, and approved by the Engineer, shall not be changed during the progress of the work; nor shall a change in the source or character of the material be made, until the Engineer has accepted such materials, and/or new proportions based on tests for the mix is resubmitted by the Contractor to the Engineer's approval.

The design mix for the latex concrete shall be as noted below in Table 1:

TABLE 1

	Latex Modified Concrete Mix
Formulated Latex - gallons/sack of cement	3.50
Percent of Fine Aggregate as percent of Total Aggregate by weight	50 - 60
* Weight ratio of cement: fine aggregate: Coarse aggregate dry basis (agg.Sp.Gr. 2.65)	1.0:2.5:2.0
Air Content - Maximum Percent of Plastic Mix (there is no minimum)	6 1/2 %
** Slump B inches	4 - 6
Water - cement ratio	0.40 Max.
Minimum compressive strength @ 28 days	4000 psi
* The dry weight ratios are approximate and should produce good workability but due to gradation changes may be adjusted within limits by the Engineer. The fine aggregate ratio may be increased by as much as 0.2 if the coarse aggregate is reduced by an equivalent volume.	
** The slump shall be measured 4 to 5 minutes after discharge from the mixer. During this waiting period, it shall not be disturbed. Care shall be exercised that traffic vibrations do not affect the measurement.	

Chloride permeabilities shall be no greater than 1500 coulombs when tested according to the Virginia Modified Method of AASHTO T277. The permeability test samples will be field-cast cylindrical specimens with a 4" diameter and at least 4" in length. They will be air cured at a temperature of 73 ± 3 F for one week and the last three weeks of the air cure will be at 100 ± 9 F. Cylinders will be tested at 28 days in accordance with the AASHTO T277 Test Method.

Construction Methods:

All equipment for surface preparation, mixing, placing, and finishing of the latex concrete shall be approved by the Engineer prior to the start of any work.

Proportioning and mixing equipment shall be a self contained, mobile, continuous mixing type subject to the following:

- a. The mixer shall be self-propelled and be capable of carrying sufficient unmixed dry, bulk cement, sand, coarse aggregate, latex modifier and water to produce on the site not less than 6 cubic yards of modified Portland Cement Concrete.

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- b. The mixer shall be capable of positive measurement of cement being introduced into the mix. A recording meter shall be visible at all times, and equipped with a ticket print-out shall indicate the quantity.
- c. The mixer shall provide positive control of the flow of water and latex emulsion into the mixing chamber. Water flow shall be indicated by flow meter and be readily adjustable to provide for minor variations in the moisture of the sand and aggregate.
- d. The mixer shall be capable of being calibrated to automatically proportion, and blend all components of indicated composition on a continuous or intermittent basis as required by the finishing operation, and shall discharge mixed material through a conventional chute directly in front of the finishing machine.
- e. The mixer shall be capable of spraying water over the entire placement width, as it moves ahead to insure that the surface to be overlaid is wetted prior to receiving the latex concrete.
- f. Mixers shall be calibrated to accurately proportion the specified mix. Certification of the calibration by approved testing laboratory will be accepted, as evidence of this accuracy if the yield is shown to be true within a tolerance of 1.0 percent according to the following test:

With the cement meter set on zero and all controls set for the desired mix activate the mixer discharging mixed material into a 0.25 cubic yard container - 36" x 36" x 9". When the container is level-struck full, making provision for settling the material into all corners, the cement meter must show a discharge of 1.875 bags of cement.

An approved finishing machine complying with the following requirements shall be used for finishing the wearing surface:

1. The finishing machine shall be self-propelled and capable of forward and reverse movement under positive control. Provision shall be made for raising all screeds to clear the screeded surface for traveling in reverse. An approved self-propelled finishing machine with one or more rotating rollers, augers, and 1,500 to 2,500 VPM vibrating pans may be used. Any modification shall be subject to approval by the Engineer.
2. Supporting rails upon which the finishing machine travels will be required and shall be sufficiently rigid so that they do not deflect under the weight of the machine. When placing overlay concrete in a lane abutting a previously completed lane, that side of the finishing machine adjacent to the completed lane, shall be specially equipped to travel on the completed lane.

Mixing of Materials

The applicable provisions of Section 602 and 812 of the Standard Specifications shall apply with the following exceptions and additional provisions:

The overlay concrete shall be thoroughly mixed in an approved mixer at the site. Mixers shall be clean and the ingredients accurately proportioned. The ingredients shall be added to the mixer in accordance with the recommendations of the manufacturer of the latex modifier.

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Bags or other containers holding ingredients, including those identified by the manufacturer as dissolving or breaking during mixing, shall not be placed in the mix.

The mixing time shall be the minimum needed to secure the air content and slump desired, and in accordance with the recommendations of the manufacturer of the latex modifier.

The overlay concrete shall be, when discharged from the mixer, uniform in composition and consistency. Mixing capacity shall be such that finishing operations can proceed at a steady pace with final finishing operations completed before the formation of the plastic surface film.

Surface Preparation

If required in the Plans, the Contractor shall scarify the existing deck to a depth of 1/4". After this initial removal, the Contractor shall sound the deck and outline areas of unsound concrete for removal, subject to the approval of the Engineer. Removal and repair work below the initial 1/4" of scarification will be measured and paid for under other items of work in this Contract.

On any bridge decks or approach slabs where a hot mix surface is removed, and no additional concrete milling is specified, the Contractor shall scarify the exposed concrete surface an additional 1/8" to 1/4" in depth to remove all hot mix latency prior to sounding the concrete as specified above and final cleaning as specified below. Cost of the scarification shall be incidental to item 602544.

Any portions of bridge decks or approach slabs that have a smooth surface shall be scarified to a depth 1/8" to 1/4" prior to placing the latex concrete overlay. It is the intent that the surface to receive the overlay has a sufficiently rough texture to assure a good mechanical bond between the existing concrete and the latex concrete overlay. Cost of the scarification shall be incidental to Item 602544.

Not more than 24 hours before placement begins, the entire surface of the bridge deck and the areas to receive latex concrete shall be thoroughly cleaned by shot or grit blasting. The edge of any previously placed lanes of concrete overlay shall be blasted to remove the trowel cut surfacing to promote bond. If necessary to remove rust, oil or other foreign materials detrimental to achieving bond, detergent cleaning followed by shot or grit blasting and air blast cleaning shall be used. Immediately prior to placement of latex modified concrete, the clean surface shall be thoroughly hosed down with water and kept wet for a period of not less than one hour. Any standing water in depressions, holes or area of concrete removal shall be blown out with compressed air free of oil. The Contractor shall take all necessary precautions with the deck preparations to ensure a good bond with the overlay.

Contamination of the cleaned and wetted deck shall be prevented by placement of a clean 4 mil (minimum) thick polyethylene film (or other covering as approved by the Engineer) completely covering the surface of the deck to be overlaid.

Transverse and longitudinal joints of previously placed overlay shall be sawn to straight and vertical edges before overlay is placed against them.

Limitations of Placing Overlay Concrete

The Contractor shall be responsible for the quality of the concrete placed in any weather or atmospheric conditions. A smooth, durable riding surface of uniform texture, true to the required grade and cross-section, shall be obtained on all bridge decks.

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The overlay concrete shall not be placed when rain is forecast within the intended working period. Adequate preparations shall be made to provide protection of the freshly placed overlay in the event of sudden or unexpected rain. If rain occurs during placing of the overlay, all operations other than protection of the already placed overlay shall immediately cease. Materials damaged by the rain shall be rejected and replaced at no additional cost to the Department.

The overlay concrete shall be placed only when the local ambient temperature is above 45°F for the entire curing period. The overlay shall not be placed if the ambient air temperature is 85°F, or higher or predicted to go above 85°F during the overlay placement regardless of the surface evaporation rate. The overlay concrete shall not exceed 85°F.

The overlay concrete shall be placed only if the overlay surface evaporation rate, as affected by ambient air temperature, concrete temperature, relative humidity, and wind velocity, is 0.15 pound per square foot per hour or less. The Contractor shall determine and document the atmospheric conditions, subject to verification by the Engineer. The chart contained in "Plastic Cracking of Concrete" by Delmar Bloem for the National Ready Mixed Concrete Association, and published in ACI 305R-89, shall be used to determine the loss of surface moisture for the overlay. The chart may be obtained from the Department's Materials and Research Section.

An overlay shall not be placed adjacent to a previous overlay which has cured for less than 3 cure-days.

Placement of Overlay Concrete

Placement shall conform to applicable requirements of Section 602. The maximum overlay depth placement, per lift, shall be 2".

Prior to placing the concrete overlay, the Contractor shall schedule a "Preplacement Meeting" with the Engineer to discuss the plan and procedure for the work. This discussion shall acceptably establish the Contractor's ability to place the overlay on a continuous basis and to consolidate, finish, texture, and commence curing within the time intervals specified.

If placement of the overlay is to be made at night, the Contractor shall submit a plan which provides adequate lighting for the work area. The plan shall be submitted at least 15 calendar days in advance and be approved by the Engineer before concrete is placed. The lights shall be so directed that they do not adversely affect traffic.

The latex manufacturer's technical representative shall be present during the placement of the overlay at no additional cost to the Department. Work which is considered by this representative as being detrimental to the integrity of the overlay will be rejected.

The maximum time allowed between the start of mixing to the completion of discharge of the overlay concrete at the worksite shall be sixty minutes (both when used as grout or as overlay).

Immediately before the overlay is placed, the concrete surfaces shall be cleaned with an air blast (oil free), cleared of any standing water, and then covered with a coating of bonding grout. The grout shall consist of the overlay, placed and brushed onto the deck. The coarse aggregate shall be removed from the deck. The overlay shall be placed only when the existing deck is "surface dry". The grout shall be scrubbed onto surface dry decks (surfaces which are dry enough to absorb some of the moisture from the grout with enough care to ensure that all surfaces are evenly covered and that excess grout will not collect in low areas. The bonding grout shall be applied for only a short distance in advance of the

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placement of the overlay. Reapplication is required when the grout dries prior to overlay placement.

The maximum allowable time between the discharge and the final finishing of the overlay concrete shall be ten minutes.

A construction dam or bulkhead shall be installed in case of major delay in the placement operation exceeding one hour in duration. During minor delays of one hour or less the end of the placement may be protected from drying with several layers of wet burlap.

If overlay concrete placement is stopped or delayed for a duration of 90 minutes or more, further placement shall be discontinued and may not resume until after a period of not less than 12 hours. This restriction does not prohibit continuation of placement provided a gap is left in the lane. The gap shall be sufficient in length for the finishing machine to clear the previously placed concrete.

Consolidating and Finishing Overlay Concrete

Immediately following application of the bonding grout, the overlay shall be placed, consolidated and finished to the Plan grades with vibrating devices. Spud vibration will be required in deep pockets, edges and adjacent to joint bulkheads. Hand finishing with a float may be required along the edge of the pour or on small areas of repair. Edge tooling is required at joints, except next to metal expansion dams, curbs, and previously placed lanes

A 10' straightedge shall be supplied and used by the Contractor to check the overlay directly behind the finishing machine. It shall also be used to check transversely along the edges of the overlay where hand finishing is done. Any irregularities exceeding 1/8" in 10' shall be corrected immediately. Any ponding problem which is noted prior to final acceptance of the overlay shall be corrected by the Contractor at no cost to the Department. The Contractor shall test the overlay concrete surface for smoothness in accordance with Subsection 602.20 of the Standard Specifications.

Curing the Overlay Concrete

As soon as the finishing operation is completed, the finished overlay surface shall be covered with a layer of clean, fully wet, saturated, burlap. After initial set, a 4 mil (minimum) thick white opaque polyethylene film shall completely cover and seal the wet burlap to maintain a 100% relative humidity environment for a period of 2 cure-days (a cure-day shall be defined as a 24 consecutive hour period of time). The curing material shall then be removed for an additional 72 hours of air cure. Wet burlap-polyethylene sheets may be substituted for the polyethylene film with the approval of the Engineer but shall not replace the initial wet burlap.

The temperature at the overlay surface shall be maintained above 35°F until the curing period is completed. Any day during which the air temperature at the overlay surface falls below 45°F shall not be counted as a cure-day.

Any cracking which occurs prior to opening to traffic shall be sealed or repaired in a manner approved by the Engineer at no cost to the Department. The deck shall be sounded and any delaminated areas removed and replaced at no cost to the Department.

Traffic will not be permitted on the finished overlay surface until after the wet burlap cure period is complete.

The surface shall be textured in accordance with Subsection 602.20.

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Any improperly cured overlay is subject to replacement at no cost to the Department.

Method of Measurement:

~~———— The item "Furnishing Latex Modified Concrete" will be measured by the cubic yard as determined from the theoretical yield of the design mix and documented by the ticket printout of the cement used and the yield tests performed. Material wasted or rejected due to any cause will not be paid for.~~

~~———— The item "Constructing Latex Modified Concrete Overlay" will be measured by area in square yard regardless of the depth of the placed mixture. The actual area finished and accepted will be measured, exclusive of areas of metal expansion dams exposed.~~

Basis of Payment:

~~———— The payment of the item "Furnishing Latex Modified Concrete" shall be made for at the Contract unit price bid per cubic yard, which price and payment shall be full compensation for furnishing, hauling and storing all latex modified concrete materials at the job site, for all labor, equipment, tools, and necessary incidentals to complete the work.~~

~~———— The payment for the item "Constructing Latex Modified Concrete Overlay" shall be made for at the Contract unit price bid per square yard, which price and payment shall constitute full compensation for the preparation of the area to receive latex modified concrete including scarifying, shot or grit blasting, removal of rust, oil and other contaminants, protection of area, bonding grout, placing of latex modified concrete, consolidating, curing, and texturing and for all labor, equipment, tools, and incidentals necessary to complete the work.~~

NE - 3/17/05

602583 - FURNISHING MICRO-SILICA MODIFIED CONCRETE
602584 - CONSTRUCTING MICRO-SILICA MODIFIED CONCRETE OVERLAY

Description:

The item "Furnishing Micro-Silica Modified Concrete" shall consist of furnishing micro-silica modified Portland cement concrete (hereafter referred to as overlay concrete) at the site of construction; and the item "Constructing Micro-Silica Modified Concrete Overlay" shall consist of preparing, placing, consolidating, curing, and texturing the micro-silica modified concrete on the bridge deck and/or other specified areas in accordance with these specifications, applicable requirements of Section 602 of the Standard Specifications, and notes on the Plans and as directed by the Engineer.

The overlay shall be constructed as a single monolithic element of the structure with respect to depth. Any joints between placements shall be placed to not be within the wheel paths of the traffic. The overlay shall be uniform, strong, dense, and well-bonded to the existing deck, and shall have a smooth, free-draining, crack-free surface.

Materials:

Micro-silica Components:

- A. Micro-silica (silica fume) shall conform to AASHTO M307
- B. Cement shall be either Type I or II, non-air entraining Portland cement conforming to Section 801.
- C. Fine Aggregates shall conform to Section 804.
- D. Coarse Aggregates shall conform to Section 805, except that only non-carbonate rock shall be used, and that its percentage of wear (Los Angeles Test - AASHTO T96) shall be not more than 30%. Non-carbonate shall be understood to be rock from any one of the following geological classifications: trap rock, granite, gneiss, quartzite, or argillite. The use of serpentine aggregate shall not be permitted. The grading shall conform to Section 813, Delaware No. 8.
- E. Air Entraining Agents shall conform to AASHTO M154.
- F. Water shall conform to Section 803.
- G. High Range Water Reducer shall conform to ASTM C495.
- H. Fiber Reinforcement shall conform to ASTM C1116, Type III with a minimum fiber length of 2" and a maximum length of 1 1/2".
- I. Evaporative Retardant shall be a product specifically marketed for the use of retarding evaporation from a concrete surface; plain water is not acceptable.

Mix Design

The mix design shall be performed by the Contractor based on the submitted component sources; the overlay concrete shall conform to Section 812, Class A, except for the following modifications:

- A. Water/ (Cement & Micro-silica) Ratio - Maximum 0.40
- B. Micro-silica - 7% of the weight of Portland cement
- C. Slump B 4 to 6 inches
- D. Air Content - 4% to 7%
- E. Compressive Strength - Minimum 4000 psi @ 28 days
- F. Chloride permeabilities shall be no greater than 1500 coulombs when tested according to the Virginia Modified Method of AASHTO T277. The permeability test samples will be field-cast cylindrical specimens with a 4" diameter and at least 4" in length. They will be air cured at a temperature of 73 ± 3 F for one week and the last three weeks of the air cure will be at 100 ± 9 °F. Cylinders will be tested at 28 days in accordance with the AASHTO T277 Test Method.
- G. Fiber Reinforcement Content - 1.5 lb/yd³

NOTE: The Contractor shall obtain a written statement from the manufacturer of the micro-silica that it is compatible with the other materials from the sources proposed by the Contractor and acceptable in the sequence in which they will be combined.

The overlay shall be centrally batched, and shall be mixed in a central mixing plant or by mixer-trucks capable of producing a workable mixture of uniform composition and consistency. Batching and mixing equipment shall conform to Section 812. Admixtures shall be introduced into the concrete in such a manner that will disperse it throughout the entire load. The mixer-truck charge shall be limited to a maximum of 75 percent of its rated capacity or to 6 cubic yards, whichever is smaller.

Bags or other containers holding ingredients, including those identified by the manufacturer as dissolving or breaking up during mixing shall not be placed in the mix.

Air entrainment and slump of the first material delivered to the deck will be determined by the Engineer. The overlay will not be placed until acceptability of the production has been verified.

Construction Methods:

All equipment for surface preparation, mixing, placing, and finishing of the concrete overlay shall be approved by the Engineer prior to the start of any work. This equipment includes the following:

- A. Power-driven scarifier;
- B. Chipping hammers (maximum nominal 35 lb. class);
- C. Abrasive blaster;
- D. Overlay mixer-trucks;
- E. Mechanical fogger; and
- F. Finishing machine

An approved finishing machine complying with the following requirements shall be used for finishing the wearing surface

1. The finishing machine shall be self-propelled and capable of forward and reverse movement under positive control. Provision shall be made for raising all screeds to clear

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the screeded surface for traveling in reverse. An approved self-propelled finishing machine with one or more rotating rollers, augers, and 1,500 to 2,500 VPM vibrating pans may be used. Any modification shall be subject to approval by the Engineer.

2. Supporting rails upon which the finishing machine travels will be required and shall be sufficiently rigid so that they do not deflect under the weight of the machine. When placing overlay concrete in a lane abutting a previously completed lane, that side of the finishing machine adjacent to the completed lane, shall be specially equipped to travel on the completed lane.

The Contractor shall provide access to the Engineer in order to obtain grade/elevation survey information before and after deck preparation has been performed.

Surface Preparation

If required in the Plans, the Contractor shall scarify the existing deck to a depth of 1/4". After this initial removal, the Contractor shall sound the deck and outline areas of unsound concrete for removal, subject to the approval of the Engineer. Removal and repair work below the initial 1/4" of scarification will be measured and paid for under other items of work in this Contract.

On any bridge decks or approach slabs where a hot mix surface is removed, and no additional concrete milling is specified, the Contractor shall scarify the exposed concrete surface an additional 1/8" to 2" in depth to remove all hot mix latency prior to sounding the concrete as specified above and final cleaning as specified below. Cost of the scarification shall be incidental to Item 602584.

Any portions of bridge decks or approach slabs that have a smooth surface shall be scarified to a depth 1/8" to 2" prior to placing the micro-silica concrete overlay. It is the intent that the surface to receive the overlay has a sufficiently rough texture to assure a good mechanical bond between the existing concrete and the micro-silica concrete overlay. Cost of the scarification shall be incidental to Item 602584.

Not more than 24 hours before placement begins, the entire surface of the bridge deck and areas to receive micro-silica modified concrete shall be thoroughly cleaned by shot or grit blasting. The edge of any previously placed lanes of concrete overlay shall be blasted to remove the trowel cut surfacing to promote bond. If necessary to remove rust, oil or other foreign materials detrimental to achieving bond, detergent cleaning followed by shot or grit blasting and air blast cleaning shall be used. Immediately prior to placement of micro-silica modified concrete, the clean surface of the entire deck shall be thoroughly hosed down with water and kept wet for a period of not less than six hours. Any standing water in depressions, holes or areas of concrete removal shall be blown out with compressed air free of oil prior to placing the overlay concrete. The Contractor shall take all necessary precautions with the deck preparations to ensure a good bond with the overlay.

Contamination of the cleaned and wetted deck shall be prevented by placement of a clean 4 mil (minimum) thick polyethylene film (or other covering as approved by the Engineer) completely covering the surface of the deck to be overlaid.

Transverse and longitudinal joints of previously placed overlay shall be sawn to straight and vertical edges before overlay is placed against them.

Limitations on Placing the Overlay Concrete

The Contractor shall be responsible for the quality of the concrete placed in any weather or atmospheric conditions. A smooth, durable riding surface of uniform texture, true to the required grade and cross-section, shall be obtained on all bridge decks

The overlay concrete shall not be placed when rain is forecast within the intended working period. Adequate preparations shall be made to provide protection of the freshly placed overlay in the event of sudden or unexpected rain. If rain occurs during placing of the overlay, all operations other than protection of the already placed overlay shall immediately cease. Materials damaged by the rain shall be rejected and replaced at no additional cost to the Department.

The overlay concrete shall be placed only when the local ambient temperature is above 45° for the entire curing period. The overlay shall not be placed if the ambient air temperature is 85°F, or higher or predicted to go above 85°F during the overlay placement regardless of the surface evaporation rate. The overlay concrete shall not exceed 80°F.

The overlay concrete shall be placed only if the overlay surface evaporation rate, as affected by ambient air temperature, concrete temperature, relative humidity, and wind velocity, is 0.15 pound per square foot per hour or less. The Contractor shall determine and document the atmospheric conditions, subject to verification by the Engineer. The chart contained in "Plastic Cracking of Concrete" by Delmar Bloem for the National Ready Mixed Concrete Association, and published in ACI 305R-89, shall be used to determine the loss of surface moisture for the overlay. The chart may be obtained from the Department's Materials and Research Section.

An overlay shall not be placed adjacent to a previous overlay which has cured for less than 3 cure-days.

Placement of Overlay Concrete

Placement shall conform to applicable requirements of Section 602. The maximum overlay depth placement, per lift, shall be 2".

Prior to placing the overlay concrete, the Contractor shall schedule a "Preplacement Meeting" with the Engineer to discuss the plan and procedure for the work. This discussion shall acceptably establish the Contractor's ability to place the overlay on a continuous basis and to consolidate, finish, texture, and commence curing within the time intervals specified.

If placement of the overlay is to be made at night, the Contractor shall submit a plan which provides adequate lighting for the work area. The plan shall be submitted at least 15 calendar days in advance and be approved by the Engineer before concrete is placed. The lights shall be so directed that they do not adversely affect traffic.

The micro-silica manufacturer's technical representative shall be present during the placement of the overlay at no additional cost to the Department. Work which is considered by this representative as being detrimental to the integrity of the overlay will be rejected.

The maximum time allowed between the start of mixing to the completion of discharge of the overlay concrete at the worksite shall be sixty minutes (both when used as grout or as overlay).

The maximum water-cement ratio of 0.40 shall not be exceeded. Any admixture added at the job

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site shall be mixed a minimum of 5 minutes, or 30 revolutions. After all components have been added, the slump range shall be 6 ± 2 ".

If a slump loss occurs after mixing and before placement of the overlay, the charge may be "re-tempered" with the high range water reducing admixture to restore plasticity; re-tempering with water shall not be allowed. The slump and air content will be rechecked to ensure conformance to the specifications. If the consistency of the charge after "re-tempering" is such as to cause segregation of the components, this will be cause for rejection of the load. The overlay material must still be placed within the original 60 minute limitation or it will be rejected.

Immediately before the overlay is placed, the concrete surfaces shall be cleaned with an oil free air blast, cleared of any standing water. The bonding grout shall consist of the overlay concrete mortar, placed and brushed onto the deck. The remaining coarse aggregate from the mortar shall be removed from the deck. The overlay shall be placed only when the existing deck is "saturated surface dry". The grout shall be scrubbed or broomed onto the deck. The overlay concrete bonding grout shall be applied for only a short distance in advance of the placement of the overlay. The distance must not allow the bonding grout to dry out before the overlay concrete is placed. If the concrete bonding grout dries out, it shall be removed from the deck placement area with water blasting, and new grout applied.

The maximum allowable time between the discharge of the concrete and the final finishing, including wet curing of the overlay concrete, shall be less than twenty minutes.

A construction dam or bulkhead shall be installed in case of major delay in the placement operation exceeding one hour in duration. During minor delays of one hour or less the end of the placement may be protected from drying with several layers of wet burlap.

If overlay concrete placement is stopped or delayed for a duration of 90 minutes or more, further placement shall be discontinued and may not resume until after a period of not less than 12 hours. This restriction does not prohibit continuation of placement provided a gap is left in the lane. The gap shall be sufficient in length for the finishing machine to clear the previously placed concrete.

Consolidating and Finishing the Overlay Concrete

Immediately following application of the bonding grout, the overlay shall be placed, consolidated and finished to the Plan grades with vibrating devices. Spud vibration will be required in deep pockets, edges and adjacent to joint bulkheads. Hand finishing with a float may be required along the edge of the pour or on small areas of repair. Edge tooling is required at joints, except next to metal expansion dams, curbs, and previously placed lanes

A 10' straightedge shall be supplied and used by the Contractor to check the overlay directly behind the finishing machine. It shall also be used to check transversely along the edges of the overlay where hand finishing is done. Any irregularities exceeding 1/8" in 10' shall be corrected immediately. Any ponding problem which is noted prior to final acceptance of the overlay shall be corrected by the Contractor at no cost to the Department. The Contractor shall test the overlay concrete surface for smoothness in accordance with Subsection 602.20 of the Standard Specifications.

If needed, a water fog may be applied by the use of mechanical fogging equipment attached to the paving machine to achieve an atomized water mist/fog above, but no on, the surface of the overlay concrete. The water fog shall be discharged at high velocity by the airstream of the mistblower. Hand-pump sprayers shall not be used for the spraying.

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Curing the Overlay Concrete

As soon as the finishing and curing operation is completed, and less than twenty minutes after initial concrete discharge, the finished overlay surface shall be covered with a layer of clean, fully wet, saturated burlap. For a period of 3 cure-days (a cure-day shall be defined as a 24 consecutive hour period of time), the burlap shall be kept wet by the continuous application of water through soaker hoses. After the initial set, 4 mil (minimum) thick white opaque polyethylene film shall completely cover the wet burlap for the entire period. After the 3-day cure period, remove the polyethylene and burlap and apply curing compound in accordance with Subsection 602.18(b) except that the surface can be subjected to traffic as soon as the curing compound has setup.

The temperature at the overlay surface shall be maintained above 35°F until the curing period is completed. Any day during which the air temperature at the overlay surface falls below 45°F shall not be counted as a cure-day.

Any cracking which occurs prior to opening to traffic shall be sealed or repaired in a manner approved by the Engineer at no cost to the Department. The deck shall be sounded and any delaminated areas removed and replaced at no cost to the Department.

Traffic will not be permitted on the finished overlay surface until after the wet burlap cure period is complete.

The surface shall be textured in accordance with Subsection 602.20.

Any improperly cured overlay is subject to replacement at no cost to the Department.

Method of Measurement:

~~———— The item "Furnishing Micro-Silica Modified Concrete" will be measured by the cubic yard as determined from the theoretical yield of the design mix and documented by the batch records. Material wasted or rejected due to any cause will not be paid for.~~

~~———— The item "Constructing Micro-Silica Modified Concrete Overlay" will be measured by area in square yard regardless of the depth of the placed mixture. The actual area finished and accepted will be measured, exclusive of areas of metal expansion dams exposed.~~

Basis of Payment:

~~———— The payment of the item "Furnishing Micro-Silica Modified Concrete" shall be made for at the Contract unit price bid per cubic yard, which price and payment shall be full compensation for furnishing and hauling all micro-silica modified concrete materials, for all labor, equipment, tools, and necessary incidentals to complete the work.~~

~~———— The payment for the item "Constructing Micro-Silica Modified Concrete Overlay" shall be made for at the Contract unit price bid per square yard, which price and payment shall constitute full compensation for the preparation of the area to receive micro-silica modified concrete including scarifying, shot or grit blasting, removal of rust, oil and other contaminants, protecting the area, bonding grout, placing of micro-silica modified concrete, consolidating, curing, and texturing and for all labor, equipment, tools, and incidentals necessary to complete the work.~~

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602588 - ANTI-GRAFFITI COATING

Description:

This work shall consist of furnishing all materials and applying anti-graffiti coating to the exterior surfaces of the masonry structure in accordance with the notes on the Plans and as directed by the Engineer.

Materials:

Anti-graffiti coating shall be one of the following products.

		Dry Film <u>Thickness</u> <u>mils</u> <u>(μM)</u>
1.	Primer:	AQUATHANE Primer 2-4 (51-102)
	Intermediate Coat:	AQUATHANE 3-5 (76-127)
	Top Coat:	AQUATHANE 3-5 (76-127)

As manufactured by TAMMS Industries (Telephone 1-800-654-0402; 1-301-470-3377);

OR

2.	Primer:	Ply-Mastic 650 Epoxy Primer 2-4 (51-102)
	Intermediate Coat:	Ply-Thane 890 Polyurethane 3-5 (76-127)
	Top Coat:	Ply-Thane 890 Polyurethane 3-5 (76-127)

As manufactured by M-A-B Paints & Coatings (Telephone - 1-800-MAB-1899; 1-215-353-5100);

OR

3.	Primer:	FX-441 (one component) 2-4 (51-102)
	Intermediate Coat:	FX-441 (two components) 3-5 (76-127)
	Top Coat:	FX-441 (two components) 3-5 (76-127)

As manufactured by Fox Industries (Telephone [no toll free number] 1-410-243-8856);

OR

Approved Equal.

All materials shall be brought to the job site in the original sealed and labeled containers of the manufacturer, and subject to inspection by the Engineer. Top coat color of anti-graffiti coating shall be as specified on the Plans.

Construction Methods:

Prior to applying the anti-graffiti coating to new concrete, surface shall be fully cured and all surface, new and existing, shall be free of dust, dirt, paint, oil, grease and any other foreign materials.

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Unless otherwise directed on the Plans, removal of contaminants shall be achieved by sandblasting the surface to sound concrete with a surface finish texture of medium grade sandpaper. Those areas of P.C.C. masonry where aggregate is exposed and deep pits exist shall be filled with approved material to a uniform surface unless otherwise directed by the Engineer. If there is a conflict between these requirements and the requirements recommended by the manufacturer of anti-graffiti coating for surface preparation, the surface preparation shall be performed in accordance with the manufacturer's recommendation unless otherwise directed by the Engineer.

Application of the anti-graffiti coating including temperature/humidity restrictions, mixing, thinning, curing and clean-up, etc., shall be performed in accordance with the recommendation of the manufacturer.

Method of Measurement:

~~———— The quantity of Anti Graffiti Coating to be paid for shall be the actual number of square yards (square meters) of surface area covered with anti graffiti coating as measured in the field and accepted.~~

Basis of Payment:

~~———— The quantity of Anti Graffiti Coating applied as provided above, shall be paid at the Contract unit price per square yard (square meter). Price and payment shall constitute full compensation for furnishing and placing all materials including surface preparation, for all labor, equipment, tools, and necessary incidentals to complete the work.~~

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602697 - FURNISHING LOW PERMEABILITY CONCRETE OVERLAY **602698 - CONSTRUCTING LOW PERMEABILITY CONCRETE OVERLAY**

Description:

The item "Furnishing Low Permeability Concrete" shall consist of furnishing low permeability Portland cement concrete (hereafter referred to as overlay concrete) at the site of construction; and the item "Constructing Low Permeability Concrete Overlay" shall consist of preparing, placing, consolidating, curing, and texturing the low permeability concrete on the bridge deck and/or other specified areas in accordance with these specifications, applicable requirements of Section 602 of the Standard Specifications, and notes on the Plans and as directed by the Engineer.

The overlay shall be constructed as a single monolithic element of the structure with respect to depth. Any joints between placements shall be placed to not be within the wheel paths of the traffic. The overlay shall be uniform, strong, dense, and well-bonded to the existing deck, and shall have a smooth, free-draining, crack-free surface.

Materials and Mix Design:

All Sections of Section 812 shall be applicable except as modified herein:

- AASHTO #8 stone will be used in the overlay concrete;
- 28 day compressive strength shall be a minimum of 4000 psi;
- Slump shall be between 4-8"; air content shall be 4-7%;
- W/C(M) ratio will be less than 0.40; and
- Bonding agent shall be used.

Chloride permeabilities shall be no greater than 1500 coulombs when tested according to the Virginia Modified Method of AASHTO T277. The permeability test samples will be field-cast cylindrical specimens with a 4" diameter and at least 4" in length. They will be air cured at a temperature of 73 ± 3 F for one week and the last three weeks of the air cure will be at 100 ± 9 F. Cylinders will be tested at 28 days in accordance with the AASHTO T277 Test Method.

The overlay shall be centrally batched, and shall be mixed in a central mixing plant or by mixer-trucks capable of producing a workable mixture of uniform composition and consistency. Batching and mixing equipment shall conform to Section 812. Admixtures shall be introduced into the concrete in such a manner that will disperse it throughout the entire load. The mixer-truck charge shall be limited to a maximum of 75 percent of its rated capacity or to 6 cubic yards, whichever is smaller.

Construction Methods:

All equipment for surface preparation, mixing, placing, and finishing of the concrete overlay shall be approved by the Engineer prior to the start of any work. This equipment includes the following:

- A. Power-driven scarifier;
- B. Chipping hammers (maximum nominal 35 lb. class);
- C. Abrasive blaster;
- D. Overlay mixer-trucks;
- E. Mechanical fogger; and
- F. Finishing machine.

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An approved finishing machine complying with the following requirements shall be used for finishing the wearing surface:

1. The finishing machine shall be self-propelled and capable of forward and reverse movement under positive control. Provision shall be made for raising all screeds to clear the screeded surface for traveling in reverse. An approved self-propelled finishing machine with one or more rotating rollers, augers, and 1,500 to 2,500 VPM vibrating pans may be used. Any modification shall be subject to approval by the Engineer.
2. Supporting rails upon which the finishing machine travels will be required and shall be sufficiently rigid so that they do not deflect under the weight of the machine. When placing overlay concrete in a lane abutting a previously completed lane, that side of the finishing machine adjacent to the completed lane, shall be specially equipped to travel on the completed lane.

The Contractor shall provide access to the Engineer in order to obtain grade/elevation survey information before and after deck preparation has been performed.

Surface Preparation

If required in the Plans, the Contractor shall scarify the existing deck to a depth of 1/4". After this initial removal the Contractor shall sound the deck and outline areas of unsound concrete for removal, subject to the approval of the Engineer. Removal and repair work below the initial 1/4" of scarification will be measured and paid for under other items of work in this Contract.

On any bridge deck or approach slab where a hot mix surface is removed, and no additional concrete milling is specified, the Contractor shall scarify the exposed concrete surface an additional 1/8" to 3" in depth to remove all hot mix latency prior to sounding the concrete as specified above and final cleaning as specified below. Cost of the scarification shall be incidental to Item 602698.

Any portions of bridge decks or approach slabs that have a smooth surface shall be scarified to a depth of 1/8" to 3" prior to placing the low permeability concrete overlay. It is the intent that the surface to receive the overlay has a sufficiently rough texture to assure a good mechanical bond between the existing concrete and the low permeability concrete overlay. Cost of the scarification shall be incidental to Item 602698.

Not more than 24 hours before placement begins, the entire surface of the bridge deck and areas to receive low permeability concrete shall be thoroughly cleaned by shot or grit blasting. The edge of any previously placed lanes of concrete overlay shall be blasted to remove the trowel cut surfacing to promote bond. If necessary to remove rust, oil or other foreign materials detrimental to achieving bond, detergent cleaning followed by shot or grit blasting and air blast cleaning shall be used. Immediately prior to placement of low permeability concrete, the clean surface of the entire deck shall be thoroughly hosed down with water and kept wet for a period of not less than six hours. Any standing water in depressions, holes or areas of concrete removal shall be blown out with compressed air free of oil prior to placing the overlay concrete. The Contractor shall take all necessary precautions with the deck preparations to ensure a good bond with the overlay.

Contamination of the cleaned and wetted deck shall be prevented by placement of a clean 4 mil (minimum) thick polyethylene film (or other covering as approved by the Engineer) completely covering the surface of the deck to be overlaid.

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Transverse and longitudinal joints of previously placed overlay shall be sawn to straight and vertical edges before overlay is placed against them.

Limitations on Placing the Overlay Concrete

The Contractor shall be responsible for the quality of the concrete placed in any weather or atmospheric conditions. A smooth, durable riding surface of uniform texture, true to the required grade and cross-section, shall be obtained on all bridge decks

The overlay concrete shall not be placed when rain is forecast within the intended working period. Adequate preparations shall be made to provide protection of the freshly placed overlay in the event of sudden or unexpected rain. If rain occurs during placing of the overlay, all operations other than protection of the already placed overlay shall immediately cease. Materials damaged by the rain shall be rejected and replaced at no additional cost to the Department.

The overlay concrete shall be placed only when the local ambient temperature is above 45° for the entire curing period. The overlay shall not be placed if the ambient air temperature is 85°F, or higher or predicted to go above 85°F during the overlay placement regardless of the surface evaporation rate. The overlay concrete shall not exceed 80°F.

The overlay concrete shall be placed only if the overlay surface evaporation rate, as affected by ambient air temperature, concrete temperature, relative humidity, and wind velocity, is 0.15 pound per square foot per hour or less. The Contractor shall determine and document the atmospheric conditions, subject to verification by the Engineer. The chart contained in "Plastic Cracking of Concrete" by Delmar Bloem for the National Ready Mixed Concrete Association, and published in ACI 305R-89, shall be used to determine the loss of surface moisture for the overlay. The chart may be obtained from the Department's Materials and Research Section.

An overlay shall not be placed adjacent to a previous overlay which has cured for less than 3 cure-days.

Placement of Overlay Concrete

Placement shall conform to applicable requirements of Section 602. The maximum overlay depth placement, per lift, shall be 2".

Prior to placing the overlay concrete, the Contractor shall schedule a "Preplacement Meeting" with the Engineer to discuss the plan and procedure for the work. This discussion shall acceptably establish the Contractor's ability to place the overlay on a continuous basis and to consolidate, finish, texture, and commence curing within the time intervals specified.

If placement of the overlay is to be made at night, the Contractor shall submit a plan which provides adequate lighting for the work area. The plan shall be submitted at least 15 calendar days in advance and be approved by the Engineer before concrete is placed. The lights shall be so directed that they do not adversely affect traffic.

The maximum time allowed between the start of mixing to the completion of discharge of the overlay concrete at the worksite shall be sixty minutes (both when used as grout or as overlay).

The maximum water-cement ratio of 0.40 shall not be exceeded. Any admixture added at the job

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site shall be mixed a minimum of 5 minutes, or 30 revolutions. After all components have been added, the slump range shall be 6 ± 2 ".

If a slump loss occurs after mixing and before placement of the overlay, the charge may be "re-tempered" with the high range water reducing admixture to restore plasticity; re-tempering with water shall not be allowed. The slump and air content will be rechecked to ensure conformance to the specifications. If the consistency of the charge after "re-tempering" is such as to cause segregation of the components, this will be cause for rejection of the load. The overlay material must still be placed within the original 60 minute limitation or it will be rejected.

Immediately before the overlay is placed, the concrete surfaces shall be cleaned with an oil free air blast, and cleared of any standing water. The overlay shall be placed only when the existing deck is "saturated surface dry". The bonding grout shall be applied onto the deck. The overlay concrete bonding material shall be applied for only a short distance in advance of the placement of the overlay. The distance must not allow the bonding material to dry out before the overlay concrete is placed. If the concrete bonding material dries out, it shall be removed from the deck placement area with water blasting, and new bonding material applied.

The maximum allowable time between the discharge of the concrete and the final finishing, including wet curing of the overlay concrete, shall be less than twenty minutes.

A construction dam or bulkhead shall be installed in case of major delay in the placement operation exceeding one hour in duration. During minor delays of one hour or less the end of the placement may be protected from drying with several layers of wet burlap.

If overlay concrete placement is stopped or delayed for a duration of 90 minutes or more, further placement shall be discontinued and may not resume until after a period of not less than 12 hours. This restriction does not prohibit continuation of placement provided a gap is left in the lane. The gap shall be sufficient in length for the finishing machine to clear the previously placed concrete.

Consolidating and Finishing the Overlay Concrete

Immediately following application of the bonding material, the overlay shall be placed, consolidated and finished to the Plan grades with vibrating devices. Spud vibration will be required in deep pockets, edges and adjacent to joint bulkheads. Hand finishing with a float may be required along the edge of the pour or on small areas of repair. Edge tooling is required at joints, except next to metal expansion dams, curbs, and previously placed lanes

A 10' straightedge shall be supplied and used by the Contractor to check the overlay directly behind the finishing machine. It shall also be used to check transversely along the edges of the overlay where hand finishing is done. Any irregularities exceeding 1/8" in 10' shall be corrected immediately. Any ponding problem which is noted prior to final acceptance of the overlay shall be corrected by the Contractor at no cost to the Department. The Contractor shall test the overlay concrete surface for smoothness in accordance with Subsection 602.20 of the Standard Specifications.

If needed, a water fog may be applied by the use of mechanical fogging equipment attached to the paving machine to achieve an atomized water mist/fog above, but no on, the surface of the overlay concrete. The water fog shall be discharged at high velocity by the airstream of the mistblower. Hand-pump sprayers shall not be used for the spraying.

Curing the Overlay Concrete

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As soon as the finishing and curing operation is completed, and less than twenty minutes after initial concrete discharge, the finished overlay surface shall be covered with a layer of clean, fully wet, saturated burlap. For a period of 3 cure-days (a cure-day shall be defined as a 24 consecutive hour period of time), the burlap shall be kept wet by the continuous application of water through soaker hoses. After the initial set, 4 mil (minimum) thick white opaque polyethylene film shall completely cover the wet burlap for the entire period. After the 3-day cure period, remove the polyethylene and burlap and apply curing compound in accordance with Subsection 602.18(b) except that the surface can be subjected to traffic as soon as the curing compound has setup.

The temperature at the overlay surface shall be maintained above 35°F until the curing period is completed. Any day during which the air temperature at the overlay surface falls below 45°F shall not be counted as a cure-day.

Any cracking which occurs prior to opening to traffic shall be sealed or repaired in a manner approved by the Engineer at no cost to the Department. The deck shall be sounded and any delaminated areas removed and replaced at no cost to the Department.

Traffic will not be permitted on the finished overlay surface until after the wet burlap cure period is complete.

The surface shall be textured in accordance with Subsection 602.20.

Any improperly cured overlay is subject to replacement at no cost to the Department.

Method of Measurement:

~~———— The item "Furnishing Low Permeability Concrete" will be measured by the cubic yard as determined from the theoretical yield of the design mix and documented by the batch records. Material wasted or rejected due to any cause will not be paid for.~~

~~———— The item "Constructing Low Permeability Concrete Overlay" will be measured by area in square yard regardless of the depth of the placed mixture. The actual area finished and accepted will be measured, exclusive of areas of metal expansion dams exposed.~~

Basis of Payment:

~~———— The payment of the item "Furnishing Low Permeability Concrete" shall be made for at the Contract unit price bid per cubic yard, which price and payment shall be full compensation for furnishing and hauling all micro silica modified concrete materials, for all labor, equipment, tools, and necessary incidentals to complete the work.~~

~~The payment for the item "Constructing Low Permeability Concrete Overlay" shall be made for at the Contract unit price bid per square yard, which price and payment shall constitute full compensation for the preparation of the area to receive low permeability concrete including scarifying, shot or grit blasting, removal of rust, oil, and other contaminants, protecting the area, bonding grout, placing of low permeability concrete, consolidating, curing, and texturing and for all labor, equipment, tools, and incidentals necessary to complete the work.~~

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SPECIAL PROVISION

 **605500 - CABLE-SUPPORTED BRIDGE SYSTEM REQUIREMENTS**

1.0 GENERAL

The requirements of this Special Provision shall apply to any cable-supported bridge structure type. For the purpose of these Contract Documents, a cable-supported bridge structure shall be defined as any bridge that includes any cable element, regardless of the constituent components of the cable, for which any part of the cable is external to the superstructure, and the cables shall be referred to as stays or cables.

The Design-Builder shall be responsible for designing, furnishing, fabricating, testing, storing, installing, erecting, monitoring, stressing, re-stressing, adjusting, and completing the assembly of all components of the complete cable-supported bridge system, including cable vibration suppression (damper) system and repair and/or replacement of damaged components (if necessary), for the cable-supported bridge in accordance with the Contract requirements and the criteria established in this Special Provision during all phases of design and construction of the project. The cable-supported bridge system shall allow control on the tension of the individual strands and facilitate future strand replacement that does not compromise strand integrity and/or corrosion protection. The system should provide independency for the strands regarding anchoring, corrosion protection, installation, tensioning, and replacement. The Design-Builder shall also be responsible for installation and performance of the completed cable-supported bridge system.

 The complete cable-supported bridge system includes, but is not limited to, strand, selected strand sheathing and/or strand coating, complete anchorage components, wedges, bearing plates, guide pipes, sealing components, stay cable vibration suppression (damper) system and components, corrosion protection provisions, temporary corrosion protection provisions during storage and construction, inert gas monitoring system (optional), stay cable pipe, elastomeric boots with braided covers, bolts, nuts, washers, clamping bands, erection devices and equipment, and all permanent and incidental materials and labor necessary to complete the cable-supported bridge system in accordance with the Contract requirements.

The cable-supported bridge system shall allow control on the tension of the individual strands and future strand replacement. The system should provide independency for the strands regarding anchoring, corrosion protection, installation, tensioning, and replacement. A minimum of fifteen (15) “reference” strands shall be distributed throughout the bridge for corrosion and service life monitoring purposes. These strands shall be installed, stressed, and protected and shall experience identical conditions to other strands of the stay cables. The Department in the future, may remove one or more reference strands for the purpose of evaluating the status of the cable-supported bridge system. Stay cables shall be designed such that reference strands that have been removed do not have to be replaced.

The Design-Builder shall design and construct the cable-supported bridge system meeting the goals of ease of inspection, low maintenance, and durability. Proposed innovations and features of the cable-supported bridge system, that are included in the successful Design-Builder’s Proposal, are not permitted to be abandoned, diminished, or removed from the design and/or the construction of the project by the Design-Builder after selection of the Design-Builder’s Proposal.

Shop drawings showing all dimensions, materials and operations for fabrication of the cable-supported bridge system components shall be submitted to the Department for review and comment. Shop drawings shall show the strand pattern for each cable (symmetrical about vertical and horizontal axis.) and shall conform to the requirements of Part 2 - DB Section 105 - Control of Work. The Design-Builder shall provide detailed procedures that are recommended by the Supplier for installing all components, insertion of the strands, installation of wedges, stressing and filling of the cable void. Complete shop drawings with supporting calculations shall be submitted showing all equipment (jack, stressing chair, etc.) and procedures required for cable force adjustments and for complete detensioning. No installation will be permitted by the Department for any portion of the production stay cables or

anchor assemblies until all required submittals of procedures and test reports are made and found to fully conform to the requirements of the Contract Documents.

The load path for all horizontal and vertical force components introduced or carried by permanent or temporary stay cables shall be entirely contained within the structural elements of the bridge. Permanent or temporary stay cable anchorage locations or structural details that transfer any principal component(s) of stay cable force into soil, earth, sand, etc. shall not be used. Use of soil, regardless of type or name, to carry, anchor or transfer forces from permanent stay cable(s) is specifically not permitted by these specifications and shall not be considered under any condition for use on this project.

Secondary or incidental forces from stay cable(s) caused by creep, elastic shortening, bearing friction or other means, result in development of forces in foundation(s), pier(s), pylon(s) or other structural member(s) shall be considered as acceptable within the provisions of this specification.

2.0 STANDARDS

Stay cables are to be provided in accordance with the Post Tensioning Institute (PTI) Guide Specification, "Recommendations for Stay Cable Design, Testing and Installation" by the PTI Committee on Cable-Stayed Bridges, Fourth Edition 2001, with 2004 interims ("soft" conversion of the Document's metric units is required), unless otherwise noted.

Testing of the cable-supported bridge system shall be in accordance with the *PTI "Recommendations for Stay Cable Design, Testing and Installation"* associated with fatigue, ultimate post fatigue strength and static load testing for both the acceptance-testing phase and all cable-supported bridge system materials and components to be incorporated into the structure. The corrosion protection (or water leak) test, as well as other designated tests, shall also be performed in accordance with the requirements of this Special Provision.

These Special Provisions are intended to complement the *PTI "Recommendations for Stay Cable Design, Testing and Installation"* and in cases of disagreements, these Special Provisions for the Cable-Supported Bridge System Requirements shall govern over the *PTI "Recommendations for Stay Cable Design, Testing and Installation"*. It is the Design-Builder's responsibility to obtain clarification of any and all unresolved ambiguity prior to proceeding with any design or construction.

2.1 EXCEPTIONS

The following acknowledgements and exceptions are taken to the *PTI "Recommendations for Stay Cable Design, Testing and Installation"*:

- A) High strength bars shall not be used for the main tension elements of the stay cables;
-  B) Stay cable pipe shall be HDPE or *ASTM A312* Type 2205 stainless steel. All associated components of the stay cable pipe protection system, such as guide pipes, bolts, nuts, washers, backer plates, weld plates, banding clamps, braid covers and other exposed items shall be stainless steel with similar corrosion resistance to *ASTM A312* Type 2205;
-  C) Saddles or Cradles shall not be used for stay cables;
- D) For epoxy coated strand (if selected by the Design-Builder), the film thickness of coating after curing shall be 25 to 45 mils inclusive;
- E) Portland cement grout will not be considered an acceptable corrosion protection barrier; and
-  F) At the Design-Builder's option, an inert gas monitoring system may be used to enhance the corrosion protection of the cable-stay system and to monitor the cable-stay system atmosphere inside the cable-stay pipe.

2.2 TESTING

An independent testing laboratory (or laboratories) selected by the Design-Builder and approved by the Department shall test all materials, strands and cable specimen assemblies required for both the initial acceptance-testing phase and the stay cable component fabrication/production phase. The Design-Builder shall be responsible for all coordination between the Design-Builder's laboratory (or laboratories), Design-Builder's supplier(s), and Department representatives.

The Design-Builder shall furnish, and make available for Department review, all materials and written test procedures, as prepared by the Design-Builder's supplier(s). Each component of the assembly, including items such as wedges, shall have an *AASHTO* or *ASTM* material and test specification. The Design-Builder's supplier(s) and the design-Builder's laboratory (or laboratories) shall prepare separate reports. Each of these reports shall independently describe all the testing data and testing results. All reports shall be submitted by the Design-Builder to the Department within 14 days of completing each test as independent records of the testing. The Design-Builder shall be responsible for subcontracting and coordinating with the Design-Builder's laboratory (or laboratories) and Design-Builder's supplier(s) for all testing laboratory services.

Material or cable-supported bridge system components tested during the acceptance-testing phase shall not be incorporated into the actual structure. All items, which comprise the permanent production cable-supported bridge system, shall be identical in nature, origin, and composition to those that were the basis of the cable-supported bridge system acceptance tests. The Design-Builder's supplier(s) shall provide written and detailed recommendations to the Design-Builder regarding storage, handling, transporting, assembly, stressing, and re-stressing of the cable-supported bridge system components. The Design-Builder's supplier(s) shall simultaneously provide copies of all such recommendations directly to the Department for the project files.

2.3 QUALITY CONTROL PROGRAM

The Design-Builder is responsible for installing stay cable material in an undamaged condition. In order to assure that only conforming material is introduced into the work, the Design-Builder shall develop a comprehensive Quality Control program that covers the procurement, packaging, and transport and delivery of all stay cable materials and components of the stay cables. This program shall include, but not be limited to, all procedures and practices necessary for the final installation of stay cables that meet the requirements of these Special Provisions and Section 6 of the *PTI "Recommendations for Stay Cable Design, Testing and Installation"* without residual damage to any component of the cable-supported bridge system.

- A) As a minimum, the Quality Control program shall include the following items:
 - 1) Packaging and shipping for main tension elements and all protective materials.
 - 2) Records for traceability and shelf life of all materials.
 - 3) Inspection of materials to assure conformance to these Special Provisions and to assure the materials are undamaged as they are installed on the bridge.
 - 4) Limitations on storage and handling, including time periods for storing materials, temperature and humidity limitations for materials, temporary corrosion protection, and any limitation on temporary storage or protection that shall be permitted to affect performance of the completed stay design.
 - 5) Coiling limitations for materials subject to set or plastic deformations, including prefabricated cables, HDPE pipe, Polyethylene-sheathed strand or epoxy-coated strands.
 - 6) Limitations on coatings, repairs of coating damage, and supplemental protection for coated materials.
- B) The Quality Control program shall be submitted to the Department for review and evaluation. Review and evaluation by the Department does not relieve the Design-Builder from the responsibility for the accuracy and adequacy of the work.
- C) The Quality Control program shall be approved by the Department and the Design-Builder's Engineer of Record prior to procuring any stay cable materials.

- D) Permanent records shall be established and maintained by the Design-Builder for all procurement, inspection, sampling, testing and installation in accordance with the requirements of Section 6 of the *PTI "Recommendations for Stay Cable Design, Testing and Installation"*.

3.0 MATERIAL

3.1 STEEL



All steel products to be used or supplied in connection with the cable-supported bridge system shall be steel products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or other similar process or processed by a combination of two or more such operations, from steel by the open hearth, basic oxygen, electric furnace, Bessemer or other steel making process.

3.2 STRAND

The Design-Builder has the option to select the strand sheathing or strand coating material for stay cables from the strand types specified in this Special Provision. Only one type of strand may be selected for use in the permanent cable-supported bridge system for the entire project. Acceptable stay cable strands meeting the following requirements shall be considered acceptable for use by the Department. Requests to use strands having other material properties or coatings, such as galvanization, must be submitted to the Department for approval.

3.2.1 Epoxy Coated Strand

- A) Epoxy coated strand for stay cables shall be 0.60" in diameter, Grade 270, $f_y = 0.9f_s$, weldless grade, low relaxation, seven wire strand conforming to the requirements of *ASTM A882/A882M, "Standard Specification for Epoxy Coated Seven Wire Prestressing Steel Strand,"* and Supplement 1 thereof. During the process of manufacture of individual wires for "weldless" strand, welding is permitted only prior to or at the site of the last thermal treatment of the rod, for example, patenting or controlled cooling. There shall be no welds in the wire after it has been drawn through the first die in the wire drawing process;
- B) Epoxy coated strand shall be of the "filled" type where the interstitial space between individual wires is completely filled with the epoxy coating meeting the requirements of the *PTI "Recommendations for Stay Cable Design, Testing and Installation"*;
- C) All coating materials shall be from one manufacturer to assure uniformity;
- D) A written certification shall be furnished by the strand coater that clearly identifies each batch of coating material as to material, quantity, date of manufacturer, shelf life (date) and that all supplied coating material meets all requirements specified herein;
- E) The epoxy coating manufacturer and the coating material shall be reviewed and evaluated by Department prior to furnishing the material. For plant approval, the plant shall furnish Quality Control procedures to insure compliance with these specifications;
- F) The material shall be tested by a private testing laboratory approved by the Department and test data furnished to the Department for review prior to use. Review and evaluation by the Department does not relieve the Design-Builder from the responsibility for the accuracy and adequacy of the work;
- G) The coating applicator shall furnish, at the time of shipment, written certifications that the coated strands were cleaned, coated and tested in accordance with the requirements of these Special Provisions. The certification shall include Quality Control reports indicating preheat temperatures, cure times, coating thickness measurements, holidays detected, and bend test results; and
- H) The epoxy coating shall extend over the entire length of the strand. No welds or joints shall be present in the finished strand.

3.2.2 Individually Sheathed Strand

- A) Sheathed strand for stay cables shall be 0.60" in diameter, Grade 270, $f_y = .9f_s$, weldless grade, low relaxation, seven wire strand conforming to the requirements of *AASHTO M203, "Specification for Steel Strand, Uncoated Seven Wire Stress Relieved for Prestressed Concrete,"* except that it shall be coated with a corrosion inhibiting material. During the process of manufacture of individual wires for "weldless" strand, welding is permitted only prior to or at the site of the last thermal treatment of the rod, for example, patenting or controlled cooling. There shall be no welds in the wire after it has been drawn through the first die in the wire drawing process;
- B) Strand coating shall be of the "filled" type where the interstitial space between individual wires is completely filled with the coating or corrosion inhibiting material meeting the requirements of the of Table 1 from the *PTI "Guide Specification - Specification of Unbonded Single Strand Tendons;"*
- C) Strands shall be individually sheathed with a corrosion inhibiting material. Acceptable sheathing includes High Density Polyethylene (HDPE) or High Density Polypropylene (HDPP) meeting the requirements of the *PTI "Recommendations for Stay Cable Design, Testing and Installation";*
- D) The amount of corrosion inhibiting material shall be sufficient to ensure complete filling of the annular space between the individual wires of the strand and the sheathing material; and
- E) The coating, corrosion inhibiting material, and the sheathing shall extend over the entire length of strand. No welds or joints shall be present in the finished strand.

3.2.3 Continuity of Strand Coating

The coating shall be free of holes, voids, cracks and damaged areas discernible to the unaided eye. During the coating process, a continuous holiday detection procedure shall be employed using an appropriate holiday detector such as the 67 1/2 volt holiday detector using water as the conductor following the manufacturer's recommended procedure. During the continuous holiday detection procedure, if more than two holidays are detected per hundred feet, the strand shall be rejected and the coating manufacturing procedure shall be corrected. Coated strand with two holidays or less per hundred feet shall be patched in accordance with the patching material manufacturer's recommendations. The patch or repair shall have the same mechanical properties as the original coating and have sufficient bond and flexibility to resist effects of handling and stressing.

3.2.4 Strand Coating in the Vicinity of Wedges



The strand coating must be removed in the vicinity of the wedges. The Design-Builder shall provide recommendations for equipment and procedures required to do so that will not damage the strand. The actual procedures to be used by the Design-Builder during production must be similarly used for the acceptance testing. The Design-Builder shall also propose an acceptable method for providing temporary and permanent corrosion protection of the area where coating has been removed in order to accommodate the wedge grips. The Design-Builder's system shall be qualified in accordance with Section 4.1 of the *PTI "Recommendations for Stay Cable Design, Testing and Installation"*.



3.3 EXTERNAL CABLE PIPE

Pipe sections shall have consistency of external diameter and uniformity (roundness) to permit the completed pipe to have a smooth, continuous appearance at each weld location. This will require more strict dimensional tolerances than standard values. The Design-Builder is responsible for achieving these dimensional requirements without exception. Cable pipe meeting the following requirements in 3.3.1-3.3.2 or the requirements in Section 3.5 of the *PTI "Recommendations for Stay Cable Design, Testing and Installation"* shall be considered acceptable for use by the Department. Requests to use cable pipe having other material properties must be submitted to the Department for approval.

3.3.1 Stainless Steel Components



- A) All portions of the exterior stay cable pipe, including termination pipe, for each individual parallel strand stay cables shall be stainless steel conforming to the requirements of *ASTM A312, Type 2205* with diameters in accordance with *ANSI/ASME B36.10M 1995*;

- B) Any portion of the guide sleeves (or pipes) embedded or not embedded in concrete shall be *ASTM 312* Type 2205 stainless steel with diameters in accordance with *ANSI/ASME B36.10M 1995*; and
-  1) All associated components of the stay cable pipe protection system, such as bolts, nuts, washers, backer plates, weld plates, banding clamps, braid covers and other exposed items shall be stainless steel with similar corrosion resistance to *ASTM A312* Type 2205.
- 2) If welding is required for stainless steel, then all welding material shall be of an equal or better grade than the base metal. Aluminum and/or steel wire brushes and/or abrasives may not be used on any stainless steel part during fabrication. All heat tint and any weld splatter shall be removed.
- C) Stainless steel bands for securing the neoprene boots in place around the stainless steel sheath pipe and the neoprene sleeve shall be a minimum 1.0 inch wide by 0.03 inch thick stainless steel strapping material with stainless crimp type seal of a type proposed by the supplier of the cable-supported bridge system.

3.3.2 Stainless Steel Component Finish

- A) All stainless steel shall be finished exclusively utilizing silicon carbide abrasives in accordance with *ASME B46.1-2002*. Wet 180-grit abrasive shall be used for the final finish resulting in a fine polished finish with a maximum surface roughness of Ra 20 micro-inches. This finish shall continue over field weld splices and connections.
-  B) The direction of the polish grain shall be oriented in the direction of free drainage of the part in its final position on the structure. For stay cable pipe, the direction of polishing shall be in the direction of the longitudinal axis of the pipe.
- C) The visible grain of the polished finish of all stainless steel components shall be uniform in appearance and direction.
- D) The Design-Builder will be responsible for protecting stainless steel bridge components from damage and contamination before final acceptance by the Department.
- E) Before installation, demonstration samples and full-scale mock-ups, not to exceed 6 feet in length, of all stainless steel components shall be submitted to the Department for review and comment.

3.4 GALVANIZED COMPONENTS

Bearing Plates shall be fabricated from *ASTM A 633* Grade E and galvanized per *AASHTO M 111 (ASTM A 123)*.

3.5 ELASTOMERIC COMPONENTS

Elastomeric components, such as boots, shall be manufactured from 100% virgin chloroprene of the thickness, shapes and hardness required by the Design-Builder's cables-stay system design. Neoprene, the sole polymer shall be 100% virgin chloroprene, which shall be not less than 60% by volume of the total compound. The elastomer shall meet the following requirements of *ASTM C864-79* and as amended below (*ASTM* designated test procedure indicated in parenthesis, if applicable):

	Physical Requirements	Procedure as per <i>ASTM</i> Design
Hardness, Durometer A	60±5	D2240
Tensile Strength, psi, min.	2,500	D412 (die C)

	Physical Requirements	Procedure as per ASTM Design
Ultimate Elongation, Percent, min.	350	D412 (die C)
Accelerated Test to Determine Long-term Characteristics Oven-aged – 70 hours at degrees 212° F	---	D573
Change Durometer Hardness, maximum points	+15	---
Change in Tensile Strength, maximum percent	-15	---
Change in Elongation at Break, maximum percent	-40	---
100 ppm ozone in air by volume, 20 percent strain, ± 100° F, 100 hours mounting	No cracks	D1149 – samples to be solvent wiped before test to remove any traces of impurities
Procedure A - Compression Set - 22 hrs at 212° F, Maximum %	35	D395, Method B

3.6 CAP SCREWS AND BOLTS

Material for cap screws, used in the cable anchorages, shall be high-strength, low alloy structural steel conforming to *ASTM A307*. High strength bolts, used in the cable anchorages, shall be high-strength, low alloy structural steel conforming to *AASHTO M164*.

3.7 WASHERS AND SHIMS

Material for split washers and split shims, if used in the cable stay anchorage, shall be high-strength, low alloy structural steel conforming to *AASHTO M223*.

3.8 MATERIAL STORAGE

The storage facility provided by the Design-Builder shall provide indoor, protected space for all materials. The storage facility shall provide appropriate temperature controlled space for any and all materials that are temperature sensitive in nature. The Design-Builder is responsible for all cable-supported bridge system materials (including cost of leasing storage facility). The Design-Builder will allow immediate access to the Department to inspect the storage facility at anytime during its use.

4.0 CABLE SUPPORT SYSTEM

4.1 COMPONENTS

- A) Cable-supported bridge system components shall meet the requirements as specified and the acceptance testing of the cable-supported bridge system. The cable anchor assembly shall consist of an externally threaded steel socket, anchor head, load bearing nut, and protective cap. It must allow for complete de-tensioning of the cables and subsequent removal of the anchorage components (except the load bearing nut) through the guide sleeve. The assembly shall pass, without failure of any component of the support testing outline elsewhere in these requirements.

Cracking of the strand wedges shall not be considered as failure.



B) The anchorage assembly and components shall be protected at all times against corrosion, particularly the wedges and wedge holes. Corrosion protection measures shall be shown on the shop drawings and shall include temporary corrosion protection of areas (if any) where coating is intentionally removed for wedge contact. The permanent protection system shall include a stainless steel cap, adhering to Section 3.3.1 of this Special Provision, to protect the exposed anchor plate and wedges from corrosion. Prior to the installation of the permanent cap, the anchor plate and exposed strand shall be coated with a suitable grease.

C) The threaded portion of the socket shall be of sufficient length for installation of the cable and future force adjustment of ± 2.5 percent simultaneously in all cables without the use of shims. The assembly shall have a capacity equal to the guaranteed ultimate strength of the cable. Calculations shall be submitted to the Department showing the service stresses in all load bearing components of the assembly.

D)



4.2 QUALIFICATION OF TEMPORARY CORROSION PROTECTION SYSTEM



A) A sample consisting of not less than 3 strands or 15 wires shall be placed in a prototype of the temporary corrosion protection system. This prototype shall include all elements of the temporary system for the free length of cable, including inhibitors, pipe, coatings, or other external elements of the system as it will be installed in the field. Sample ends shall be sealed. The prototype shall be exposed in a weatherometer to thermal and wetting cycles of a number equivalent to 125% of the number of days for which the system will be qualified. Temperature cycles shall range from not more than 40° F (5° C) to not less than 100° F (38° C). Wetting in each cycle shall consist of water spray applied at 40° F (5° C) as necessary to completely wet the specimen. Acceptance shall be in accordance with Contract requirements.

B) Temporary corrosion protection shall encompass the entire length of main tension elements prior to cable assembly and installation.



4.3 CABLE DAMPING REQUIREMENTS

4.3.1 General Requirements

This work shall consist of the design, installation, and testing of a stay cable vibration suppression system as specified herein. The cable-supported bridge system shall include a vibration suppression system consisting of one or more overlapping systems (dampers (other than neoprene washers), cross ties, and/or cable surface modifications)

The Design-Builder shall design and construct the stay cable system to prevent excessive vibration of stay cables due to all affects of operating and environmental loadings over the range of temperature associated with steel design in the AASHTO LRFD Code. Excessive vibration is defined at two levels:

1. Vibration which exceeds one cable diameter under normal operating conditions, which includes rain-wind excitation and normal wind conditions up to and including 25 mph.
2. Vibration under any service, strength or extreme loading condition that causes damage to or fatigue failure of any strand, cable, appurtenance or bridge component. The acceptable level of vibration and displacement for strength and fatigue limit states shall be established by test.

The design-builder shall establish displacement criteria for service, strength and extreme load vibration levels, in addition to the normal operating criteria noted above, that is based on and consistent with cable testing and detailed analysis of cables and bridge components, and submit criteria to the Owner for approval. The design-builder shall, in all cases, provide at least a mass-damping parameter in conformance with the commentary of Section 5.2.3.2 of the *PTI "Recommendations for Stay Cable Design, Testing and Installation"*.



The design-builder shall warrant construction of the wind design for the stay cable system for a period of 2 years from date of final acceptance of the bridge. The design-builder will modify damping system(s), cable surface

treatment and cable stiffening ropes as required to achieve the performance requirements for cable vibration at no additional cost to the Owner. The design-builder will replace or repair to like-new condition all cable elements, appurtenances, or bridge components damaged by cable vibration or damaged by other environmental loading conditions in combination with cable vibration for the duration of the warranty period.

The Design-Builder shall have an independent laboratory perform on site testing before and after installation of the dampers to verify that the additional damping provided by the system meets the specified value. The Design-Builder shall also propose a detailed pre-installation qualification plan for the damper devices to demonstrate through physical testing that the installed devices will meet these requirements. The pre-installation qualification plan shall provide detailed methods for remedy of damping value if the post-installation testing indicates that the required additional damping value has not been achieved for each stay cable.

In order to determine the appropriate combination of supplemental dampers and stabilizing cables, it is necessary to estimate the effective damping ratio of the proposed stay cable with the supplemental damping system. The determination of effective damping ratio shall be based upon full-scale test results and shall be subject to review and comment by the Department.

4.3.2 Additional Performance Requirements



Provisions shall be made by the Design-Builder to facilitate rapid introduction of temporary suppression measures for stay cable susceptible to vibrations during construction. The cables shall be monitored for vibrations. Monitoring shall take place during erection at the time of major wind events and under the combined action of wind and rain.

- A) Full scale damping measurements of all of the stay cables shall be made to ensure that stay cable damping estimates used in the design of the vibration suppression system are met. If actual damping differs sufficiently from the values used in design of the vibration suppression system, additional stabilizing cables or damping shall be provided, at no cost to the Department to ensure that the vibration suppression system meets with the intended performance level.
- B) Following completion of these tests, the Design-Builder shall submit to the Department a report that demonstrates that the performance of the vibration suppression system meets or exceeds the required performance level.

4.4 CABLE MONITORING SYSTEM (OPTIONAL)

If utilized by the Design-Builder, the Cable Monitoring System shall be designed by the Design-Builder's Supplier. The contractor shall submit complete detailed Shop Drawings with supporting calculations for the Cable Monitoring System. All Shop Drawings shall conform to the requirements of Section 105 - Control of Work.

The Cable Monitoring System shall be designed as a closed system filled with an inert gas that is 100% compatible with the support system components (gasses which may cause reactions between metals shall not be used). The Design-Builder shall submit the desired gas and an analysis demonstrating the changes in pressure due to temperatures extremes in the region. Each analysis shall define the initial ambient temperature at which the system is expected to be when gas charged. The system shall be designed to retain the maximum pressure for the life of the cable-supported bridge system. After the cables and superstructure have been erected the completed cable-supported bridge system shall have the gas injected under a pressure of 10 psi. The Design-Builder shall provide and activate an automated electronic monitoring system capable of recharging the system in case of slow loss of the inert gas.

A reserve gas bottle shall be located near the monitoring location of each cable to replenish small amounts of gas that may leak from the system. This replenishment system shall serve as a precaution only and shall not be relied on for the initial design or testing unless stated otherwise. The connections shall be stainless steel with a welded fitting at the anchor. There shall be provisions for removal of the cable anchor cap and gas bottle through the use of threaded fittings or other mechanical devices. Inert gas charge shall be monitored continuously at the reserve bottle fittings with a precision rotometer/flowmeter and an electronic sensor capable of monitoring gas flow from the reserve gas bottle to the cable-supported bridge system. The sensors shall be capable of measuring to within 0.01 psi any gas flow resulting from a cable-supported bridge system inert gas pressure change. A secondary pressure

gage is required at each anchor location. Information on gas transfer and the pressure within the cable-supported bridge system shall be collected by data acquisition.

Following final assembly of the cable-supported bridge system the Design-Builder shall test the system for leaks at 15 psi for a 24-hour period. Each joint shall be tested for leaks at the beginning of the 24-hour test period. The test shall be electronically monitored; with instruments capable of reading gas pressures to 0.01 psi, and located at each lower anchorage location. Monitoring shall provide constant pressure data through out the entire test.

One mock-up pressure test shall be performed by the Supplier to prove the design of the monitoring system. The test shall include all components to be used in the final Cable Monitoring System. The Design-Builder shall submit shop drawings and procedures for the initial mockup test and include all testing parameters, procedures and expected results. This test shall be successfully completed prior to the fatigue tests described elsewhere in this specification.

The support cable system shall be completely purged of oxygen during final injection of gas for both the mockup test and the final cable-supported bridge system injection.

Shop drawings shall be submitted to the Department for approval showing all dimensions, locations, materials, inserts, fittings, gas type, reserve gas bottle size and expected volume displacement capabilities, cable system pressure testing, purging and filling procedures, electronic devise flow meters, pressure gauges, secondary gages, date acquisition, and other components related to the system. In addition to Shop Drawings, the Design-Builder must submit a detailed description of the data acquisition collection capabilities, duration of data storage, data format and means of down loading data.

The Data Acquisition Unit (s) shall continuously record gas pressure conditions in each individual support cable system and have the capabilities to store data of the system's performance. The data for monitoring must include but is not limited to, current pressure and a warning device for positive gas flow between the reserve gas bottle and the support cable system. The Data Acquisition Unit (s) must provide enough memory to store continuous data for a period of 1 year at a minimum.

The Design-Builder shall monitor the system until the Final Acceptance date and all systems have been proven effective.

Anchorage and Miscellaneous Components. The anchorage components and miscellaneous components shall be provided by the Supplier as part of the system and may include but not be limited to sealing components, boots, damping components, bolts, clamping bands and inert gas filler and monitoring system.

5.0 CABLE TESTING

The Design-Builder is responsible for delivery of all materials to the laboratory and fabrication of test specimens in a timely fashion. Fabrication of any anchors, components or stay cable strands for permanent installation in the structure shall not begin until all initial phase tests are successfully completed and written approval is given by the Quality Control Manager. The Design-Builder shall also allow for review and comment of materials and test specimens by the Department prior to fabrication. The Design-Builder shall provide an initial proposed schedule for the cable system testing that includes the following milestones:

- A) Delivery of materials and conducting the first axial fatigue test on a specimen. Upon completion of this test the leak test shall be performed on the specimen. This specimen will not be tested for ultimate post-fatigue strength and static load testing.
- B) Delivery of materials and conducting base strand tests and single strand friction tests.
- C) Delivery of materials and conducting the second axial fatigue test. This specimen will be tested for ultimate post-fatigue strength and static load testing.

Dismantling of the previously tested specimen shall occur concurrently with setup/testing of the next specimen.

The Design-Builder shall coordinate the Supplier and Laboratory activities for fabrication, installation and set up of the fixture for the axial fatigue tests with the fabrication of anchorage components along with the testing of base strand material.

5.2 ACCEPTANCE OF PRIOR TESTS OF CABLES

 When the cable tests (or similar cable tests) have been conducted for previous projects on specimens identical in design and details to those proposed for this project, the previous tests may, at the Department's sole discretion, be used as the basis for cable-supported bridge system approval for this project. However the quality control tests outlined in Section 3.2 of the *PTI "Recommendations, Support Cable Design, Testing and Installation"* shall establish that the strand supplied for this project has fatigue characteristics comparable to the strand used in the acceptance tests of the support cable (or stay cable) specimens in the previous project. Further, the load bearing anchorage hardware shall be the same as in the previous tests.

5.3 INDIVIDUAL SHEATHING ACCEPTANCE TEST

HDPE, HDPP and corrosion inhibiting material shall meet the requirements of the *PTI "Recommendations, Support Cable Design, Testing and Installation."* The resultant acceptable values of the primary properties for HDPE and HDPP material shall be tested and meet the requirements of the values found in Table 3.2 of *PTI* specifications referenced above.

5.3.1 HDPE Sheathing Requirements

The Design-Builder shall furnish to the Department a certified test report prepared by an independent laboratory documenting compliance of the HDPE with the following requirements:

- A) HDPE material shall meet the specific requirements of *ASTM D4976 "Standard Specification of Polyethylene Plastics Molding and Extrusion Materials."*
- B)  The material shall be UV stabilized and suffer no property degradation for a minimum exposure period of 6 months. In applications where the PE sheathed strand may be exposed to UV radiation for periods in excess of 6 months, the requirements of Section 3.5.3.2C of the *PTI "Recommendations for Stay Cable Design, Testing and Installation"* shall apply.
- C) HDPE material shall not react with the inert gas (if used), the prestressing steel corrosion inhibiting coating material or any other material, it is permitted to come in contact with, as part of the stay cable sheath and shall be free of water soluble chloride.
- D) HDPE material shall be chemically stable without embrittlement or softening over the anticipated exposure temperature and service life of the structure.

5.3.2 HDPP Sheathing Requirements

The Design-Builder shall furnish to the Department a certified test report prepared by an independent laboratory documenting compliance of the HDPP with the following requirements:

- A) HDPP material shall meet the requirements of *ASTM D4101 "Standard Specification for Propylene Plastic Injection and Extrusion Materials."*
- B) The material shall be UV stabilized and suffer no property degradation for a minimum exposure period of 6 months.
- C) HDPP material shall not react with the inert gas, the prestressing steel corrosion inhibiting coating material or any other material, it is permitted to come in contact with, as part of the stay cable sheath and shall be free of water soluble chloride.
- D) HDPP material shall be chemically stable without embrittlement or softening over the anticipated exposure temperature and service life of the structure.

5.4 EPOXY COATED STRAND ACCEPTANCE TEST

The epoxy coating of each strand shall be with a protective fusion bonded polymer coating applied by the electrostatic deposition method. Epoxy coating and patching materials shall be in accordance with *ASTM A882*. All coating materials shall be from one supplier to assure uniformity. The Design-Builder shall supply written certification from the supplier that clearly identifies each batch of coating material as to material type, quantity, date of supplier, shelf life (date), and that all supplied coating material meets all requirements specified herein. The epoxy coating supplier and the coating material shall be approved for use by the Department prior to furnishing the material. For plant approval, the plant shall furnish quality control procedures to insure compliance with these requirements. The Design-Builder shall provide at the time of shipment, written certifications from the coating applicator that the coated strands were cleaned, coated and tested in accordance with this requirement. The certification shall include quality control reports indicating all coating thickness measurements, holidays detected, and bend test results.

The surface of the steel strand to be coated shall be cleaned in conformance with the coating requirements of *ASTM A882*. The coating shall be applied by the electrostatic deposition method, or other methods recognized by *ASTM A882*, and in conformance with the written recommendations of the supplier of the coating material. Before packing, the coating shall be fully cured in conformance with *ASTM A882* and the written recommendations of the supplier of the coating material. The coating shall be applied to the cleaned surface as soon as possible after cleaning, and before oxidation of the surface discernible to the unaided eye occurs. However, in no case shall application of the coating be delayed more than 8 hours after cleaning. The coating shall be applied in a continuous process after drying. No inert particles may be impregnated into the surface of the coating. The uniform film thickness of the coating (exclusive of local surface imperfections discernible to the unaided eye) after curing shall be between 25 mils and 40 mils inclusive. Local surface imperfections shall be defined as holes, cracks, depressions and damaged areas not exceeding 0.5 square inches in area, or 0.5" in maximum dimension. Larger imperfections regardless of origin shall be cause for rejection. Any surface irregularity that results in a local film coating thickness of less than 25 mils shall be cause for rejection.

All local surface imperfections, smaller than that requiring rejection, shall be repaired in conformance with this specification. The thickness of the coating shall be measured using a magnetic gauge or other method recognized by *ASTM A882* and the results furnished to the Department for review and comment prior to the coating process. The gauge, or other approved method, shall be capable of measuring the coating thickness of a coated wire of circular cross section with a diameter in the range of 0.1 to 0.3". The allowable error on a single measurement of the coating thickness on the coated crown of an outer wire of the strand shall be +/- 5 percent.

During the coating process, a continuous holiday detection procedure shall be employed in accordance with Section 3.2.3 of this Special Provision.

The resistance of the strand coating to abrasion shall be determined by the falling sand method of *ASTM D968* adapted for testing coated strand. The net loss of coating shall not exceed 10 mils per 1,000 liters.

The adhesion and shear strength of the coating shall be evaluated by bending a sample from a finished reel of coated strand 180° around a mandrel diameter equal to 32 times the nominal diameter of the strand. Test specimens shall be at thermal equilibrium between 68° and 86° Fahrenheit (20° and 30° Celsius). No cracking or de-bonding of the coating shall be visible to the unaided eye on the outside radius of the bent strand. Evidence of cracking or de-bonding of the coating shall be considered cause for rejection of all coated strand represented by the bent sample test. Fracture of the steel wire or strand in the bend test shall not be considered as adhesion failure of the coating. Another sample of the same production shall be tested if wire or strand failure occurs. The adhesion of coating shall also be evaluated by a tensile test in accordance with *ASTM A882*, and the tensile strength shall be recorded. The coated strand shall satisfy the requirements for breaking strength, yield strength (1 percent extension), and ultimate elongation as delineated in *ASTM A882*. No cracks visible to the unaided eye shall occur in the coating up to an elongation of 1 percent (yield point). The sample that is used for the bend test shall be at least 5' long. Sample length for the tension test shall follow the requirements of *AASHTO T244*. Evidence of cracking or debonding of the coating shall be considered cause for rejection of the coated strand represented by the tensile test sample.

Adhesion tests shall be conducted at the tail end of each manufactured length. If the specimen for coating thickness, continuity, or adhesion of coating fail to meet the specified requirements of *ASTM A882*, two additional tests shall

be made on strand samples adjacent to the first sample from the same reel. If the results of both retests meet the specified requirements, the reels represented by the samples shall be accepted.

The maximum amount of damage to any one strand shall not exceed 2 percent of the surface area in any foot of length. Larger amounts of damage are cause for rejection. All damaged areas visible to the unaided eye shall be repaired with approved patching material.

Patching shall be done in accordance with the recommendations from the supplier of the patching materials.

5.5 COATING TEST REQUIREMENTS FOR ALL STRAND OPTIONS

The Design-Builder shall furnish to the Department for review and comment, a test report prepared by an independent laboratory documenting compliance with the following tests:

- A) Chemical Resistance. The chemical resistance of the coating shall be evaluated in accordance with *ASTM G20* by immersing coated strands in each of the following: distilled water, a 3 M (Molar) aqueous solution of CaCl_2 , a 3 M (Molar) aqueous solution of NaOH , and a solution saturated with Ca(OH)_2 . Tests with specimens without holidays and specimens with intentional 0.25" diameter holes drilled through the coating shall be performed at $75\pm 4^\circ$ Fahrenheit. Minimum test time shall be 45 days. The coating must not blister, soften, lose bond, nor develop holidays during this period. The intentionally made holes shall exhibit no undercutting during the 45 day period.
- B) Chloride Permeability. The chloride permeability characteristics of the films of cured coatings having the minimum thickness as proposed for use shall be measured by the methods outlined in *FHWA RD 74 18*. The test shall be performed at $75\pm 4^\circ$ Fahrenheit for 45 days. The accumulative concentration of chloride ions permeating through the film shall be less than 0.0039 inches of total penetration.
- C) Impact Test. The resistance of a strand coating to mechanical damage shall be determined by the falling weight test. A test apparatus similar to that described in *ASTM G14* shall be used along with a 4 lb tup. Impact shall occur on the crown areas on the coated strand. The test shall be performed at 70° F. With an impact of 80 in-lbf, no shattering, cracking, or bond loss of the coating shall occur except at the impact area, that is, the area permanently deformed by the tup.
- D) Salt Spray Fog Test. Coated strand specimens shall be tensioned to 70% of the maximum ultimate tensile strength and exposed to salt fog for 3,000 hours in accordance with *ASTM B117*. Care shall be taken to protect the end anchorage used from salt fog or corrosion so as not to influence the test results. Observation for signs of corrosion shall be made and recorded every 250 hours. After 3,000 hours of exposure, no evidence of rust shall be present, and the specimen shall be holiday free. After the salt spray test is completed, the specimen shall undergo a tensile strength test, in accordance with *AASHTO T244* to determine if the ultimate tensile strength of the strand has been affected. The tensile strength of the strand after being exposed to the salt spray shall satisfy the requirements of Section 6, *ASTM A416*. No cracks visible to the aided eye shall occur in the HDPE or HDPP up to and elongation of 1% (yield point). Results from previous tests for a current project maybe submitted for acceptance provided the testing complied with all of the procedures and requirements mentioned above.

The Design-Builder shall have an independent testing laboratory (not the primary Laboratory contracted by the Design-Builder) perform project specific tests defined in tests A through D above. The Design-Builder shall submit the certified test results from the independent testing laboratory that all aspects of these requirements have been met.

All above tests shall be completed prior to completion of the testing of the full size specimens and shall show that all strand requirements are met by the individually plastic coated/sheathed or epoxy coated strand to be supplied. The Laboratory shall perform tests on all material, strands and cable specimen assemblies required for both the acceptance testing phase and the cable component fabrication/production phase as defined by the Strand Acceptance Test and Fatigue Strength Testing of Cables sections of these special provisions. The Design-Builder is responsible for the supply and delivery of all testing materials to the laboratory. Coated strand represented by test samples that do not meet all requirements of the contract shall be rejected.

5.6 STRAND ACCEPTANCE TEST

The following conditions shall be met:

- A) One 16' long sample strand shall be taken for every 10 tons of strand produced from each heat of steel. This sample shall be used for both fatigue and ductility testing.
- B) All strands and test samples shall be marked in such a manner to ensure traceability during production, transit, storage and testing.
- C) The test strands shall be protected from failure in the gripping zone. Should any test strand fail in the gripping zone, the test will be discarded and another test specimen made from the same sample.
- D) One test for each manufactured length shall be made for the following:
 - 1) Minimum guaranteed ultimate tensile strength: $f_s = 270$ ksi
 - 2) Minimum yield strength: $f_y = 0.90 f_s$
 - 3) Young's Modulus: $E = 28,600$ ksi + 5%

5.6.2 Fatigue Testing

- A) One tensile fatigue test shall be conducted on an approximately 4' long test specimen from each sample. Minimum length shall be 36" face-to-face of grips.
- B) The test strand shall withstand without wire failure 2 million cycles of stress variation from 98.6 ksi to 121.5 ksi.
- C) After successful completion of the fatigue testing, each test specimen shall withstand a minimum static load of 95% of the guaranteed ultimate tensile strength of the strand without wire failure.
- D) Rejection Criteria: If the first valid test strand from each sample fails, two additional tests shall be made from the same samples. If failure occurs in either of these tests, the strand represented by that sample shall be rejected. Retesting shall not be permitted.

5.6.3 Ductility Testing

A "one-pin" test shall be conducted on each sample. The details and method of the test shall be as defined in Appendix "A" of the *PTI "Recommendations for Support Cable Design and Testing and Installation."*

5.6.4 Acceptance Criteria

For acceptance, the tensile force in the sample during the one-pin test shall equal at least 80% of the tested ultimate strength of the sample.

The above strand acceptance tests shall be performed for materials to be incorporated into the stay cable test specimens and for production materials to be incorporated into the permanent structure.

5.7 FATIGUE STRENGTH TESTING OF CABLES

5.7.1 Test Specimens

Three (3) complete, fully assembled stay cable specimens with multiple strands shall be fabricated for axial load testing in accordance with Section 4.2 of *PTI "Recommendations, Support Cable Design, Testing and Installation"*. The three testing specimens shall represent the largest, the smallest and the average sizes of the proposed production cables. Each specimen shall be fully representative of all materials, details, number of strands, fabrication and assembly procedures proposed for production anchorages.

- A) Axial and Flexural Acceptance Tests. Two (2) complete, fully assembled specimens shall be fabricated and subjected to the combined axial and flexural test. These test specimens shall include the largest and average-sized test cables.

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- 1) Each support cable system shall be tested with all load-bearing appurtenances. Polyethylene sheathing may be substituted in the free length portions of the specimen in lieu of any stainless steel sheathing proposed for production cables.
- 2) Each specimen shall consist of two anchorages (including all appurtenances).
- 3) The free length of the cables between the anchorage systems shall be the maximum obtainable within the geometric limits of the testing facility. It is desired that the free length of cables between the anchorages be at least 15 ft.
- 4) Combined axial and flexural testing shall only be performed upon successful completion of the fatigue acceptance test. Each load test specimen shall be tested to withstand a minimum static load of 95 percent (256.5 ksi) of the guaranteed ultimate tensile strength of the stay cable.
- 5) The testing laboratory shall submit full details of the stay cable specimens, including anchorages, detailed drawings and computations. Fabrication and testing of the combined axial/flexural load test specimens shall only proceed upon review and written comment by the Department.
- 6) The axial load test shall include an evaluation of the effects of the sheathing to strand interaction. The testing laboratory shall develop and submit to the Department for review and written comment proposed details that incorporate a section of welded sheathing and its contact with the cable strand. The intent of this requirement is to simulate the interaction of the sheathing resting on the cable along its free length. The proposed details shall not permit fatigue stresses to be directly introduced into the sheathing sample.

After the static load test, both axial ultimate load test specimens shall be fully dismantled to allow visual verification of the number and location of wire breaks.

- B) Fatigue Acceptance Tests. All three test specimens shall be tested for fatigue with an upper stress limit of $0.45f_s$ for 2 million cycles at the applicable stress range for the type of stay being tested.
- 1) During testing, not more than two percent of the number of individual wires (rounded to the nearest whole number) may fail. Wire breaks are to be distributed on a random basis throughout the stay cable. No break shall occur within the anchorage zones. The frequency for all fatigue tests shall be a constant value between 2 Hz and 4 Hz.
- C) Corrosion Protection Qualification of Anchorage Assembly (Leak Test). After fatigue testing, the smallest cable specimen shall be subjected to the corrosion protection (Leak) test, rather than the ultimate static strength test.
- 1) Strand Replacement. After fatigue testing, but prior to corrosion protection testing, four (4) strands shall be removed from the test cable specimen and two (2) strands shall be replaced. The procedures for removal and replacement shall mimic those that would be required in the field as part of the future maintenance and monitoring program for the stay cables. Appropriate provisions for corrosion protection shall be made for the replacement strands and the abandoned strand areas prior to the performing the corrosion test.
 - 2) Specimen. Corrosion protection systems at the anchorage shall be tested as complete assemblies using cable components that have been subjected to the fatigue test described in section (B) above.

The full stay cable anchorage specimen, complete with transition zone expansion coupling, a minimum of 3.5 ft. of free length, and all seals, coatings and coverings that will be installed in the actual application shall be subjected to a Leak Test as defined below.

All connections, clamps, seals, adhesives, coatings or other corrosion protection details

that will be subjected to stress in the loaded cable shall be installed on the specimen before it is subjected to the fatigue test. End caps, strand caps, or other seals at the rear of the anchorage that are not subject to live load stress or strain may be added to the cable after the fatigue test, provided that they will be added to the installed cable after stressing in the field. Special sealers, tapes, clamps or other devices that will not be part of the installed cable may not be used for the leak test.

- 3) Preparation. The specimen shall be placed in a chamber so that the anchorage, transition zone, and all connections between the transition zone and free length of cable are subjected to not less than a 10 ft. head of water and dye solution. The solution shall contain 3% by volume of red dye #2. Head may be applied by static measure or pumping.

If the fatigue assemblies are cut in the free length to produce the specimen for this leak test, the free end of the specimen shall be sealed against leakage. This free end need not be subjected to the Leak Test, provided the required head can be established at the level of the transition connection as noted above.

- 4) Testing. The test specimen shall be subject to the required head of red dye solution for a continuous period of 96 hours. At the end of this period, the specimen shall be removed from the test solution and immediately subject to destructive examination.

- 5) Acceptance Criteria.

a) Barriers. Each tested barrier sample shall be destructively examined and recorded by color photographs. The dissected samples shall be destranded (in the case of strand) and compared with the reference standards for surface corrosion. In order to be acceptable, the tested sample shall not show signs of tensile element corrosion that cannot be fully removed by wiping with a soft untreated cotton cloth. Photograph 2 of the *May June 1992 PCI Journal* shall apply. Any pitting shall be cause for rejection.

b) Anchorage Assembly. The tested anchorage assembly shall be dissected to inspect the Main Tension Element (MTE) for signs of dye. Specimens will be acceptable if visual inspection shows that dye has not reached the MTE.

The above testing procedures notwithstanding, all elements of the specified corrosion protection system shall be inspected during and at the end of bridge construction, and shall be totally intact as the bridge construction phase is completed. Nothing in this testing program should be construed as permitting partial damage to the corrosion protection system as the bridge is placed into service.

- D) Documentation. Each test produced under these recommendations shall be documented by two independently written reports. Each report shall include, but not be limited to, the following information:

- 1) Complete description of the test set up, design details of all cable components and test procedures.
- 2) Complete description of the chamber and methods used for the salt fog testing.
- 3) Complete description of all materials used for all components of the tests, including material sources and certifications.
- 4) Detailed test and proposed in-service methods for handling, removing, replacing, coating and/or treating of replacement strands.
- 5) Complete documentation of the results from testing, including color photographs or color copies of photographs that document the condition of all MTE and metallic elements of the prototype specimens tests from companion wires, strands or bars.

- 6) Complete detailed VHS video, with audio, of the step-by-step fabrication and the setup/testing.

6.0 HANDLING AND INSPECTION

6.1 STRAND

The Department shall have unrestricted access to all manufacturing, fabrication, and testing performed at the supplier's facilities, laboratories and shipping and storage facilities. The Design-Builder shall furnish to the Department for approval, complete test reports and certificates that are prepared by the Supplier for the strand from each production lot number, including stress-strain curves and modulus of elasticity of the coated strand. The strand will be furnished in coils and shall have padded contact areas, wherever possible. Each coil will identify the cable into which it is to be installed and the length of strand on the coil. Each coil shall be protected by a supplier-approved method to ensure a uniformly sheathed and coated strand having no adhering foreign matter or damage to the coating, including that from ultraviolet exposure. The ends of the strand shall be sealed at all times.

At all times, the strand shall be properly stored in a weatherproof enclosure. A weatherproof enclosure shall be considered to be a fully enclosed building complete with floor or a fully enclosed container with wooden or metal roof, sides and floor capable of protecting the strand reels and packing from exposure to rain, wind, snow/ice and sunlight. All strands shall similarly be shipped in closed bed trucks or containers to avoid exposing packing to weather. Each coil shall also be marked with the order number, coil number and heat number. The starting end of each coil shall also be marked. The Design-Builder shall minimize unnecessary bends in the field when uncoiling strands. Handling resulting in sharp kinks or short radius bends less than the spool radius shall be cause for rejection. If, as determined by the Department, the kink or short radius bend was inherent in the coil, it shall be immediately replaced by the Design-Builder.

All systems for handling coated strands shall have added contact areas. All bundling bands shall be padded or suitable banding shall be used to prevent damage to the coating. All reels of coated strand shall be lifted with a strong back, spreader bar, multiple supports, or a platform bridge to prevent abrasion. The reels and strand shall not be dropped or dragged.

All strand ends shall be sealed with approved patching materials by the end of the same day that the strand is cut.

Any damage to the coating shall be repaired by the Design-Builder utilizing project approved materials, procedures and personnel. If the stay cables sheathing is to remain non-grouted along the free length of the stays, it is imperative that the strand coating be undamaged over the full length of cable in order to provide long-term protection to the strands.

6.2 SHEATHING

The Design-Builder shall use padded points of contact during storage, handling, fabrication and erection. Care shall be taken at all stages of the construction process to avoid damage to the finish. The Design-Builder shall immediately repair any damage to the surface finish. The visible grain of the finish shall be uniform in appearance and direction.

These handling/finish requirements shall also apply to exposed portions of any guide pipes.

6.3 ANCHORAGE AND MISCELLANEOUS COMPONENTS

The anchorage components and miscellaneous components shall remain in their original shipping containers as supplied by the Supplier until ready for immediate use unless specified otherwise by the Supplier. These components shall be kept in appropriate weatherproof enclosures. During handling, fabrication, erection and all construction operations, the Design-Builder shall use the utmost in care to protect the components from any damage. Any and all damage shall be repaired by the Design-Builder utilizing previously approved procedures for this project and/or shall replace damaged components.

7.0 FABRICATION OF CABLES

- A) Cables shall be fabricated in a manner consistent with the design and testing requirements for the cable-supported bridge system as indicated in these Special Provisions. Appropriate measures shall be taken to ensure that all strands are installed parallel to each other.
- B) The Design-Builder shall develop and implement procedures to assure that stay cable components including stainless steel sheathing will not be damaged during handling. All stay cable components shall be protected from corrosives, heat, abrasion and other harmful effects throughout the fabrication and installation.
- C) Spreader bars and slings or other appropriate devices shall be used to handle all cable and sheathing components. Slings or similar devices shall be positioned on the cable to carry both the anchor and adjacent cable in a tangent position, preventing bending of the cable at the anchor. Slings and spreader devices shall be padded to prevent damage to the cable sheath.
- D) All damage to cables or any components thereof shall be evaluated and remedied by the Design-Builder, to the satisfaction of the Department, prior to installation of the cable. Damaged strand shall be replaced. Damage to non-load carrying components shall be repaired or replaced to the Department's satisfaction prior to the installation of the cables. Any damage occurring after installation shall similarly be evaluated and immediately remedied by the Design-Builder to the satisfaction of the Department.
- E) Storage, handling, fabrication, assembly, erection, stressing and completion of all cable-supported bridge system components shall follow without deviation the procedures, details, methods and equipment used as presented in the Design-Builder's approved shop drawings and detailed, step by step erection manual.
- F) Guide Sleeve and Bearing Plate. The Design-Builder shall install and align the guide sleeve and bearing plate assemblies during construction. The manual of geometric controls to be developed by the Design-Builder for the Department's review and comment shall include a detailed survey and alignment procedures for such alignment. The construction manual shall include detailed equipment and procedures used to secure the guide sleeve and bearing plate assemblies during concrete placement and curing.
- G) Stay Pipe. All pipe ends shall be prepared for joining with full penetration welds. The welds must be flush with the pipe walls inside and outside. The Design-Builder shall submit to the Department for review and comment recommendations for the welding details and procedures to achieve the weld. The Design-Builder shall submit individually for each welder, a detailed qualifications and experience resume. Each welder proposed for the project must prove substantial experience in welding pipe material using the method proposed by the Design-Builder. In addition, at least 60 days prior to a welder beginning work on production pipe the Design-Builder shall, concurrent with the experience / qualifications resume, supply to the Department a pipe weld sample produced by the proposed welder. The sample shall utilize the same materials and methods to be used for production welds. The sample shall include at least one (1) full circumferential weld and have a length of sample not less than 2' and not more than 4'. Review of the test weld by the Department shall in no way be interpreted as any acceptance of responsibility by the Department for the quality of the welder's future work on the project.
- H) The Design-Builder shall follow the approved welding details and procedures. All stainless steel welding shall conform to *AWS B2.1 98* and *AWS D1.6 99*. One hundred percent of all steel welds shall be tested by ultrasonic methods and/or radiographic (non destructive) testing as specified by *ANSI/AASHTO/AWS D1.5 Bridge Welding Code*. The minimum length section of pipe provided and installed shall not be less than 5' in length.
- I) The Design-Builder shall demonstrate that the welding procedures consistently result in a flush inside surface by video inspection of the cable pipe interior. The Department may at any time require, at no additional cost to the project, video inspection of any portion of any cable pipe.



-  J) No welding of the pipe shall take place with the coated strands inside. Finishing of all welds to the required finish shall principally occur prior to installation of the strands into the pipe. Any remaining finish repair to the weld or other areas shall be conducted in a manner that will not heat the pipe at any point to more than 150° Fahrenheit.
-  K) Strand Installation. Installation of strands shall follow the fully engineered procedures contained in the Design-Builder's shop drawings and detailed step-by-step erection manual. Deviations from procedures, methods, details or equipment shall not be permitted. The resulting installed strands shall be parallel and damage free.
- L) Anchorage and Miscellaneous Components. The anchorage components and miscellaneous components shall be installed following the fully engineered procedures contained in the Design-Builder's shop drawings and detailed step-by-step erection manual. Deviations from procedures, methods, details or equipment shall not be permitted. The installed anchorage and miscellaneous components shall be damage free. Flame cutting of strands is not permitted.

8.0 CABLE STRESSING

- A) Accurate calibration of the cable jacks and gauges is critical to the geometry control of the cable-supported structure and the resulting state of stress in the structure. Jacks and gauges for cable installation shall be match calibrated using a load cell or calibrated static load machine by an independent laboratory within one month prior to the beginning of the cable installation, and every 6 months thereafter, for the duration of the cable installation. Calibration shall be accomplished with the jack actively applying load to the machine, not the machine applying load to the jack. Prior to use after each calibration, each field gauge shall be calibrated against the master gauge for reference purposes. Any internal work performed on the jack shall require recalibration.
- B) The detailed cable installation procedure, contained as part of the erection manual, shall prescribe force, cable elongation and deck elevations for each jacking operation, and shall establish the priority of force or geometry for control of the jacking operation. This procedure shall stipulate the permissible variance between force and elongation and deck elevation for each cable to be installed.
-  C) The cable stressing procedures shall include detailed provisions for monitoring the installation of each cable.
- D) Permanent records shall be established by the Design-Builder for each cable installation. Such records shall include survey records; date, time and ambient temperatures; cable forces; cable elongation measurements; ring nut setting; deck loading conditions; and all other special notations necessary and sufficient to establish the conditions under which the cable was installed. This record shall include the as built profile grade elevation of the deck along each web and atop each cable anchor block immediately prior to and immediately after each stressing operation. Copies of this data shall be provided by the Design-Builder to the Department within 24 hours of completing each cable stressing operation.

9.0 COMPLETION OF CABLE-SUPPORTED BRIDGE SYSTEM

After successful closure of the main span superstructure, the Design-Builder shall complete all remaining cable-supported bridge system installation requirements. These include, but are not limited to final restressing (if necessary), final finish of the stay cable pipe, installation of protective end caps, injection of inert gas (optional), installation of permanent cable dampers, boots and miscellaneous hardware.



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605545 - SOIL BORINGS, LAND

Description:

Soil Borings are those drillings advanced through unconsolidated or partly consolidated sediments by use of Mud Rotary drilling and sampling with a split barrel sampling spoon at locations designated on the Plans or as directed by the Department's Project Manager.

Standard Penetration Tests (SPT) and Split Barrel Sampling of the soils shall be taken at the ground surface and at 5' intervals thereafter, or as directed by the Department's Project Manager in all borings.

Mud Rotary Method

The Design-Builder shall use power-driven, continuous wash rods and roller cone or drag bits in conjunction with the circulation of weighted drilling fluid to advance and maintain the hole. If necessary, the Design-Builder may use casing to maintain the stability of the hole, subject to the approval of the Department's Project Manager. The clear inside diameter of the boring and/or casing must be large enough to allow for the insertion of a 3.0" OD Shelby Tube soil sampler and attached rods when elevations are reached for securing soil samples.

When advancing borings, the relative resistance to penetration, general feel and performance of the drilling operation, and the cuttings obtained from the drilling fluid shall be observed and recorded for detection of changes in the materials encountered.

All boreholes shall be preserved from collapse and bottom instability during advancement and sampling operations. When drilling below the natural ground water level, drilling fluid shall be maintained inside the boring at a level above the ground water level at all times. If it is required to prevent bottom instability, drilling fluid shall be added to maintain a positive static water head inside the augers during drilling and withdrawal of the drilling rods. Cleaning out of the borehole shall be required if the accumulation of material at its base between sampling intervals is of a degree that is detrimental to the purpose of the sampling operation. Cleaning out the borehole shall be performed with wash rods and a roller or side discharge chopping bit.

The Design-Builder shall make suitable arrangements for properly procuring and disposing water and drilling fluid.

If the Design-Builder abandons a boring before adequate information is obtained and starts another boring adjacent to it in preference to carrying the boring through an obstacle, or because of a broken or misaligned casing, no payment will be made for the work done on the abandoned boring.

Sampling Device

The sampling device for ordinary, dry samples from Soil Borings shall be a standard split barrel sampler meeting the requirements of the "Standard Method for Penetration Test and Split Barrel Sampler of Soil", ASTM D1586. The sampler shall be a split barrel tube with an outside diameter of 2", an inside diameter of 1-3/8", a minimum length of 18" between the driving shoe and the smaller head, and a minimum total length of 27". The drive shoe shall be hardened steel and shall be replaced or repaired when it becomes dented or distorted. The sampler head shall have a 1/2" minimum diameter vent ports and shall contain a reliable ball check valve.

Sampling Procedure

The sampling procedure for ordinary samples from Soil Borings shall be in accordance with the requirements of the "Standard Method for Penetration Test and Split Barrel Sampler of Soil", ASTM D1586. The borehole shall be drilled to the sampling depth and the loose material within cleaned to its bottom before driving the sampler. Clean out shall be accomplished by roller cone bit or drag bit in conjunction with the circulation of weighted drilling fluid, or other method approved by the Department's Project Manager.

The sampler shall be driven into the soil below the bottom of the borehole for a distance of eighteen (18) inches or until further penetration is impossible with a one hundred and forty (140) pound hammer falling freely through a vertical distance of thirty (30) inches. The number of blows of the hammer shall be recorded for each six (6) inches of penetration and if six (6) inches is not penetrated in one hundred (100) blows, the sampler will be considered to have met refusal and the blows shall be recorded as 100/number of inches penetrated. All sampling devices, including driving mechanisms used by the Design-Builder shall be approved by the Department's Project Manager.

Samples of the soil retained in the split barrel sampler shall be taken from that portion of the soil column between six (6) and eighteen (18) inches below the bottom of the casing. The sample so obtained shall be representative of the material from which it is taken and shall be in an unwashed condition. Samples recovered from wash water, commonly termed "wash samples" will be unacceptable. If less than nine (9) inches of soil is retained in the sampler, a second sample shall be taken immediately below the deficient sample, after first advancing the boring. If more than one soil type is present in the sampler, a sample shall be taken of each type, and the length of each type of soil in the sampler shall be noted on the boring log.

Preservation and Identification of Samples

The disturbed samples obtained with the split barrel sampler shall be removed with as little disturbance as possible, and immediately placed in a suitable, tightly capped sample jar. Samples which retain form upon removal from the sampling spoon, shall not be jammed or forced into the jar. These jars shall be clear glass, have a minimum 8 oz. capacity, and be about two (2) inches in diameter and five (5) inches or more in height with a mouth wide enough to accommodate samples from the split barrel sampler and shall be equipped with a screw top and suitable gasket seal. Each sample jar shall be clearly and permanently labeled to show the project and section, boring number, station location, elevation or depth at which the sample was taken, the kind of material and the number of blows of the sampler.

If two or more materials are encountered in a sampler, separate jars shall be used for each material. The letters "A", "B", etc. shall be added to the sample number on each jar to designate the different materials.

The Design-Builder shall provide the sample containers, keeping a sufficient supply on hand to prevent any delay in the work.

The Design-Builder shall pack all glass jar samples in containers acceptable to the Department's Project Manager, and of sufficient durability to withstand handling without breakage of the sample jars. On the top and one end of each container, the Design-Builder shall neatly and legibly paint or stencil, using waterproof paint, the following identifying data: title of project and designations of section thereof; location of site by name and/or survey station; boring numbers; and name of Design-Builder; all as required or directed by the Department's Project Manager.

During the period of active work in the field, the Design-Builder shall provide and be responsible for storing all soil samples in a warm, dry, locked, temporary storage facility convenient to the work areas. At period determined by the Department's Project Manager or in any case at the completion of all field work, the Design-Builder shall transport all boxed samples to storage location in Dover, Delaware specified by the Department's Project Manager.

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Ground Water

Depth to ground water shall be determined when initially encountered and upon completion. The Design-Builder shall also take a water level reading 24 hours after the augers are removed. In the event the hole collapses before the ground water is observed the depth to the collapsed portion shall be recorded. Ground water determination as described in this paragraph will not be paid for separately, but will be considered incidental to the work.

Records and Logs

The Design-Builder shall keep a complete and accurate record of all details of the Soil Boring operations in a field book and on suitable boring log forms provided by the Design-Builder. Upon completion of each boring two copies of the field log, on 8-1/2" x 11" paper shall be given to the Department's Project Manager. The description of the soil, rock and other material encountered in the boring shall be made by the driller with the assistance of the Department's Project Manager. Each boring log shall record the information pertinent to the boring work being accomplished as outlined in the following sections or as deemed necessary by the Department's Project Manager. The following general information shall be recorded on each and every boring log:

- a. Title of project and section designation
- b. Location of site by name, and/or survey station, and offset, if any, right or left of survey baseline
- c. Hole number as specified on the Plans or as furnished by the Department's Project Manager
- d. Names of the Department's Project Manager, Design-Builder, Inspector, and drilling crew
- e. Date of starting and completing each boring
- f. Ground elevation of the top of the hole as provided by the Department's Project Manager
- g. Depth to the top of ground water, if present.
- h. Type of drill rig used
- i. Size, type and length of casing where used
- k. Method used to clean out casing between sampling intervals
- l. The number of blows of the hammer for each six (6) inches of penetration of the sampler out of a total minimum penetration of eighteen (18) inches for each sample. Where six (6) inches is not penetrated in one hundred (100) blows of the hammer, the distance penetrated in one hundred (100) blows shall be recorded
- m. Depth to beginning and end of sampling drive, and the length of sample recovered from the sampler
- n. Depth to the top of each change or stratum of material
- o. Description of the material encountered shall be in accordance with standard practice and shall include:
 - 1. Type - topsoil, sand, silt, clay, gravel, silty clay, sandy silt, etc.
 - 2. Color - light brown, dark reddish brown, etc.
 - 3. Moisture - dry, moist, wet, very wet, etc.
 - 4. Consistency - soft, loose, medium, firm, stiff, etc. as determined by "N" values in Table 1 below.

**TABLE 1
DEGREE OF DENSITY OR CONSISTENCY**

<u>Non-Cohesive Soils</u> <u>Descriptive Term</u>	(Sand) Standard Penetration "N" - <u>Blows/Ft.</u>	Cohesive Soils <u>Descriptive Term</u>	(Clay) Standard Penetration "N"- <u>Blows/Ft.</u>
Very loose	0-4	Soft	0-4

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Loose	5-10	Firm	5-8
Medium	11-30	Stiff	9-15
Dense	31-50	Very Stiff	16-30
Very Dense	51+	Hard	31+

- p. Unusual occurrences such as running sand, voids, loss of water, etc.
- q. The distance through which a roller bit is used to advance the hole in soft or weathered rock which is too soft to core drill and too hard to advance augers.

False Starts

The Design-Builder is to verify the exact location of all known utilities prior to drilling. If the Design-Builder is unable to drill any boring due to encountering underground pipes, cables, conduits, or other underground utilities or structures, the existence and location of which were not previously know, or because obstacles or obstructions are encountered which the Department’s Project Manager considers are of an unusual nature and that failure to penetrate them is not the fault of the Design-Builder's methods or equipment, a false start will be allowed. The length of the false start will be measured as specified and paid for at the applicable Contract unit price, providing, however, that the Design-Builder shall submit to the Department’s Project Manager a complete record of all such false starts. If the Design-Builder abandons a hole prior to approval of the Department’s Project Manager, no payment will be made for the hole so abandoned. For the new hole, bored to replace the abandoned hole, the Design-Builder shall conduct his operations as if a completely new hole was bored obtaining soil samples, standard penetrations tests, etc., in the depths reached by the abandoned hole.

Method of Measurement:

~~The quantities for the item Soil Borings for which payment will be made will be the total depth of each boring actually made and accepted by the Department’s Project Manager. Measurement will be from the surface of existing ground to the bottom of the hole. The bottom of the hole shall include the depth of the last sample when obtained below the bottom of the drilled hole.~~

~~Payment for Soil Borings will be made at the contract unit price per linear foot, which price and payment shall include the cost of all labor, materials, and plant necessary for completing the borings as required; the cost of taking, packing, storing, and delivering samples; the cost of moving plant and equipment between sites and within sites; the cost of taking and recording ground water observations; the cost of filling holes and surface restoration; and all else in connection with or incidental to the drilling.~~

Basis of Payment:

~~_____ Payment will be made under Item 605545 L.F. Soil Boring, Land~~

605589 - BRIDGE EXPANSION JOINT DEVICES

1.0 DESCRIPTION

The Design-Builder shall be responsible for designing, furnishing, fabricating, storing, installing, erecting, adjusting, and completing the assembly of all components of bridge expansion joint devices, including repair and/or replacement of damaged components (if necessary) for the bridge in accordance with the Contract requirements and the criteria established in this Special Provision during all phases of design and construction of the Project. All bridge expansion joint devices shall adequately provide for thermal expansion and contraction, rotation, camber changes, creep and shrinkage of structural members, and movements during all phases of construction and during the service life of the structure. Designing and developing detailed replacement procedures, including equipment, shoring, blocking, and other such procedures and operations for bridge expansion joint devices are the responsibility of the Design-Builder. The Design-Builder shall also be responsible for the satisfactory performance of the bridge expansion joint devices installed on the bridge for the Contract required warranty period.

Complete bridge expansion joint devices include, but are not limited to, sealed finger joints with appropriate elastomeric seals; prefabricated neoprene strip seals; drainage troughs and piping with outfall protection; structural steel and/or other metal and non-metallic components; anchors and/or fixing devices; armor and cover plates; treatment of sliding plates and other similar details to the profiles of curbs and barriers; complete anchorage materials and components including grout, hardware, bolts, connectors, nuts, washers and shims; corrosion protection provisions; temporary corrosion protection provisions during storage and construction; erection devices and equipment; and all permanent and incidental materials and labor to install each bridge expansion joint device in accordance with the Contract requirements.

Any bridge expansion joint device(s) or type of bridge expansion joint device(s), proposed by the Design-Builder for use on the Project, must adhere to the requirements of this Special Provision and must be submitted for approval to the Department prior to completion of the Preliminary Design Review.

2.0 STANDARDS

Bridge expansion joint devices are to be provided in accordance with this Special Provision and the “AASHTO LRFD Bridge Design Specifications,” Third Edition, 2004 (U.S. Customary Units), with Interims through 2006, unless otherwise noted.

These Special Provisions are intended to complement the “AASHTO LRFD Bridge Design Specifications” and in cases of disagreements, these Special Provisions for bridge expansion joint devices shall govern over the “AASHTO LRFD Bridge Design Specifications.” It is the Design-Builder’s responsibility to obtain clarification of any and all unresolved ambiguity prior to proceeding with any design or construction.

3.0 ACCEPTABLE BRIDGE EXPANSION JOINT DEVICES

Acceptable bridge expansion joint devices are listed below. The Department shall consider other bridge expansion joint device(s) or other types of bridge expansion joint devices as unacceptable for use for this Project.

- A) Sealed Finger Joints with Elastomeric Seals for bridge movements greater than 3 inches; and
- B) Strip Seal Expansion Joints with Elastomeric Seals for bridge movements of 3 inches or less.

4.0 MATERIALS

All materials shall be new and unused, with no reclaimed material incorporated in the finished bridge expansion joint devices.

4.1 STEEL

All steel products to be used or supplied in connection with any bridge expansion joint device shall be steel products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or other similar process or processed by a combination of two or more such operations, from steel made in the United States by the open hearth, basis oxygen, electric furnace, Bessemer or other steel making process. “United States” means the United States of America and includes all territories, continental or insular, subject to the jurisdiction of the United States.

- A) All steel used shall conform to the minimum requirements of ASTM A 709, Grade 36, or Grade 50.
- B) Anchor bolts, nuts, and washers shall conform to ASTM A 307.
- C) Materials utilized to produce shapes suitable to mechanically lock elastomeric strip seals shall conform to the properties of ASTM A 588.
- D) All steel shall be hot-dipped galvanized in accordance with ASTM A 123 after fabrication.
- E) The requirements of this section also apply to the sliding plate assemblies on the barriers.

4.2 CONCRETE

Concrete for backfill of expansion joint blockouts and details shall be of the same class and strength as that in the adjacent bridge deck, unless otherwise required by the Design-Builder’s design, with the exception that the maximum size of aggregate shall be 3/8 inch.

4.3 LUBRICANT ADHESIVE FOR STRIP SEALS

Elastomeric strip seals shall be installed utilizing a one-part moisture curing polyurethane and aromatic hydrocarbon solvent mixture that complies with ASTM D 4070.

REINFORCED ELASTOMERIC SHEETS

Elastomeric sheets for troughs or membranes shall be manufactured from 100% virgin chloroprene or EPDM (Ethylene propylene dienemonomer) with good to excellent resistance to weather, oxygen, ozone, radiation and water of the thicknesses, shapes and hardness required by the Design-Builder’s bridge expansion joint device design. Neoprene, the sole polymer shall be 100% virgin chloroprene, which shall be not less than 60% by volume of the total compound. Elastomeric sheets shall be internally reinforced with synthetic or natural fabric. The elastomer shall meet the following requirements of ASTM C864-79 and as amended below:

Property	Physical Requirements	Procedure as per ASTM Designation
Hardness, Durometer A	50 points minimum	D2240, Modified
Tensile Strength, psi, min.	1,500	D412

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Property	Physical Requirements	Procedure as per ASTM Designation
Maximum Elongation at Ultimate, Percent	Greater than 30%	D412
100 ppm ozone in air by volume, 20 percent strain, ± 100° F, 70 hours mounting (Procedure B)	No cracks	D1149 – samples to be solvent wiped before test to remove any traces of impurities

4.4 ELASTOMERIC STRIP SEALS

The elastomeric strip seal material shall be 100% virgin Polychloroprene (Neoprene) with good to excellent resistance to weather, oxygen, ozone, radiation and water of the thicknesses, shapes and hardness required by the Design-Builder’s bridge expansion joint device design. The strip seal shall be an extruded neoprene material meeting the requirements of ASTM D 2628 modified to omit the recovery test. The elastomeric strip seal material shall meet the following requirements determined by applicable ASTM tests and as amended below:

Property	Physical Requirements	Procedure as per ASTM Designation
Hardness, Durometer A, Points	60±7	D2240, Modified
Tensile Strength, psi, min.	2,000	D412 (die C)
Ultimate Elongation, Percent, min.	250	D412 (die C)
Compressive Set, Accelerated Test to Determine Long-term Characteristics Oven-aged – 70 hours at degrees 212° F, Percent, max.	40	D573
Abrasion Resistance Index	200 or greater permissible	D1630
Oil Swell, ASTM Oil #3, 70 hours at degrees 212° F, Weight Change, Percent, max.	45	D471
Low Temperature Stiffening, 7 days at degrees 14° F, Durometer A, Points, max.	+15	D2240
300 ppm ozone in air by volume, 20 percent strain, ± 140° F, 70 hours mounting (Procedure B)	No cracks	D1149 – samples to be solvent wiped before test to remove any traces of impurities

5.0 REQUIREMENTS

5.1 GENERAL

- A) Before the fabrication of any bridge expansion joint device, the Design-Builder shall submit shop drawings to the Department for review and approval. The shop drawings shall be stamped by a professional engineer employed by the Design-Builder's bridge expansion joint device fabricator with a minimum of 5 years of documented history of bridge expansion joint device design experience. The shop drawings, detailed by the Design-Builder's bridge expansion joint device fabricator, shall include, but shall not be limited to, the following for each bridge expansion joint device used for the Project:
- 1) Detailed drawings showing plan, elevation, and section views;
 - 2) Complete details and sections showing all ASTM, AASHTO, or any other material designations;
 - 3) The size, quantities, and locations of bridge expansion joint devices including the movement capacities of the devices;
 - 4) The Design-Builder's delivery and installation procedures and methods;
 - 5) All appropriate notations and instructions for field installation;
 - 6) Complete details for inspection and construction purposes
 - 7) Bridge expansion joint device blockouts and all bridge expansion joint device connection details;
 - 8) Coating requirements;
 - 9) Complete and detailed replacement procedures, including equipment, shoring, blocking, and other such procedures and operations; and
 - 10) Complete design calculations, material specifications and certifications, and fabrication procedures verifying the conformance with the provisions of this Special Provision and the Contract requirements.
- B) The Design-Builder shall submit an installation procedure for the each specific expansion joint proposed. This plan will be in accordance with the recommendation from the Design-builder's supplier. This plan will include at a minimum:
- 1) Step by step installation procedures
 - 2) Method for securing the joint
 - 3) Method for adjusting the joint for temperature, creep & shrinkage considerations
 - 4) Method for insuring rideability
 - 5) Method for placing surrounding concrete, reinforcing and post tensioning
 - 6) Method for attaching the barrier rail cover plates
- C) The Design-Builder shall be responsible for coordinating the location of connections to both the superstructure and substructure and to verify that there are no conflicts with post-tensioning or reinforcement with any bridge expansion joint device.
- D) The Design-Builder shall be responsible for designing, detailing, furnishing and installing downspouts, scuppers, cleanouts, trench drains, splash blocks, and any other such materials for the proper conveyance of the colleted discharge from the bridge expansion

joint devices. Redundancy and protection of all bridge surfaces shall be robustly designed by the Design-Builder in the event of failure of the seals of the bridge expansion joint devices. The drainage system shall be concealed with-in the bridge and shall tie-in with the bridge drainage system.

5.2 SEALED FINGER JOINTS WITH ELASTOMERIC SEALS

The sealed finger joints with elastomeric seals system shall accommodate the longitudinal and other movements required by the Design-Builder's design while maintaining a smooth riding surface with minimal space between fingers and shall prevent passage of water through the joint system. The joints shall also be designed to sustain all loads and impacts without damage or fatigue of the joint or the structure to which it is secured and supported. All design loads and movements shall be included in the Design-Builder's design, shop and working drawings. Joints shall be provided such that they can be easily replaced in short sections.

- A) For safe operation of motorbikes, when the maximum longitudinal opening in the direction of traffic exceeds 8 inches, the transverse opening shall not exceed 2 inches. For longitudinal openings less than 8 inches, the transverse opening shall not exceed 3 inches. Where narrow bicycle tires are anticipated (outside shoulders and sidewalk) special floor plates or other appropriate details shall provide a continuous path for the tires with minimal transverse steps or irregularities. Floor plates in pedestrian pathway shall also meet the requirements of "The Americans with Disabilities Act of 1990."
- B) The minimum joint opening, (maximum design temperature with minimum creep and shrinkage of the superstructure) in the longitudinal direction shall be 0.5 inch.
- C) At the maximum joint opening, (minimum design temperature with maximum creep and shrinkage of the superstructure) the minimum tooth overlap shall be no less than 2 inches.
- D) Fingers (teeth) shall be aligned parallel to the direction of movement of the adjacent bridge bearing devices (generally the longitudinal direction of the bridge) as shown on the Design-Builder's Plans and Department approved Shop Drawings.
- E) The finished elevation of the finger joint and any securing devices shall be a minimum of 1/8 inch and a maximum of 3/16 inch below the adjacent top surface of the deck slab, approach slab or finished roadway riding surface as appropriate. Approved armoring, concrete or synthetic material details shall be provided locally to buttress the exposed top edge of the adjacent riding surfaces at the rear of the finger plate installation on both sides of the joint, as necessary.
- F) The fingers of the joint shall be shaped and installed as necessary to ensure that the fingers remain below the level of the riding surface at all times under all anticipated movements and rotations of the superstructure and substructure.
- G) Special armoring shall be provided to contain the edge of the structural support surface at the edges of the opening underneath both sides of the finger joint and around all sides of the bridge barriers.
- H) Preformed troughs, seals and membranes shall be fabricated as a single piece without splices. Joints in troughs, seals or membranes shall be properly made according to manufacturer's requirements and shall not leak. All material shall be cut cleanly, with a true edge using suitable, sharp tools and methods to provide a straight and accurate installation.
- I) Elastomeric drainage troughs, seals or membranes shall be provided to collect all rainwater run off, de-icing materials and detritus materials from the roadway that flows

through the openings of the fingers. The troughs, seals or membranes shall be so attached, weather lapped and sealed to the assembly of the finger joint so that no liquid or debris can leak or escape to run onto the adjacent parts of the structure. Seals shall be turned up and properly detailed at curbs and barriers to prevent leakage.

- J) Drainage troughs shall be installed at a slope that is self cleaning so that debris does not accumulate and shall positively discharge (minimum slope shall be 1 inch per foot), without splash back flow or overflow, into drainage pipes, chutes, or other accommodation for appropriate discharge.

5.3 STRIP SEAL EXPANSION JOINTS WITH ELASTOMERIC SEALS

- A) Steel shapes suitable to mechanically lock elastomeric seals shall have a minimum thickness of 1/4inch as measured from the internal locking mechanism cavity to the top of the steel shape.
- B) Steel shapes shall be monolithic with a machined retainer cavity. To assure watertightness, the steel shape sealing cavity shall maintain a tolerance of $\pm 10/1000$ (.010) inches. Multiple components welded steel shape and rolled steel, which is bent or crimped to achieve the final shape, or seal retainer cavity will not be allowed.
- C) Provide 5/8 inch diameter by 6 inch concrete anchor studs factory welded to steel shapes and as detailed on the Design-Builder's fabricator's Shop Drawings for cast-in-place conditions. Material shall meet the requirements of ASTM A 108 with a maximum spalling of 12 inch on center. Any alternate anchorage system shall be submitted by the Design-Builder to the Department for approval.
- D) Installation of the prefabricated strip seal, and application of adhesives, shall be in accordance with the Design-Builder's supplier's written recommendations and instructions. The Design-Builder's supplier shall provide special tools for insertion of elastomeric strip seals.
- E) The strip seal shall be furnished in one piece for the full width of the joint.

6.0 TESTING

An independent testing laboratory (or laboratories) selected by the Design-Builder and approved by the Department shall test all materials and bridge expansion joint device assemblies in accordance of with the testing requirements of this Special Provision for each specific type of bridge expansion joint device proposed by the Design-Builder for the Project. The Design-Builder shall be responsible for all coordination between the Design-Builder's laboratory (or laboratories), Design-Builder's supplier(s), and Department representatives. The Design-Builder shall notify the Department 14 days prior to any testing to be performed on bridge expansion joint devices and the Department shall be allowed to witness all testing.

The Design-Builder shall furnish all material and written test procedures, as prepared by the Design-Builder's supplier(s) to the Department for review and approval. Each component of the assembly shall have an AASHTO or ASTM material and test specification. The Design-Builder's supplier(s) and the design-Builder's laboratory (or laboratories) shall prepare separate reports. Each of these reports shall independently describe all the testing data and testing results. All reports shall be submitted by the Design-Builder to the Department within 14 days of completing each test as independent records of the testing. The Design-Builder shall be responsible for sub-contracting and coordinating with the Design-Builder's laboratory (or laboratories) and Design-Builder's supplier(s) for all testing laboratory services.

The Design-Builder's supplier(s) shall provide written and detailed recommendations to the Design-Builder regarding storage, handling, transporting, assembly, aligning, and verification of performance of

the bridge expansion joint devices. The Design-Builder's supplier(s) shall simultaneously provide copies of all such recommendations directly to the Department for the project files.

7.0 CERTIFICATION

- A) A copy of the test certificates documenting the tests performed and mill tests for all materials used in the bridge expansion joint device fabrication shall be submitted by the Design-Builder to the DelDOT Office of Materials and Research for review and approval.
- B) The certification package shall include, but not limited to, the following:
 - 1) Material test reports for all steels used except AISI C1018 and AISI C1020 for which a mill conformance certificate is acceptable;
 - 2) Certificate of Compliance for all non ferrous metals;
 - 3) Material test reports for any elastomeric components;
 - 4) Certificate of Compliance for any adhesives used;
 - 5) A Certificate of Compliance for the bridge expansion joint devices executed by an officer of the Design-Builder's bridge expansion joint device fabricator's company;
 - 6) Certificate of Compliance for any dowels or bolts supplied; and
 - 7) Test reports for the performance tests.
- C) In addition, the Design-Builder must contact the DelDOT Office of Materials and Research to confirm materials are approved seven days before shipping the bridge expansion joint devices to the site.

8.0 FABRICATION, HANDLING AND STORAGE

- A) The Design-Builder shall provide the Department with written notification thirty days prior to the start of bridge expansion joint device fabrication. This notification shall include all of the information shown on the shop drawings, which are required by this Special Provision.
- B) Every bridge expansion joint device shall have the Design-Builder's fabricator's name, Project Identification Number, Lot Number, and Individual Expansion Joint Device Number stamped with steel impression style stamps on a side that will be visible during inspection after erection.
- C) After fabrication assembly, bridge expansion joint device components and assemblies shall be securely fixed together as units so that they may be shipped to the job site and stored without relative movement of the bridge expansion joint device parts and to prevent disassembly. Steel strapping or other means may be used to prevent relative movement of the bridge expansion joint device parts and disassembly until the time of installation and/or inspection. Packaging shall be adequate to prevent damage from impact and bridge expansion joint devices shall be wrapped in moisture resistant and dust resistant material to prevent contamination during shipping and storage at the jobsite. It is the Design-Builder's responsibility to ensure that all bridge expansion joint devices are properly stored and protected from damage.
- D) Bridge expansion joint devices delivered to the Project site shall be stored under cover on

a platform above the ground surface until installation. Bridge expansion joint devices shall be protected at all times from damage. When placed, bridge expansion joint devices shall be dry, clean, and free from dirt, oil, grease, or other foreign substances.

9.0 CONSTRUCTION

- A) The Design-Builder shall also have a representative from the bridge expansion joint device supplier on site during the installation of at least the first joint of each type and provide written certification that the bridge expansion joint device was installed properly. This written certification shall be submitted to Department.
- B) Field welding of steel or metal alloy components shall comply with approved standards. All deck surface preparation including planing or milling, grinding and blasting, along with satisfaction of the rideability Special Provisions shall occur before installation of the joints. Also, installation shall not proceed without the approval of the Department of all material and installation methods.
- C) The Design-Builder shall exercise care during installation to avoid damage to the components. Any damage to troughs, seals or membranes shall be removed, replaced and made good, in a manner acceptable to the Department and at the Design-Builder's expense.
- D) Anchor bolts, armor and fixing devices shall be accurately located and securely held to correct line and level during placement of block out concrete. All concrete shall be placed, properly consolidated with no voids, finished and cured to ensure the correct strength. The Design-Builder shall detail his method for aligning, securing, and the timely release of the joint to account for thermal movements of the structure, to protect the closure concrete, and to provide a smooth riding surface within the required tolerances.
- E) All materials used to form the secondary pour of the expansion device block out and to temporarily support the expansion device shall be removed prior to final acceptance.

605702 - BRIDGE BEARING DEVICES

1.0 DESCRIPTION

The Design-Builder shall be responsible for designing, furnishing, fabricating, testing, storing, installing, erecting, adjusting, and completing the assembly of all components of bridge bearing devices, including repair and/or replacement of damaged components (if necessary) for the bridge in accordance with the Contract requirements and the criteria established in this Special Provision during all phases of design and construction of the Project. All bridge bearing devices shall adequately provide for applied loads, thermal expansion and contraction, rotation, camber changes, creep and shrinkage of structural members, and movements during all phases of construction and during the service life of the structure. Designing and detailing replacement procedures, including jacks, equipment, shoring, blocking, and other such procedures and operations for bridge bearing devices are the responsibility of the Design-Builder. The Design-Builder shall also be responsible for the satisfactory performance of bridge bearing devices installed for the bridge for the Contract required warranty period.

Complete bridge bearing devices include, but are not limited to, bearing assemblies; bearing, masonry, sole and/or distribution plates; bearing, disc, and/or distribution pads; guide bars; permanent and temporary restraint mechanisms (including up-lift restraint mechanisms if required by the Design-Builder's design or erection method); shear pins; elastomer; confining pots, sealing rings, and pistons; machined, faced, and polished sliding surfaces; polytetrafluoroethylene (PTFE) sheets and/or coatings; complete connection hardware; complete anchorage materials and components including grout, hardware, bolts, connectors, nuts, washers and shims; corrosion protection provisions; temporary corrosion protection provisions during storage and construction; erection devices and equipment; and all permanent and incidental materials and labor to install each bridge bearing device in accordance with the Contract requirements.

Any bridge bearing device(s) or type of bridge bearing device(s), proposed by the Design-Builder for use on the Project, shall adhere to the requirements of this Special Provision and shall be submitted to the Department for review and comments prior to completion of the Preliminary Design Review.

2.0 STANDARDS

Bridge bearing devices are to be provided and tested in accordance with this Special Provision and the "AASHTO LRFD Bridge Design Specifications," Third Edition, 2004 (U.S. Customary Units), with Interims through 2006, unless otherwise noted.

These Special Provisions are intended to complement the "AASHTO LRFD Bridge Design Specifications" and in cases of disagreements, these Special Provisions for bridge bearing devices shall govern over the "AASHTO LRFD Bridge Design Specifications." It is the Design-Builder's responsibility to obtain clarification of any and all unresolved ambiguity prior to proceeding with any design or construction.

3.0 ACCEPTABLE BRIDGE BEARING DEVICES

Acceptable bridge bearing devices are listed in Sections 3.1 through 3.3. The Department shall consider other bridge bearing device(s) or other types of bridge bearing devices as unacceptable for use for this Project.

3.1 ELASTOMERIC BEARING PADS

Elastomeric bearing pads shall be designed, furnished, and constructed in accordance with the Delaware Department of Transportation Standard Specifications.

3.2 CONFINED ELASTOMERIC BRIDGE BEARING DEVICES (OR “POT” BEARING DEVICES)

Confined elastomeric bearing devices shall be supplied as fixed, guided expansion bearings, and/or non-guided expansion bearings as required by the Design-Builder’s design.

3.2.1 Fixed Bearings

- A) Fixed bearings shall consist of an elastomeric rotational element, confined and sealed by a piston and steel base pot.
- B) Fixed bearings shall allow rotation but horizontal movement shall be restricted in all directions. To restrict movement the bearing shall transmit horizontal forces through contact between the piston and the inside of the pot wall.
- C) Fixed bearings shall be designed to resist a horizontal load of not less than 10 percent of the ultimate vertical capacity of the device. Larger values shall be used if required by Design Criteria or the Design-Builder’s proposed design.

3.2.2 Guided (uni-directional) Expansion Bearings

- A) Guided expansion bearings shall consist of an elastomeric rotational element, confined and sealed by a piston and steel base pot.
- B) Guided expansion bearings shall allow rotation and longitudinal movement, but transverse movement shall be restricted. To restrict transverse movement, either a guide bar or keyway system shall be used.
- C) To allow longitudinal movement, the upper surface of the steel piston shall be faced with a PTFE sheet and shall support a sliding steel top bearing plate.
- D) The mating surface of the sliding steel bearing plate shall be faced with polished stainless steel.
- E) Guided expansion bearings shall be designed to resist a horizontal load of not less than 10 percent of the ultimate vertical capacity of the device. Larger values shall be used if required by the Design-Builder’s proposed design.
- F) The guide bar or keyway systems and their mating steel surfaces shall be faced with strips of PTFE (may be filled or unfilled as per “AASHTO LRFD Bridge Design Specifications”) and stainless steel.

3.2.3 Non-guided (multi-directional) Expansion Bearings

- A) Non-guided expansion bearings shall consist of an elastomeric rotational element, confined and sealed by a steel piston and steel base pot.
- B) Non-guided expansion bearings shall allow rotation, longitudinal and transverse movement in the bearing plane.
- C) To allow longitudinal and transverse movement, the upper surface of the steel piston shall be faced with PTFE sheet and shall support a sliding steel top bearing plate.

- D) The mating surface of the sliding steel bearing plate shall be faced with polished stainless steel.

3.3 MULTI-ROTATIONAL, HIGH-LOAD DISC BEARING DEVICES

Multi-rotational, high-load disc bearing devices shall be supplied as fixed, guided, and/or non-guided bearings as required by the Design-Builder's design.

3.3.1 Fixed Bearings

- A) Fixed disc bearings shall consist of a polyether urethane structural element (disc) confined by upper and lower steel bearing plates. The bearing shall be equipped with a shear restriction mechanism to prevent lateral movement of the disc.
- B) Fixed disc bearings shall allow rotation, but horizontal movement shall be restricted in all directions. To restrict horizontal movement the shear resisting mechanism shall be locked between the upper and lower steel bearing plates.
- C) Fixed disc bearings shall be designed to resist a horizontal load of not less than 10 percent of the rated capacity of the device. Larger values shall be used if required by the Design-Builder's proposed design.

3.3.2 Guided (uni-directional) Disc Bearings

- A) Guided disc bearings shall consist of a polyether urethane structural element (disc) confined by upper and lower steel bearing plates. The bearing shall be equipped with a shear restriction mechanism to prevent lateral movement of the disc.
- B) Guided disc bearings shall allow rotation and longitudinal movement, but transverse movement shall be restricted. To restrict transverse movement a guide bar shall be used.
- C) To allow longitudinal movement, the upper surface of the upper steel bearing plate shall be faced with a PTFE sheet and shall support a sliding steel sole plate.
- D) The mating surface of the sliding steel sole plate shall be faced with polished stainless steel.
- E) Guided expansion bearings shall be designed to resist a transverse load of not less than 10 percent of the rated capacity of the device. Larger values shall be used if required by the Design-Builder's proposed design.
- F) The guide bars and their mating steel surfaces shall be faced with strips of PTFE (may be filled or unfilled as per "AASHTO LRFD Bridge Design Specifications") and stainless steel.

3.3.3 Non-guided (multi-directional) Disc Bearings

- A) Non-guided disc bearings shall consist of a polyether urethane structural element (disc) confined by upper and lower steel bearing plates. The bearing shall be equipped with a shear restriction mechanism to prevent lateral movement of the disc.
- B) Guided disc bearings shall allow rotation, longitudinal movement, and transverse movement in the bearing plane.
- C) To allow longitudinal and transverse movement, the upper surface of the upper steel bearing plate shall be faced with PTFE sheet and shall support a sliding steel sole plate.
- D) The mating surface of the sliding steel sole plate shall be faced with polished stainless steel.

steel.

4.0 MATERIALS

All materials shall be new and unused, with no reclaimed material incorporated in the finished bridge bearing devices.

4.1 STEEL

All steel products to be used or supplied in connection with any bridge bearing device shall be steel products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or other similar process or processed by a combination of two or more such operations, from steel made by the open hearth, basis oxygen, electric furnace, Bessemer or other steel making process.

- A) All steel used shall conform to the minimum requirements of ASTM A 709, Grade 36, or Grade 50.
- B) Stainless steel shall conform to the requirements of ASTM A 240, Type 304. Higher grades of stainless are permissible.
- C) Anchor bolts, nuts, and washers shall conform to ASTM A 307 and shall be galvanized in accordance with ASTM A 153.

4.2 LEAD SHEET

- A) Lead sheet used under the masonry plate of confined elastomeric bridge bearing devices shall be of the shape and thickness shown in the plans, but not less than 1/8 inch thick, conforming to the requirements of ASTM B 29.

4.3 POLYTETRAFLUOROETHELENE (PTFE)

- A) PTFE shall be manufactured from pure virgin (not reprocessed) unfilled PTFE resin.
- B) Finished PTFE sheet shall be resistant to all acids, alkalis, and petroleum products, stable at temperatures up to +500° F, non-flammable, and non-absorbing of water.

4.4 ELASTOMERIC DISCS FOR CONFINED ELASTOMERIC BRIDGE BEARING DEVICES

- A) The physical properties of neoprene and natural rubber used in these bridge bearing devices shall conform to “AASHTO LRFD Bridge Design Specifications.”
- B) Elastomeric discs may be either chloroprene or natural polyisoprene with a 50 ± 5 Shore A durometer hardness and shall be individually molded and monolithic. No layering of elastomers will be allowed.

4.5 ELASTOMERIC DISCS FOR MULTI-ROTATIONAL, HIGH-LOAD DISC BEARING DEVICES

- A) The physical properties of the polyether urethane elements shall conform to “AASHTO LRFD Bridge Design Specifications.”
- B) Elastomeric rotational element shall be molded as a single piece, separate layers are not allowed.
- C) Caution shall be taken to ensure that the steel temperature directly adjacent to the polyether urethane rotational element does not exceed 225° F. The polyether urethane

disc shall not be exposed to direct flame or sparks.

5.0 REQUIREMENTS

5.1 GENERAL

- A) The Design-Builder and the Design-Builder's bridge bearing device supplier(s) and/or fabricator(s) shall show previous documented experience in the design, fabrication, testing, and installation of bridge bearing devices. Documented experience, showing a minimum of five years of experience and 10 bridge installations shall be submitted to the Department for review and approval.
- B) The Design-Builder's bridge bearing device fabricator shall be certified by the American Institute of Steel Construction (AISC) for Conventional Steel Structures Category.
- C) Before the fabrication of any bridge bearing device, the Design-Builder shall submit shop drawings to the Department for review and comment. The shop drawings shall be stamped by a Delaware-licensed Professional Engineer employed by the Design-Builder's bridge bearing device fabricator with a minimum of 5 years of documented history of bridge bearing device design experience. The shop drawings, detailed by the Design-Builder's bridge bearing device fabricator, shall include, but shall not be limited to, the following for each bridge bearing device used for the Project:
 - 1) Detailed drawings showing plan, elevation, and section views;
 - 2) Complete details and sections showing all ASTM, AASHTO, or any other material designations;
 - 3) Vertical, horizontal load capacities and rotational and movement capacities;
 - 4) All bridge bearing device offsets if required by the Design-Builder's design;
 - 5) The Design-Builder's alignment plan and installation method;
 - 6) The size, quantities, and locations of bridge bearing devices;
 - 7) Bridge bearing device seats and all bridge bearing device connection details;
 - 8) Complete details for inspection and construction purposes;
 - 9) Shop paint and/or coating requirements;
 - 10) All appropriate notations and instructions for field installation;
 - 11) Complete and detailed replacement procedures, including equipment, shoring, blocking, and other such procedures and operations; and
 - 12) Complete design calculations verifying conformance with the provisions of this Special Provision and the Contract requirements.
- D) The Design-Builder shall be responsible for coordinating the location of shear connectors in both the superstructure and substructure and verify there are no conflicts with post-tensioning or reinforcement with any bridge bearing device.

5.2 REQUIREMENTS FOR BOTH CONFINED ELASTOMERIC AND MULTI-ROTATIONAL, HIGH-LOAD DISC BRIDGE BEARING DEVICES

5.2.1 Permanent Corrosion Protection, Metallizing

All steel surfaces exposed to the atmosphere, except stainless steel surfaces and metal surfaces to be welded, shall be metallized.

- A) All exposed carbon steel surfaces shall be blasted clean to a near white finish, degreased, and zinc metallized to a minimum uniform thickness of 8 mil.
- B) All interior surfaces, including but not limited to, the pot and piston assembly and masonry plate recess, shall receive no less than 1 mil nor more than 3 mil thickness of zinc metallizing.
- C) All metallizing shall be performed with good work quality in accordance with American Welding Society Specification AWS C 2.2.

5.2.2 Temporary Corrosion Protection

Metal surfaces to be welded shall be given a coat of clear lacquer, or other protective coating, if the time of exposure before welding takes place is to exceed three months. The coating shall be removed at the time of welding. No metallizing will be done to these surfaces prior to the completion of welding.

5.2.3 PTFE Sliding Surfaces

- A) The properties of the PTFE shall conform to the current AASHTO Specifications for the PTFE bearing surfaces.
- B) The area of the PTFE shall be designed in accordance with AASHTO LRFD Section 14.7.2. Unfilled PTFE shall meet the following requirements:
 - 1) PTFE shall be bonded and recessed into the surface of the piston for half its thickness. It shall be a minimum of 0.1875 inch thick and not more than 0.25 inch thick.
 - 2) PTFE shall have a minimum ultimate tensile strength of 2,500 psi.
- C) Bonding of the PTFE, if required, shall meet the peel test requirements (ASTM D 903) of 25 lb/in at an angle of 180°. Bonding must be complete and without air gaps under the PTFE sheet in order to seal out moisture and provide a smooth, flat sliding surface.

5.2.4 Stainless Steel Sliding Surfaces

- A) Stainless steel in contact with the PTFE sheet shall be polished to a finish of less than 20 micro-inches RMS or less.
- B) The stainless steel surface shall cover the PTFE surface in all operating positions plus 1 additional inch in every direction of movement.
- C) Stainless steel shall be a minimum of 0.07 inch to a maximum of 0.08 inch thick and shall be connected to the sole plate by means of a continuous neat seal weld around the entire perimeter of the plate. Welding slag or other residues on the stainless sliding surfaces is not permitted. Stainless steel used on guide bars or in keyways shall also meet these thickness and other general quality requirements.
- D) Welding procedures shall be chosen such that the stainless steel surface is in contact with

the sole plate and the surface is smooth and flat.

- E) For confined elastomer bridge bearing devices designed with center-guided key, the finished recess in the sole plate shall be a maximum of 1/8 inch wider than the PTFE bonded shear key.
- F) Stainless sliding surfaces shall face downward.

5.2.5 Guide Bars

- A) Guide bars may be connected to sole plates by means of either welding or recessed high tensile fasteners. High tensile fasteners, if required by design, shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications.
- B) Guide bars and all connections to the sole plate shall be designed for the horizontal forces on the bridge bearing device and not less than 10 percent of the ultimate vertical capacity of the bridge bearing device.
- C) Unless the space between the guide bars is specified, it shall be a total of 1/8 inch.
- D) Guiding arrangements shall be designed so that the guided member is always within the guides at all bridge bearing device translation points.
- E) Guiding off the fixed base or any extension of it will not be allowed.

5.3 FOR CONFINED ELASTOMERIC BRIDGE BEARING DEVICES ONLY

5.3.1 Elastomeric Discs

Elastomeric Discs shall conform to the following requirements:

- A) Confined elastomeric discs shall have a minimum thickness as determined by the following formula:

$$t = ID/C$$

Where: t = minimum elastomeric disc thickness

ID = inside diameter of pot cylinder

C = 25 for less than 0.011 radians of rotation

C = 20 for 0.011 thru 0.016 radians of rotation

C = 15 for over 0.016 radians of rotation

- B) Areas of elastomeric discs shall be designed for an average working stress of 3,500 psi at the total dead and live loads of the structure.
- C) The upper edge of the elastomer shall be recessed to receive the brass rings.
- D) The entire top and bottom of the elastomeric disc shall be lubricated with an even film (approximately 1 to 3 mils thick) of silicone grease meeting Military Specification MIL S 8660C.

Steel Pots and Masonry Plates

Steel pots and masonry plates shall conform to the following requirements:

- E) Pots shall be made from a solid plate by machining.

- F) The depth of the pot cavity shall be equal to or greater than the design rotation + 0.02 radians + 0.1 inch + the thickness of the elastomeric disc.
- G) Inside diameters shall be the same as the elastomeric disc.
- H) The pot shall be seated in a machined recess of 0.000125 inch RMS max. profile (before metallizing) in the masonry plate, without welding, to a depth required by design, but not less than 0.25 inch.
- I) The inside dimension of the finished recess shall be 0.03 inch to 0.05 inch larger than the actual outside dimension of the finished pot base.
- J) The juncture formed between the edge of the pot and the top masonry plate surface must be caulked with a durable moisture sealant recommended by the bridge bearing device manufacturer and approved by the Design-Builder's Quality Control Manager.
- K) The anchor bolt spacing in the masonry plate and any other considerations shall be incorporated in the design of the bridge bearing devices to allow for future removal, replacement, or repair of the pot cylinder and piston assembly.
- L) Concrete bearing stress shall be checked for pots or masonry plates in accordance with the AASHTO LRFD Bridge Design Specifications.

5.3.2 Pistons

Pistons shall conform to the following requirements:

- A) The piston and/or top plate shall be seated in a machined recess of 0.000125 inch RMS max. profile (before metallizing) in the sole plate, without welding, to a depth required by design, but not less than 0.25 inch.
- B) The inside dimension of the finished recess shall be 0.03 inch to 0.05 inch larger than the actual outside dimension of the finished piston or top plate.
- C) Pistons shall be designed with outside diameters as follows:
 - 1) Flat brass sealing rings, 0.03 inch to 0.05 inch less than pot inside nominal diameters.
 - 2) Round brass sealing rings, 0.02 inch to 0.1 inch less than pot inside nominal diameters.
- D) Piston thickness shall be:
 - 1) POT ID x 0.08 (minimum) for square shape pots.
 - 2) POT ID x 0.06 (minimum) for round shape pots.
- E) Pistons for round cross section sealing rings shall have the lower outside edge beveled to accept and retain the ring and allow full design rotation.
- F) For laterally restrained confined elastomer bridge bearing devices having a shear key in the piston, the top surface shall have keyway slot and cold finished bar press fit and welded at the ends. Pistons of this design shall be machined from one piece of steel.

5.3.3 Elastomeric Sealing Rings

Elastomeric Sealing Rings shall conform to the following requirements:

- A) Flat brass sealing rings shall meet the following requirements:

- 1) Width shall be 0.375 inch minimum for bridge bearing devices up to 1,000 kips of capacity and 0.5 inch minimum for over 1,000 kips capacity. Rings shall be manufactured to a tolerance of ± 0.005 inch.
 - 2) The thickness shall be 0.05 inch minimum.
 - 3) Up to 1,000 kip capacity, 2 rings shall be used; from 1,000 kips to 3,000 kips, 3 rings; and over 3,000 kips, 4 rings shall be used.
 - 4) Rings shall fit the ID of the pot snugly, and the ends shall be cut at 45°. When installed in the pot, the maximum gap shall be 0.05 inch.
 - 5) Flat brass rings shall conform to the ASTM B 36, half-hard requirements.
 - 6) Round cross section brass rings shall conform to the Federal Specification QQB626, composition half-hard requirements.
 - 7) When 2 seal rings are used, the ring gaps shall be staggered 180° apart. When more than 2 rings are required, the gaps of the successive rings shall be evenly spaced around the perimeter of the pot.
- B) Round cross section brass sealing rings shall meet the following design requirements:
- 1) Rings shall fit the POT ID snugly.
 - 2) Rings shall be made from one piece rolled into a circle and brazed.

6.0 TESTING

An independent testing laboratory (or laboratories) selected by the Design-Builder, acceptable to the Department shall test all materials and bridge bearing device assemblies in accordance with the testing requirements of this Special Provision for each specific type of bridge bearing device proposed by the Design-Builder for the Project. The Design-Builder shall be responsible for all coordination between the Design-Builder's laboratory (or laboratories), Design-Builder's supplier(s), and Department representatives. The Design-Builder shall notify the Department 14 days prior to any testing to be performed on bridge bearing devices and the Department shall be allowed to witness all testing.

The Design-Builder shall furnish all material and written test procedures, as prepared by the Design-Builder's supplier(s) to the Department for review and comment. Each component of the assembly shall have an AASHTO or ASTM material and test specification. The Design-Builder's supplier(s) and the design-Builder's laboratory (or laboratories) shall prepare separate reports. Each report shall independently describe all the testing data and testing results. All reports shall be submitted by the Design-Builder to the Department within 14 days of completing each test as independent records of the testing. The Design-Builder shall be responsible for sub-contracting and coordinating with the Design-Builder's laboratory (or laboratories) and Design-Builder's supplier(s) for all testing laboratory services.

Materials and components, which comprise the permanent production bridge bearing devices, shall be identical in nature, origin, and composition to those that were the basis of the bridge bearing devices acceptance tests. The Design-Builder's supplier(s) shall provide written and detailed recommendations to the Design-Builder regarding storage, handling, transporting, assembly, aligning, and verification of performance of the bridge bearing devices. The Design-Builder's supplier(s) shall simultaneously provide copies of all such recommendations directly to the Department for their use.

6.1 CERTIFICATION

- A) A copy of the test certificates documenting the tests performed and mill tests for all materials used in the bridge bearing device fabrication shall be submitted by the Design-Builder to the DelDOT Office of Materials and Research for review and comment.
- B) The certification package shall include, but not limited to, the following:
 - 1) Material test reports for all steels used except AISI C1018 and AISI C1020 for which a mill conformance certificate is acceptable;
 - 2) Certificate of Compliance for all non ferrous metals;
 - 3) Material test reports for any elastomeric components;
 - 4) Certificate of Compliance for PTFE and any adhesives used;
 - 5) A Certificate of Compliance for the bridge bearing devices executed by an officer of the Design-Builder's bridge bearing device fabricator's company;
 - 6) Certificate of Compliance for any dowels or bolts supplied; and
 - 7) Test reports for the performance tests.
- C) In addition, the Design-Builder shall contact the DelDOT Office of Materials and Research to confirm materials are acceptable at least seven days before shipping the bridge bearing devices to the site.

6.2 CONFINED ELASTOMER (POT) BEARING DEVICE TESTING

All confined elastomer (pot) bearing devices tested shall show no signs of failure or any other defects while under load or subsequently upon disassembly and in accordance with the requirements of "AASHTO LRFD Bridge Design Specifications." Any resultant defects, such as bond failure, physical destruction or cold flow of PTFE to the point of debonding, shall be cause for rejection. Defects such as cracked steel shall also be cause for rejection.

All confined elastomer (pot) bearing devices from the production lot shall be tested as follows:

- A) A proof load test shall be performed on each bridge bearing device of each type (fixed, guided expansion, and/or non-guided expansion). Each bearing device tested shall be loaded to 150 percent of the maximum vertical design load at Service Limit States for a period of one hour. The guided expansion bearings shall also be loaded as follows:
 - 1) 100 percent of the minimum vertical design load in combination with 150 percent of the maximum horizontal load, whether lateral or longitudinal at Service Limit States.
 - 2) These loadings shall be maintained for at least 1 hour.
- B) The Department requires the efficacy of any sealing system, regardless of design or material, to be demonstrated and therefore, an elastomer seal test shall be performed on each bridge bearing device. The elastomer seal test shall be performed as follows:
 - 1) A Department approved independent testing laboratory (see Section 6.0) shall perform the test.
 - 2) A Delaware-licensed Professional Engineer, who shall be a staff employee of the testing laboratory, shall witness and certify the elastomer seal test.
 - 3) A bevel plate equal to the design rotation of the bridge bearing device shall be

inserted between the test machine and the test bridge bearing device.

- 4) The load shall be applied to the test bridge bearing device uniformly and smoothly over a period of 5 minutes up to the full test load.
 - 5) The test load shall be 3 times the capacity at Service Limit States of the bridge bearing device and shall be maintained for a period of 6 hours with no change in the load.
 - 6) During the test, the bridge bearing device shall be carefully examined for any sign of extrusion of the elastomer.
 - 7) After removal of the test load, the bridge bearing device shall be disassembled and examined for any sign of damage or permanent deformation of the sealing system. Bridge bearing devices, which show no sign of extrusion of the elastomer and no deformation of the sealing system, may be considered acceptable.
- C) The coefficient of friction shall be determined for all production bridge bearing devices of each type. Specially made or test bridge bearing devices shall not be used for this test.

6.3 MULTI-ROTATIONAL, HIGH-LOAD DISC BEARING DEVICE TESTING

All multi-rotational, high-load disc bearing devices tested shall show no signs of failure or any other defects while under load or subsequently upon disassembly and in accordance with the requirements of “AASHTO LRFD Bridge Design Specifications.” Any resultant defects, such as bond failure, physical destruction or cold flow of PTFE to the point of debonding, shall be cause for rejection. Defects such as extruded or deformed elastomer or cracked steel shall also be cause for rejection.

All multi-rotational, high-load disc bearing devices from the production lot shall be tested as follows:

- A) A proof load test shall be performed all bridge bearing devices of each type (fixed, guided, and/or non-guided). Each bearing device tested shall be loaded to 150 percent of the maximum vertical design load at Service Limit States for a period of one hour. The guided expansion bearings shall also be loaded as follows:
 - 1) 100 percent of the minimum vertical design load in combination with 150 percent of the maximum horizontal load, whether lateral or longitudinal at Service Limit States.
 - 2) These loadings shall be maintained for at least 1 hour.
- B) The coefficient of friction shall be determined for all production bridge bearing devices of each type. Specially made or test bridge bearing devices shall not be used for this test.

6.4 BRIDGE BEARING DEVICE MOVEMENT TESTING

If a group of 3 or more guided bearings is proposed at any support location, the Design-Builder shall develop and submit to the Department for review and comment a testing procedure for verifying proper bearing movement and function. The test shall confirm the bearing group is capable of moving through the full range of loads without binding. The Design-Builder’s testing plan shall be submitted to the Department for review and comment 45 days prior to the test being performed. The tests shall not cause damage to any bridge bearing device.

7.0 FABRICATION, HANDLING, AND STORAGE

7.1 GENERAL

- A) The Design-Builder shall provide the Department with written notification thirty days prior to the start of bridge bearing device fabrication. This notification shall include all of the information shown on the shop drawings, which are required by this Special Provision.
- B) Every bridge bearing device shall have the Design-Builder's fabricator's name, Project Identification Number, Lot Number, and Individual Bearing Device Number stamped with steel impression style stamps on a side that will be visible for inspection after erection.
- C) All welding shall conform to, and all welders shall be qualified in accordance with, the requirements of the American Welding Society (AWS).
- D) After assembly (including sole plates and masonry plates), bridge bearing device components and assemblies shall be securely fixed together as units so that they may be shipped to the job site and stored without relative movement of the bridge bearing device parts and to prevent disassembly. Steel strapping or other means may be used to prevent relative movement of the bridge bearing device parts and disassembly until the time of installation and/or inspection. Packaging shall be adequate to prevent damage from impact and bridge bearing devices shall be wrapped in moisture resistant and dust resistant material to prevent contamination during shipping and storage at the jobsite. It is the Design-Builder's responsibility to ensure that all bridge bearing devices are properly stored and protected from damage.
- E) Bridge bearing device assemblies shall be handled by their bottom surfaces only. Do not lift devices by their tops, sides and/or shipping bands.
- F) Bridge bearing devices delivered to the Project site shall be stored under cover on a platform above the ground surface until installation. Bridge bearing devices shall be protected at all times from damage. When installed, bridge bearing devices shall be dry, clean, and free from dirt, oil, grease, or other foreign substances.
- G) Multi-rotational, high-load disc bridge bearing devices shall not be disassembled unless otherwise permitted by the Design-Builder's bridge bearing device supplier.
- H) Before installation, confined elastomeric bearing devices will be disassembled on the Project site by the Design-Builder under supervision of the Design-Builder's bridge bearing device fabricator for inspection by the Department for conformance with the approved shop drawings and Contract requirements. Following the inspection, the bridge bearing devices shall be repackaged and stored until installation.
- I) The edges of all parts shall be rounded by grinding so that there are no sharp edges.

7.2 FABRICATION TOLERANCES

- A) Gross bridge bearing device dimensions shall have a tolerance of minus 0, +1/8 inch.
- B) The overall height of a bridge bearing device shall not exceed the nominal height by more than 3/16 inch or be less than 1/16 inch under.
- C) Except as noted, all bearing surfaces of steel plates shall be finished or machined flat within 0.010 inch per foot. Out of flatness greater than 0.010 inch per foot on any plate

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shall be cause for rejection. The bottom surfaces of lower bearing plates (masonry plates) designed to rest on bearing pads shall not exceed an out of flatness value of 0.0625 inch per foot.

- D) Oxygen cut surfaces shall not exceed a surface roughness value of 1000 micro inches as defined by ANSI B46.1.
- E) Flatness tolerances shall be as follows:
 - 1) Class "A": $0.0005 \times$ "Nominal Dimension".
 - 2) Class "B": $0.001 \times$ "Nominal Dimension".
 - 3) Class "C": $0.002 \times$ "Nominal Dimension".
 - 4) "Nominal Dimension" shall be interpreted as the actual dimension of the plate, in inches, under the straightedge where the straightedge is not parallel to any plan dimension of the plate being measured.
 - 5) In determining the flatness, the straightedge may be located in any position on the surface being measured.
- F) Elastomeric disc tolerances shall be as follows:
 - 1) Diameters greater than 20": $+ 3/32$ inch.
 - 2) Diameters less than 20": $\pm 1/16$ inch.
 - 3) Thickness shall be 0.0 inch to $+ 1/8$ inch.
- G) PTFE and stainless steel sliding surface tolerances shall be as follows:
 - 1) Plan dimensions: total nominal design area 0.0 to $+5.0$ percent.
 - 2) Flatness: Class "A" tolerance.
- H) Masonry and distribution plate tolerances shall be as follows:
 - 1) Plan dimensions over 30": 0.0 inch to $+ 3/16$ inch.
 - 2) Plan dimensions under 30": 0.0 inch to $+ 1/8$ inch.
 - 3) Flatness: Class "B" tolerance.
- I) Sole plates shall conform to the following tolerances:
 - 1) Plan dimensions over 30": 0.0 inch to $+ 3/16$ inch.
 - 2) Plan dimensions under 30": 0.0 inch to $+ 1/8$ inch.
 - 3) Thickness: $1/32$ inch to $+ 1/8$ inch.
 - 4) Flatness of the upper surface: Class "B" tolerance.
 - 5) No beveled edge shall be less than $5/8$ inch thick.
- J) Guide bar tolerances shall be as follows:
 - 1) Length: $\pm 1/8$ inch.
 - 2) Section dimensions: $\pm 1/16$ inch.
 - 3) Flatness, where it bears on another plate: Class "A" tolerance.
 - 4) Bar to Bar tolerance: "Nominal Dimension" $\pm 1/32$ inch.

The finished PTFE bonded guide bars shall not be more than 1/32 inch out of parallel, vertically or horizontally.

- K) Steel pots for confined elastomeric bridge bearing devices shall meet the following tolerances:
 - 1) The inside diameter shall be machined to a tolerance of ± 0.005 inch up to 20 inch diameter and ± 0.007 inch over 20 inch diameter;
 - 2) Pot undersides shall be machined parallel to the inside to a Class "A" tolerance as defined in this Special Provision; and
 - 3) Internal finish shall be 0.000125 inch RMS or better.
- L) Piston tolerances for confined elastomeric bridge bearing devices shall be as follows:
 - 1) Diameters greater than 20": ± 0.007 inch.
 - 2) Diameters less than 20": ± 0.005 inch.
 - 3) Upper side flatness: Class "A" tolerance.
 - 4) Lower side flatness: Class "B" tolerance.
 - 5) Machine finishes shall be 0.000125 inch RMS or better.
- M) Confined elastomer bridge bearing devices tolerances for flatness - Flatness of bridge bearing device surfaces shall be determined by the following method:
 - 1) A precision straightedge longer than the nominal dimension to be measured shall be placed in contact with the surface to be measured as parallel to it as possible.
 - 2) An attempt shall be made to insert a feeler gauge, equal to the tolerance allowed and having an accuracy of ± 0.001 inch, under the straightedge.
 - 3) Plates are "acceptable" if the feeler gauge does not pass under the straightedge.

8.0 INSTALLATION

- A) Bridge bearing devices shall be installed in accordance with the Design-Builder's bridge design, the Design-Builder's bridge bearing device supplier's recommendations, the requirements of this Special Provision, and the Contract requirements.
- B) Removal of the sole, top, bearing, and/or other load distribution plates for separate attachment to the structure is not permitted except under the direct supervision of the Department and the Design-Builder's bridge bearing device fabricator.
- C) For bearing groups (*see* Section 6.4), the Design-Builder shall verify the following installation tolerances have been met for each bearing device group. The Design-Builder, in the presence of the bridge bearing device supplier and the Department shall inspect the bridge bearing device components to assure that they are level and parallel to within $\pm 1/32$ inch per foot. Any deviations in excess of the allowed tolerances shall be corrected.

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605704 - BRIDGE COATING

Description:

This work shall consist of the preparation of the concrete surfaces, cleaning the surfaces, furnishing and applying the masonry coating as described herein. The masonry coating shall be applied to all concrete surfaces indicated on the plans or as directed. The coating shall be applied only after completion of the surface preparation specified herein. The areas to be coated shall include:

- > Exterior of the superstructure (except for the bridge deck surface and pedestrian pathway surface) including tie beam and back span center beam
- > Concrete bridge railing
- > Abutment walls and retaining walls

Materials:

The masonry coating material shall be a commercial product, one-component ready to use concrete protective coating, designed specifically for coating concrete and must be suitable for application on damp, uncured concrete and/or cured concrete. Only one coating material shall be used on an individual structure. It shall be delivered to the job site in sealed containers bearing the manufacturer's original labels. The brand, color, and type shall be clearly marked on each container. A copy of the manufacturer's printed instructions shall be made available.

The coating material shall be stored in airtight, upright containers. The containers shall be stored in a dry location where the temperature is above 40°F and less than 100°F.

The masonry coating shall have a shelf life of not less than 12 months. After application, the coating shall be dry to the touch within 48 hours and shall achieve a final cure within 2 to 3 weeks under ideal conditions.

The color of the applied masonry coating shall be in accordance with Federal Color Standard No. 33510. A 10' x 20' mock up of the specified color shall be provided for the Engineer's approval of the color before coating any of the surfaces specified in the Plans or as directed.

Surface Preparation

Surface preparation by the general contractor, prior to the application of an applied finish coating shall consist of a general surface finish in accordance with the standard specifications.

Surface to be coated shall be free from efflorescence, flaking coatings, oil, curing compounds, release agents and other deleterious substances prior to the application of the applied coating. Curing compound and release agent must be removed and may require light sandblast or water blast at a minimum 2500 psi or greater.

Application

The application, including equipment used, shall be in accordance with the manufacturer's recommendations. The material shall be applied by qualified personnel experienced in the work.

The material shall be thoroughly mixed in its original container. If skins have formed, they shall

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be removed prior to mixing the material. The material shall not be thinned. The masonry coating may be applied over damp, but not wet surface. It shall be applied at a uniform film thickness at a rate of 50±10 square feet per gallon. The application rate shall be sufficient to produce a uniform color and texture. The material shall be applied only when the ambient temperature is between 40°F and rising, and 100°F. It shall not be applied over frozen surfaces or if rain is imminent. Should rain occur on a freshly applied surface, re-coating may be necessary based on the damage, if any.

The Contractor shall schedule the application of the masonry coating as one of the final finishing operations to minimize construction-generated dust. To prevent lap marks, a wet edge shall be maintained at all times. Stopping and starting in midsections shall be avoided. Every attempt shall be made to start or end at natural breaks in the surface such as at a panel edge, corner or joint. When applying the coating with a roller, the material shall be applied in vertical strokes initially, cross rolled for even film and appearance, and then finished with vertical strikes.

The Contractor shall mask all surfaces to prevent overspray on portions of existing structures and other items surrounding the bridge and roadway. The Contractor shall clean all overspray at no additional cost to the Department.

Finished Product

The coating material in the finished state shall be capable of accommodating the thermal and elastic expansion ranges of the substrate without cracking.

The texture of the completed finish coat shall be fine. The completed finished coating shall be tightly bonded to the structure and present a uniform appearance and texture. If necessary, additional coats shall be applied to produce the desired surface texture and uniformity.

Coatings shall be entirely removed from the structure upon their failure to positively adhere without chipping, flaking or peeling, or attaining the desired surface appearance. The finish coating shall be reapplied after proper surface preparation until the desired finish product is achieved. The average thickness of the completed finish coating shall not exceed 1/8 of an inch.

Certification

Before material is applied a certification shall be furnished attesting that the commercial product furnished is in accordance with the same formula as that previously subject to the tests specified below and approved. Copies of the current tests reports shall be attached to certification.

Testing

All testing shall be performed by a qualified commercial testing laboratory acceptable to the Engineer. The Contractor is responsible for the cost of testing necessary to provide material certification. Prior to use of the applied finish coating on any structure, meet the requirements of the test listed below:

Freeze-Thaw Tests

The applied finish coating shall be subjected to freeze-thaw cycle tests as follows:

1. Three concrete specimens, not less than 4" by 6" by 6", of the mix design for the structure shall be cast and cured. Fourteen days moist curing with a drying period at room temperature, 60° to 80°F, for 24 hours will be required before the specimens are coated

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with the applied finish. Caution shall be taken that there be no excessive oil on specimen forms. The finish coating shall be applied to the sides of specimens at a spreading rate of 50 ± 10 square feet per gallon. The coating shall be applied by rolling on or mechanically spraying and as approved by the Engineer. Cementitious coatings shall be cured at room temperature and 30 percent relative humidity for 24 hours, at room temperature and 90 percent relative humidity for 48 hours, and at room temperature and 50 percent relative humidity for 4 days for a total curing time of 7 days. Other coatings shall be cured at room temperature for 48 hours after the completion of curing.

2. The specimens shall be immersed in water at room temperature for 3 hours, and then removed.
3. The specimens shall be placed in cold storage at -15°F for 1 hour, and then removed.
4. The specimens shall be thawed at room temperature for one hour.

Steps 3 and 4 shall be repeated for a total of 50 cycles. At the end of 50 cycles, the specimens shall show no visible defects.

Accelerated Weathering

The applied finish coating shall be subjected to 7,500-hour exposure test in a Twin-Carbon-Arc-Weatherometer, ASTM G 23, and Type D, at an operating temperature of 145°F . The test shall be made at 20-minute cycles consisting of 17 minutes of light and 3 minutes of water spray plus light. At the end of the exposure test, the exposed samples shall show no chipping, flaking, or peeling. The panels for this test shall be prepared by applying the coating at a spreading rate of 50 ± 10 square feet per gallon to both sides and edges of panels cut from asbestos cement shingles in accordance with Federal Specification SS-S-346, Type I. Curing time shall be in accordance with Freeze-Thaw Test Section.

Fungus Growth Resistance

The applied finish coating to be used shall pass a fungus resistance test in accordance with Federal Specification TT-P-29g. Fungus growth shall not be indicated after a minimum incubation period of 21 days.

Abrasion Resistance

The applied finish coating to be used shall pass the 2,000-litre sand abrasion test in accordance with Method 6191 Abrasion Resistance-Falling Sand, Federal Test Method Standard 141a, ASTM D968-81. The specimens for this test shall be prepared by applying the coating to a cleaned steel panel at a spreading rate of 50 ± 10 square feet per gallon. The specimens shall be cured at room temperature for 21 days.

Impact Resistance

The coating shall be applied to a concrete panel prepared according to Federal Text Method Standard 141a, Method 2051, at a spreading rate of 50 ± 10 square feet per gallon, and allowed to cure for 21 days at room temperature. The test shall then be run using the Gardner Mandrel Impact Tester in accordance with ASTM D 2794 using a $\frac{1}{2}$ of an inch indenter with an impact load of 6 inch-pounds. The coating shall show no chipping under this impact load.

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Salt-Spray Resistance Test

A concrete specimen shall be coated at the rate of one gallon per 50 square feet ± 10 percent and cured for 21 days at room temperature. The coated specimen shall be exposed to a 5 percent salt solution in accordance with ASTM B 117 for 2,500 hours where the atmospheric temperature is maintained at $90^{\circ} \pm 2^{\circ} \text{F}$. At the end of 2500 hours of exposure, the coating shall show no ill effects, loss of adhesion, or deterioration.

Flexibility Test

A sheet metal specimen shall be coated with the applied finish coating at a rate of one gallon per 45 square feet ± 10 percent and allowed to cure for 48 hours at room temperature. The coated specimen shall be bent 180° over a one-inch round mandrel. After bending, the coating shall show no breaking.

In addition to the certification and test reports required above, a service record shall be supplied showing that the finish coating material has a satisfactory service record on concrete surfaces for a period of not less than 5 years prior to the date of submission of the service record. The finish coating shall also have shown satisfactory service characteristics without peeling, chipping, flaking, and non-uniform change in texture or color. A specific structure for the specific product shall be named for the service record.

In addition to the above requirements, the manufacturer shall submit, for each batch of material used, the following product analysis data:

- > Weight per gallon
- > Viscosity
- > Weight percent pigment.
- > Weight percent vehicle solids
- > Infrared spectra of vehicle solution.

Chloride Ion Penetration Resistance

This test shall determine the resistance of a concrete specimen to the penetration of chloride ion. The test shall be performed in accordance with AASHTO T259/T260.

Scaling Resistance

ASTM C672 A rating of "No Scaling" after 100 cycles on the sealed concrete (non-air entrained concrete) as compared to "Severe Scaling" on untreated concrete.

Absorption

ASTM C642 (non-air entrained concrete). Concrete should be proportioned and mixed in accordance with ASTM C672. Sealed concrete, under total immersion, will not exceed 1.0% after 48 hours or 2.0% after 50 days.

Cube Test

NCHRP 244, Series II

Weight Gain - not to exceed 25% of untreated cube

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Absorbed chloride - not to exceed 25% of untreated cube.

Southern Exposure

NCHRP 244, Series IV

Absorbed Chloride - not to exceed 10% of untreated concrete

Method of Measurement:

~~———— The quantity to be paid for will be the area of Bridge Coating, in square yards, completed and accepted.~~

Basis Of Payment:

~~———— Payment will be made for completed and accepted work, including surface preparation, material, labor, application, equipment, pre-qualification testing costs and all incidentals necessary shall be included in the cost of this work.~~

3/11/05

618513 - DYNAMIC PILE TESTING

Description:

The item shall consist of furnishing all equipment and performing dynamic testing and monitoring of driven piles through the use of electronic monitoring equipment in accordance with this Special Provision, the Contract Documents, and as directed by the Design-Builder's Geotechnical Engineer.

Equipment:

The Design-Builder shall furnish a Pile Driving Analyzer (PDA), and all associated equipment including transducers and accelerometers for conducting the dynamic pile testing.

Testing:

The Design-Builder shall employ a firm with a minimum of five (5) years experience in the use of the PDA and related equipment to install or supervise the installation of the necessary equipment and to perform the dynamic monitoring. Documentation of such experience shall be submitted to the Department's Project Manager for approval a minimum of 30 calendar days prior to beginning work.

Dynamic pile testing (monitoring) shall be in accordance with ASTM D4945 and shall be conducted in the presence of the Design-Builder's inspection staff. PDA monitoring is required at all times during initial driving, re-driving, and pile restrikes. The Design-Builder shall notify the Department's Project Manager of any planned dynamic pile testing a minimum of 24 hours in advance of the work.

The use of pile splices shall be avoided or minimized after initial driving has begun. Should pile splices be required, PDA monitoring shall be performed during the initial drive prior to the splice as well as the re-driving after the splice has been completed. To the extent possible, the delay in the PDA monitoring of the spliced pile should be similar to the anticipated delay for production piles.

All Test Piles shall be dynamically monitored during the full driving length. All Monitoring Piles shall be dynamically monitored for at least the last 25 feet of anticipated driving. Piles shall be driven until the PDA indicates the required nominal resistance, minimum tip elevation, and/or penetration have been obtained or as otherwise directed by the Design-Builder's Geotechnical Engineer.

Pile restrike testing shall be conducted no sooner than 48 hours after the pile, or any pile within a 25' radius, has been driven. Additional restrikes shall be performed for longer set-up periods. All pile restrikes shall be in accordance with the *DelDOT Standard Specifications* and shall be monitored with PDA. Prior to restriking piles, the hammer shall be warmed up and checked for proper operation by striking another pile or pile cut-off at least 20 blows at full stroke. Piles shall be restruck for at least 20 blows at the stroke height required or as directed by the Design-Builder's Geotechnical Engineer.

Redriving of piles shall be performed with the same hammer and driving system used for the initial drive unless otherwise directed by the Design-Builder's Geotechnical Engineer. Wave Equation Analyses shall be performed and submitted to the Department for review and comment at least 30 calendar days in advance of the use of each proposed hammer and driving system. Wave Equation analyses shall be in accordance with the *DelDOT Standard Specifications* and the *Geotechnical Requirements Performance Specification*.

The results of PDA results and CAPWAP analyses for each pile monitored shall be submitted to the Department's Project Manager as a PDA Testing Report and shall include the following information for

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the end of initial drive, the beginning and end of re-driving, all re-strikes, and for any other relevant blows occurring during the driving:

- a) Driving logs;
- b) Any unusual or noteworthy behavior during or after driving;
- c) Any suspected pile damage;
- d) Nominal bearing resistance from the Case Goble Method;
- e) Input and reflection values of force and velocity;
- f) Maximum transferred energy;
- g) Maximum compression and tensile stress;
- h) Velocity and displacement;
- i) Blows per minute (bpm);
- j) Values of upward and downward wave velocities; and
- k) Ram stroke and corresponding blow sequence.

The PDA Testing Report shall indicate whether the anticipated results were achieved, whether any remedial action is necessary, and what conclusions the Design-Builder's Geotechnical Engineer has made based on the results. This information and findings shall be signed and sealed by a Delaware-licensed Professional Engineer and submitted to the Department's Project Manager within 48 hours of the restrike testing.

All data shall be recorded to CD-ROM media and made available upon the request of the Project Manager.

The Design-Builder shall furnish the Department's Project Manager a Pile Load Test Report (if applicable) and Dynamic Testing Report signed and sealed by a Delaware-licensed Professional Engineer. The reports shall include the following for each pile tested relative to the submission:

- a) Its location;
- b) Date of testing;
- c) Driving log, all data obtained during the test;
- d) Any unusual or otherwise noteworthy behavior observed during or after driving or testing;
- e) Plot of applied load versus average butt settlement with determination of nominal resistance, as required by the specifications;
- f) PDA Testing Report including pile and test information specified above;
- g) A summary of nominal bearing resistances from both Static Loading and Dynamic Testing, including an evaluation of the correlation between the two approaches and discussion of any discrepancies; and
- h) Recommended driving criteria for production piles.

The results of the Dynamic Testing shall be evaluated by the Design-Builder's Geotechnical Engineer in conjunction with the results of any static load testing to estimate available unit side resistance, end bearing resistance values, production pile lengths, and tip elevations for each pile group. Where bitumen coating and driving collars are required, appropriate driving criteria shall be prepared specifically for such piles.

Production piles shall not be driven until the PDA / CAPWAP test pile results are reviewed by the Design-Builder's Geotechnical Engineer and driving criteria is provided to the Department's Project Manager for review and comment.

Verification testing and monitoring shall be performed by the Design-Builder through PDA monitoring and CAPWAP analyses on all Monitoring Piles as required in the *Geotechnical Requirements Performance*

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Specification included in Part 3 of the Contract Documents.

Static load testing shall be performed in accordance with Special Provision 619508 - *Quick Pile Load Test*, as included in Part 4 of the Contract Documents.

If required, bitumen coatings shall be in accordance with Special Provision 619518 – *Bitumen Coating on Piles*, as included in Part 4 of the Contract Documents.

618517 - STEEL PIPE PILES

Description:

This work consists of manufacturing, furnishing, driving, cutting off, cleaning out, concreting, etc., of steel pipe piles of the sizes shown on the Design-Builder's Plans. This Work includes performing all other incidental work as shown on the Plans and as described herein. Piles shall be furnished and driven as specified.

Site Information:

Prior to submitting a Proposal, the Design-Builder shall visit and examine the work site and all conditions thereon and take into consideration all such conditions that may affect this work, in accordance with Section 102.05 of the Standard Specifications. Subsurface data previously collected from the site has been included in the Reference Documents section of the Scope of Services Package. This data has been furnished to provide general indications regarding the existing sub-surface site conditions but should not be considered by the Design-Builder as a warranty of actual subsurface conditions.

Engineering boring sheets are included in the Indicative Plans in the Contract Documents, Part 6 – Scope of Services Package Plans. These sheets contain information that may be critical to the design and construction of drilled shafts such as soil descriptions and groundwater conditions, including the presence of localized artesian pressures in the vicinity of the likely foundations. Data on subsurface conditions are not intended as representations or warranties of continuity of such conditions. It is expressly understood that the Department will not be responsible for interpretations of and/or conclusions made by the Design-Builder's review of this material. The data is made available for the convenience of the Design-Builder and may be used to satisfy the minimum sub-surface investigation requirements specified in the *Geotechnical Requirements* Performance Specification.

Submittals:

All submittals described in this Special Provision shall be submitted to the Department's Project Manager at least 30 Calendar Days prior to mobilization, unless otherwise specified. The Design-Builder shall perform no test pile or production pile installation until the Department's Project Manager has reviewed and approved all *Qualifying Experience* submittals as described herein. In addition, the Design-Builder will not be permitted to start construction of any steel pipe piles until the complete *Installation Plan* and *Working Drawing* submittals described herein have been received, reviewed and commented on by the Department. The Design-Builder shall allow at least 21 Calendar Days for the Department's review and/or approval of all submittals. Note that any additional time required by the Design-Builder to address and resolve comments shall not be cause for delay or impact claims. All costs associated with submittals not conforming to the Contract requirements shall be the responsibility of the Design-Builder.

1. *Qualifying Experience.* The Design-Builder shall submit to the Department's Project Manager for approval proof that the proposed superintendent in responsible charge has a minimum of five years of experience (within the last eight years) installing steel pipe piles of dimensions similar to the specified dimensions of the drilled shaft foundation system for this project and under soil conditions similar to the subsurface conditions indicated in the soil boring logs for this project. The Design-Builder may hire Specialty Subcontractors specializing in the installation and/or testing of pile foundation systems, provided the Subcontractors submit proof of qualifying

experience satisfying the requirements defined herein.

- a. The Design-Builder shall provide documentation of its proposed superintendent's qualifications, experience record, and prior project references. All prior project references shall be currently available personnel who can verify the quality of the Design-Builder's previous work and shall include current name, address, and telephone number. This documentation shall reference the experience of the Design-Builder and the Design-Builder's superintendent who is to be in responsible charge of the steel pipe pile installation operations. This documentation shall reference successful installation and load testing of at least 5 similar sized steel pipe piles projects in similar soil conditions.
 - b. Welder certifications and approved procedures in accordance with Section 826.12(c) of the Standard Specifications.
 - c. Certifications for all weld inspectors and technicians performing visual inspection, radiographic inspection, ultrasonic inspection, and all other Quality Control on behalf of the Design-Builder.
2. *Installation Plan.* The Design-Builder shall submit to the Department's Project Manager for review and comment an installation plan for the installation of all steel pipe piles as detailed in this Special Provision. The submittal shall include the following:
- a. Pile Driving Schedule. The Design-Builder shall provide a tentative pile driving schedule and sequence of driving anticipated for all test, monitor and production piles. The schedule shall identify concurrent activities that are anticipated by the Design-Builder.
 - b. Equipment List. The Design-Builder's/subcontractor's list of proposed equipment with sufficient capacity to undertake and complete the work within the specified contract time and the tentative pile driving schedule. The list of proposed equipment shall include, but not be limited to cranes, hammer type, lead lengths, drills, augers, and other appurtenances as applicable to the work.
 - c. Wave Equation Analyses. Wave Equation Analyses shall be prepared and submitted in accordance with Part 4 - Special Provisions, *Dynamic Pile Testing* and Part 3 – Performance Specifications, *Geotechnical Requirements*.
 - d. Plan for Field Splices. The Design-Builder shall avoid or minimize the need for field splicing where possible; however, provisions shall be made in advance of the work to accommodate field-splicing needs. The Design-Builder shall prepare a plan and details addressing how splicing will be performed, how proper alignment of pile sections will be achieved, how damaged pile ends will be corrected prior to splicing, how the quality of splices will be verified, and what anticipated corrective actions might be taken. Where pipe cutting is required, pipe ends shall be cut using automated guided cutting equipment. Manual flame cutting shall not be used. All welding required for the steel pipe piles shall meet the minimum requirements specified herein.
 - e. Concreting Methods. Methods of cleaning open-end pipe pile plugs shall be specified and shall include tremie concrete mix designs and methods of placement. Mix designs for concrete core materials shall also be provided as well as methods of placement, curing and protection during curing. Methods of placing, supporting, and maintaining proper clear cover for reinforcing steel shall also be identified.
3. *Working Drawings.* The Design-Builder shall submit to the Department's Project Manager for review and comment Steel Pipe Pile Working Drawings. The Design-Builder shall not be permitted to start installation of steel pipe piles until the proper Working Drawing checks, reviews, and certifications have been performed by the Design-Builder in accordance with Part 2 – DB Section 111-10 of the Contract Documents. Such certifications will not relieve the Design-

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Builder of responsibility for results obtained by the use of these drawings or any of its other responsibilities under the contract. At a minimum, the Working Drawings shall include the following items:

- a. Details and calculations demonstrating how to provide and maintain the specified axial alignment of the pile to within 1/8" per foot of pile length.
 - b. Details and calculations demonstrating adequate support and stability for the pile with the full operating weight and dynamic loading of the proposed hammer at the top of the pile.
 - c. Provisions to provide stability and maintain alignment during placement of the piles and in wind.
 - d. Provisions to adequately accommodate the forces associated with or prevent the pile from running under its own weight and the weight of the hammer.
 - e. Provisions for providing adequate workspace for pile welding, cutting and inspection.
 - f. Provisions for providing adequate alignment and support to prevent movement during field-welding and to ensure that welding tolerances are met if pile extension is directed.
 - g. Details and equipment used for handling of pile including the use of temporary supporting brackets.
 - h. Calculation of pile stresses resulting from handling operations.
4. *Construction Reports.* Submittals to the Department during construction shall include record information for each pile and details of any integrity testing performed. The following information shall be furnished to the Department:
- a. Details to be included on Record Information reports for each pile.
 - b. Driving Logs within 24 hours of completion of installation of each pile.
 - c. Dynamic Pile Testing Reports in accordance with Part 4 - Special Provisions, *Dynamic Pile Testing.*
 - d. Quick Pile Load Test results in accordance with Part 4 – Special Provisions, *Quick Pile Load Test.*
 - e. Surveyed location of all piles within a pile group within 5 Calendar Days of completion of all pile driving work within each pile group.
 - f. Documentation of any corrective measures within 24 hours of such measures being taken.

All submittals and calculations shall be signed and sealed by a Professional Engineer registered in the State of Delaware.

Materials:

Refer to sections 604, 605, 618, 803, and 812 of the Standard Specifications and the following requirements:

Steel Pipe Piles shall conform to the requirements of ASTM A572, Grade 50.

Construction Methods:

The equipment for driving the steel pipe piles shall conform to these provisions. All equipment shall be in conformance with the approved wave equation analysis.

Steel Pipe Pile Fabrication

Fabrication and inspection of piles shall be in accordance with the Department's standard

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specifications.

Steel pipe to be used for pipe piling shall conform to the following tolerances:

- a. Thickness: The thickness of the pipe piles shall not vary by more than 1/8" from the corresponding thickness specified on the Design-Builder's Plans for thicknesses greater than or equal to 2 inches and no more than 1/16" for thicknesses of less than 2".
- b. Diameter: The outside diameter of the steel pipe shall not vary by more than 1%, or more than 1/4" from that corresponding to the diameter shown on the Design-Builder's
- c. Out of Round: The pipe shall not be out of round by more than 1 percent of the diameter, nor more than 1/2".
- d. Straightness: Maximum deviation in straightness in any 10' section of pipe shall be 1/8". For lengths over 10', use the following formula, not to exceed 3/8" in any 40' length:
$$1/8 \times (\text{total length in feet}/10')$$
- e. Circumference: The outside circumference at any point in a length of pipe shall not vary by more than 1% of the nominal circumference nor more than 1/2".

All welding required for the steel pipe piles shall conform to AWS D1.1 and D1.5. All welding required for splicing of the steel pipe piles shall be full penetration welds and shall be capable of developing the pile in tension or bearing. Welding procedures shall be submitted to the Department for approval at least 30 calendar days prior to the beginning of fabrication.

Welders and welding operators shall be qualified in conformance with the Department's requirements. All welds shall receive 100% visual inspection. All automatic welds shall then receive 10% Radiographic Inspection (RT) or Ultrasonic Inspection (UT), all other welds shall receive either 25% RT or UT in conformance with AWS D1.1 and D1.5. In addition, 10% of all weld intersections shall be inspected as described above for a minimum of 6" in each direction.

Acceptance for RT shall be in accordance with AWS D1.5M Section 9.21.2.2 and UT shall be in accordance with AWS D1.5M Section 9.21.3.1, Table 9.5.

If unacceptable discontinuities are found during these nondestructive tests, an additional 12" of weld on each end beyond the discontinuity shall be tested.

Automatic welding is any welding with equipment that performs the welding operation without manual manipulation of the welding arc by a welding operator. The equipment may or may not load and unload the work pieces.

A certified Welding Inspector (CWI) shall perform all visual inspections. Technicians certified to ASNT-TC-1A Level II in accordance with the requirements of American Society Nondestructive Testing (ASNT), and approved by the Department shall perform all nondestructive testing and inspections.

All unacceptable discontinuities shall be repaired in accordance with AWS D1.1 and D1.5. After repairs of defects have been made, the repair area plus 2" shall be re-inspected (UT or RT) for full 100% in accordance with the above inspection procedures.

Storage and Handling

The piles shall be stored and protected to avoid damage and shall be picked up in a manner that will avoid damage. If the piles are damaged due to improper storage or handling by the Design-Builder, they

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shall be rejected and replaced by the Design-Builder at no expense to the Department.

Driving Hammers

Steel pipe piles shall be driven with pile hammers and driving systems consistent with those submitted as part of the wave equation analyses in accordance with Part 4 - Special Provisions, *Dynamic Pile Testing* and Part 3 – Performance Specifications, *Geotechnical Requirements*. The pile hammers shall be sized to ensure that stresses associated with hammer impact do not exceed the permissible driving stresses specified in the *AASHTO LRFD Bridge Design Specifications*.

The hammer shall be maintained in proper adjustment consistent with manufacturer's recommendations and shall be operated at the manufacturer's rated number of blows per minute and at the rated pressure. The compressor shall be equipped with an accurate pressure gage and automatic read-out of ram velocity and delivered energy to the pile.

The hammer, hammer cushion and pile cushion used to drive the piles shall be the same type and size as those used in the Wave Equations Analysis. No modifications or substitutions will be permitted without resubmission of a revised Wave Equation Analysis unless otherwise authorized by the Department's Project Manager.

Piles damaged because of misalignment of the leads, failure of hammer cushion, failure of splices, malfunctioning of the pile hammer, or for any other reason shall be cause for rejection of the pile if it is determined by the Department or the Design-Builder's QC Manager that the strength of the pile has been compromised. Replacement piles shall be driven at no additional cost to the Department.

Hammer Cushion

Impact pile driving equipment designed to be used with a hammer cushion shall be equipped with a suitable thickness of hammer cushion material to prevent damage to the hammer and to insure uniform driving behavior. Hammer cushions shall be made of durable manufactured materials, proved in accordance with the hammer manufacturer's guidelines. Wood, wire rope and asbestos hammer cushions are specifically disallowed and shall not be used. A striker plate as recommended by the hammer manufacturer shall be placed on the hammer cushion to insure uniform compression of the cushion material. The hammer cushion shall be removed from the helmet and inspected in the presence of the Design-Builder's QC Manager when beginning pile driving at each pile location or after each 100 hours of pile driving, whichever is less. Any reduction of hammer cushion thickness exceeding 50% of the original thickness shall be replaced by the Design-Builder before driving is permitted to continue.

Driving Helmet

A driving helmet shall be used between the top of the pile and the ram to prevent impact damage to the piles. The driving helmet shall be capable of transferring hammer energy uniformly over the top of the pile. The driving helmet shall fit loosely around the top of the pile so that the pile is not restrained by the driving helmets if the pile tends to rotate during driving.

Driving the Piles

Pipe piles shall be driven to the minimum tip elevation and bearing resistance specified by the Design-Builder's Geotechnical Engineer. Pre-augering to aid in the installation of piles may be used within

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depths expressly permitted by the Design-Builder's Geotechnical Engineer. Piles shall not be installed by water jetting. Any pile damaged by improper driving, or driven out of its proper location of alignment shall be removed, or as an option, a second pile may be driven adjacent thereto. All rejected piles shall be at the expense of the Design-Builder.

Piles shall be visually checked for structural integrity after driving. In addition, the Design-Builder shall monitor the piles by survey for heave during driving of adjacent piles. Piles pushed up more than 1/4" shall be driven back to their original tip elevation at a minimum.

The Design-Builder shall maintain records of pile lengths, hammer speeds, blows per foot, tip elevations and other relevant data pertinent to all piles driven. The Design-Builder shall also provide assistance to the Department when needed for Quality Assurance inspections, including all required equipment such as lifts, lights, work platform, measuring devices, etc., all in conformance with applicable safety regulations.

All piles shall be driven at locations shown on the Design-Builder's Plans or as directed by the Design-Builder's Geotechnical Engineer. They shall be driven within an allowed variation of 1/8" per foot of pile length from the vertical as shown on the Plans. The piles shall be driven with a variation of not more than 4" in any direction at the cutoff elevation from the positions indicated on the Plans. Any pile driven out of position shall be corrected to the satisfaction of the Department's Project Manager or else withdrawn and replaced. The tops of all piles shall be cut off to a true plane at the elevation shown on the Design-Builder's Plans. Pile driving records shall be completed in accordance with Part 2 – DB Section 112 of the Contract Documents and submitted to the Department upon completion of all pile driving within a pile group.

The Design-Builder shall conduct surveys prior to, during and after pile driving operations to monitor the impact of pile driving vibrations on existing structures. If vibrations caused by pile driving induce settlement of the existing structures, the Design-Builder shall be required to reduce the hammer stroke for driving piles. If the settlement of the existing structures continues, the Design-Builder shall stop pile driving adjacent to the affected area and submit a revised installation procedure for approval before pile driving can resume at these locations. There will be no measurement and payment for stoppage of Design-Builder's work that is a result of Design-Builder pile driving operations.

Where additional piles must be installed to replace unacceptable piles, such additional piles will be located as required to maintain concentric loading on pile caps or footings. Depending upon the location of previously installed piles at any pile cap or footing location where one or more piles is determined to be unacceptable, it may be necessary to install a number of additional piles greater than the number of piles determined to be unacceptable in order to maintain concentric loading on the pile cap or footing. It may also be necessary to revise or enlarge the pile cap dimensions in order to accommodate the additional piles. Submit complete details of proposed installation of piles required to replace unacceptable piles, including the proposed location of replacement piles and any necessary pile cap modifications, for Department's Project Manager's review and comment. Do not install replacement piles prior to receiving the Design QC Manager's approval. Furnish and install all such additional piles, and perform all pile cap redesign and associated construction at no additional cost to the Department.

Pile Cut Off

Piles shall be cut-off to a true plane at the elevations shown on the Design-Builder's Plans. All pile cut-offs will become the property of the Design-Builder and shall be removed from the site and disposed of by the Design-Builder at no additional cost to the owner and in a manner acceptable to the Department's

Project Manager.

Concreting Steel Pipe Piles

Soil and debris shall be removed from the portion of the pile in the areas to be filled with reinforced and tremie concrete as shown on the Design-Builder's Plans. The depth of the reinforced concrete inside the pipe pile shall be as shown on the Design-Builder's Plans. The depth of the tremie concrete below the cast-in-place concrete shall be determined by the Design-Builder. After removal of soil and debris, the inside surface of the pile shall be cleaned. Prior to beginning work, the Design-Builder shall submit to the Department's Project Manager for review and comment, a cleanout method for open-ended steel pipe piling as indicated in the "Submittals" section of this Special Provision. Care shall be taken during cleanout of the steel pipe piling to prevent disturbing the material surrounding the pile. Equipment or methods used for cleanout shall not cause blow-ins, quick soil conditions, scouring, or caving around or below the tip of the steel pipe pile. If the use of water jets for cleaning the insides of the steel pipe and airlifts for cleaning out the steel pile are proposed by the Design-Builder, methods and limits of water jetting shall be clearly identified in the *Installation Plan* submittal.

The soil inside of the steel pipe piles shall not be excavated until the top of the soil elevation inside the pile has been measured and record information submitted to the Department. Soil removed from inside the pipe piles may be used for fill in other portions of the project provided it conforms to the specification for fill material defined in the special provisions for DelDOT contract #23-073-03, BR-156 on SR-1 Over the Indian River Inlet (Roadway and Approaches). Otherwise the soil shall be disposed of at an approved site. No excavated material shall be dumped in the water.

A tremie concrete plug shall be placed and cured prior to dewatering of the pipe pile. The Design-Builder shall design and submit computations signed and sealed by a Delaware-registered Professional Engineer for the tremie plug. If the tremie concrete plug fails prior to filling with concrete, the Design-Builder shall remove the failed plug, re-design, and submit new, signed computations, of a new plug system at no additional cost to the Department. The reinforcement unit shall be placed in the pile prior to filling with concrete. All work shall be in accordance with the Design-Builder's Plans.

After the steel pipe piles have been cleaned out, the water level inside the piles shall be maintained at the inlet level outside the piles. No dewatering shall be permitted until the tremie concrete plugs have been placed and allowed to cure adequately. The opening of the pile shall be covered immediately after cleaning. The steel piles shall be free of any soil, rock or other material deleterious to the bond between the steel shell and concrete prior to placing reinforcement and concrete. Reinforcement shall be placed and secured symmetrically about the axis of the pile and shall be securely blocked to clear the sides of the steel shell.

All pipe piles within each individual pile group shall be driven and accepted by the Design-Builder's Construction QC Manager prior to any concrete fill placement.

Immediately prior to concreting, water (deeper than 3") or other foreign substances found in a shell or pipe type pile shall be removed. Any water removed from the pile shall be collected and sediment removed in accordance with the Contract requirements. The concrete shall be deposited in one continuous operation using methods conforming to ACI 336.1 "Standard Specifications on the Construction of Drilled Piers", Section 3.5.

Inspection of Steel Pipe Piles

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Steel pipe piles shall be inspected on the inside by visual methods by the Design-Builder's QC Manager for the entire length of each pile (except for the soil plug) after driving and cleaning and prior to placing reinforcement. No reinforcement or concrete shall be placed until the Design-Builder's QC Manager approves the pile.

The Design-Builder shall provide a means of access to the interior of the pipe piles for use by the Department for inspection. Means of access shall be in accordance with OSHA standards.

Testing of Steel Pipe Piles

Steel Pipe Pile testing shall be performed in accordance with the requirements of the following Contract Documents:

1. Part 4 - Special Provisions, *Dynamic Pile Testing*;
2. Part 4 – Special Provisions, *Quick Pile Load Test*; and
3. Part 3 – Performance Specifications, *Geotechnical Requirements*.

618519 - DRILLED SHAFTS

Description:

This work shall consist of all labor, materials, equipment, and services necessary to perform all operations to complete the installation, integrity testing, and load testing of drilled shafts consistent with this special provision, the specifications, and all other applicable contract requirements. Technique shafts and load testing shall be required as specified in the *Geotechnical Requirements* Performance Specification. Integrity testing, including crosshole sonic logging, shall be required during construction of all drilled shafts.

The following definitions apply:

1. Drilled Shaft. A cast-in-place foundation element consisting of a shaft section that derives a portion of its compression load capacity through load transfer to the shaft base and the remainder of its load capacity from side friction.
2. Bearing Stratum. A layer of soil that provides bearing support at base of the shaft.
3. Shaft Section in Soil. Length of drilled shaft from ground surface to proposed bearing elevation at the bottom/tip of the drilled shaft.
4. Permanent Casing. Steel pipe, of cylindrical shape, installed by drilling or pushing that, when filled with concrete, becomes a permanent part of the drilled shaft.
5. Obstruction. A natural or man-made object above the bottom of shaft's proposed tip elevation that cannot be removed by drilling with conventional earth augers or under reaming tools, and that requires the use of special rock augers, core barrels, air tools, or hand excavation.
6. Tip Elevation. The bottom of the drilled shaft elevation.
7. Mini-SID. A Miniature Drilled Shaft Inspection Device consisting of a digital video camera and video-control housing unit used for inspection of the bottom of all excavated shafts. The inspection is annotated and recorded on a video recorder for project documentation.

Site Information

Prior to submitting a Proposal, the Design-Builder shall visit and examine the work site and all conditions thereon and take into consideration all such conditions that may affect this work, in accordance with Section 102.05 of the Standard Specifications. Subsurface data previously collected from the site has been included in the Reference Documents section of the Scope of Services Package. This data has been furnished to provide general indications regarding the existing sub-surface site conditions but should not be considered by the Design-Builder as a warranty of actual subsurface conditions.

Engineering boring sheets are included in the Indicative Plans in the Contract Documents, Part 6 – Scope of Services Package Plans. These sheets contain information that may be critical to the design and construction of drilled shafts such as soil descriptions and groundwater conditions, including the presence of localized artesian pressures in the vicinity of the likely foundations. Data on subsurface

conditions are not intended as representations or warranties of continuity of such conditions. It is expressly understood that the Department will not be responsible for interpretations of and/or conclusions made by the Design-Builder's review of this material. The data is made available for the convenience of the Design-Builder and may be used to satisfy the minimum sub-surface investigation requirements specified in the *Geotechnical Requirements Performance Specification*.

Submittals:

All submittals described in this special provision shall be submitted to the Department's Project Manager at least 30 Calendar Days prior to mobilization unless otherwise specified. The Design-Builder shall perform no drilled shaft construction, including test shafts, until the Department's Project Manager has reviewed and approved all *Qualifying Experience* submittals as described herein. In addition, the Design-Builder will not be permitted to start construction of any drilled shafts until the complete *Installation Plan* and *Working Drawing* submittals described herein has been received, reviewed and commented on by the Department. The Design-Builder shall allow at least 21 Calendar Days for the Department's review and approval of all submittals.

1. *Qualifying Experience.* The Design-Builder shall submit proof that proposed superintendent in responsible charge has a minimum of five years of experience (within the last eight years) installing drilled shafts of dimensions similar to the specified dimensions of the drilled shaft foundation system for this project and under soil conditions similar to the subsurface conditions indicated in the soil boring logs for this project using both cased and slurry methods, and a signed statement that the Design-Builder has inspected both the project site and all the subsurface information made available in the Contract Documents. The Design-Builder may hire Specialty Subcontractors specializing in the installation and/or testing of drilled shaft foundation systems, provided the Subcontractors submit proof of qualifying experience satisfying the requirements defined herein.
 - a. The Design-Builder shall provide documentation of its proposed superintendent's qualifications, experience record, and prior project references. All prior project references shall be currently available personnel who can verify the quality of the Design-Builder's previous work and shall include current name, address, and telephone number. This documentation shall reference the experience of the Design-Builder and the Design-Builder's superintendent in responsible charge of the drilled shaft operations. This documentation shall reference successful construction of similar sized shafts in the following conditions:
 - > Experience in successfully installing drilled shafts of the size shown on the plans or larger, on schedule, using both cased and slurry methods. The minimum experience shall consist of five (5) similar-sized projects with the work being performed in the past eight (8) years;
 - > Experience in performing the load testing specified herein. The minimum experience shall consist of installing the instrumentation and performing the required O-Cell testing on no less than five (5) similar-sized projects in the past five (5) years;
 - > Experience in crosshole sonic logging (CSL) testing. The crosshole sonic logging subcontractor shall have previous experience in conducting CSL tests on at least five drilled shaft projects of similar size in the past eight years;
 - > Experience in cleaning shaft bottoms when working under wet conditions or with slurry methods; and
 - > Welder certifications and approved procedures in accordance with Section

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826.12(c) of the Standard Specifications.

2. *Installation Plan.* The Design-Builder shall submit to the Department's Project Manager for review and comment an installation plan for the construction of drilled shafts as detailed in this Special Provision. The submittal shall include the following:
- a. The Design-Builder's/subcontractor's list of proposed equipment with sufficient capacity to undertake and complete the work within the specified contract time. The list of proposed equipment shall include, but not be limited to cranes, drills, augers, bailing buckets, final cleaning equipment, de-sanding equipment, slurry pumps, sampling equipment, tremie, concrete pumps, casing, and other appurtenances as applicable to the work;
 - b. The Design-Builder shall prepare a descriptive narrative of the proposed method of access to each drilling location, additional equipment, source and supply of materials, concrete mix design, procedure of drilling, installing reinforcement bars and placing concrete including sample forms for slurry testing, summary of concrete placement, and any tests of completed drilled shafts;
 - c. Details of overall construction operation sequence and the sequence of shaft construction in bents or groups, including scaled plan and profile showing the location, size and movements of equipment setup and operations. The completion of any required integrity and loading tests shall be noted in the construction operation sequence;
 - d. Details of shaft excavation and proposed stabilization methods;
 - e. Data giving the physical and chemical properties of any proposed slurry. Details of the method proposed to mix, circulate, and dispose of slurry shall be provided as part of the slurry management plan. Include method of collecting displaced slurry from the excavation;
 - f. Method of monitoring and continuously maintaining slurry level in drilled shaft, if applicable, including method of maintaining stability of drilled shafts in the event of sudden slurry loss or loss of slurry stabilization properties;
 - g. Method of monitoring verticality of the shaft during excavation and details of proposed corrective measures to be implemented as necessary;
 - h. Specific details of methods to clean the shaft excavation. Details shall include at least three alternative bottom-cleaning methods with descriptions of equipment to be used when installing drilled shafts in accordance with the Design-Builder's proposed methods. Include details of method for identifying type of bearing material for consistency with design assumptions prior to placement of concrete;
 - i. Details of reinforcement placement including methods for lifting, lowering, support and centralization, and methods for suspending reinforcement cage if required for shaft depth extensions resulting from inadequate bearing at the plan depth;
 - j. Details of planned load test instrumentation and test procedures including methods for Osterberg Cell (O-Cell) and/or other instrumentation installation. Current equipment calibration certificates shall be completed within three months prior to load tests. Pressure dial gages shall be used for load tests and shall be calibrated within 30 days of use;
 - k. The concrete mix design, including admixtures to be used. Details of concrete placement, curing, and protection. Concrete mix design should include a slump loss versus time curve for the Design-Builder's proposed mix design. The concrete mix design shall provide for a minimum 4 inch slump during the entire concrete placement period for each drilled shaft;
 - l. Quality Control methods to be used for confirming field conditions when using high

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- m. slump concrete or self-compacting concrete;
 - n. Methods for controlling heat of hydration for mass concrete pours. *See the Mass Concrete Performance Specification in Part 3 for additional requirements;*
 - o. A copy of the proposed report format for planned shaft installation and inspections. Record information for each shaft and details of any required load or integrity tests;
 - p. Methods to be used maintaining, measuring, and verifying tolerances;
 - q. Details of proposed crosshole sonic logging tube installation or other proposed non-destructive quality control measures; and
 - r. Other information requested by the Department's Project Manager.
3. *Working Drawings.* The Design-Builder shall submit to the Department's Project Manager for review and comment Drilled Shaft Working Drawings. The Design-Builder shall not be permitted to start the construction of drilled shafts until the proper Working Drawing checks, reviews, and certifications have been performed by the Design-Builder in accordance with Part 2 – DB Section 111-10 of the Contract Documents. Such certifications will not relieve the Design-Builder of responsibility for results obtained by the use of these drawings or any of its other responsibilities under the contract.
4. *Construction Reports.* Submittals to the Department during construction shall include record information for each shaft and details of any required loading or integrity tests as required. The following information shall be furnished to the Department:
- a. Details to be included on Record Information reports for each drilled shaft.
 - b. Installation logs and Record Information Reports within 24 hours of completion of each shaft.
 - c. Daily slurry testing records submitted on a weekly basis during drilled shaft construction activities.
 - d. CSL reports within seven (7) calendar days of the test being performed.
 - e. Surveyed location of all drilled shafts within a foundation unit upon completion of all drilled shaft work within each foundation unit.
 - f. Documentation of any corrective measures within 24 hours of such measures being taken.

All submittals and calculations shall be signed and sealed by a Professional Engineer registered in the State of Delaware.

Materials:

Hydraulic Cement Concrete

Hydraulic cement concrete for the drilled shafts shall meet the requirements specified in Section 812 of the Standard Specifications. The hydraulic cement concrete is to provide a Design Minimum Laboratory Compressive Strength at 28 days of 4,500 psi, or greater, if required by the Design-Builder. Water used in mixing concrete or slurry shall conform to Section 803 of the Standard Specifications.

1. **Minimum Slump.** Concrete mix for slurry displacement method shall have an initial slump of 8" +/- 1" and be capable of maintaining a minimum slump of 4" until completion of concrete placement.
2. **Air Content.** Do not use air-entrained concrete for drilled shafts.

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3. Cementitious Materials. Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 limits.
4. Content Limits. Limit water-soluble, chloride-ion content in hardened concrete to 0.08% by weight of cement.
5. Concrete Mix. Mix design adjustments may be considered if characteristics of materials, project conditions, weather, test results or other circumstances warrant. Resubmit to the Department for review and written comment any proposed changes to concrete-mix proportions, prior to the placement of concrete.
6. Aggregate Size. The maximum aggregate size for the concrete mix shall be 3/8" diameter.
7. Ready-Mixed Concrete. Measure, batch, mix and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - a. Do not add water to concrete mix after mixing.
 - b. Maintain concrete temperature to not exceed 90° F.
8. Admixtures. Admixtures must be certified by manufacturer to contain not more than 0.08% water-soluble chloride ions by weight of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride. If any admixtures are added to the concrete at the site, the admixture shall be added to the concrete by a qualified Design-Builder-furnished technician. Immediately after the addition of the admixture, the drum shall be turned, not less than thirty revolutions, until the concrete is thoroughly mixed. The technician shall then test the slump and consistency of the concrete mixture. Under no circumstances shall the Design-Builder add additional water to the concrete mixture to reach the desired slump. If used, admixtures shall conform to the following specifications:
 - a. Water-Reducing Admixture: ASTM C 494, Type A
 - b. Water-Reducing and Retarding Admixture: ASTM C 494, Type D
 - c. High-Range, Water-Reducing Admixture: ASTM C 494, Type G
 - d. Plasticizing and Retarding Admixture: ASTM C 1017, Type II
9. Concrete Cover. Minimum concrete cover for reinforcing steel within drilled shafts shall be as follows:

Diameter (feet)	Minimum Cover (inches)
≤ 6	4"
> 6	6"

Bar Reinforcement

Deformed reinforcing bars shall be in accordance with the sizes, spacing, dimensions, and details shown on the Design-Builder's plans and shall conform to ASTM A 615, Grade 60, and the requirements of Section 603 of the Standard Specifications. Epoxy coating is not required for drilled shaft reinforcing steel.

Threaded mechanical reinforcement coupling device shall meet the requirements of Section

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603.07. A wedge or crimp system may be used for spiral reinforcement only. Mechanical bar splices must develop in tension or compression, as required, at least 125% of the specified yield strength of the bars being spliced.

Bar ties shall be provided at a minimum of 50% of the bar reinforcing interfaces and shall be evenly distributed throughout the reinforcing steel cage. Additional ties shall be provided, as needed, to properly stabilize the reinforcing cage.

Slurry

Polymer slurries meeting the following requirements are permitted for use during drilled shaft construction. The Design-Builder may submit alternate polymer or mineral slurry specifications for the Department's review and approval. Blended mineral-polymer slurries shall not be permitted for use.

1. Polymer slurry shall be a stable suspension of polymer in potable water. The Design-Builder shall anticipate encountering brackish groundwater and other agents that may be deleterious to slurry. The Design-Builder is responsible for and shall modify the slurry mix as required so as to maintain a stable suspension at all times.
2. The slurry shall be readily displaced by the hydraulic cement concrete.
3. Additives shall be used in the slurry if needed to maintain the necessary properties.
4. Fluid loss in an open excavation shall be limited to a drop in the slurry level of no greater than 1" per hour per 20' of excavation depth, and no more than 24" total in a twenty-four-hour period.
5. Polymer slurry shall be a suspension of powdered polyacrylamide or vinyl polymer. Polymers shall be mixed with water to provide a stable colloidal suspension; complying with ACI 336.1 with the following density, viscosity, and pH:

Range of Acceptable Values (at 70°F for Polymer Slurry)			
Property(Units)	Time of Slurry Introduction	Time of Concentrating (In Hole)	Test Method
Density (lb/ft ³)	65 to 69	65 to 69	Density Balance
Viscosity (sec/gal)	200 minimum	200 minimum	Marsh Cone
pH	8 to 11	8 to 11	pH paper or meter

Notes:

- a. Sand content shall not exceed 1% (by volume) at any point in the shaft excavation as determined by ASTM D 4381 sand content test.
- b. Maximum viscosity by Marsh Funnel method shall be in accordance with manufacturer's recommendations.
- c. Mixing time shall be a minimum of fifteen minutes for polymer slurry.
- d. Storage time to allow hydration shall be a minimum of two hours for polymer

slurry.

6. A minimum of four sets of tests to determine density, viscosity and pH shall be made during the first 8 hours of slurry use. When the results show consistent behavior, the testing frequency may be decreased to one set every 4 hours of slurry use.
7. A technical representative from the slurry manufacturer shall be present at the site, as a minimum, during construction of the technique shafts and first drilled shaft at each foundation. If slurry based difficulties are encountered on other shafts, the Design-Builder will be required to have the slurry manufacturer's representative present for any remaining shafts, as required by the Department, at no additional cost to the Department.
8. The Design-Builder shall insure that heavily contaminated slurry suspension, which could impair the free flow of concrete, has not accumulated in the bottom of the shaft. Prior to placing concrete in any shaft excavation, the Design-Builder shall take slurry samples using a sampling tool approved by the Department's Project Manager. Slurry samples shall be extracted from the base of the shaft and at intervals not exceeding 10 feet up the slurry column in the shaft, until two consecutive samples produce acceptable values for density, viscosity, and pH throughout the shaft.
9. When any slurry samples are found to be unacceptable, the Design-Builder shall take whatever action is necessary to bring the slurry within specification requirements. Concrete shall not be poured until the slurry in the hole is re-sampled and test results produce acceptable values.
10. Reports of all tests required above signed by an authorized representative of the Design-Builder, shall be furnished to the Department's Project Manager on completion of each drilled shaft.
11. During construction, the level of mineral slurry in the shaft excavation shall be maintained at a level not less than 4 feet above the highest expected piezometric pressure head along the depth of the shaft, and the level of polymer slurry shall be maintained at a level not less than 6 feet above the highest expected piezometric pressure head along the shaft. If at any time the slurry construction method fails, in the opinion of the Department's Project Manager, to produce the desired final results, then the Design-Builder shall both discontinue this method and propose an alternate method for the approval of the Department's Project Manager.

Welding Material

AWS D1.1 Structural Welding Code shall be used.

Sand-Cement Grout

Sand-cement grout for drilled shafts shall consist of Portland cement, ASTM C 150, Type II; clean natural sand, ASTM C 404; and water to result in grout with a minimum 28-day compressive strength of 1000 psi, and of consistency required for application.

Construction Methods:

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Protection of Existing Structures

Precautions shall be taken to prevent damage to all existing structures and utilities. Existing structures shall include, but not be limited to, the approach roadway retaining walls, the existing bridge, adjacent drilled shafts, and other previously constructed new bridge elements. These measures shall include, but are not limited to, selecting construction methods, equipment and procedures that will prevent excessive caving of the shaft excavation, monitoring, and controlling the vibrations from the driving of casing or sheeting, and drilling of the shaft.

All monitoring noted below shall apply to the existing bridge structure regardless of the distance from the drilled shaft construction. All requirements shall apply to technique shafts, load test shafts, and production shafts.

1. The Design-Builder shall verify that there are no subsurface utilities in close proximity of each shaft before beginning excavation activities.
2. The Design-Builder shall conduct surveys prior to, during, and after the start of drilled shaft installation to monitor the impact of construction on existing structures. The location of the survey points shall be painted with a small spot of fluorescent paint so that future surveys may be taken at the same locations.
3. During drilling of the drilled shafts, surveyed elevations of the adjacent structures shall be obtained daily. After the drilled shaft has been filled with concrete, adjacent structure spot elevations shall be obtained within two hours of concrete placement and on a weekly basis for ten weeks, thereafter.
4. Differentials in surveyed spot elevation greater than 0.2" shall immediately be brought to the Department Project Manager's attention for evaluation and the Design-Builder may be required to cease all or part of the drilling work. Only the Department's Project Manager can give approval to restart drilling activity.
5. After drilling has been halted, the Design-Builder shall propose remedial action for presentation to the Department's Project Manager for review and approval.
6. A report of all surveying of the existing adjacent highway and bridge structures shall be submitted to the Department's Project Manager at the completion of drilling operations. Interim reports as noted above shall be submitted weekly and be included with the final report. Remedial action shall also be included in the final report.

Preparation

1. Drilled shafts shall be excavated to depths and dimensions as required. Bottoms of drilled shafts shall be cleaned of loose or soft material and leveled. Cleaning operations shall be performed in accordance with section "Excavation Inspection" of this special provision prior to concrete placement. The Design-Builder shall inspect each shaft bottom for cleanliness through the use of an inspection device. The cleanliness of each shaft bottom shall be approved by the Construction QC Manager. Excavated material and/or slurry materials shall be disposed of in accordance with Federal, State and Local Regulations. Sediment-laden water and excavated soil from within the drilled shaft shall not be permitted to re-enter the inlet, bay, ocean or other water surface body. Water shall be cleaned in accordance with Section 110.13 of the Standard Specifications prior

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discharge into a water body.

2. During the drilling of the drilled shafts, the surrounding soil shall be adequately and securely protected against cave-ins, by means of temporary casing and polymer slurry.
3. Water/slurry in the excavation shall be continuously removed, as concrete is being placed. The concrete shall be placed using underwater tremie methods.
4. Each drilled shaft excavation will be inspected and approved by the Design-Builder's Construction QC Manager prior to the placement of concrete. A record of all inspections, including results from the mini-SID, with related construction changes, shall be kept by the Design-Builder. The Design-Builder shall provide the necessary support personnel for inspection and testing procedures.
5. The locations and techniques of the permanent casing method shall be subject to the Department's review and written comment.
6. Blasting shall not be permitted unless otherwise authorized by the Department's Project Manager.

Equipment

The Design-Builder shall furnish all equipment and instrumentation necessary for installation, inspection, and load testing of the drilled shafts.

1. A description of the equipment that is proposed for use shall be submitted as part of the Design-Builder's Installation Plan and will be subject to the Department's review and written comment.
2. The Design-Builder shall furnish all equipment and instrumentation necessary for the installation, shaft bottom inspection (mini-SID), CSL testing, and load testing of the shafts.
3. The excavation and drilling equipment shall have adequate capacity including power, torque, and down thrust (crowd) to excavate a hole of the maximum diameter required to a depth of 15' beyond or 20 percent beyond the anticipated depths required, whichever is greater.
4. The excavation and tools shall be of adequate design, size, and strength to perform the work shown on the Design-Builder's Plans or described herein. When the material encountered cannot be drilled using conventional earth augers with soil or rock teeth, drilling buckets, and/or over-reaming tools, the Design-Builder shall provide special drilling equipment as necessary to construct the shaft excavation to the size and depth required.
5. The Design-Builder shall provide equipment that produces a stable slurry suspension and provides mechanical or hydraulic agitation. Provide a temporary pipeline or other safe method to transport slurry. Provide equipment that removes detrimental quantities of excavated material from the slurry.
6. There shall be a descriptive listing of available equipment provided by the Design-Builder that is fully capable of cleaning shaft bottoms when shafts are excavated under wet or slurry conditions.

Construction Sequence

No construction activity, including drilling, within a radius of three shaft diameters (center-to-center spacing) of a freshly drilled shaft shall take place until the concrete shaft has cured for at least 24 hours and the Construction QC Manager has provided written approval.

1. Excavation. Any disturbance to the footing area caused by shaft installation shall be repaired by the Design-Builder prior to the footing pour.
2. Drilled Shaft Construction. Construction of each drilled shaft shall be performed so that placement of the reinforcing steel cage occurs immediately following the completion of the drilling operation. The concrete placement shall begin immediately thereafter and conclude within 24 hours after final approval of excavation by the Construction QC Manager.
3. Reinforcing Steel Placement. The reinforcing steel cage shall be installed into the open drilled shaft, immediately after approval of the drilled shaft by the Construction QC Manager. The reinforcing steel cage shall be rigid and shall not separate during placement.
4. Reinforcement Steel Cage Tolerances. The top of the reinforcement steel cage shall be within the limits specified in section “Tolerances”.
 - a. In order to maintain spacing from the sides of the drilled shaft, the reinforcement steel cage shall have sets of spacers attached to the perimeter of the reinforcing steel cage. Each spacer set shall include a minimum of four (4) spacers equally spaced around the perimeter of the cage but no more than 30 inches circumferentially apart. Each spacer sets shall be spaced no more than 10 feet apart vertically. Approved cylindrical concrete feet shall be provided to maintain a minimum of 6” spacing between the bottom of the rebar cage and bottom of shaft excavation.
 - b. Additional reinforcing steel (or crossbars) shall be placed across the reinforcing steel cage, as needed, to maintain the regular shape of the reinforcing steel prior to placement. If used, additional crossbars shall be removed as the rebar cage is placed into the hole ensuring that none of the removed cross bars fall into the hole.
5. Concrete Placement. After the reinforcing steel cage has been installed in the drilled shaft and approved by the Construction QC Manager, approval will be given for the concrete placement to begin.
 - a. Concrete shall be continuously placed by methods that ensure against segregation and dislodging of excavation sidewalls, and shall completely fill the shaft. Concrete shall be placed by tremie or pumping in wet holes. Concrete placement shall be performed in accordance with section “Concrete Placement, Curing, and Protection” of this special provision.

Tolerances

The following construction tolerances shall be maintained in constructing drilled shafts unless more stringent requirements are included on the Design-Builder’s plans:

1. Drilled shafts shall be installed with top centerline location deviating not more than 3" from the

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proposed centerline location in any direction.

2. Drilled shafts shall be installed plumb with a maximum deviation of ½” for the first 10' and 1 ½” for each 10' of additional depth.
3. After all the shaft concrete is placed, the top of the reinforcing steel cage shall be no more than 3" above or below plan position.
4. The minimum diameter of the drilled shaft shall not be more than 1" less than the diameter specified on the Design-Builder's plans.
5. The maximum diameter for any section of drilled shaft shall be no more than 4” greater than the diameter specified on the Design-Builder's plans. If telescoping casing is to be used, no more than two separate diameters shall be permitted within a drilled shaft.
6. The top elevation of the shaft shall be within plus 1" or minus 3” of the plan top of shaft elevation.
7. The drilled shaft tip elevation shall be determined by the Department's Project Manager. The bottom of the shaft excavation shall be normal to the axis of the shaft within ½” per foot of shaft diameter.
8. The reinforcing steel shall be placed and the position maintained so that the outer edges of the reinforcing cage are located uniformly a minimum of 4" inside the perimeter for drilled shafts less than or equal to 6'-0 in diameter and 6” inside the perimeter for drilled shafts greater than 6'-0” in diameter.

Drilled shaft excavations constructed in such a manner that the concrete shaft cannot be completed within the required tolerances will be considered defective. Correction methods shall be submitted by the Design-Builder for the Department Project Manager's approval. Approval shall be obtained before continuing with the drilled shaft construction. Materials, engineering and work necessary to correct for out-of-tolerance drilled shafts shall be furnished by the Design-Builder at no cost to the Department.

Excavations

Excavations required for shafts shall be performed through whatever materials are encountered, to the dimensions and elevations required. The method used shall be suitable for the intended purpose and materials encountered. The wet or slurry method with temporary and/or permanent casings shall be used as necessary to produce sound, durable concrete foundation shafts that are free of defects.

1. **Wet Construction Method.** The wet construction method consists of using slurry to maintain stability of the hole perimeter while advancing the excavation to final depth, placing the reinforcing cage, and shaft concrete. Temporary surface casings shall be provided to aid shaft alignment and position, and to prevent sloughing of the top of the shaft excavation.

Polymer slurries shall be premixed thoroughly with clean fresh water and allowed adequate time for polymerization prior to introduction into the shaft excavation. Adequate slurry tanks will be required. Steps shall be taken as necessary to prevent the

slurry from "setting up" in the shaft excavation, such as agitation, circulation, and adjusting the properties of the slurry. The level of the slurry shall be maintained at a height sufficient to prevent caving of the hole, and shall at all times be maintained at a level not less than 6 feet above the highest expected piezometric pressure head along the shaft.

The Design-Builder shall carry out control tests on slurry to determine density, viscosity, and pH using suitable testing apparatus. Tests to determine density, viscosity, and pH values shall be performed during the shaft excavation to establish a consistent working pattern.

Prior to placing shaft concrete, the Design-Builder shall collect slurry samples from the bottom and at intervals not exceeding 20' for the full height of slurry until two consecutive sets of samples produce acceptable values for density, viscosity and pH. Heavily contaminated slurry, above the 1% sand limit and not meeting the criteria provided herein, that has accumulated at the bottom of the shaft shall be eliminated. The slurry shall be within specification requirements including sand content immediately before shaft concrete placement. Concrete shall be placed in accordance with section "Concrete Placement, Curing and Protection".

2. Temporary Casing Construction Method

The temporary casing construction method consist of installing temporary casing to maintain the stability of the hole while advancing the excavation to final depth, placing the reinforcing cage and shaft concrete. The casing may be either placed in a predrilled hole or advanced through the ground by twisting, driving, or vibration before being cleaned out. Vibration shall only be permitted a minimum of 24 hours after adjacent drilled shaft concrete pours have been completed.

3. Alternative Construction Methods. The Design-Builder may propose alternative methods to prevent caving and control ground water. Such proposals, accompanied by supporting technical data, shall be submitted in accordance with section "Submittals." Written approval from the Department's Project Manager is required before the use of alternative construction methods.

The bottom elevation of drilled shafts shown on the Design-Builder's plans may be adjusted during construction if the Department or the Construction QC Manager determines that the foundation material encountered during excavation is unsuitable or differs from that anticipated in the design of the drilled shaft. The Design-Builder shall perform exploration borings including Standard Penetration Testing (SPT) and soil sampling in accordance with Part 4 – Special Provisions, *Soil Borings* and in general accordance with ASTM D 1586 prior to excavation of production shafts to determine the character of the material near the proposed shaft tip elevations. The Design-Builder's Geotechnical Engineer shall inspect the samples and determine the final depth of required shaft excavation. Samples shall be available for examination by the Department.

The Design-Builder shall maintain a construction method log during shaft excavation. The log shall contain information such as the description and approximate top and bottom elevation of each soil material strata encountered seepage or groundwater, and remarks, including a description of the tools and drill rigs used and any changes necessitated by changing ground conditions. A sample log indicating the minimum acceptable information is attached to this Special Provision.

The Design-Builder shall provide the necessary equipment to remove and dispose of any materials encountered in forming the drilled shaft excavation to the dimensions shown on the Design-Builder's plans or as directed by the Department's Project Manager.

Obstructions

The Design-Builder shall remove surface and subsurface obstructions at drilled shaft locations. Such obstructions may include man-made and natural materials. Special tools and/or procedures shall be employed by the Design-Builder after the hole cannot be advanced more than 1 foot in thirty minutes using approved equipment operating at maximum power, torque, and crowd. Such special procedures/tools may include but are not limited to: chisels, boulder breakers, core barrels, air tools, hand excavation, temporary casing, and increasing hole diameter. Blasting shall not be permitted unless specifically approved in writing by the Department's Project Manager. If unforeseen obstructions requiring special tools and/or procedures are encountered, notification and payment shall be in accordance with Part 2, DB Section 104-7 of the Contract Documents.

Lost Tools

Drilling tools that are lost in the excavation shall not be considered obstructions and shall be promptly removed by the Design-Builder without compensation. All costs due to lost tool removal shall be borne by the Design-Builder including but not limited to costs associated with hole degradation due to removal operations or the time the hole remains open.

Excavation Inspection

Shaft cleanliness and the bearing surface condition will be evaluated and approved by the Design-Builder's QC Manager prior to concrete placement. After the Design-Builder has prepared the bottom of the shaft excavation, the Design-Builder shall notify the Department's Project Manager. The Design-Builder shall conduct inspection of the drilled shaft including the use of the mini-SID on all shafts. The data from the mini-SID shall be available for review by the Department's Project Manager. The Design-Builder shall coordinate schedules for excavation inspection with the Department's Project Manager.

The bottom elevations may be adjusted by the Design Builder's Geotechnical Engineer to obtain the required design capacity based on the actual bearing material encountered during installation of each drilled shaft or to obtain the minimum length required to meet the design requirements. The Geotechnical Engineer's recommendations shall be subject to review and approval from the Design QC Manager.

Prior to placement of reinforcing steel and concrete, the Design-Builder shall ensure that loose material from the bottom and sides of the excavation have been removed and that shaft is within the specified tolerances. Specified tolerances are listed in section "Tolerances". The shaft excavation shall be cleaned to remove accumulated sediment to allow for a maximum of 1/2" or less of accumulated sediment over maximum of 50% of the shaft bottom, and no more than 1 1/2" of sediment in any part of the shaft bottom. Final shaft depth shall be measured after final cleaning.

The Construction QC Manager shall determine whether the sidewall of the hole has softened, swelled or otherwise degraded. The Design-Builder shall submit to the Department for review and written comment any proposed corrective measures including over-reaming. The Design-Builder shall bear all costs associated with corrective measures.

1. Design-Builder Supervision. The Design-Builder shall provide appropriate supervision of all phases of drilled shaft construction. Each drilled shaft excavation shall be checked by the Design-Builder for its depth, cleanup, and workmanship and for all tolerance requirements before any concrete is placed. A mini-SID shall be provided and used by the Design-Builder to inspect the full depth of the drilled shaft. The Design-Builder shall have the proper equipment available to check the dimensions and alignment of each shaft excavation when needed. The Design-Builder shall determine the shaft dimensions and alignment under the observation and/or direction of the Department's Project Manager. The Design-Builder shall be responsible for correcting drilled shafts that are not constructed within the specified tolerances. Remedial measures and/or repairs, including engineering analysis and redesign, to correct for out-of-tolerance drilled shaft foundations, shall be performed at no additional cost to the Department.

2. Department Quality Assurance. The Department shall have the option to inspect each drilled shaft excavation immediately after the Design-Builder has checked each drilled shaft using the mini-SID inspection method. The Design-Builder shall furnish the Department all necessary equipment required for proper inspection of drilled shaft excavations and the installed reinforcing steel cage.

Reinforcing Steel Cage Construction and Placement

The reinforcing steel, cage stiffener bars, spacers, centralizers, and other necessary appurtenances shall be completely assembled and placed as a unit immediately after the shaft excavation is inspected and accepted and prior to shaft concrete placement. Prior to installation of the steel cage in the shaft excavation, inspect and clean the reinforcing steel of materials that prevent effective bonding. Clear spacing between bars of the rebar cage shall be at least five times the size of the maximum coarse aggregate. Hooks at the top of the rebar cage shall not be bent outward if temporary casing will be used. Similarly, interior hooks shall be designed to permit adequate clearance for a concrete tremie pipe (i.e., 1' minimum), if concrete is to be tremied into place. The assembled rebar cage outside diameter shall be as shown on the Design-Builder's plans. Internal stiffeners shall be removed as the cage is placed in the borehole so as not to interfere with the placement of concrete.

The reinforcing steel in the shaft shall be tied at a minimum of 50% of the bar intersections and supported so that the reinforcing steel will remain within allowable tolerances until the concrete supports the reinforcing steel. When concrete is placed by tremie methods, temporary hold-down devices shall be used to prevent uplifting of the steel cage during concrete placement. Concrete spacers or other approved non-corrosive spacing devices shall be used at sufficient intervals (near the bottom and at intervals not exceeding 10' up the shaft using a minimum of one spacer per 30" of rebar cage circumference at each level) to ensure concentric spacing for the entire cage length. Spacers shall be constructed of approved material equal in quality and durability to the concrete specified for the shaft. The spacers shall be of adequate dimension to ensure minimum concrete cover is provided between the outside of the reinforcing cage and the side of the excavated hole. Approved cylindrical concrete feet (bottom supports) shall be provided to insure that the bottom of the cage is maintained the proper distance above the base. If an oversize casing or excavation is used, spacer sizes shall be adjusted to ensure concentric spacing.

In the event that any shaft has to be extended due to unacceptable bearing at the plan depth, all reinforcing steel shall be similarly extended and supported once the additional depth exceeds 2'. If the extra depth of shaft is less than 2', the additional depth may be filled with unreinforced concrete.

Installation Requirements for Integrity Testing

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Access tubes shall be installed in each shaft to permit access for Integrity Testing or other instrumentation installation. The number of tubes installed shall be as designated on the Design-Builder's plans. The guidelines in the table shall be followed.

<u>Shaft Diameter</u>	<u>Number of CSL Pipes</u>	<u>Tube Spacing</u>
6'	6 minimum	60°
8'	8 minimum	45°

CSL pipes shall be 2" inside diameter schedule 40 steel pipe only. CSL probes may typically be 1.5" or smaller diameter, typically 6 to 10" long. The pipes shall have round, regular internal diameter free of defects or obstructions, including any at pipe joints, in order to permit the free, unobstructed passage of source and receiver probes. The tubes shall be watertight and free from corrosion to ensure a good bond between the concrete and the tubes. The pipes shall each be fitted with a watertight shoe on the bottom and a removable cap on the top. The pipes shall be securely attached to the interior of the reinforcement cage. The Design-Builder shall install the tubes in each shaft in a regular, symmetric pattern. The Design-Builder shall install the tubes such that each tube is spaced the maximum distance possible from each adjacent tube, with spacing in degrees around the perimeter of the cage to correspond to the design drawings or that called out in the table above for the selected number of tubes.

The tubes are typically wire-tied to the reinforcing cage at 3' maximum intervals or otherwise secured such that the tubes stay in position during placement of the reinforcing steel cage and concrete. The Design-Builder shall submit to the Department's Project Manager the selection of tube material and size, along with its proposed method to install the tubes, prior to construction. The tubes shall be as near to vertical as possible. The tubes shall extend from 6" above the shaft bottoms to at least 3' above the shaft tops. Under no circumstance should the tubes be allowed to rest on the bottom of the drilled excavation. If the shaft top is subsurface, the tubes shall extend at least 3' above the ground surface. Any joints required to achieve full-length tubes shall be made watertight. Care shall be taken during reinforcement installation operations in the drilled shaft hole not to damage the tubes.

After placement of the reinforcement cage, the CSL tubes shall be filled with clean water as soon as possible and before concrete placement. The tube tops shall be capped or sealed to keep debris out of the tubes. Care shall be exercised in the removal of caps or plugs from the pipes after concrete placement as to not apply excess torque, hammering, or other stresses, which could break the bond between the tubes and the concrete.

Prior to the beginning of downhole logging, the Design-Builder shall ensure that the test probes can pass through every tube to the bottom. If a tube is obstructed, the Design-Builder shall, at the Design-Builder's expense, remove the obstruction or core an adjacent logging hole positioned such that the coring will not result in any damage to the reinforcing steel in the shaft. All holes shall accommodate the logging equipment for the full depth of the drilled shaft. Downhole testing may commence once all obstructions are removed and/or alternative logging holes are provided, but no sooner than five (5) days after the concrete placement is completed.

Upon completion of the CSL testing of production shafts, all water shall be removed from the access pipes and any other drilled holes. For production shafts, the pipes and holes shall then be completely filled with an approved grout, having strength properties equivalent to or better than those of the drilled shaft concrete.

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Concrete Placement, Curing, and Protection

All concrete placement, consolidation and curing activities shall conform to the recommendations of Section 602 of the Standard Specifications.

Concrete placement shall begin immediately after reinforcing steel cage placement. Concrete placement shall be continuous from the bottom to the top cut-off elevation of the shaft. Placement shall continue after the shaft is full until good quality concrete is evident at the top of the shaft.

Concrete to be placed in water or slurry shall be placed by tremie method. The tremie pipe shall be supported so as to permit free movement or permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be sealed closed at the start of work so as to prevent water or slurry from entering the tube before the tube is filled with concrete. After placement has started, the tremie pipe shall be kept full of concrete to the bottom of the hopper. If water enters the tube after placement is started, the tremie pipe shall be withdrawn, the discharge end resealed, and the placement restarted. The flow of concrete shall be continuous until the work is completed. The discharge end of the tremie shall always be located a minimum of 5' below the level of the already placed concrete. As concrete is placed in the excavation, the slurry shall be collected and properly disposed of as approved by the Department's Project Manager. The Design-Builder shall submit its plan for collection and disposal of slurry to the Department's Project Manager for approval.

The Design-Builder shall prepare and submit a concrete mix design as part of the *Installation Plan* requirements included in this specification. Prior to placement, the Design-Builder shall demonstrate that the mix is capable of maintaining a minimum slump of 4 inches throughout the anticipated concrete placement period. This verification shall include test results of both a trail mix and a slump loss test conducted by an approved testing laboratory using approved methods to demonstrate that the concrete meets this requirement. The trail mixes and slump loss tests shall be conducted using concrete and ambient temperatures appropriate for site conditions. Admixtures such as water reducers, plasticizers, and retarders shall only be used when conditions encountered on the job site during a concrete pour require an adjustment to the concrete mix in order to maintain the concrete in a workable plastic state throughout the entire placement period.

The tremie pipe shall be a minimum of 10" in diameter. Tremie pipes shall not have aluminum parts. Pump hoses shall be a minimum of 4" diameter. All tremie pipe or pump hoses and connections shall be watertight.

The concrete placing rate shall be at least 25 cubic yards of concrete per each one-hour period or greater to meet the required time limit for the mix design. The concrete mix shall be of such design that the concrete remains in workable plastic state throughout the placement of the concrete for the entire drilled shaft.

All concrete within the top 5 feet of the drilled shaft shall be vibrated except where soft soil or slurry remaining in the excavation will possibly mix with the concrete. After placement, any exposed surfaces of the shaft concrete shall be protected to allow proper curing.

Construction Records

The Design-Builder shall provide the following minimum record information. For each drilled shaft foundation installed, record on drilled shaft installation logs the location, alignment, dimensions, elevation of the top and bottom, depth of the bearing stratum penetration, description of the materials

encountered at all elevations, elevation of the water table during excavation, condition of the bottom of the excavation, slurry test data, concrete data, verticality and deviation of shaft or reinforcing steel from the plan location, and other data called for on the report form or pertinent to the drilled shaft. Record the theoretical volume of excavation, volume of concrete placed versus depth, and total volume of concrete placed. Report observed irregularities to the Department's Project Manager immediately upon discovery.

The Design-Builder shall develop methods for recording and reporting appropriate record information for each drilled shaft. At a minimum, the record information shall be in accordance with FHWA Publication No. IF-99-025 "Drilled Shafts" or Association of Drilled Shaft Design-Builders' "Drilled Shaft Inspector's Manual" (1989). A copy of the inspection report planned for use shall be submitted to the Department's Project Manager for review and written comment prior to drilled shaft work commencing. The Design-Builder shall provide the Department's Project Manager with completed shaft installation logs within 24 hours of completion of each shaft. Maintain daily records of slurry testing in accordance with section "Wet Construction Method" of this Special Provision. Submit records on a weekly basis, or more frequently if variation occurs.

Upon completion of all drilled shaft work, the Design-Builder shall provide a record of centerline of the drilled shaft locations based on the survey of the registered surveyor provided by the Design-Builder. In addition, any corrective measures shall be similarly surveyed and recorded as appropriate. A complete tabulation of all records pertaining to approved drilled shafts shall be delivered to the Department's Project Manager at the completion of all drilled shaft installation for this project. Record Drawings for drilled shafts shall be prepared and submitted to the Department in accordance with Part 2, DB Section 111 of the Contract Documents.

Integrity Testing

All completed drilled shaft foundations shall be tested with the nondestructive testing (NDT) method called "Crosshole Sonic Logging" (CSL) after at least five (5) days of curing time has elapsed to allow the concrete to harden sufficiently. The Department's Project Manager may require a longer minimum time if special retarders, mix designs, or other factors result in slower-setting concrete.

All CSL testing shall be completed by the Design-Builder within 45 calendar days of concrete placement. The CSL tests shall be undertaken by an independent testing organization approved by the Department. The CSL testing organization shall meet the minimum *Qualifying Experience* requirements included in this specification.

The Design-Builder's Geotechnical Engineer shall evaluate and report on the test results. The Design-Builder shall be responsible for submitting to the Department's Project Manager test reports on any given shaft within 7 Calendar Days of the integrity tests performed on that shaft. Each test report shall include a narrative discussing the findings and any additional investigations or additional actions proposed. The report shall be reviewed and approved by the Construction QC Manager prior to submission to the Department. The Department's Project Manager will notify the Design-Builder within 15 Calendar Days of receipt of the test report as to whether any additional investigation for integrity verification is requested by the Department.

1. Description. The CSL test measures the time it takes for an ultrasonic pulse to travel from a signal source in one access pipe to a receiver in another access pipe. In uniform, good quality concrete, the travel time between equidistant pipes will be relatively constant and correspond to a reasonable concrete pulse velocity from the bottom to the top of the foundation. In uniform, good quality concrete, the CSL test will also produce

records with good signal amplitude and energy. Longer travel times and lower amplitude/energy signals indicate the presence of irregularities such as poor quality concrete, voids and soil intrusions. The signal will be completely lost by the receiver and CSL recording system for the more severe defects such as voids and soil intrusions.

2. Test Equipment. The CSL equipment consists of the following components:
 - a. A microprocessor based CSL system for display of individual CSL records, analog-digital conversion and recording of CSL data, analysis of receiver responses and printing of CSL logs.
 - b. Ultrasonic source and receiver probes that shall fit into 2" inside diameter pipe.
 - c. An ultrasonic voltage pulsar to excite the source with a synchronized triggering system to start the recording system.
 - d. A depth measurement device to determine and record depths.
 - e. Appropriate filter/amplification and cable systems for CSL testing.

3. CSL Logging Procedures. Information on the shaft bottom and top elevations and/or length, along with construction dates shall be provided by the Design-Builder to the testing organization before or at the time of the CSL tests. CSL tests shall be conducted between pairs of tubes, with the determination of which pairs will be tested being made by the independent testing agency. Typically, perimeter and/or major diagonal tube pairs are tested. Additional logs may be conducted in the event any anomalies are detected in the specified logs. The full depth of all pipes shall be used for conducting CSL tests unless approved otherwise by the Department's Project Manager. Should an access tube be blocked, the Department's Project Manager will determine what action should be taken in response.

The CSL tests shall be performed in accordance with ASTM D-6760. Tests shall be carried out with the source and receiver probes in the same horizontal plane unless test results indicate potential anomalies/defects in which case the questionable zone may be further evaluated with angled tests (source and receiver vertically offset in the tubes). CSL measurements shall be made at depth intervals of 2.5" or less, and shall be performed from the bottom to the top of each shaft. The probes shall be pulled simultaneously, starting from the bottoms of the tubes. Any slack shall be removed from the cables prior to pulling to provide for accurate depth measurements in the CSL records. Any anomalies/defects indicated by longer pulse arrival times and/or significantly lower amplitude/energy signals shall be reported to the Department's Project Manager on site and any further tests carried out as required to evaluate the extent of such anomalies/defects.

4. CSL Results. The CSL results shall be presented in a report. The test results shall be in accordance with ASTM D-6760 and shall include CSL logs with analyses of:
 - a. Initial pulse arrival time or compression wave velocity versus depth.
 - b. Pulse energy/amplitude versus depth.

A CSL log shall be presented to the Department's Project Manager for each tube pair tested within 7 days of the test with anomaly/defect zones discussed in the report as appropriate.

5. **CSL Test Locations.** Non-destructive integrity testing by crosshole sonic logging shall be completed on each technique shaft, each load test shaft and on all production shafts.
6. **Other NDT Methods.** Other acceptable non-destructive testing (NDT) methods, which could be used in addition to CSL testing but not as a substitute, include Angled Crosshole Sonic Logging, Crosshole Tomography, Singlehole Sonic Logging, Gamma-Gamma Nuclear Density Logging, and/or Sonic Echo and Impulse Response tests.
7. **Concrete Coring.** If coring is to be used for verification, the proposed coring equipment, hole location and procedures shall be submitted to the Department for review and written comment prior to the coring process beginning. The coring method shall provide for complete core recovery and shall minimize abrasion and erosion of the core. The core hole shall be placed at a position in the shaft that will not produce damage to the reinforcing steel in the shaft. The core hole shall be logged, voids or defects indicated on the log, and the log submitted to the Department's Project Manager. Cores shall be stored on site and available to the Department for inspection.
8. **Acceptance of Completed Drilled Shaft Foundations.** The acceptance of each drilled shaft shall be at the sole discretion of the Department. At a minimum, the following requirements must be met by the Design-Builder on the construction of a drilled shaft in order for it to be considered acceptable.
 - a. All construction and quality control shall be performed by and under the supervision of personnel meeting the qualifying experience requirements included in this Special Provision and approved by the Department prior to the work being performed.
 - b. All submittals required by this Special Provision have been made by the Design-Builder at the time specified.
 - c. All construction methods and materials used to perform the work are in conformance with this Special Provision and the requirements of the Contract.
 - d. All permissible construction tolerances have been met.
 - e. Required tip elevations have been achieved.
 - f. All required integrity testing has been performed and all remedial repairs have been completed.
 - g. The Construction QC manager has approved the completed drilled shaft.

Rejection of a shaft shall not be solely based on NDT records and reports. The NDT records are intended to identify areas in need of further investigation and verification of the structural integrity of the shafts by the Design-Builder. Should evidence be found through concrete coring, excavation around the shaft, or other means that conclusively shows a defect in the shaft exists, which will result in inadequate or unsafe performance under service loads, the shaft shall be rejected. The Design-Builder shall then submit to the Department a plan for remedial action including planned repairs to the rejected shaft and alterations to construction methods, if appropriate, to ensure proper construction of additional shafts.

Any modifications to the foundation shafts and load transfer mechanisms caused by the remedial action will require calculations and working drawings to be developed and reviewed in accordance with Part 2, DB Section 111 of the Contract Documents. Any modifications shall account for both geotechnical and structural adequacy of the proposed changes. All labor and materials required to perform remedial shaft action shall be

provided at no cost to the Department and with no extension of the contract time.

Site Operations

The Design-Builder shall conduct its operations in a neat and orderly manner. Equipment and materials shall not be placed or stored beyond limits approved by the Department’s Project Manager and shall promptly be removed when no longer needed. All materials, water, slurry, and auger cuttings shall be confined to the specified work area so as not to migrate from the specified work area.

Technique Shafts and Load Test Shafts

General Requirements

1. **Technique Shaft.** A drilled shaft shall be constructed using the same procedure, appropriately sized reinforcing steel cage and approved concrete to an equal depth and diameter of a typical production shaft required for the project. The Technique Shaft may be considered acceptable as a production drilled shaft if all acceptance criteria included in this Special Provision are satisfied. All required Technique Shafts shall be completed prior to the construction of the Load Test Shafts.
2. **Load Test Shaft.** A sacrificial drilled shaft shall be constructed using the same procedure, shaft diameter, and reinforcing steel as the deepest production shaft it is intended to represent. High early strength concrete may be used for the Load Test Shaft. The proposed concrete mix design for the Load Test Shaft shall be submitted to the Department for review and comment.
3. **Locations.** At a minimum, two (2) Technique Shafts and two (2) Load Test Shafts shall be constructed and tested (Note: Load testing required for Load Test Shafts only) prior to any production shaft construction. Precise locations shall be designated on the Design-Builder’s Plans and shall be in accordance with the requirements of Part 3 – Performance Specifications, *Geotechnical Requirements*.
4. **Technique Shaft construction** shall be performed under the supervision of the Design-Builder’s Geotechnical Engineer.
5. **Load testing of Load Test Shafts** shall be performed under the supervision of the Design-Builder’s Geotechnical Engineer. Prior to the commencement of work, all test procedures shall be submitted to the Department for review and written comment.
6. **The Load Test Shaft** shall be loaded as specified in section “Load Testing” but shall not exceed the nominal concrete resistance at the time of loading. The load shall be applied in increments of 5% of the nominal soil resistance specified on the Design-Builder’s Plans, or as directed by the Department’s Project Manager.
7. **Five copies of the load test report** shall be submitted directly to the Department’s Project Manager.

Technique Shafts

Technique shafts and loading-testing of Load Test Shafts shall be completed before construction of any production drilled shafts. A minimum of two (2) Technique Shafts are required prior to Load Test Shaft construction work commencing. Locations of the Technique Shafts shall be clearly shown on the Design-Builder's Plans. The Technique Shafts shall be constructed to the same construction tolerances as production shafts. The Design-Builder shall include provisions to install longer Technique Shafts to allow for field adjustments during installation, if necessary. In the event the Department's Project Manager determines that the methods of installation of the Technique Shafts are not acceptable due to the presence of defects or the exceedance of construction tolerances, the Design-Builder shall submit to the Department's Project Manager for approval alternate construction methodology to correct installation methods prior to start of production work. Additional Technique Shafts required verifying acceptability of alternate construction methodologies shall be provided at no cost to the Department.

Load Test Shafts

Upon the successful completion of all Technique Shafts, the Design-Builder shall construct a minimum of two (2) sacrificial Load Test Shafts at the locations shown on the Design-Builder's Plans. The Design-Builder shall provide standard and other instrumentation and testing procedures required herein subject to the approval of the Department. The Design-Builder shall provide strain gages, dial gages, telltales, and an appropriate data acquisition system in accordance with the requirements specified in the following sections. Test loads shall be measured with a jack pressure gauge that has been calibrated within three months prior to the date of the load test. In addition, all measuring equipment shall be similarly calibrated. The Design-Builder shall submit to the Department for review and comment a load-testing plan that provides a summary of all instrumentation and techniques to be used for the load-testing. Load Test Shaft construction shall not commence prior to the Department's acceptance of the Technique Shafts and submission of the load-testing plan. The Design-Builder shall allow 15 Calendar Days after submitting results of any load test for the analysis of the load test data by the Department's Project Manager to determine its acceptability.

Loading tests shall include the following:

1. Install Load Test Shafts at non-production locations, as shown on the Design-Builder's plans, to assess installation, equipment, and length requirements.
2. The equipment and construction means and methods used to install the Technique Shafts shall be used for the installation of the Load Test Shafts and all production shafts. At a minimum, this equipment would include the drill rig, slurry mixing, de-sanding equipment and pump. The Design-Builder shall include provisions to install longer Load Test Shafts to allow for field adjustments during installation, if necessary.
3. The Design-Builder shall conduct one exploration borehole at each Technique, Load Test, and Production Shaft location. Exploration boreholes will be completed in accordance with Part 4 - Special Provisions, *Soil Borings* and shall be in accordance with ASTM D 1586.
4. Exploration boreholes, Load Test Shaft installation, integrity testing and loading tests shall be completed in the presence of the Design-Builder's QC Manager. Complete integrity testing reports shall be provided to the Department's Project Manager at least 24 hours prior to loading tests. Loading tests shall not be performed until the concrete has reached the minimum design compressive strength as determined from concrete cylinders breaks.

5. Complete Osterberg cell (O-Cell) load tests shall be performed by the Design-Builder for each Load Test Shaft in accordance with section “O-Cell Load Test” of this provision.

O-Cell Load Test

This work shall consist of furnishing the required materials and labor necessary for conducting O-Cell load tests for each Load Test Shaft installed by the Design-Builder. The Design-Builder will be responsible for administering and monitoring the load test under the supervision of the Geotechnical Engineer. The drilled shaft(s) used for the load test program shall be instrumented as described herein or as otherwise approved by the Department. Instrumentation shall include strain gages or other appropriate means to distinguish the load transfer in the various bearing materials with no more than a 15' interval between measurement points. At least 30 Calendar Days in advance of the start of the Load Test Shaft installation, the Design-Builder shall submit to the Department’s Project Manager for review and written comment a detailed plan prepared by the Specialty Subcontractor showing the intended instrumentation placement.

The Load Test Shafts shall each be installed in accordance with section “Construction Methods” of this Special Provision and reinforced as shown on the Design-Builder’s Plans. The shaft shall be extended its full diameter to the test bearing elevation or as directed by the Design-Builder’s Geotechnical Engineer.

Quality Assurance

The Design-Builder shall employ a testing firm that has successfully completed no less than five O-Cell load test projects in the past five years to perform the testing and report preparation. The qualifications of the testing firm shall be submitted to the Department’s Project Manager for approval.

General Procedures

When the Technique Shaft excavation has been completed, inspected and approved by the Design-Builder’s QC Manager, a thin seating layer of fluid concrete shall be placed in the base of the drilled shaft. The mix design for the concrete to be used and the placement methods shall be submitted to the Department as part of the *Installation Plan*. The Design-Builder shall then install the O-Cell assembly at the tip elevation of the Load Test Shaft (while the concrete is still fluid) so that the O-Cell assembly is resting firmly in the concrete. The Design-Builder shall use the utmost care in handling the placement/test equipment assembly so as not to damage the instrumentation during installation. The O-cell shall be mounted from a reinforcing cage that is identical to the reinforcing cage to be used in the production shafts.

After seating the O-Cell assembly, the drilled shaft shall be concreted in the manner specified for production of drilled shafts. The concrete strength for Load Test Shafts shall be the same as that used for production shafts. At least six concrete compression test cylinders shall be molded from the concrete used in the test drilled shaft. At least one of these cylinders shall be tested prior to the load test and at least two cylinders shall be tested on the day of the load test. The O-Cell test shall not commence until the minimum concrete design compressive strength specified for production shafts on the Design-Builder’s plans has been achieved.

If during the period required to perform the load test, the test apparatus shows any signs of negative effects due to construction activities, such construction activities shall cease immediately.

Materials:

The Design-Builder shall supply all materials and personnel required to install the O-Cell and other instrumentation. The Design-Builder shall be responsible for performing the tests, and coordinating with the Specialty Subcontractor who will supply the O-Cell to determine and/or verify all required equipment, materials quantities, procedures and other applicable items necessary to complete the O-Cell load testing as provided.

The O-Cells to be provided shall have a test capacity of at least 150% of the nominal resistance specified on the Design-Builder's Plans and shall be equipped with all necessary hydraulic lines, fittings, pressure source, pressure gauge, strain gauges, telltale devices and other equipment necessary to perform the load testing as specified herein.

Materials supplied by the Design-Builder, which do not become a part of the finished test shafts become the responsibility of the Design-Builder at the conclusion of each load test and shall be removed from the job site.

Materials required include, but are not limited to, the following:

- a. Osterberg Load Cells (O-Cells)
- b. Piping and Supplies: Requirements for installation of each O-Cell
- c. Fresh water from an approved source to mix with a water-soluble oil, to form the hydraulic fluid shall be used to pressure the O-Cell.
- d. Materials sufficient to construct a protected work area with a minimum area of 25' by 25' (including provisions such as a tent or shed for protection from inclement weather or direct sunlight for the load test equipment and personnel).
- e. Electric power, as required for lights, welding, instruments, etc.
- f. Lighting as required.
- g. Steel bearing plates, as required.
- h. 25' of 2" structural steel angles.
- i. Surveyors level and tripod. Level shall be checked for vertical tolerance using the peg method before field measurements are begun.

Instrumentation

The Design-Builder shall provide four to six pairs of vibrating wire strain gages (sister bars) and appropriate lengths of cable. All cable runs from each sister bar to the readout device shall be unspliced. Locate gages in pairs on opposite sides of the reinforcement cage. The actual locations are to be set by the Design-Builder's Geotechnical Engineer after determination of the actual tip elevation of the Load Test Shaft.

The Design-Builder shall supply a suitable strain gauge readout box(es) compatible with the vibrating wire strain gauges and capable of reading and recording at least 48 channels of data.

The Design-Builder shall supply two telltales for each test shaft, or as directed by the Design-Builder's Geotechnical Engineer. Telltale rods shall extend approximately 1' above the elevation of the working surface platform, to be established by the Design-Builder. Telltale casing shall be attached to the inside of test shaft rebar cage. A sufficient length of telltale rods shall be provided for the load tests. Undamaged telltale rods may be reused for other load tests.

Equipment and Personnel

The Design-Builder shall supply equipment and personnel required to assist the Specialty Subcontractor in installing the O-Cell and instrumentation, conducting the load tests, and removing the load test apparatus as required. Equipment/personnel required includes but is not limited to:

- a. Furnishing the load test Specialty Subcontractor with personnel to assist with the assembly, welding, and placing of all O-Cell and to assist with the O-Cell load tests.
- b. Welding equipment and certified welding personnel, as required, for assembling the test equipment, attaching pipes and fittings to the O-Cell, attaching O-Cell to reinforcement cages, and preparing the work area.
- c. An acceptable pressurized gas source consisting of either an approved air compressor (150 cubic feet per minute capacity or greater) or compressed nitrogen (four 230 cubic foot filled cylinders of nitrogen per load test).
- d. Equipment and operators for handling the O-Cell and piping, and test shaft reinforcing cages during the installation of the O-Cell and during the performance of the tests, including but not limited to a crane or other lifting device for the O-Cell and piping, manual labor, and hand tools as required by the load test Specialty Subcontractor.
- e. Equipment and labor sufficient to erect the protected work area and monitoring reference beam system, to be constructed for each O-Cell load test.
- f. Wood reference beams, supports, and dial gauges necessary to measure axial deflections.

Test Equipment Installation Procedure

The O-Cell piping and other instrumentation shall be assembled and made ready for installation under the direction of the Specialty Subcontractor, in a suitable area, adjacent to each test shaft. The following guidelines shall be followed:

- a. Steel top and bottom bearing plates, as required, shall be welded to the O-Cell.
- b. If steel bearing plates are used, the lower surface of the bottom bearing plate shall be coated with grease prior to installation into the shaft, to prevent concrete bonding with the bottom plate.
- c. Attach the O-Cell (s) and plate assembly to the reinforcement cage or carrier bars. Install all instrumentation as indicated on the plans. All hydraulic hoses, telltale casings, slip joints, strain gauges, etc. shall be securely fastened to the rebar cage and/or the O-Cell prior to installation into the shaft. The top of any piping shall be protected to keep dirt, concrete, or other deleterious materials from entering the piping.
- d. The Design-Builder shall limit the deflection of the reinforcing cage to 2' between pick points while lifting the cage from the horizontal position to vertical. A minimum of three pick points shall be used. Provide additional support, bracing, strong backs, etc. to maintain the deflection within the specified tolerance.
- e. Place approximately 6" of fluid concrete into the bottom of the drilled shaft as a seating bed for the O-Cell immediately prior to placing the rebar cage. After placement of the rebar cage continue with concrete placement as described in section "Concrete Placement, Curing and Protection" of this Special Provision.
- f. After the completion of each load test, and at the direction of the Department's Project Manager, the Design-Builder shall remove any equipment, material, waste, etc., that is not a part of the test shaft.
- g. After testing is completed on all Load Test Shafts, the shafts shall be abandoned by

cutting off the tops of the shafts so that they remain 3' below existing site grades. The abandoned shaft shall be covered with at least 3' of suitable fill and compacted to the satisfaction of the Department's Project Manager.

Load Testing

The Design-Builder shall apply the test loads and record the data from the instrumentation. The Design-Builder shall maintain the test area and support equipment and supply labor assistance as directed by the Specialty Subcontractor.

The load testing shall be performed in general compliance with ASTM D 1143. For each O-Cell load test, the load shall be placed on the shaft in increments equal to approximately five percent of the nominal resistance specified on the Design-Builder's Plans, until the failure criterion as indicated by the instruments is approached. The Geotechnical Engineer may elect to stop the loading increments when it is determined that the failure criterion has been met. Each subsequent load increment shall be applied immediately after a complete set of readings is recorded and verified from all gauges and instruments. Each increment of load shall be applied within the minimum length of time practical and the instrument system readings shall be taken immediately. It is intended that the addition of a load increment and the completion of the instrument system readings shall be completed within 5 to 10 minutes. The Department's Project Manager may elect to have the maximum applied load held for up to one hour.

Direct movement indicator measurements shall be made of the following:

- a. Downward drilled shaft end-bearing movement (one indicator is required).
- b. Upward top-of-drilled shaft movement (minimum of three indicators required).
- c. The strain gauges shall be equally spaced at intervals of no more than 15 feet along the length of the test shaft and at the soil interfaces. The Design-Builder's Geotechnical Engineer shall be responsible for specifying strain gage locations.
- d. After each load increment, or decrement, movement indicators shall be read at 1.0, 2.0 and 4.0 minute intervals while the load is held constant. Strain gauge readings shall be concurrent with shaft movement readings. Additional cycles of loading and unloading using similar procedures shall be performed, as required by the Geotechnical Engineer, following the completion of the initial test cycle.

Dial gauges, digital gauges or LVDTs used to measure end bearing, side shear movement and shaft compression shall have a minimum travel of 8" and be capable of being read to the nearest 0.025" division. End bearing movement may be alternately monitored using LVDTs capable of measuring the expansion of the O-Cell. The reference beam selected shall have a minimum length equal to six times the test drilled shaft diameter and shall be monitored for movement during load testing using a surveyor's level.

The load shall be removed in decrements of about 10% of the nominal resistance specified on the plans. Each decrement of load shall be removed within the minimum length of time practical and the instrument system readings shall be taken immediately. It is intended that the removal of a load decrement and the completion of the instrument system readings shall be completed within 5 to 10 minutes. The Department's Project Manager may also require up to two reloading cycles with five loading increments and three unloading decrements. The final recovery of the shaft shall be recorded for a period up to one hour after the last unload interval.

The criteria described herein shall be used to establish the failure load unless otherwise modified

by the Design-Builder and approved by the Department's Project Manager prior to the start of the test. The failure load is defined as the sustained load at which continued shaft top or end bearing deflection occurs, or the load that causes a shaft top deflection equal to or greater than the calculated theoretical elastic compression of the test shaft plus 3.33% of the shaft diameter. The shaft top deflection and the associated load used to determine the failure load shall be obtained from the "Equivalent Top Load/Deflection Curves" generated from the O-Cell test data.

Report

The Specialty Subcontractor shall reduce and analyze the data collected during each load test and prepare a written report, which shall be submitted, to the Department's Project Manager within two weeks of the load test. Installation of the production shafts shall not begin until the Department's Project Manager approves the load testing report. The report shall include at least the following items:

- a. Drawing showing the location of all instrumentation.
- b. Plots of shaft tip movements vs. applied load.
- c. Discussion of load distribution in the shaft with appropriate supporting graphs.
- d. Equivalent Top Load/ Deflection Curves.
- e. Printouts of strain, load, and deflection readout.

<http://www.fhwa.dot.gov/engineering/geotech/pubs/inspectforms/summary.pdf>

619501 – PRODUCTION PILE RESTRIKES

Description:

This item shall consist of the Design-Builder furnishing all labor, equipment, and analysis required for production pile restrikes requested by the Department's Project Manager as part of the Department's Quality Assurance Program. The Design-Builder shall perform the Production Pile Restrikes requested by the Department in the same manner as the restrikes required as part of the Design-Builder's Quality Control Plan and monitoring. The Department may, at its sole discretion, choose to waive the Dynamic Pile Testing and monitoring requirements for Department-requested production pile restrikes.

The Design-Builder shall perform production pile restrikes on up to 2 or 5% (whichever is greater) of all production piles within each pile group, including previously designated test piles and/or monitoring piles. The purpose of the Department investigations shall be to further investigate or verify pile integrity, nominal bearing resistances gains/losses as part of the Department's Quality Assurance Program. Accordingly, the Department's Project Manager may require a longer waiting time than that specified by the Design-Builder.

The Department's Project Manager will attempt to promptly schedule any Department-ordered pile restrikes so as to avoid or minimize delays in driving operations.

Procedure:

Within two working days of production pile completion within a pile group designated on the Design-Builder's Plans, the Department's Project Manager may require production pile restrikes be performed within that group after the requested waiting time has elapsed. In no case, shall the Department, request a wait time of greater than 7 Calendar Days unless it can be accommodated without adversely impacting the Design-Builder's scheduled pile driving operations. The following procedures shall be followed by the Design-Builder:

1. The pile hammer used during initial driving must be used for the Restrike.
2. The hammer shall be warmed-up by striking another pile or pile cut-off at least 20 blows at full stroke.
3. The elevation of the top of pile shall be established prior to performing the restrike.
4. The hammer shall be carefully lowered and positioned on the pile. The hammer shall strike the pile 20 blows at the required stroke height.
5. The hammer shall be removed from the pile, and the new top of pile elevation shall be established.
6. After completion of the pile restrike, the Department will review the driving records and dynamic monitoring data, if applicable. The Design-Builder shall be notified immediately of any concerns raised as a result of the Production Pile Restrikes.

Method of Measurement/Basis of Payment:

All costs associated with the Design-Builder's work for this item, shall be borne solely by the Design-Builder, including any perceived mobilization costs, set-up costs, delay costs, etc. or actual labor, materials, and analysis costs. Accordingly, the Design-Builder's Lump Sum Price Proposal shall account for the full number of Department-requested Production Pile Restrikes whether they are used or not during the course of completing the Work.

619508 – QUICK PILE LOAD TEST

Description:

This work consists of furnishing all materials, equipment, tools, and labor necessary to perform a static axial compressive load test at approximate locations as shown on the Design-Builder's Plans in accordance with the applicable requirements of ASTM D1143-81 and as modified herein. All Quick Pile Load Tests are to be completed prior to any production piles being driven.

The Design-Builder shall furnish and install the test pile for load testing, all necessary reaction piles, load test reaction frame components, measurement and load application devices. The Design-Builder shall prepare, review and submit drawings and calculations for this item in accordance with Part 2, DB Section 111, of the Contract Documents. The Design-Builder shall allow the Department at least 30 Calendar Days to review and provide written comment on the drawings and calculations. The Design-Builder shall allow additional time to address and/or resolve any issues prior to beginning work. The drawings shall show the method of performing the load tests, including complete details of equipment, reaction frames and measurement systems, etc. The drawings shall also include the load testing schedule to be followed during the test including load hold periods for each load step. The calculations shall include the design of the complete reaction system and calibration plots for all jacks and/or load cells to be used for the test. All drawings and calculations shall be signed and sealed by a Professional Engineer licensed in the State of Delaware.

Construction Methods:

The Design-Builder shall install a sacrificial test pile at each load test location specified on the Design-Builder's Plans. The load test pile shall be of the same type, materials, size (diameter) and length and shall be installed with the same pile driving equipment anticipated for production pile use. The ground elevation around the load test piles shall be prepared to match the proposed bottom of footing elevation for the foundation unit it is intended to represent. Adequate pile length shall be provided above ground to accommodate the static load testing. The installation of the load test pile shall be monitored in accordance with the *Dynamic Pile Testing* Special Provision.

The static load test and analysis of results shall be performed by experienced personnel having performed a minimum of five (5) similar tests within the past five (5) years. The Design-Builder shall submit resumes of the proposed static load testing personnel to the Department's Project Manager for approval at least 30 Calendar Days prior to conducting the static load tests.

The minimum test load shall be 150% of the nominal bearing resistance specified for the pile or as indicated on the Design-Builder's Plans. The test load shall be applied no sooner than 5 full Calendar Days after completion of the last restrike.

The apparatus for measuring movement shall be as described in ASTM D1143-81 Section 4 except as modified herein. The test pile shall be monitored with three dial gauges spaced 120° around the pile reading to .0001" and two wire, mirror, and scale systems shall be suitably mounted on opposite sides of the pile as auxiliary monitoring devices. The reaction system shall also be monitored with wire, mirror, and scale systems or with direct reading scales visible to a surveyor's level or laser beam set up outside the immediate test area. All gauges and measuring devices shall be protected from the weather. Such protection shall include shelter from direct sunlight, wind, rain and snow. Alternative systems and methods of measurement may be submitted with the test frame drawings and calculations for review and approval by the Department.

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The vertical loading procedure shall be in accordance with the applicable requirements of Section 5.6 of ASTM D1143-81. Procedures for obtaining vertical measurements of vertical pile movements shall be as specified in Sections 6.1 and 6.4 of ASTM D1143-81.

The Pile Load Test Report shall consist of time, load and displacement data all reduced and presented in appropriate tabular and graphical form. Also, the nominal bearing resistance of the piles shall be estimated using the criteria developed by Davisson (1975) and this information along with the time-settlement curves shall be included in the report. A report shall be prepared for each load test by qualified personnel of the Design-Builder and shall include interpretations of the results. The report shall be signed and sealed by a Delaware-licensed Professional Engineer. Three copies of the report shall be submitted to the Department's Project Manager for review and comment within 10 Calendar Days of the test being performed.

The Pile Load Test Report shall be utilized by the Design-Builder's Geotechnical Engineer in conjunction with the PDA Testing Report results to establish appropriate driving criteria and production pile lengths for the pile groups in accordance with the *Dynamic Pile Testing* Special Provision. The Geotechnical Engineer may revise driving criteria during the course of the Construction based on his evaluation of subsequent information. The Design-Builder shall not implement revised driving criteria until the Department's Project Manager has been properly notified of the proposed revisions at least 48 hours in advance of the implementation of such modifications.

619518 - BITUMEN COATING ON PILES

Description:

This work shall consist of furnishing and all materials and labor required for applying bituminous coating and primer, and installing oversized steel driving collars to steel pipe pile surfaces as shown on the Plans and as described herein.

Submittals

The Contractor shall submit to the Engineer for review and approval a written Work Plan describing its planned methods for installing oversized steel driving collars and applying primer and bituminous coating to the steel pipe pile surfaces. This Work Plan shall also describe the Contractor's proposed methods of handling, storage, and driving of coated piles. This Work Plan shall be submitted to the Engineer at least thirty days prior to the start of pile driving operations. No pile driving work shall be performed by the Contractor until the Engineer has approved of its work Plans as described herein.

Materials:

Bituminous Coating on Steel

Bituminous coating shall be a canal liner bitumen conforming to AASHTO M 239 (ASTM D2521) and shall have a softening point of 190° F to 200° F., a penetration of 56 to 60 at 77° F., and a ductility in excess of 1.4" at 77° F.

Primer

Primer shall conform to the requirements of AASHTO M 116 (ASTM D41).

Steel Driving Collars

Steel Driving Collars shall conform to the requirements for steel pipe piles as described in Special Provisions 608517 - Steel Pipe Piles, Abutment 4' Diameter.

Construction Requirements:

Install steel driving collars and apply bituminous coating and primer as shown on the Plans and as directed by the Engineer. All fabrication and welding of the steel driving collars required to attached them to the steel pipe piles shall be in accordance with the requirements for steel pipe pile fabrication as described in Special Provision 608517 - Steel Pipe Piles, Abutment 4' Diameter. All surfaces to be coated with bitumen shall be dry and thoroughly cleaned of dust and loose materials. No primer or bitumen shall be applied in wet weather, nor when the temperature and the temperature of the steel pipe pile is below 65° F.

If the Contractor wishes to apply the primer or Bitumen in temperatures below 65° F he shall provide a Work Plan to the engineer for approval to meet the temperature application requirements as described herein.

Application of the prime coat shall be with a brush or other approved means and in a manner to thoroughly coat the surface of the piling with a continuous film of primer at the rate of one gallon per 100 sq.

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ft. of surface. The primer shall be applied to the surfaces and to be dry to the touch before the bituminous coating is applied.

Bitumen coating on steel pipe piles shall be heated to 300° F and applied at a temperature between 200° F and 300° F by one or more mop coats, or other approved means, to apply an average coating depth of 3/16". White-washing of the coating may be required, as directed by the Engineer, to prevent running and sagging of the bituminous coating prior to driving during hot weather.

Bitumen coated steel pipe piles shall be stored immediately after the coating is applied for protection from sunlight and heat. Pile coatings shall not be exposed to damage or contamination during storage, hauling, or handling. The Contractor shall take appropriate measures to preserve and maintain the bitumen coating on the steel pipe piles during storage. Once the bitumen coating has been applied, the Contractor will not be allowed to drag the piles on the ground or to use cable wraps around the pile during handling. Pad eyes, or other suitable devices, shall be attached to the pile to be used for lifting and handling. If necessary, the Contractor shall recoat the piles, at its expense, to comply with these requirements.

The Contractor shall protect the bitumen coating during driving. This includes protection from being scraped off of the pile by the driving leads and protection from being scraped off of the pile by the dense granular soils within the embedded portion of the pile. The bitumen coating may be protected by both proper alignment in the driving leads, pre-augering through the dense granular material of Stratum 1, and the installation of oversized driving collars at regular intervals as shown on the plans.

A nominal length of pile shall be left uncoated where field splices will be required. After completing the field splice, the splice area shall be brush or mop coated with at least one coat of bitumen.

A nominal area of the pile shall be left uncoated where dynamic testing equipment is to be installed on the pile. After dynamic testing of the pile has been completed, including pile restrike testing, the uncoated area shall be brush or mop coated with at least one coat of bitumen.

Method of Measurement:

~~———— The quantity of Bitumen coating applied and accepted will be measured by the square foot.~~

Basis of Payment:

~~———— The quantity of Bitumen coating will be paid for at the Contract unit price per square foot. Price and payment will constitute full compensation for furnishing and placing all materials including, installation of the oversized driving collar, applying the bituminous coating and primer, protection of the coating, storage, handling and provisions for applying in temperatures below 65° F and for all labor, equipment, tools and incidentals required to complete the work.~~

623513 - PRESTRESSING

1.0 DESCRIPTION

The Design-Builder shall be responsible for designing, furnishing, fabricating, storing, installing, stressing and grouting of the prestressing system, including repair and/or replacement of damaged components (if necessary), for the bridge in accordance with the Contract requirements and the criteria established in this Special Provision during all phases of design and construction of the Project.

Complete prestressing system shall include any appurtenant items necessary for the particular prestressing system proposed by the Design-Builder, including but not limited to, anchorage assemblies, additional reinforcing bars required to resist stresses caused by anchorage assemblies, ducts, vents, inlets, outlets, grout used for pressure grouting ducts, and all permanent and incidental materials and labor to install the system in accordance with the Contract requirements.

The term “prestressing” globally includes both pre-tensioning and post-tensioning for structural concrete. The requirements of this Special Provision shall apply directly to post-tensioning systems.

2.0 DEFINITIONS

The following terms apply to prestressing:

- A) Post-Tensioning: The application of a compressive force to the concrete by stressing tendons or bars after the concrete has been cast and cured. The force in the stressed tendons or bars is transferred to the concrete by means of anchorages.
- B) Post-Tensioning Scheme or Layout: The pattern, size and locations of post-tensioning tendons provided by the Design-Builder on the Plans.
- C) Post-Tensioning System: A proprietary system where the necessary hardware (anchorages, wedges, strands, bars, couplers, etc.) is supplied by a particular manufacturer or manufacturers of post-tensioning components.
- D) Pre-Tensioning: The application of a compressive force to the concrete by stressing tendons before the concrete has been cast and cured. The force in the stressed tendons is transferred to the concrete by means of bond and friction along the length of the tendon. Corrosion protection of the ends of the tendons is accomplished by applying a coating of epoxy to the end of the concrete member.
- E) Pre-Tensioning System: A proprietary system where the necessary hardware (anchorages, wedges, strands, etc.) is supplied by a particular manufacturer or manufacturers of pre-tensioning components.
- F) Tendon: A single or group of prestressing elements and their anchorage assemblies, which impart prestress to a structural member or the ground. Also included are ducts, grouting attachments and grout. The main prestressing element is usually a high strength steel member made up of a number of strands, wires or bars.
- G) Strand: An assembly of several high strength steel wires wound together. Strands usually have six outer wires wound in long pitch helix around a single straight wire of a similar diameter.
- H) Wire: A single, small diameter, high strength steel member and, normally, the basic component of strand, although some proprietary post tensioning systems are made up of individual or groups of single wires.
- I) Bar: Post-tensioning bars are high strength steel bars, normally available from 5/8 inch

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- to 1-3/4 inch diameter and usually threaded with very coarse thread.
- J) Coupler: The means by which the prestressing force may be transmitted from one partial length prestressing bar to another.
 - K) Anchorage: An assembly of various hardware components that secure a tendon/bar at its ends after it has been stressed and imparts the tendon/bar force into the concrete.
 - L) Anchor plate: that part of the anchorage hardware that bears directly on the concrete and through which the tendon/bar force is transmitted.
 - M) Wedge: A small conically shaped steel component placed around a strand to grip and secure it by wedge action in a tapered hole through a wedge plate.
 - N) Wedge Plate: A circular steel component of the anchorage containing a number of tapered holes through which the strands pass and are secured by conical wedges.
 - O) Set (Also Anchor Set or Wedge Set): Set is the total movement of a point on the strand just behind the anchoring wedges during load transfer from the jack to the permanent anchorages. Set movement is the sum of slippage of the wedges with respect to the anchorage head and the elastic deformation of the anchor components. For bars, set is the total movement of a point on the bar just behind the anchor nut at transfer and is the sum of slippage of the bar and the elastic deformation of the anchorage components.
 - P) Anticipated Set: Anticipated set is that set which was assumed to occur in the design calculation of the post-tensioning forces immediately after load transfer.
 - Q) Bleed: the autogenous flow of mixing water within or its emergence from, newly placed grout; caused by the settlement of the solid materials within the mass.
 - R) Duct: material forming a conduit to accommodate post-tensioned tendon installation.
 - S) Initial Set of Grout: a degree of stiffening of the grout mixture less than the final set, indicating the time in hours and minutes required for the grout to stiffen sufficiently to resist to an established degree, the penetration of a weighted needle test.
 - T) Final Set of Grout: a degree of stiffening of the grout mixture greater than the initial set, indicating the time in hours and minutes required for the grout to stiffen sufficiently to resist to an established degree, the penetration of a weighted needle test.
 - U) Fluidity: A measure of time, expressed in seconds, necessary for a stated quantity of grout to pass through the orifice of the flow cone.
 - V) Grout: a mixture of cementitious materials and water, with or without mineral additives or admixtures, proportioned to produce a pumpable consistency without segregation of the constituents; injected into the duct to fill the space throughout the prestressing steel, anchorages and ducts.
 - W) Inlet (also inlet pipe or grout injection port): small diameter tubing or duct used for injection of grout into a duct.
 - X) Outlet (also ejection pipe or grout outlet vent or vent): a small diameter tubing or duct used to allow the escape of air, water, grout and bleed water.
 - Y) Thixotropic: the property of a material that enables it to stiffen in a short time while at rest, but to acquire a lower viscosity when mechanically agitated, the process being reversible. Grouts having thixotropic properties can be highly resistant to bleed. Admixtures that may produce thixotropic properties include anti-bleed admixtures and silica fume.

3.0 SHOP DRAWINGS

The Design-Builder shall submit to the Department for review and comment detailed shop drawings that include, but are not limited to:

- A) A complete description of, and details covering, each of the prestressing systems (temporary and permanent) to be used for tendons and/or bars. This shall include:
 - 1) Designation of the specific prestressing steel, anchorage devices, bar couplers, duct material and accessory items.
 - 2) Properties of each of the components of the prestressing system.
 - 3) Details covering assembly of each type of prestressing tendon or bar.
 - 4) Equipment to be used in the prestressing sequence.
 - 5) Procedure and sequence of operations for prestressing and securing tendons and/or bars.
 - 6) Procedure for releasing the prestressing steel elements.
 - 7) Parameters to be used to calculate the typical tendon/bar force such as: expected friction coefficients, anchor set and prestress steel relaxation curves.
- B) A table detailing the prestressing jacking sequence, jacking forces and initial elongations of each tendon at each stage of erection for all prestressing.
- C) Complete details of the anchorage system for prestressing including certified copies of the reports covering tests performed on prestress anchorage devices as required in the Materials Section, and details for any reinforcing steel needed due to stresses imposed in the concrete by anchorage plates.
- D) For the operation of grouting prestressing tendons/bars: the materials and proportions for grout, details of equipment for mixing and placing grout and methods of mixing and placing grout; also, locations and details of inlets and outlets for grouting and the direction of grouting.
- E) Calculations to substantiate the prestressing system and procedures to be used including stress-strain curves typical of the prestressing steel to be furnished, required jacking forces, elongation of tendons during tensioning, seating losses, short-term prestress losses, long-term prestress losses, temporary overstress, stresses in prestress anchorages including distribution plates and reinforcing steel needed in the concrete to resist stresses imposed by prestress anchorages. These calculations shall show a typical tendon force after applying the expected friction coefficient, anticipated thermal affects and anticipated losses for the stressing system to be used including anchor set losses.
- F) Elongation calculations shall be revised when necessary to properly reflect the modulus of elasticity of the wire or strand as determined from in place friction testing in accordance with the Materials Section.
- G) Complete details of the apparatus and method to be used by the Design-Builder for the testing required by the Materials Section.

4.0 MATERIALS

All materials to be incorporated into the prestressing system shall be in accordance with the requirements set out herein.

4.1 PRESTRESSING STEEL

- A) Strand: Strand shall be uncoated, Grade 270 low relaxation 7 wire strand conforming to requirements of ASTM A 416.
- B) Thread Bar: Prestress bars shall be uncoated, Grade 150 high strength deformed thread bars conforming to the requirements of ASTM A 722, Type II.
- C) Wires: Wire shall be uncoated, low relaxation wire conforming to the requirements of ASTM A 421.

4.2 THREAD-BAR COUPLERS

Thread bar couplers shall meet the requirements of ASTM A 722. Bar couplers shall be used only at locations approved by the Department. A bar coupler shall develop the required ultimate strength of the bar with a minimum elongation of two percent when tested in the unbonded condition measured in 10 foot gauge lengths, without failure of the coupler or the thread bar.

Testing of couplers shall be performed using samples of the prestressing bar to be used on the Project. The test specimen shall be assembled in an unbonded state and, in testing, the anticipated set shall not be exceeded.

Only threaded type couplers shall be used with post-tensioning thread bars. Post-tensioning thread bars shall be threaded into 1/2 the length of the coupler + 1/4 inch so that when two bars are mated in a coupler, the length of each bar positively engaged in the coupler shall be half the coupler's length within the acceptable tolerances. No coupling or splicing will be permitted with strands.

4.3 PRESTRESS ANCHORAGES

All prestressing steel shall be secured at the ends by means of permanent type anchoring devices. Prestress anchorages shall develop at least 95 percent of the minimum specified ultimate tensile strength of the prestressing steel. Wedges shall be three-part (Two part wedges shall not be used).

Testing of anchorage devices shall be performed using samples representing the type of prestressing steel and concrete strength to be used on the Project. The test specimen shall be assembled in an unbonded state and, in testing, the anticipated anchor set shall not be exceeded. Certified copies of test results for the anchorage system shall be supplied to the Department. The anchorage system shall be so arranged that the prestressing force in the tendon may be verified prior to the removal of the stressing equipment.

For tendon anchorages, the design and furnishing of any local zone reinforcement which is needed to resist bursting and splitting stresses imposed on the concrete by the proposed anchorage system shall be the responsibility of the Design-Builder.

Prestress anchorage devices shall effectively distribute prestressing loads to the concrete and shall conform to the following requirements:

- A) The bearing stress in the concrete created by the anchorage plates shall comply with "AASHTO LRFD Bridge Design Specifications."
- B) Bending stresses in the plates or assemblies induced by the pull of the prestressing steel shall not exceed the yield point of the material in the anchorage plate when 95 percent of the ultimate strength of the tendon is applied. Nor shall it cause visual distortion of the anchor plate as determined by the Department.

4.4 DUCTS

All duct material shall be sufficiently rigid to withstand loads imposed during placing of concrete and internal pressure during grouting while maintaining its shape, remaining in proper alignment and remaining watertight.

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The duct system, including splices and joints shall effectively prevent entrance of cement paste or water into the system and shall effectively contain pressurized grout during grouting of the tendon. The duct system shall also be capable of withstanding water pressure during flushing of a duct in the event the grouting operation is aborted.

The interior diameter of ducts for single strand, bar or wire tendons shall be at least ¼ inch greater than the nominal diameter of the tendon. The interior diameter of ducts for tendons consisting of more than one strand, bar or wire shall be such that the interior area of the empty duct is not less than 2.25 times the net area of the prestressing steel.

4.4.1 Duct Type Designation

- A) Type A: Galvanized Rigid Steel Pipe (Sch 40)
- B) Type B: Galvanized Rigid Steel Pipe (Sch 10)
- C) Type C: Corrugated Plastic
- D) Type D: Smooth Plastic

Specific Duct Applications			
Number of Strands in Tendon		Tendon Radius (R) ft.	Duct Type Material
0.5 inch dia.	0.6 inch dia.		
---	4 (Transverse Flat Duct)	10 or more	C
1 to 13	1 to 8 (Round Duct)	30 or more 10* to 30 2 to 10	A, B, C A A
14 to 18	9 to 13	30 or more 12* to 30 2.5 to 12	A, B, C A A
19 to 32	14 to 37	50 or more 25* to 50 3 to 25	A, B, C A A
* - This radius is the minimum radius allowed for a tendon unless otherwise approved by the Department based upon test data.			

4.4.2 Duct Type Designation Notes:

- A) Type D duct material shall only be used for those portions of a tendon not embedded in concrete. External ducts shall be Type D.
- B) Type A duct material shall be used throughout the entire length of the particular element where an external tendon is embedded in a deviation block, beam or diaphragm.
- C) Type A duct material which is embedded shall be bent to a uniform radius along a curve extending between tangent points located 3 inch inward from the face of the deviation block, beam or diaphragm.
- D) Type A or B duct material shall be used in all areas classified as mass concrete. Grout vents and inlets shall consist of galvanized rigid steel pipe (Sch 40) with watertight

connections.

- E) Type B duct material shall be used for portions of tendons embedded in mass concrete elements not required to be Type A duct material due to their tendon radius
- F) Type C duct material shall be used in environments designated as aggressive exposure.

4.4.3 Specific Material Properties of Ducts and Attachments

- A) Type A Galvanized Rigid Steel Pipe (Sch 40). Steel pipe duct shall be galvanized steel pipe conforming to the requirements of ASTM A 53, Type 3, Grade B. The nominal wall thickness of the pipe shall not be less than that of Schedule 40. The pipe shall be bent so as to accurately conform to the alignment of the tendon taking into consideration the minimum bending radius shown in the contract plans or shop drawings.
- B) Type B Galvanized Rigid Steel Pipe (Sch 10). Steel pipe duct shall be galvanized steel pipe conforming to the requirements of ASTM A 53, Type 3, Grade B. The nominal wall thickness of the pipe shall not be less than that of Schedule 10. The pipe shall be bent so as to accurately conform to the alignment of the tendon taking into consideration the minimum bending radius shown in the contract plans or shop drawings.
- C) Type C Corrugated Plastic (HDPE or HDPP). Plastic duct shall be made of either high-density polyethylene (HDPE) or high-density polypropylene (HDPP). HDPE shall conform to ASTM D3350 02a, cell classification range 424432C to 335534C. HDPP shall conform to ASTM D4101, cell classification range PP210B43542 to PP210B65542.
 - 1) Plastic duct shall be corrugated with a pitch not less than 1/10 of the radius of the duct. Material thickness shall be 0.08 inch as manufactured, and 0.06 inch after tensioning.
 - 2) Corrugated plastic duct shall be designed so that a force equal to 40 percent of the ultimate tensile strength of the tendon will be transferred through the duct into the surrounding concrete in a length of 2.5'. Twelve static pull out tests shall be conducted to determine compliance of a duct with the force transfer requirement. If ten (10) of these tests exceed the specified force transfer, the duct is acceptable. The Design-Builder shall provide to the Department certified test reports verifying that the duct meets specification requirements in regard to force transfer.
 - 3) To satisfy the intent of these tests, the results for static pull out tests from previous Projects utilizing identical duct and prestressing steel with similar concrete and grout material may be submitted to the Department in lieu of executing new pull out tests. However, if the previous results are unacceptable or if there is a significant difference in the materials used, then the Design-Builder shall provide results from new tests for this Project.
- D) Type D Smooth Plastic for External Tendons. Ducts for external tendons inside box girders shall be black, smooth, high density polyethylene pipe (HDPE) with a minimum wall thickness of $D_o/18$, where D_o denotes outside diameter with a minimum Hydrostatic Design Basis (HDB) of 1,250 psi conforming to one of the following designations:
 - 1) ASTM D 2239 or ASTM D 3035, cell classification PE345433C
 - 2) ASTM F 714, cell classification PE 345433C
 - 3) ASTM D 2447, grade P33 or P34
- E) Inlets and Outlets (Ports or Vents) for Grout. Inlets (Grout Injection Ports) shall be provided for injecting grout into the duct. Outlets (Grout Exit Vents) shall allow the

escape of air, water, grout and bleed water. The inner diameter of inlets and outlets shall be at least 3/4 inch for strand tendons and 3/8 inch for single bar tendons. Inlets and outlets shall be of flexible, HDPE or HDPP pipe (except as noted below for inlets and outlets in mass concrete). Plastic components, if selected, shall not react with concrete or enhance corrosion of the post-tensioning steel, and shall be free of water soluble chlorides. Inlets and outlets shall be located and attached in accordance with Construction Methods Section "Installation of Ducts, Grout Injection Ports and Outlet Vents" below. Inlets and outlets placed in mass concrete elements shall be Schedule 10 Rigid Steel Pipe (galvanized).

4.4.4 Minimum Radius of Curvature

Tendon ducts shall preferably be installed with a radius of curvature of 20' or more. Ducts with sharper curvature down to a minimum of 10' shall have confinement reinforcement detailed to tie the duct into the concrete. Duct curvature with radii less than 10' may be approved by the Department based on review of test data. The minimum radius for corrugated polyethylene duct shall be 30'. The confinement reinforcement shall be proportioned in accordance with "AASHTO LRFD Bridge Design Specification."

4.5 GROUT

Grout for tendons shall consist of Portland Cement, potable water, mineral admixtures for partial cement replacement and other specified admixtures which impart low water content, flow, fluidity, minimum bleeding, non-shrink and, when necessary, set retarding properties to the grout. Also, when specified, the grout shall have enhanced corrosion resisting properties such as increased resistance to chloride penetration. There shall be no deliberate addition of materials containing chlorides.

Commercial, prepackaged, cement based grout mixtures, meeting the requirements of this Special Provision, may be used subject to approval by the Department.

4.5.1 Classification of Grouts

Two classifications of grouts are used in this specification to reflect different requirements depending on exposure conditions. Exposure conditions shall be determined by the Design-Builder and noted in the Plans for review and comment by the Department.

4.5.1.1 Normal Grout

Normal Grout is to be used only in non-aggressive exposure conditions. The primary constituents of Normal Grout are cement and water. Chemical admixtures may be required, but mineral admixtures such as silica fume and fly ash would not normally be compulsory to meet the performance criteria for Normal Grout. In general, Normal Grout will not have thixotropic properties.

4.5.1.2 Enhanced Grout

Enhanced Grout is to be used in all aggressive exposure conditions or as otherwise required for this Project. Enhanced Grout will normally contain both mineral admixtures for partial cement replacement and chemical admixtures to provide improved corrosion protection and resistance to bleed. Enhanced Grout may or may not have thixotropic properties, depending on the admixtures used.

4.5.2 Grout Ingredients

Both Normal Grout and Enhanced Grout may be in the form of commercial, prepackaged, cement based grout mixtures, meeting the requirements of this Specification, and subject to approval by the Department.

4.5.2.1 Cement

Portland Cement shall conform to requirements of AASHTO M 85 Type I or Type II. The cement shall be fresh and not contain lumps or other indication of hydration or "pack set". The Design-Builder shall

furnish the Department, for each shipment of cement, a manufacturer's report stating results of tests made on samples of the material taken during production or transfer and certifying compliance with the applicable requirements of AASHTO M 85.

4.5.2.2 Cement Replacement for Enhanced Grout

The following cementitious materials may be used for cement replacement in order to enhance the corrosion resisting and durability characteristics of grout used for aggressive environments.

- A) Silica Fume: 5 to 15% replacement by weight of Portland Cement
- B) Fly Ash (Class C): 0 to 35% replacement by weight of Portland Cement.
- C) Fly Ash (Class F): 0 to 25% replacement by weight of Portland Cement.
- D) Slag: 0 to 55% replacement by weight of Portland Cement.

The water content shall be calculated for the total weight of cementitious material (cement + replacement material) and expressed as water/cementitious ratio.

4.5.2.3 Water

Water shall be potable, clean and free of injurious quantities or substances (chlorides, sulfides, sulfates and nitrates) known to be harmful to Portland Cement or prestressing steel.

Water shall have chloride, sulfide, sulfate, and nitrate contents not greater than 20, 100, 15 and 13 ppm respectively.

Water used for grouting tendons shall be tested for the chemicals noted above at regular intervals not to exceed 120 days. Water shall be tested at the location where the water is placed into containers for the Project. If the water is stored in containers, which might contaminate it (e.g. unlined metal tanks) then the Department can request that tests be performed on water coming from the storage tanks.

4.5.2.4 Admixtures

Admixtures shall consist of chemicals that impart the following properties when incorporated into the grout mixture. These properties are low water content, good flow, fluidity, minimum bleeding (sedimentation of cement), expansion or non-shrink and, when necessary, increase in setting time. Any admixture containing chlorides, sulfites, fluorides or nitrates shall not be used in the grout. The date of manufacture and shelf life shall be clearly stamped on each container. No admixture shall be used for which the shelf life recommended by the manufacturer has expired.

4.5.2.5 Non-Shrink Properties and Expansion Agents

Grout shall have non-shrink properties. However, gas evolving expansion agents and/or additives containing free aluminum, shall not be used.

4.5.2.6 Corrosion Inhibitors

Corrosion inhibiting chemical admixtures shall not be used.

4.5.2.7 Chloride Ion Content

All constituent materials shall be such that the acid soluble chloride ion content of the grout shall not exceed 0.08% by weight of Portland Cement as measured by ASTM C1152 "Standard Test Method for Acid Soluble Chloride in Mortar and Concrete."

4.5.3 Grout Properties

The Design-Builder shall determine the exact material proportions and admixture requirements to meet the requirements of the Section. Laboratory trial batches of the proposed grout mix shall be prepared

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using the same materials to be used on the job site. Trial batches shall be subjected to the tests described in this Section at a Laboratory approved by the Department to demonstrate that the proposed grout mix meets the requirements of this Specification. Testing shall be performed by personnel experienced in testing of grouts, and under temperature and humidity conditions expected at the site.

Laboratory testing requirements may be waived at the discretion of the Department if:

- A) The Design-Builder proposes to use a commercial prepackaged grout that has previously met the requirements of this Specification as independently certified by a Laboratory approved by the Department; or
- B) The results of earlier tests (not exceeding 12 months) on grouts with the same design, same material sources and same procedures are satisfactory and within the requirements of this Specification.

Prior to beginning grouting operations, the Design-Builder shall furnish the Department with a report detailing the results of all laboratory testing, including the types and number of tests performed, test procedures, results and comparison of results with specified values.

In order to qualify, Normal Grout shall have the physical properties listed in Table 1 when mixed, prepared and tested in a Laboratory approved by the Department.

In order to qualify, Enhanced Grout shall have the physical properties listed in Table 1 and Table 2 when mixed, prepared and tested in a Laboratory approved by the Department.

Table 1 – Physical Property Requirements for Normal Grout and Enhanced Grout		
Physical Property	Requirement	Test Method
Water-Cementitious Material Ratio	Maximum 0.45	n/a
Setting Time	Minimum 3 hours Maximum 12 hours	ASTM C953
Grout Cube Strength	Min. 3,000 psi at 7 days Min. 5,000 psi at 28 days	ASTM C942
Pumpability and Fluidity for Non-Thixotropic Grouts (Flow Cone Efflux Time)	Immediately after mixing: Min. 20 sec., Max. 30 sec. After letting stand for 30 min. and remixing for 30 sec.: Max. 30 sec.	ASTM C939
Control of Bleed (Wick Induced Bleed Test)	Max. 0% bleed after 3 hours	ASTM C940, Modified *

* - The modified version of ASTM C940 is described in the PTI "Guide Specification for Grouting of Post Tensioned Structures."

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Table 2 – Additional Physical Property Requirements for Enhanced Grout		
Physical Property	Requirement	Test Method
Permeability	2, 500 (max.) Coulombs after 6 hours **	ASTM C1202 **
Volume Change	Vertical height change of cylinder: 0.0% to 0.1% at 24 hours Less than 0.2% at 28 days	ASTM C1090
Pumpability and Fluidity for Thixotropic Grouts (Modified Flow Cone Efflux Time for 1 liter discharge***)	Immediately after mixing: Min. 9 sec., Max. 20 sec. After letting stand for 30 min. and remixing for 30 sec.: Max. 30 sec.	ASTM C939 ***
Control of Bleed	See Table 2A****	Pressure Bleed Test****

** - When evaluating grouts, the ASTM C1202 procedure shall be modified to perform the test at 30 volts rather than 60 volts. Testing shall be performed on grout samples at 28 days of age. For grouts containing pozzolanic mineral admixtures, testing may be performed on grout samples at 90 days of age.

*** - Grouts containing anti-bleed admixtures or silica fume may have thixotropic characteristics. For Enhanced Grouts with thixotropic properties, the modified flow cone efflux time shall be measured, and the pumpability and fluidity requirements of Table 2 shall supercede those of Table 1. The modified version of C939 involves filling the flow cone to the top instead of the standard level, and the efflux time is measured as the time to fill a 1-liter container placed directly under the flow cone. If an Enhanced Grout does not have thixotropic properties, the pumpability and fluidity requirements of Table 1 shall apply.

**** - The Pressure Bleed Test using Gelman Filter Funnel is described in the PTI "Guide Specification for Grouting of Post-Tensioned Structures." The pressure to be used during the test is a function of the maximum expected vertical rise in the tendon under consideration, as indicated in Table 2A.

Table 2A – Bleed Under Pressure Limits for Enhanced Grouts		
Maximum. Vertical Rise Along Tendon, x	Gelman Pressure	Bleed After 10 min. (% of sample volume)
0 ft ≤ x ≤ 2 ft	20 psi	4%
2 ft < x ≤ 6 ft	30 psi	2%
6 ft < x < 100 ft	50 psi	0%

5.0 SAMPLING AND TESTING

5.1 PRESTRESSING ELEMENTS

All testing shall be done in accordance with ASTM Specifications. The following samples of materials and devices selected at locations designated by the Department shall be furnished by the Design-Builder at his expense:

- A) Three samples of 7' long prestressing wire or bar for each size from each heat number or production lot.
- B) Three samples of 5' long prestressing strand for each size from each heat number or production Lot.
- C) If bar couplers are to be used, three samples with two specimens each consisting of 4' lengths of the specific prestressing bar coupled with a bar coupler from the materials to be used on the Project.
- D) One unit of each prestress anchorage to be used on the Project. For each type of duct material intended for the Project, one sample, 4' long, from each production lot or per 10,000 linear feet, whichever is greater.

Samples shall be furnished at least 90 days in advance of the time they are to be incorporated into the work. The Department reserves the right to reject for use any material or device that is obviously defective or was damaged subsequent to testing.

5.1.1 Manufacturer's Lots (Design-Builder's Quality Control)

The manufacturer of prestressing steel, prestress anchorages and bar couplers shall assign an individual number to each Lot of strand, wire, bar or devices at the time of manufacture. Each reel, coil, bundle or package shipped to the Project shall be identified by tag or other acceptable means as to Manufacturer's Lot number. The Design-Builder shall be responsible for establishing and maintaining a procedure by which all prestressing materials and devices can be continuously identified with the manufacturer's Lot number. Items that at any time cannot be positively identified as to lot number shall not be incorporated into the work.

Low relaxation strand shall be clearly identified as required by ASTM A 416. Any strand not so identified will not be acceptable.

The Design-Builder shall furnish to the Department manufacturer's certified reports covering the tests required by this Specification. A certified test report stating the guaranteed minimum ultimate tensile, yield strength, elongation and composition shall be furnished to the Department for each lot of prestressing steel. When requested, typical stress-strain curves for prestressing steel shall be furnished. A certified test report stating strength when tested using the type prestressing steel to be used in the work shall be furnished to the Department for each Lot of prestress anchorage devices.

5.1.2 Testing of Prestressing Tendons by the Design-Builder

The Design-Builder shall perform certain testing of prestressing tendons as specified herein.

5.1.2.1 In Place Friction Test of Tendons

For the purpose of accurately determining the friction loss in stressing draped or sloped tendons, prior to stressing a draped tendon, the Design-Builder shall test, in place, a draped tendon selected by the Department. If deemed necessary by the Department to accurately establish friction loss, the Design-Builder shall perform tests on additional tendons selected by the Department. The test procedure shall consist of stressing a tendon at an anchor assembly with the dead end anchor incorporating a calibrated load cell. The results of the tests (loss due to friction and modulus of elasticity) shall be submitted to the Department. Apparatus and methods used to perform the tests shall be proposed by the Design-Builder

and be subject to the approval of the Department. The Design-Builder shall notify the Department at least two weeks in advance of performing a friction test.

5.1.2.2 Dynamic Testing of Unbonded Tendons

Unbonded tendons are defined as tendons located essentially external to the concrete. For unbonded superstructure tendons, the Design-Builder shall perform two dynamic tests on a representative specimen and the tendon shall withstand, without failure, 500,000 cycles from 60 percent to 66 percent of its minimum specified ultimate strength. In the second test the tendon shall withstand without failure 50 cycles from 40 percent to 80 percent of its minimum specified ultimate strength. The period of each cycle involves the change from the lower to the upper stress level and back to the lower. The specimen used for the second dynamic test need not be the same used for the first dynamic test. Systems utilizing multiple strands, wires, or bars shall be tested utilizing a test tendon of full size. The Design-Builder shall notify the Department at least two weeks in advance of performing a dynamic test. In lieu of the dynamic testing, the Design-Builder may submit data from prior tests. Acceptance of data from prior tests is subject to the approval of the Department.

5.2 GROUT

Acceptance testing for grout physical properties shall be performed during grouting operations as provided below.

In order to qualify, Normal Grout shall have the physical properties listed in Table 3 when mixed, prepared and tested on site during grouting operations.

In order to qualify, Enhanced Grout shall have the physical properties listed in Table 4 when mixed, prepared and tested on site during grouting operations.

In order to qualify, Commercial Prepackaged Grout that has previously met the requirements of this Specification (see Materials Section “Grout Properties”) as independently certified by a Laboratory approved by the Department, shall have the physical properties listed in Table 5 when mixed, prepared and tested on site during grouting operations.

For large Projects with extensive grouting requirements, the frequency of testing listed in Tables 3, 4 and 5 may be reduced at the discretion of the Department.

Table 3 – Acceptance Testing Requirements for Normal Grout			
Physical Property	Frequency of Testing *	Requirement	Test Method
Grout Cube Strength	One strength test per 2 cubic yards of grout	Min. 3,000 psi at 7 days Min. 5,000 psi at 28 days	ASTM C942
Pumpability and Fluidity (Flow Cone Efflux Time)	For each 2 cubic yards of grout or every 2 hours of grouting: One (1) test after mixing and before injection, One (1) test on grout collected at duct outlet	Immediately after mixing: Min. 20 sec, Max. 30 sec. After collection at duct outlet: Max. 30 sec.	ASTM C939

* - Each test shall be performed at least once per grouting operation.

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Table 4 – Acceptance Testing Requirements for Enhanced Grout			
Physical Property	Frequency of Testing *	Requirement	Test Method
Grout Cube Strength	One strength test per 2 cubic yards of grout	Min. 3,000 psi at 7 days Min. 5,000 psi at 28 days	ASTM C942
Pumpability and Fluidity (Flow Cone Efflux Time)	For each 2 cubic yards of grout or every 2 hours of grouting: One (1) test after mixing and before injection, One (1) test on grout collected at duct outlet	Thixotropic Grouts** Modified Flow cone Efflux Time: 1) Immediately after mixing: Min. 9 sec., Max. 20 sec. 2) After collection at duct outlet: Max. 30 sec.	ASTM C939
Volume Change (Vertical height change of cylinder)	One test per 2 cubic yards of grout	0.0% to 0.1% at 24 hours Less than 0.2% at 28 days	ASTM C1090
Control of Bleed	One test per 2 cubic yards of grout, sample taken at mixer	See Table 2A***	Pressure Bleed Test ***

* - Each test shall be performed at least once per grouting operation.

** - Grouts containing anti-bleed admixtures or silica fume may have thixotropic characteristics. The modified version of ASTM C939 involves filling the flow cone to the top instead of the standard level, and the efflux time is measured as the time to fill a 1-liter container placed directly under the flow cone.

*** - The Pressure Bleed Test using Gelman Filter Funnel is described in the PTI Grouting Specification (until the PTI document is published, Appendix B includes requirements for this test). The pressure to be used during the test is a function of the maximum expected vertical rise in the tendon under consideration, as indicated in Table 2A.

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Table 5 – Acceptance Testing Requirements for Prepackaged Grout

Physical Property	Frequency of Testing *	Requirement	Test Method
Pumpability and Fluidity (Flow Cone Efflux Time)	For each 2 cubic yards of grout or every 2 hours of grouting: One (1) test after mixing and before injection, One (1) test on grout collected at duct outlet	Non- Thixotropic Grouts Flow Cone Efflux Time: 1) Immediately after mixing: Min. 20 sec., Max. 30 sec. 2) After collection at duct outlet: Max. 30 sec. Thixotropic Grouts** Modified Flow Cone Efflux Time: 1) Immediately after mixing: Min. 9 sec., Max. 20 sec. 2) After collection at duct outlet: Max. 30 sec.	ASTM C939 ASTM C939, Modified

* - Each test shall be performed at least once per grouting operation.

** - Grouts containing anti-bleed admixtures or silica fume may have thixotropic characteristics. The modified version of ASTM C939 involves filling the flow cone to the top instead of the standard level, and the efflux time is measured as the time to fill a 1-liter container placed directly under the flow cone.

6.0 CONSTRUCTION REQUIREMENTS

6.1 PROTECTION OF PRESTRESSING STEEL PRIOR TO INSTALLATION

Before installation of tendons in ducts, all prestressing steel shall be protected against physical damage at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. Any reel that is found to contain broken wires shall be rejected and the reel replaced.

Prestressing steel shall be packaged in containers or shipping forms for protection of the steel against physical damage and corrosion during shipping and storage. A corrosion inhibitor, which prevents rust or other results of corrosion, shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material, or when permitted by the Department, a corrosion inhibitor may be applied directly to the steel. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Inhibitor carrier type packaging material shall conform to the provisions of Federal Specifications MIL P 3420. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.

The prestressing steel shall be stored in a manner which will at all times prevent the packing material from becoming saturated with water and allow a free flow of air around the packages. If the useful life of the corrosion inhibitor in the package expires, it shall immediately be rejuvenated or replaced.

At the time the prestressing steel is installed in the work, it shall be free from loose rust, loose mill scale, dirt, paint, oil, grease or other deleterious material. Removal of tightly adhering rust or mill scale will not be required. Prestressing steel that has experienced rusting to the extent it exhibits pits visible to the naked eye shall not be used in the work.

The shipping package or form shall be clearly marked with the heat number and with a statement that the package contains high strength prestressing steel, and care is to be used in handling. The type and amount of corrosion inhibitor used, the date when placed, safety orders and instructions for use shall also be marked on the package or form.

6.2 PROTECTION OF PRESTRESSING STEEL DURING AND AFTER INSTALLATION

The prestressing steel shall be protected from corrosion and the duct system shall be sealed to prevent moisture intrusion from the time of tendon installation to the time of grouting, as provided below.

As discussed in Construction Methods Section 6.3, “Installation of Ducts, Grout Injection Ports and Outlet Vents”, the ends of ducts and anchorages and all duct connections shall be sealed at all times following installation in the forms to prevent entry of moisture and debris. In addition, all grout ports and vents shall be closed or plugged at all times during the period prior to grouting.

Grouting shall proceed as soon as possible after installation and stressing of the tendons. The time from installing the tendons in an unstressed condition to grouting after stressing shall not exceed the following without approval of the Department:

- A) Very damp atmosphere (RH > 70%) or over salt water = 7 days
- B) Moderate to dry atmosphere (RH < 70%) = 10 days

6.2.1 Tendon Protection Between Installation and Stressing

Measures shall be taken to protect the prestressing steel when there is a period of more than 24 hours between installation of the tendons in ducts and stressing. Bare strand projecting out of the duct shall be wrapped continuously in plastic sheeting and sealed using waterproof tape. The plastic wrap shall extend to the tendon anchorage, and the anchorage opening shall be sealed with plastic and waterproof tape sufficient to prevent moisture intrusion. All grout ports and vents shall be closed or plugged, and all duct connections shall be sealed.

6.2.2 Tendon Protection During Staged or Segmental Construction

When plans provide for the tendons to be installed in one unit or segment, either longitudinally, transversely or vertically, with a length of bare strand left projecting for purposes of threading into another unit or segment during later erection operations, the provisions described in Construction Methods Section 6.1, “Protection of Prestressing Steel” shall apply. All of the prestressing steel shall be protected immediately after it is first installed in the first unit or segment until the tendon is grouted in the second unit or segment.

6.2.3 Tendon Protection Between Stressing and Grouting

Anchorages should be capped or otherwise sealed again immediately following stressing and cutting of strand tails.

In aggressive exposures where permanent end anchorage protection caps are to be used, the time period between stressing and installation of the permanent end caps shall not exceed 12 hours without approval of the Department.

In non-aggressive exposures, permanent grout caps may or may not be in use. If permanent grout caps are to be used, grout caps shall be installed within 48 hours of stressing. If permanent grout caps are not used, the end anchorage region of the tendon shall be sealed against moisture intrusion using plastic sheeting and waterproof tape within 48 hours of stressing.

In all cases, tendons and ducts shall be thoroughly blown dry with oil free compressed air immediately prior to sealing or capping of the anchorages. In addition, all grout ports and vents shall remain plugged, sealed or otherwise capped, and all duct connections shall be sealed.

6.2.4 Use of Temporary Corrosion Inhibitors

The time between the first installation of the post-tensioning steel in the duct and the completion of the stressing and grouting operations shall not exceed the time specified in Section 6.2 unless the use of a corrosion inhibitor is approved by the Department. The corrosion inhibitor shall not reduce the bond between the post-tensioning steel and the grout or the grout and the ducts, and the removal of the corrosion inhibitor shall not introduce remnant moisture into the ducts or annular spaces between the wires of the post-tensioning strand. Any light surface corrosion forming during this period will not be cause for rejection of the post-tensioning steel.

6.3 INSTALLATION OF DUCTS, GROUT INJECTION PORTS AND OUTLET VENTS

6.3.1 Ducts

Ducts shall be securely tied in position, carefully inspected and repaired before placing of the concrete is started. Care shall be exercised during placement of the concrete to avoid displacing or damaging the ducts. Internal ducts shall be supported at intervals necessary to prevent deflection and or displacement, not to exceed 4'. Any additional mild reinforcing required to support post-tensioning ducts shall be supplied by the Design-Builder. The tolerance on the location of the tendons shall be plus or minus 1/4 inch at any point. After installation in the forms, the ends of ducts shall at all times be sealed to prevent entry of water and debris.

6.3.2 Grout Inlets and Outlets

Pipes, as specified in the Construction Methods Section “Grouting”, shall be installed on each duct to serve as injection or vent ports during grouting. These shall be at locations shown on the approved Shop Drawings and in accordance with the following:

- A) Inlets (Grout Injection Ports) shall be provided for injecting grout into the duct.
- B) Outlets (Grout Exit Vents) shall allow the escape of air, water, grout and bleed water. The inner diameter of inlets and outlets shall be at least 3/4 in. for strand tendons and 3/8 in. for single bar tendons.
- C) Inlets and Outlets shall be of flexible HDPE or HDPP pipe, except in mass concrete.
- D) The length of an inlet port or outlet vent shall extend sufficiently out of the concrete to allow for proper closing. At all high points the outlet shall connect at the uppermost part of the duct profile.
- E) Inlets and Outlets shall be placed at locations shown on the Shop Drawings, and on the Grouting Operation Plan (below).
 - 1) At the top of each tendon anchorage and top of grout cap.
 - 2) At each high point of the duct profile when the vertical distance between the highest and lowest point is more than 20 inch.
 - 3) An outlet at each low point of the tendon.
 - 4) An inlet at the lowest point of the tendon. Note judgment should be used in locating the lowest point. For example, if the absolute low point is in a deviation block for an external tendon, then place the inlet close to the block in the accessible portion of the duct.
 - 5) At all low points the inlet/outlet shall be free draining.
 - 6) At major changes in the cross section of the duct, such as couplers and anchorages.
 - 7) At each side of couplers.

- 8) At a distance of approximately 3 ft. from each high point in the direction of grout flow.
- 9) For external tendons, provide vents as close to the inside face of the diaphragm as practical, located on the top of the duct.
- 10) At other locations recommended by the Department.
- F) All connections to ducts shall be made with metallic or plastic structural fasteners. Waterproof tape shall also be used at all connections including vent and grouting pipes, except where otherwise specified herein. Vents shall be mortar tight, taped as necessary, and shall provide means for injection of grout through the vents and for sealing the vents by mechanical shut off valves.
- G) All inlet and outlets shall be permanently sealed to prevent water infiltration to the grouted tendon. Sealing details are to be submitted for review and comment to the Department.
- H) All grout injection and vent pipes shall be fitted with positive mechanical shut off valves. Vents and injection pipes shall be fitted with valves, caps or other devices capable of withstanding the pumping pressures.
- I) Inlets and outlets will not be required for the Temporary Post-Tensioning Bars.

6.3.3 Standpipes for Vertical Tendons

For all vertical tendons, which have strands as the prestressing steel, a standpipe shall be provided at the upper end of the tendon to store bleed water and allow it to be reabsorbed by the grout. This device shall be designed so that the level of the grout can be brought to an elevation which will assure that bleeding or subsidence will at no time cause the level of the grout to drop below the highest point of the upper anchorage device. It will also be designed so that as bleed water migrates to the top, grout is able to migrate downward to replace it. Provision shall be made to assure that bleed water rises into the standpipe, not into the uppermost part of the tendon and anchorage device.

6.3.4 Care and Protection of Ducts, Vents, Anchorages and Blockouts

Care shall be taken to ensure that all ducts, anchorages, blockouts, openings and vents are kept clean and free of debris, fuel, oils, other contaminants and site trash at all times prior to and after installing the tendons. Temporary plugs, seals and covers shall be used. Minor damage to ducts may be repaired by removing the local damage and splicing duct or couplers onto the intact section (prior to the placing of concrete). Repair of major duct damage requires the removal and replacement of the entire duct section.

Connections from grout hose to inlet and ejection ports and to vents shall be kept free from dirt and airtight.

6.3.5 Pre-Grouting Air Pressure Test of Duct System

Following assembly of the complete duct system, including installation of all ducts, grout inlets and outlets, couplers and connections, and immediately prior to placement of the prestressing tendon or after stressing of the tendon, an air pressure test shall be performed on each complete duct system.

The air pressure test shall involve pressurizing the complete duct system with dry, oil free air to 1.5 psi, and monitoring the pressure in the system for a period of 5 minutes. If the pressure loss during this 5 minute period exceeds 10%, all sources of leakage shall be identified, and measures shall be taken to reduce or eliminate the identified leaks, such that upon repeating the pressure test, the pressure loss is limited to less than 10% in 5 minutes.

The operation of each vent shall be tested by blowing dry, oil free air into the duct system and opening and closing each vent in turn.

6.4 POST-TENSIONING OPERATIONS, GENERAL REQUIREMENTS

6.4.1 Concrete Strength

Post-tensioning shall only be applied when the concrete has attained the required compressive strength as determined from test cylinders cured under the same conditions as the structural concrete. The design of the structure is based on the assumed friction and wobble coefficient shown in the plans.

6.4.2 Stressing Tendons

All post tensioning shall be tensioned by means of hydraulic jacks. Monostrand stressing shall not be used for tendons with 5 or more strands.

6.4.3 Maximum Stress at Jacking

The maximum temporary tensile stress at jacking in prestressing steel shall not exceed 80 percent of the specific minimum ultimate tensile strength of the prestressing steel. Tendons shall not be overstressed to achieve elongation.

6.4.4 Initial and Permanent Stress

The prestressing steel shall be anchored at initial stresses in a way that will result in the ultimate retention of permanent forces of not less than those shown on the Plans or the Approved Shop Drawings, but in no case shall the initial stress, after anchor set, exceed 70 percent of the specified minimum ultimate tensile strength of the prestressing steel.

Permanent force and permanent stress are the force and stress remaining in the prestressing steel after all losses, including creep and shrinkage of concrete, elastic shortening of concrete, relaxation of steel, thermal effect, losses in post-tensioned prestressing steel due to sequence of stressing friction and take-up of anchorages, and all other losses peculiar to the method or system of prestressing have taken place or have been provided for in an approved stressing plan.

6.4.5 Excessive Friction

When friction must be reduced, water-soluble oil or graphite with no corrosive agent may be used as a lubricant subject to the approval of the Department. Lubricants shall be flushed from the duct as soon as possible after stressing is completed by use of water pressure. These ducts shall be flushed again just prior to the grouting operations. Each time the ducts are flushed, they shall be immediately and thoroughly blown dry with oil free air. The waste fluid flushed from the duct system shall be captured and disposed of properly.

6.5 POST-TENSIONING OPERATIONS, STRESSING REQUIREMENTS

6.5.1 Stressing Equipment

Each jack shall be equipped with a pressure gauge having an accurate reading dial at least 6 inch in diameter for determining the jack pressure.

6.5.2 Calibration

Prior to use for stressing on the Project, each jack and its gauge shall be calibrated as a unit. Initial calibration shall be done, using a proven load cell, at an independent testing laboratory, approved by the Department.

Calibration shall be done with the cylinder extension approximately in the position that it will be when applying the final jacking force and with the jacking assembly in an identical configuration to that which will be used at the job site (i.e. same length hydraulic lines). Certified calibration calculations and a calibration chart, both in English units of measure, shall be furnished to the Department for each jack and gauge unit.

Recalibration of each jack shall be done at six month intervals and at other times when requested by the Department. At the option of the Design-Builder, calibrations subsequent to the initial laboratory calibration may be accomplished by the use of a master gauge. The master gauge shall be calibrated at the same time as the initial calibration of the jacks, and shall be part of the unit for each jack. The data recorded during the initial calibrations shall be furnished to the Department for use in the field. The master gauge shall be supplied by the Design-Builder in a protective waterproof container capable of protecting the calibration of the master gauge during shipment. The Design-Builder shall provide a quick attach coupler next to the permanent gauge in the hydraulic lines which enables the quick and easy installation of the master gauge to verify the permanent gauge readings. The master gauge shall remain in the possession of the Department for the duration of the Project.

If a jack is repaired or modified, including replacing the seals or changing the length of the hydraulic lines, the jack shall be recalibrated by the approved testing laboratory.

6.6 STRESSING OF TENDONS

Post-tensioning forces shall not be applied until the concrete has attained the specified compressive strength as evidenced by tests on representative samples of the concrete. These samples shall be stored under the same conditions as the concrete in order to accurately represent the curing condition of the concrete in place.

The tensioning process shall be so conducted that tension being applied and the elongation of the post-tensioning steel may be measured at all times. A permanent record shall be kept of gauge pressures and elongations at all times and shall be submitted to the Department. The post-tensioning force may be verified as deemed necessary by the Department.

For all tendons, excluding post-tensioning bars with lengths less than 20', the tendon force measured by gauge pressure shall agree within seven percent of the theoretical elongation or the entire operation shall be checked and the source of error determined and remedied to the satisfaction of the Department before proceeding with the work. Elongations shall be measured to the nearest 1/16 inch. In determining why the measured tendon force and the theoretical elongation do not agree within seven percent, the Design-Builder may elect to establish that the apparent modulus of elasticity of the post-tensioning steel varies from the value shown in the general notes to the plans by conducting a bench test on a full size tendon in accordance with a procedure acceptable to the Department. This test may be performed at a site remote from the Project provided that the Design-Builder pays the cost to the Department of sending a representative to witness the test. Equipment for tensioning the tendons must be furnished by the manufacturer of the system. Should agreement between pressure gauge readings and measured elongations fall outside the acceptable tolerances, the Department may require additional in-place friction tests in accordance with the Materials Section 5.1.2 "Testing of Prestressing Tendons by the Design-Builder".

The anchor force for all permanent post-tensioning bars with lengths less than 20' shall be verified with a lift off after initial stressing operations. The resulting lift off shall be within 5% of the expected final anchor force as specified in the plans.

Multi strand post-tensioning tendons having wires that have failed by breaking or slippage during stressing may be accepted providing that:

- A) The completed structure must have a final post-tensioning force of at least 98% of the design total post-tensioning force at the affected sections.
- B) At any stage of erection, the post-tensioning force across a mating surface must be at least 98% of the force required for that stage.
- C) Any single tendon must have no more than 5% reduction in cross sectional area of the post-tensioned steel.

If these conditions cannot be met, then the affected tendon(s) shall be removed and replaced. Previously tensioned strands shall not be re-used. Any of these conditions may be waived by the Department when the Design-Builder is able to propose an acceptable means of restoring the post-tensioning force lost due to wire failure or slippage.

Post-tensioning bars used to apply temporary post-tensioning may be reused as temporary bars if they are undamaged.

Prestressing steel shall be cut by an abrasive saw within 3/4 inch to 1-1/2 inch away from the anchoring device.

6.7 GROUTING

6.7.1 GENERAL

After post-tensioning and anchoring of a tendon has been completed and accepted, the annular space between the prestressing steel and the duct shall be grouted in accordance with this Specification. The interval between post-tensioning and grouting shall be limited as specified in Construction Methods Section 6.2, "Protection of Prestressing Steel". Immediately after post-tensioning, all anchorages and duct connections of each tendon shall be temporarily sealed to prevent entrance of air and water until just prior to tendon grouting.

6.7.2 Grouting Operation Plan

At least six weeks before grouting commences, the Design-Builder shall submit to the Department for review and comment a "Grouting Operation Plan". A written response of this review from the Department is required before grouting occurs. Any adjustments to the plan as a result of trials or mock-ups shall be incorporated. Grouting operations shall be under the supervision of a qualified and experienced person, acceptable to the Department.

- A) The Grouting Operation Plan shall address the following:
- 1) Names and experience of grouting crew and Supervisor.
 - 2) Training to be provided or undertaken prior to operations.
 - 3) Type and brand of equipment to be used, including capacity in relation to demand.
 - 4) Working condition of equipment, back up and spare parts.
 - 5) Types, brands and certifications of materials.
 - 6) Identity of independent testing laboratory for certification of materials.
 - 7) Production of grout fluidity, on site flow testing, adjustments and controls.
 - 8) Estimate of grout required per tendon or group of tendons.
 - 9) Method of controlling rate of flow and filling of ducts.
 - 10) Locations, types and sizes of inlet and outlet vents.
 - 11) Means of sealing and protecting tendons and ducts prior to grouting.
 - 12) Grout mixing and pumping procedures.
 - 13) Tendon or groups of tendons to be grouted in one operation.
 - 14) Direction of grouting and sequence of using inlets and closing vents.
 - 15) Procedures for handling blockages, including flushing of ducts.
 - 16) Procedures for possible re-grouting to detect and fill voids.

- 17) Procedures for controlling w/c ratio and ensuring that the water used is acceptable.
- 18) Design-Builder's QC forms that are to be signed daily by Grout Supervisor.
- 19) Storage of Materials.
- B) Before grouting operations commence, a joint meeting shall be held with the Design-Builder, Grouting Crew, the Department, and Engineering Inspection Team to discuss and understand the grouting operation plan, required testing and corrective procedures.

6.7.3 Grouting Personnel Qualifications

All grouting operations shall be carried out by workers trained for the tasks required, and having at least 3 years experience on previously successful Projects of similar type and magnitude.

Grouting shall be performed under the immediate control of a Grouting Supervisor skilled in the various aspects of grouting, and having experience on at least four previous and satisfactorily completed Projects of a similar size and scope. The Grouting Supervisor shall be named and shall furnish proof of experience as required by the Department.

Grouting Supervisors shall have ASBI Grouting Certification and previous experience on satisfactorily completed Projects of a similar size and scope.

6.7.4 Equipment

Grouting equipment consists of measuring devices for water and admixtures, a mixer, a storage hopper, and a pump with all the necessary connecting hoses, valve, pressure gauges, and test equipment. Accessory equipment shall provide for accurate solid and liquid measures of all materials to be batched.

The equipment shall have sufficient capacity to ensure that the post-tensioning duct or group of ducts to be grouted can be filled and vented without interruption at the required rate of injection. Under normal conditions, the equipment shall be capable of continuously grouting the longest tendon (or group of tendons) on the Project in 30 minutes.

6.7.4.1 Mixer

The mixer shall be capable of continuous mechanical mixing. It shall produce a homogeneous and stable grout free of lumps and undispersed solids (cement or grout mix) and shall be able to deliver a continuous supply of grout to the pumping equipment. A colloidal mixer is preferred.

There shall be a gravity feed to the pump inlet from the mixer and/or hopper attached to and directly over it. An additional storage hopper may be incorporated between the mixer and the pump. It shall be fitted with an agitator to keep the grout moving continuously before it is pumped into the duct. The storage hopper shall be kept partially full at all times to prevent air from being drawn into the duct.

The grouting equipment shall contain a screen having clear openings of 1/8 inch maximum size to screen incompletely mixed lumps from the grout prior to its introduction into the grout pump or storage hopper. If the grout contains a thixotropic admixture, a screen opening of 3/16 inch will be satisfactory. The screen shall be located between the mixer and the pump, or when a storage hopper is used, between the mixer and the storage hopper. This screen shall be easily accessible for inspection and cleaning.

6.7.4.2 Injection Equipment

Grout pumps shall be capable of pumping the grout in a continuous operation with little variation of pressure and shall include a system for re-circulating grout when injection is not in progress. The equipment shall be capable of maintaining a pressure on completely grouted ducts and shall be fitted with a valve that can be locked off without loss of pressure in the duct. The use of compressed air for pumping grout shall not be allowed.

Grout pumps shall be a positive displacement type capable of producing an outlet pressure of not less than

145 psi and shall have seals adequate to prevent introduction of oil, air or other foreign substance into the grout and to prevent loss of grout or water.

A pressure gauge having a full-scale reading of no greater than 290 psi shall be placed at some point in the grout line between the pumping outlet and the duct inlet.

All piping to the pump shall have a minimum number of bends, valves and changes in diameter and shall incorporate a sampling tee. The diameter and rated pressure capacity of the hoses must be compatible with the pump output, the assumed maximum pressure and the length needed. Grout hoses shall be firmly connected to pump outlets, pipes and inlets of the duct.

6.7.4.3 Stand by Equipment

During grouting operations, provide adequate flushing equipment to facilitate complete removal of the grout in the event of a breakdown of the grouting equipment or other disruption before the grouting operation has been completed. This equipment shall be kept in working order. Where potable water is unavailable, a tank of sufficient water will be required meeting the same requirements for potable water.

6.7.4.4 Equipment for Thixotropic Grout

The following additional equipment shall be used. The grout equipment shall have two identical charging/holding tank units. Each unit alternates between duties either as a blender or holding tank. The tank units shall have a high shear (colloidal) mixer and pump and the placing pump shall have exact pressure control capabilities, and be fed from the holding tank. In addition, a pressure filter type grout test kit is required.

6.7.5 Mixing Grout

The sequence for charging the mixer shall be: first add water, start mixer and add cement. When cement and water are reasonably well mixed, admixtures shall be introduced in accordance with the written instructions of the manufacturer of each admixture. The mixing procedures shall prevent admixture from getting caught on the blades or sides of the drum and from forming gel globules. The mixing procedure may be varied in accordance with the written recommendations of the manufacturer of the admixtures.

The grout shall be mixed until a uniformly blended mixture is obtained and shall be continuously agitated until it is introduced into the grout pump. Batches of grout shall be placed within 30 minutes of mixing. No water shall be added to the grout to modify its consistency after the initial mixing operation is completed.

6.7.6 Cleaning and Flushing Tendons

Tendons shall not be flushed with water except in situations where a water soluble lubricant is applied to the prestressing steel, as described in Construction Methods Section 6.4, "Post-Tensioning Operations", or as otherwise permitted or directed by the Department.

If flushing is to be performed as required in Construction Methods Section 6.4, "Post-Tensioning Operations", the inside of the duct system shall be flushed with water (under pressure) meeting the quality requirements of Section 4.5.2.3 to remove all traces of the lubricant (or other contaminant). Following the flushing operation, water shall be totally drained from within the duct system and it shall be blown out with compressed oil free air to the extent necessary to dry the prestressing steel and inside surfaces of the ducts. The waste fluid flushed from the duct system shall be captured and disposed of properly.

6.7.7 Injecting Grout

Grouting shall start at the lowest injection port with all vent holes open. A continuous one way flow of grout shall be maintained at all times.

The maximum rate of grout injection shall be 16 ft. per minute for vertical ducts and 50 ft. per minute for horizontal ducts.

Grout shall be pumped through the duct and flow continuously at the first vent hole after the injection port until no visible slugs or other evidence of air or water are ejected and the grout being ejected has the same consistency as the grout being injected. At this time, at least one gallon of grout for tendon sizes seven (7)-0.6 inch and smaller and 3 gallons of grout for tendon sizes nine (9)-0.6 inch and larger shall be vented from the first vent hole into a suitable receptacle and discarded properly. The first vent valve shall then be closed. Grout injection shall continue until all vents have been closed one after another in the direction of flow following the same process. At intermediate crests where vents have been provided both at the crest and immediately downstream from the crest, the vent downstream of the crest shall be closed before the associated crest vent.

When the tendon duct is completely filled with grout and after the last outlet vent has been closed, the injection port shall be closed immediately following stoppage of the grout pump.

When a one-way flow of grout cannot be maintained, or when grouting is interrupted, the grout shall be immediately flushed out of the entire length of the duct with water. A water pump shall be available on site for this purpose as part of the standard flushing equipment. The flushing pressure shall not exceed the grouting pressures listed in Construction Methods Section 6.7, "Grouting".

6.7.8 Grouting Pressure

The pumping pressure at the tendon inlet shall not exceed the following:

- External tendons of HDPE pipe, 145 psi
- Internal PE ducts, 145 psi
- Internal flat or oval steel ducts, 145 psi
- Internal circular steel ducts, 250 psi

However, normal operations shall be performed at approximately 75 psi.

If the actual grouting pressure exceeds the maximum permitted pumping pressure, the inlet shall be closed and grouting shall continue at any vent hole that has been or is ready to be closed as long as a one way flow of grout is maintained. Grout shall not be injected into a succeeding outlet from which grout has not yet flowed. Any such outlet used for injection shall be fitted with a positive shut off.

6.7.9 Vertical Grouting

All vertical tendons that have strands as the prestressing steel shall be fitted with a standpipe as specified in the Construction Requirements. As grouting is completed, the standpipe shall be filled with grout to a level, which will assure that, as settlement of grout occurs, the level of grout will not drop below the highest point in the upper anchorage device. If the level of grout drops below the level of the highest point in the anchorage device, additional grout shall immediately be added to the standpipe. After the bleed water is absorbed and the grout has hardened, the standpipe shall be removed.

For long, vertical internal tendons, if the grouting pressure exceeds the maximum permitted pumping pressure specified in Construction Methods Section 6.7, "Grouting", then the grout shall be injected at increasingly higher vents (which become injection locations) which have been or are ready to be closed as long as a one way flow of grout is maintained.

For external vertical tendons, lifts of grout shall not exceed 30' until the lower lift has set without approval of the Department. Two steel band clamps shall be securely fastened around the external duct at the top of the lower lift. Injection shall proceed from a point just above the top of the lower lift. Only grout with no bleed shall be used for external vertical tendons.

6.7.10 Temperature Considerations

When it is anticipated that the air temperature will fall below 32°F, ducts shall be kept free of water so as

to avoid freeze damage to ducts. No grouting shall be done when the temperature of the grout is below 45°F or when weather reports indicate that the temperature may fall below 45° F for the anticipated duration of the grouting operation. The temperature of the concrete and air surrounding the tendon shall be maintained at 35°F or above from the time grout is placed until the compressive strength of the grout, as determined from tests on 2 inch grout cubes cured under the same conditions as the in-place grout, exceeds 800 psi.

Under hot weather conditions, grouting shall take place early in the morning when daily temperatures are lowest. No grouting shall be done when the temperature of the grout exceeds 90°F or when weather reports indicate that the temperature may rise above 90° F for the anticipated duration of the grouting operation. It may be necessary to chill mixing water or take special measures to lower the grout temperature.

6.7.11 Post-Grouting Measures at Injection and Vent Ports

Grouting vents at high points shall be reopened 10 minutes after completion of grouting and any escape of air, water or grout recorded.

Within approximately 30 minutes of grouting and before the grout has hardened, all opened vents shall be checked for voids. At locations where voids are observed, grout shall be topped off through the outlet, or a regrouting operation shall be performed using an injection port and outlet vent.

Not less than 48 hours after the completion of grouting, the level of grout at all injection port and outlet vent locations shall again be inspected and topped up as necessary with freshly mixed grout. This process will continue until the Department is assured that there are no bleed water or subsidence voids. Subsequent spot inspections may be conducted on one or more selected anchorages per span as long as no voids are found. If voids are found then all tendons will be checked for voids until the Department is assured that the voids are not occurring.

6.7.12 Post-Grouting Inspection of Anchorages by Design-Builder

Not less than 48 hours after the completion of grouting, all end anchorages shall be inspected for the presence of voids behind the anchorage.

The grout injection port on the anchorage shall be drilled out or otherwise cleaned of grout to allow the inspection of potential voids immediately behind the anchorage or within the trumpet region of the tendon. Care shall be taken during the drilling process to ensure that the drilling operation does not come into contact with the strands or bar(s) of the tendon.

Assessment of the potential void space shall involve physical probing through the grout injection port with a suitable wire or probe, or visual inspection using of a flexible fiberscope or videoscope. The presence of a void and an estimation of its extent or length shall be recorded.

6.7.12.1 Void Regrouting Procedures

All voids identified behind anchorages shall be regrouted as follows:

- A) Regrouting shall involve insertion of a grout tube through the grout injection port into the void space, and filling of the void with freshly mixed grout meeting the requirements of Materials Section 4.5 “Grout”.
- B) Grout tube shall be a flexible plastic of sufficient rigidity to allow grouting under pressure without excessive bulging or rupture. The size of the grout tube shall be 0.5 inch maximum O.D.
- C) Grout material shall be placed by pumping the material at low pressures (<100 psi). Pressure shall be sufficiently low to prevent segregation and bleeding of the grout.
- D) Grout tube shall be inserted into the trumpet as far as possible. Tube shall remain within

the trumpet and immersed within the grout at all times during the grouting operation except as specified.

- E) The tendon anchorages shall be grouted continuously. No interruptions in grouting will be allowed.
- F) Grouting shall continue until all air, water, or other foreign material is completely purged from trumpet and duct. Grouting shall further continue until an uninterrupted stream of sound, uncontaminated grout flows from the port for a minimum of ten (10) seconds. At this time, the grout tube shall be slowly and continuously removed from the port while grout is still flowing out of the tube under pressure.
- G) Upon completion of grouting, all ports shall be cleaned and then sealed so as to prevent grout leakage until final set of the grout.

Other regrouting methods, including vacuum grouting, may be used.

6.7.13 Post-Grouting Operations

Except as specified in Construction Methods Section 6.7, “Grouting”, shut off valves shall not be opened on injection ports or vent ports, nor shall pipes or caps at port locations be removed until the grout has set.

After the grout has set, pipes used as injection or vent ports shall be cut off as described below.

In non-aggressive exposures, metal pipes shall be cut off 1 inch below the surface of the concrete. Plastic pipes shall be cut off flush with the surface of the concrete.

In aggressive exposures, metal and plastic pipes shall be cut off at least 1 inch below the surface of the concrete. The resulting recess shall be filled with a non-shrink mortar, and an elastomeric waterproof membrane shall be applied over the repair area. Suitable waterproofing membrane materials include urethane, neoprene or silicone based elastomers with the following minimum properties:

- A) Tensile Strength (ASTM D412)
 - 1) at 75° F, 100 psi
 - 2) at 0° F, 500 psi
- B) Percent Elongation (ASTM D412)
 - 1) at 75° F, 500%
 - 2) at 0° F, 250%

All waterproofing materials shall be UV resistant, and shall be reviewed for comment by the Department prior to use.

For vent ports on external tendons, saddles, vent hoses and all other hardware shall be removed and the holes in the ducts shall be sealed using a heat shrink repair sleeve. The heat shrink repair sleeve shall extend a minimum of 6 inch beyond the vent opening in the duct in both directions. All heat shrink repair materials and procedures shall be reviewed for comment by the Department prior to use.

All miscellaneous material (tie wire, waterproof tape, etc.) used for sealing grout inlet or vent connections shall be removed prior to carrying out further work to protect end anchorages. End anchorage protection shall be installed as described in Construction Methods Section 6.7, “Grouting”.

6.8 PROTECTION OF PRESTRESS ANCHORAGES

6.8.1 Requirements for Aggressive Environments

For exposures designated as aggressive, a permanent, non-corroding grout cap shall be used. The permanent grout cap shall completely encapsulate the anchorage wedge plate, and shall attach directly to the anchor plate. A suitable gasket shall be used to prevent moisture intrusion behind the grout cap. Any bolts or fixtures used to secure the permanent grout cap to the anchorage shall have a minimum cover of 1 inch and shall be of stainless steel or other rust free material. Grout caps shall be submitted to the Department for review and comment. Additional protection in the form of a block out shall be utilized, consisting of one coat of epoxy bonding compound, approved non-shrink concrete or mortar to fill the block out, and an elastomeric waterproofing membrane.

For external anchorages (not recessed) not located at expansion joints or other location where moisture may directly come in contact with the anchorage, additional protection shall consist of an elastomeric waterproofing membrane.

For recessed anchorages, additional protection shall consist of one coat of epoxy bonding compound, approved non-shrink concrete or mortar to fill the anchorage recess, and an elastomeric waterproofing membrane.

Anchorage recesses or block-outs shall be filled as specified in Construction Methods Section 6.7, "Grouting".

Waterproofing membranes shall be as specified in Construction Methods Section 6.7, "Grouting".

The permanent grout cap shall remain in place at all times following grouting of the tendon.

Anchorage protection for temporary Post-Tensioning Thread Bars will not be required.

6.8.2 Filling of Anchorage Recesses or Block-Outs

For external (not recessed) anchorages to be encapsulated with a block-out, mild steel reinforcement or stainless steel anchors shall be provided to anchor the block-out concrete or mortar to the segment or structural member. A minimum of two (2) hairpin reinforcing ties (bar size #4 or larger) or a minimum of four (4) stainless steel anchors shall be used for each block-out. Minimum concrete or mortar clear cover to all reinforcement or anchors shall be 2 in. Hairpin reinforcement may be installed during segment or member fabrication, or following tendon placement and stressing. In the latter case, all reinforcement shall be dowelled into segment or member concrete a minimum of 4 in. and bonded in place using an appropriate epoxy adhesive that has been submitted to the Department for review and comment. Stainless steel anchors shall be installed in accordance with the manufacturer's recommendations.

Prior to filling of anchorage recesses or block-outs, all exposed end anchorages, strands, grout caps, block out reinforcement and other metal or non-metal accessories or components shall be cleaned of rust, misplaced mortar, grout and other such materials.

Immediately following cleaning operations, the entire surface of the anchorage recess or area to be covered by the block-out (all metal and concrete) shall be thoroughly dried and uniformly coated with an epoxy bonding compound meeting the requirements of AASHTO Specification M 235, Class III. The epoxy shall be applied in a manner and thickness as recommended by the manufacturer.

Immediately following application of the epoxy bonding compound, tight fitting forms shall be installed to encase the entire anchorage system, including reinforcement ties or anchors, where applicable. The anchorage recess or block-out shall be completely filled with pea gravel concrete or non-shrink, cement based mortar. The concrete or mortar filler shall be placed within the time limits specified by the epoxy bonding compound manufacturer. The filler shall exhibit no shrinkage, and shall contain no aluminum powder, iron particles, chlorides, sulfites, fluorides or nitrates.

6.8.3 Waterproof Membrane

An elastomeric waterproofing membrane shall be applied at all anchorage locations following finishing and curing of the pour-back concrete. Suitable waterproofing membrane materials include urethane,

neoprene or silicone based elastomers with the following minimum properties:

- A) Tensile Strength (ASTM D412)
 - 1) at 75° F, 100 psi
 - 2) at 0° F, 500 psi
- B) Percent Elongation (ASTM D412)
 - 1) at 75° F, 500%
 - 2) at 0° F, 250%

All waterproofing materials shall be UV resistant, and shall be submitted to the Department for review and comment prior to use.

The waterproofing membrane shall completely cover the pour-back concrete used to fill the anchorage recess, block-out or pour-back and shall extend for a distance of not less than 12 in. beyond the extent of the pour-back concrete. The membrane shall terminate at a groove cut into the concrete not less than 3/8 in. wide by 3/8 in. deep.

6.9 RECORDS

6.9.1 Record of Stressing Operations:

The Design-Builder shall keep a record of all post-tensioning operations for each tendon installed and stressed. This shall include, but shall not necessarily be limited to the following:

- A) Project name and number
- B) Design-Builder and/or Sub-contractor
- C) Tendon location, size and type
- D) Date tendon was first installed in ducts
- E) Coil/reel number for strands or wires and heat number for bars and wire
- F) Assumed and actual cross sectional area
- G) Assumed and actual modulus of elasticity
- H) Date stressed
- I) Jack and gauge numbers per end of tendon
- J) Required jacking force
- K) Gauge pressures
- L) Elongations (anticipated and actual)
- M) Anchor sets (anticipated and actual)
- N) Stressing sequence (i.e. tendons before and after this)
- O) Stressing mode (1 end only, 2 ends in sequence, or 2 ends simultaneous)
- P) Witnesses to stressing operation (Design-Builder and Department staff)
- Q) Record of any other relevant information

Within 72 hours, the Design-Builder shall provide the Department with a complete copy of each tendon

stressing operation.

6.9.2 Record of Grouting Operations:

The Design-Builder shall keep a record of all grouting operations for each tendon installed, stressed and grouted. This shall include, but shall not necessarily be limited to the following:

- A) Tendon or group of tendons grouted in one continuous operation
- B) Date grouted
- C) Number of days from stressing to grouting, per tendon
- D) Type of grout mix and additives
- E) Fluidity of grout (flow cone) per batch for both newly mixed and 30 minute rested grout
- F) Density of grout per batch of fresh mix
- G) Location of injection port and direction of grout flow (note: injection port may not necessarily be at an end anchorage)
- H) Applied grouting pressure during normal pumping and maximum pressure sustained for one minute after closing all vents grouting
- I) Theoretical volume of grout anticipated in order to fill the duct or ducts
- J) Actual quantity of grout in place in the duct(s) after grouting (For one grout mixing and injection operation, this is the quantity mixed less the quantity wasted at the vents, less the quantity remaining in the mixer and injection equipment)
- K) Summarize any difficulties encountered and corrective action taken
- L) Witnesses to grouting operation (Design-Builder and Department staff)
- M) Time of commencement and completion of grout pumping
- N) Weather conditions at the time of grouting

Within 72 hours, the Design-Builder shall provide the Department with a complete copy of all tendon grouting operations.

623515 - EPOXY FOR STRUCTURAL BRIDGE APPLICATIONS

1.0 GENERAL REQUIREMENTS

Adhesive bonding material systems for structural applications shall consist of pre-packaged 2-part chemical components. The material systems shall be specifically intended for use in structural applications for the following application classes.

1.1 EPOXY APPLICATION CLASS A

Epoxy bonding system for bonding anchors and dowels to hardened concrete limited to anchors and dowels, installed positions shall range from vertically downward to horizontal only.

1.2 EPOXY APPLICATION CLASS B

Epoxy bonding system for bonding of match cast faces of all joints between precast concrete elements. This Special Provision covers use of normal setting epoxy bonding agents and slow setting epoxy bonding agents. The work covered by this section shall also include temporary post-tensioning across a joint, if required, by provisions contained elsewhere in this Special Provision.

2.0 REQUIREMENTS – EPOXY APPLICATION CLASS A

Material systems for Type V materials may be supplied in two pre-proportioned containers with one container sized to allow the contents of the second container to be added and mechanically mixed. The two components shall be distinctly pigmented so that mixing produces a third color similar to the color of concrete. Do not use material from containers that are damaged or have been previously opened. Use only full packages of components. Combining of epoxy bonding components from bulk supplies is not permitted.

Material systems for Type HV and HSHV shall be pre-packaged to automatically proportion and mix the materials for use. Manual proportioning of the components will not be permitted.

2.1 TYPE V ADHESIVES

Use Type V adhesive bonding materials for constructing doweled pile splices in concrete piles. The dowel holes for these splices shall be oriented in the vertical position. Type V adhesives may not be substituted for Type HV or HSHV adhesives.

2.2 TYPE HV ADHESIVES

Use Type HV adhesive bonding materials for all horizontal installations and vertical installations other than constructing doweled pile splices, except when Type HSHV is required. Type HV adhesives may not be substituted for Type HSHV adhesives.

2.3 TYPE HSHV ADHESIVES

Use higher strength Type HSHV adhesive bonding materials for installation of traffic railing barrier reinforcement and anchor bolts into existing concrete bridge decks and approach slabs. Type HSHV adhesives may be substituted for Type V or Type HV adhesives.

2.4 APPROVED PRODUCTS LIST

The Department does not maintain an “Approved Products List.” Individual adhesive bonding material systems shall be submitted to the Department for review and comment. Submittals shall include certified test reports from an independent testing laboratory that shows the material system meets all the requirements specified herein.

2.5 MINIMUM PERFORMANCE REQUIREMENTS (FM 5-568)

When tested in accordance with FM 5-568, the adhesive bonding material system, for general use, shall meet the following requirements:

Table 2-1 - Uniform Bond Stress			
	Type V	Type HV	Type HSHV
Confined Tension	2,290 psi	2,290 psi	3,060 psi
Damp-Hole Installation	1,680 psi	1,680 psi	1,830 psi
Elevated Temperature	2,290 psi	2,290 psi	3,060 psi
Horizontal Orientation	Not Applicable	2,060 psi	2,060 psi
Short-Term Cure	1,710 psi	1,710 psi	1,710 psi
Specified Bond Strength	1,080 psi	1,080 psi	1,830 psi

Maximum Coefficient of Variation for Uniform Bond Stress: 20%

Long-Term Load (Creep):

- A) The rate of displacement shall decrease during the 42-day application of load.
- B) At 42 days the total displacement due to creep (with load still applied) shall be less than 0.03 inch and during the last 14 days of the 42 day load duration, the total displacement due to creep shall be less than 0.003 inch .
- C) After removal of the 42-day load, the uniform bond Stress from a subsequent Confined Tension Test shall not be less than 1,826 psi.

2.6 PRODUCT IDENTIFICATION (FINGERPRINT) PROPERTIES (FM 5-569)

References for comparison including Infrared Absorption, Density or Average Weight, Gel Time or Setting Time and Bond Strength shall be determined in accordance with FM 5-569.

2.7 PACKAGING AND MARKING

The adhesive bonding material system shall be delivered to the Project site in original unopened containers with the manufacturer’s label identifying the product. Each package shall be clearly marked with the following information:

- A) Manufacturer’s name and address;
- B) Product Name;
- C) Date of Manufacture;
- D) Expiration Date;
- E) LOT Identification Number; and
- F) Storage, Handling, Mixing and Application Requirements.

Each package shall include the manufacturer’s instructions for anchor and dowel installation. The instructions shall include the following information:

- 1) Diameters of drilled holes for applicable anchor and dowel sizes;
- 2) Cleaning procedure for drilled holes, including a description of permitted and prohibited equipment and techniques;
- 3) Allowable temperature ranges for storage, installation and curing;

- 4) Identification of acceptable mixing/dispensing nozzles;
- 5) Fabrication requirements for anchors and dowels;
- 6) Description of tools permitted or required for installation;
- 7) Method of identifying properly proportioned and mixed adhesive materials;
- 8) Time and temperature schedule for initial set and full-strength cure; and
- 9) Special requirements for special installation conditions, such as damp holes, or horizontal or near horizontal orientation of the anchor or dowel.

3.0 REQUIREMENTS – EPOXY APPLICATION CLASS B

Epoxy bonding agents for match cast joints between precast elements shall be thermosetting 100 percent solid compositions that do not contain solvent or any non reactive organic ingredient except for required coloring pigments. Epoxy bonding agents shall be of two components, a resin and a hardener. Both components shall be distinctly pigmented, so that mixing produces a third color similar to the concrete in the elements on the exterior of the elements. Samples shall be provided to the Department along with the concrete samples required elsewhere in the Special Provisions for the project.

In its workable state, epoxy bonding agent must provide lubrication along the keys as the precast concrete elements are brought together. In its hardened state, epoxy bonding agent must provide a watertight seal between precast concrete elements. For superstructure precast concrete elements, hardened epoxy bonding agent must provide shear stress transfer across the joint without reliance on shear keys to transfer forces.

Epoxy bonding agents shall be insensitive to damp conditions during application, and after curing, the epoxy shall exhibit high bonding strength to cured concrete, good water resistance, low creep characteristics and tensile strength greater than the concrete.

The components shall be packaged in two parts in sealed containers, pre proportioned in the proper reacting ratio, ready for combining and mixing in accordance with the manufacturer's instructions. Each container shall bear a label designating the manufacturer's name, the type component (resin or hardener), the range of substrate (surface of concrete) temperature over which application is suitable, the date of formulation, the shelf life of the material and the manufacturer's Lot number. Material from containers that are damaged or have been previously opened shall not be used. Combining of epoxy bonding agent components from bulk supplies will not be permitted. Only full buckets of components will be mixed immediately after opening.

Instructions shall be furnished by the manufacturer for the safe storage, handling, mixing and application of the material. The Design-Builder shall furnish to the Department samples of the material for testing, upon request, and certified reports of tests performed by an independent laboratory approved by the Department.

3.1 CLASSIFICATION OF MATERIALS

This Special Provision provides for epoxy bonding agents that remain workable for a short time referred to herein as normal-set epoxy bonding agents and epoxy bonding agents that remain workable over an extended period of time referred to herein as slow-set epoxy bonding agents.

3.2 FORMULATION FOR TEMPERATURE RANGE

An epoxy bonding agent shall be formulated to provide application temperature ranges which are suitable for erection of elements with substrate temperatures between 20°F and 115°F or as recommended by the manufacturer. There shall be a minimum of two, and preferably three, formulations dividing the overall range into equal subsets which overlap by 5°F. Additionally, each of these formulations shall be

- | | | |
|----|----------------|----------------------|
| 2) | Slow-Set Epoxy | 1,000 psi at 14 Days |
|----|----------------|----------------------|

For slow-set epoxy, an additional test specimen shall be made and tested to failure at 24 hours. The formulation being tested is acceptable only if the epoxy bonding agent exhibits a brittle break.

3.3.5 Compressive Yield Strength

This property is the compressive yield strength of the epoxy bonding agent at various ages. Comparison of this property between batches is an indication of the level of quality control achieved in manufacturing the material.

- A) The required compressive yield strength of the epoxy bonding agent shall be determined according to ASTM C 881 87 with the following modifications.
 - 1) Epoxy bonding agent shall be poured into the mold for forming specimens within ten minutes after starting mixing of the components.
 - 2) Normal-Set Epoxy 2,000 psi at 24 Hours and 7,000 psi at 48 Hours
 - 3) Slow-Set Epoxy 1,000 psi at 36 Hours and 2,000 psi at 72 Hours

3.3.6 Bond Strength

This property is the strength of epoxy bonding agent as it bonds with concrete.

This bond strength property shall be determined in accordance with and conform to ASTM C 881 87 that references ASTM C 882 with the following modifications:

- A) The test cylinder of mortar shall have a compressive strength of at least 6,000 psi at seven days age.
- B) The specimens shall be conditioned by soaking in water that is at the minimum temperature of the application temperature range for the formulation being tested.
- C) The required strength of ASTM C 881 87 shall be modified as follows:
 - 1) Normal-Set Epoxy 1,000 psi at 48 Hours
 - 2) Slow-Set Epoxy 1,000 psi at 14 Days

3.3.7 Heat Deflection of Epoxy Bonding Agent

This property is the temperature at which an arbitrary deflection occurs under arbitrary testing conditions in the cured epoxy bonding agent. It is a screening test to establish performance of the epoxy bonding agent throughout the temperature range at which a particular formulation may be applied. It shall be tested and satisfy the requirements in accordance with ASTM C 881 87.

3.3.8 Testing

An independent testing laboratory (or laboratories) selected by the Design-Builder and approved by the Department shall test all materials from each manufactured lot in accordance of with the testing requirements of this Special Provision. The Design-Builder shall be responsible for all coordination between the Design-Builder’s laboratory (or laboratories), Design-Builder’s supplier(s), and Department representatives. The Design-Builder shall notify the Department 14 days prior to any testing to be performed and the Department shall be allowed to witness all testing.

The Design-Builder shall furnish all material and written test procedures, as prepared by the Design-Builder’s supplier(s) to the Department for review and comment. The Design-Builder’s supplier(s) and the design-Builder’s laboratory (or laboratories) shall prepare separate reports. Each of these reports shall independently describe all the testing data and testing results. All reports shall be submitted by the Design-Builder to the Department within 14 days of completing each test as independent records of the

testing. The Design-Builder shall be responsible for sub-contracting and coordinating with the Design-Builder's laboratory (or laboratories) and Design-Builder's supplier(s) for all testing laboratory services.

The Design-Builder's supplier(s) shall provide written and detailed recommendations to the Design-Builder regarding storage, handling, transporting, mixing, applying and curing of epoxy materials. The Design-Builder's supplier(s) shall simultaneously provide copies of all such recommendations directly to the Department for their use.

The test reports shall document that the epoxy material has passed all tests required in this Special Provision and the Contract requirements.

3.3.9 Application

An epoxy bonding agent meeting the requirements of this Special Provision shall be applied to joining surfaces of all precast concrete elements. The epoxy bonding agent shall be applied only when the substrate temperature of both surfaces to be joined is between 20°F and 115°F or as recommended by the manufacturer.

The formulation of epoxy bonding agent used shall have an application temperature range as previously defined in the Epoxy Material section of this Special Provision, which conforms to the substrate temperature of the surfaces to be joined. If the surfaces have different substrate temperatures, the formulation for the higher temperature shall be used for joining the elements.

The Design-Builder's construction scheme shall provide for a minimum contact pressure of 40 psi compression over the entire joint of precast concrete elements while the epoxy is curing in the joint. The Design-Builder shall plan his erection and post-tensioning operations such that for the particular formulation of epoxy bonding agent being used, the time elapsing between initial mixing of the components for the first batch of epoxy bonding agent and application of the minimum contact pressure of 40 psi compression shall not exceed 70 percent of the contact time.

Prior to beginning erection, the Design-Builder shall submit to the Department for review, details covering how compliance with this 40 psi contact pressure and the time limit will be achieved during erection of elements.

For superstructure elements, the compressive force across a joint (contact pressure) may be accomplished through temporary post-tensioning or permanent post-tensioning. The specified contact pressure shall be continuously maintained across a joint while the epoxy is curing in the joint.

3.3.10 Qualifications of Design-Builder's Personnel

The work of mixing, handling and applying the epoxy bonding agent shall be under the direct supervision of a person who has extensive knowledge of and experience in the use of this material. The Department may require the Design-Builder to arrange for a technical representative of the manufacturer to be at the site as an advisor at the beginning of this operation.

The Design-Builder shall ensure that all personnel who will be working with the epoxy bonding agent are thoroughly familiar with the safety precautions necessary when handling this material.

3.3.11 Cleaning of Surfaces to be Joined

The surfaces to which the epoxy bonding agent are to be applied shall be free from oil, form release agent, laitance, curing compound or any other material that would prevent the epoxy bonding agent from bonding to the concrete surface. Light sandblasting or high-pressure water blasting with a minimum pressure of 5,000 psi shall remove these detrimental materials.

The surfaces shall have no free moisture on them at the time the epoxy bonding agent is applied. Free moisture will be considered to be present if a rag, after being wiped over the surface, becomes damp.

3.3.12 Mixing Epoxy Bonding Agent

Only epoxy bonding agent components from full containers opened immediately prior to being combined and for which the shelf life indicated on the containers has not expired shall be used during erection. Each container of a component shall be thoroughly mixed prior to combining of the components.

The two components of the epoxy bonding agent shall be combined and thoroughly mixed in a mechanical mixer in strict accordance with the manufacturer's recommendations.

Mixing of the epoxy bonding agent shall be scheduled so that the material in a batch is applied to the face of the joint within 20 minutes after the components are combined.

3.3.13 Applying Epoxy Bonding Agent

The epoxy bonding agent shall be uniformly applied to a nominal thickness of 1/16" or in accordance with the manufacturer's recommendations with a spatula or by gloved hand. The material shall be applied to only one of the faces to be joined except that material shall be applied to both faces in the vicinity of post-tensioning ducts. No material shall be placed within 2" of a post-tensioning duct except, regardless of spacing, a bead of epoxy bonding agent shall be applied between all adjacent post-tensioning ducts.

No epoxy bonding agent from a batch shall be used for which the time since combining of components has exceeded 20 minutes.

After concrete elements have been joined and the specified contact pressure applied, a discernable bead line of epoxy bonding agent must appear along the entire exposed edges of a joint. All excess epoxy bonding agent shall be cleaned from exterior surfaces of the concrete element in such a way as to not damage or stain the concrete surface. Excess epoxy squeezed from a joint shall be captured and not allowed to free-fall from the structure onto the ground, river or traffic lanes below.

3.3.14 Artificial Heating

If the Design-Builder elects to erect elements in cold weather when the substrate temperature of the joint surfaces of concrete elements is below 20°F (or other minimum temperature as recommended by the manufacturer), they shall provide an artificial environment to increase the substrate temperature subject to the following restrictions.

- A) The artificial environment shall be created by an enclosure surrounding the joint through which warm air is circulated.
- B) The temperature of the concrete shall be raised to at least 20°F (or other minimum temperature as recommended by the manufacturer) to a depth of approximately 3" beneath the surface to be joined.
- C) Localized heating shall be prevented and the temperature of the substrate shall not exceed 105° F at any point on the surface of a joint.
- D) The temperature of substrate surfaces shall be maintained between 20° F and 105° F for at least 24 hours after joining of the surfaces for normal-set epoxy and 72 hours for slow-set epoxy.
- E) The Design-Builder may propose, for review by the Department, an optional method of raising and maintaining the substrate temperature of the joint surfaces. Any optional method shall meet the restrictions set out above. The Department will base the acceptance of an optional method on it accomplishing an environment suitable for the epoxy bonding agent to perform satisfactorily.

3.3.15 Failure to Comply with Time Limits

If the time limit between mixing of the epoxy bonding agent and application of contact pressure to a joint

is exceeded, the concrete elements shall be moved apart and all epoxy bonding agent shall be removed from both faces of the joint. If solvent is used to remove the epoxy bonding agent, reapplication of the epoxy bonding agent to the joint surfaces shall not be done for at least 24 hours.

3.3.16 Cantilever Element Support

- A) The Design-Builder shall determine the maximum number of elements that can be supported in cantilever beyond an epoxy joint, which has not developed a state of substantial cure. For this requirement, substantial cure is defined as that state in which the epoxy will transfer an average shear stress of 250 psi across a joint of two plane surfaces.
- B) The Department may require the Design-Builder to submit calculations substantiating the joints ability to safely transfer all applied forces.

3.3.17 Failure to Provide Watertight Seal:

In the event that water seepage through the deck slab at an epoxy precast element joint becomes evident, the Design-Builder shall take measures to seal the joint such as applying a gravity feed low viscosity concrete crack sealer or epoxy pressure injection. Proposed methods for sealing leaking element joints shall be submitted to the Department for review and comment.

3.3.18 Record of Element Joining

The Design-Builder shall record and make available to the Department the following information:

- A) General: For the period when precast elements are being erected
 - 1) Weather condition.
 - 2) Air temperature at the site on an hourly basis.
- B) For Each Joint: Identified as to Location in the Structure
 - 1) Lot number for the epoxy bonding agent components.
 - 2) Temperature of the concrete on the surface of each concrete element when application of epoxy bonding agent was started.
 - 3) Time of mixing the first batch of epoxy bonding agent and when it was applied to the joint.
 - 4) Time of applying the specified contact pressure to the joint.
 - 5) Date of joining elements with epoxy.

742500 - FLAGGER REQUIREMENTS

742.01 Description. Flagger shall consist of furnishing personnel and necessary equipment for the controlling of traffic through work areas.

742.02 Flagger Requirements. Flaggers shall be governed by and familiar with the Manual on Uniform Traffic Control Devices (MUTCD) Part VI, latest edition, and updates, and shall conform to the requirements of the latest version of the manual entitled "Delaware Traffic Controls for Street and Highway Construction, Maintenance, Utility and Emergency Operations" (latest edition with all revisions made up to the date of Advertisement of this project and from hereon shall be addressed as the Traffic Manual). Flaggers shall have completed flagger training and testing, within the last 4 years as offered by American Traffic Safety Services Association (ATSSA) or the Delaware Construction Craft Laborers' Apprenticeship Program. The Contractor shall provide appropriate documents showing the flagger certification status throughout the duration of Contract. When additional flagpersons are needed on a project the Contractor shall supply the Engineer with this documentation prior to them beginning work. The Contractor shall also have available a person certified to flag who will relieve the flagperson for any necessary breaks. Flaggers are required to have their approved flagger card, and a photo identification card on their person at all times while flagging. Failure to produce an approved card, when requested to do so by anyone authorized by DelDOT, shall be grounds to have that person removed from the flagger job.

Flagger shall be completely covered (clothed) from neck to feet. The minimum clothing requirements for flagger shall be long pants and a standard T-shirt with sleeves along with appropriate footwear (no open toe shoes). In addition to this, flaggers shall be required to wear high visibility clothing in accordance with Section 6E.02 High-Visibility Clothing of the MUTCD. When directed by the Engineer, the flagger shall be equipped with a two-way radio or an approved communication device.

Flagging Procedure:

Flagging procedure shall conform to paragraphs E-4 through E-7 of Traffic Manual. Flaggers and operators of construction machinery or trucks shall be made to understand that every reasonable effort must be made to allow the driving public the right-of-way and prevent excessive delays. Whenever flagpersons are relieved or rotated it shall be the Contractor's responsibility to assure that the relief flagperson has been fully orientated about the operation.

Flaggers are required to use DelDOT approved STOP/SLOW (S/S) paddles as hand signaling devices. Flags are generally only allowed for emergencies. S/S paddles are required to meet the requirements of Section E-2 of the Traffic Manual. Any border around the SLOW side shall be black. S/S paddles shall be a minimum of 24 inches x 24 inches (600 mm x 600 mm) with minimum 8 inch (200 mm) high, "C" series letters on the STOP side of the paddle and 8 inch (200 mm) high, "B" series letters on the SLOW side of the paddle and are required to have high intensity retroreflective sheeting for the orange, red and white colors (both day and night). A rigid handle shall be provided such that the bottom of the sign paddle shall be 6 feet (1.8 m) above the ground. Flagger stations shall be sufficiently illuminated at night in accordance with Section E-5 of the Traffic Manual. Care shall be taken to assure that traffic is not blinded from any direction of travel by illumination of the flaggers' station. The flagger must be positioned so as to be clearly visible to traffic.

Any Flagger not performing duties in accordance with Delaware Traffic Controls for Street and Highway Construction, Maintenance, Utility and Emergency Operations Manual or non compliance to the specifications shall be justification for the Engineer to suspend work in conformance with Subsection 104.07 of the Standard Specifications. The flaggers shall be replaced and when the flaggers are in

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compliance with the policies outlined in this specification, the work may resume.

Flagger Cards may be confiscated from personnel flagging improperly. The Engineer shall contact the Contractor's supervisor. The supervisor shall confiscate the card from the flagger. The card shall be turned over to the Engineer and forwarded to DeIDOT's Safety Section. The Safety Section shall forward the card, or if the person refuses to give up the card, a letter to ATSSA's main office for the purpose of removing the individual's name from the certified list. Any flagger whose card has been confiscated shall be retrained and retested prior to consideration for reinstatement. Retraining and retesting shall not occur until at least one month after the infraction.

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743514 - FURNISH AND MAINTAIN MESSAGE BOARD

Description:

The item shall consist of furnishing, placing, operating and maintaining trailer mounted message board during the construction of the project. When no longer required for use on the project as decided by the Engineer, the message board with trailer and related hardware shall become the property of the Contractor.

The message board must be approved by the Department prior to use. For a list of approved message boards and approval process, contact the Department's Chief Safety Officer.

Operation and Maintenance:

The message board shall be placed and relocated on the job site at location(s) as determined by the Engineer. The Contractor shall have qualified and trained message board programmer(s) to program desired messages, and mechanic(s) to perform required service on the message board unit, available on a 24 hour basis. The Contractor shall maintain and service the message board unit throughout the period of its operation on the job.

Basis of Payment:

~~The payment for the item shall be made for at the Contract unit price per Each Day bid for the item "743514 - Furnish and Maintain Message Board", which price and payment shall constitute full compensation for furnishing the message board with trailer, placing, relocating, operating programming, final removal when no longer required, and for all labor, tools, equipment, and necessary incidentals to complete the work.~~

~~Should an operational problem be reported to the Contractor at any time during use of the unit, the Contractor shall have two hours after receipt of notification to rectify the problem to the Engineer's satisfaction. If such repair is not made satisfactorily, no payment will be made for the six hour quarter day in which the failure occurred. Also, a second failure within any 6 hour quarter day period will void payment for that period.~~

~~It is the Department's intent to provide a continuously operating Message Board whenever the unit is in service. The Contractor is required to make all necessary arrangements to assure continuous operation of the unit. To this end, the Contractor shall designate an on site representative, other than the Project Superintendent, who shall be the Department's contact on all project issues related to the Message Board. The Contractor shall also designate a Manufacturer's Representative to be on call for technical assistance or as otherwise necessary.~~

NE - 1/24/01

746574 - BRIDGE ELECTRICAL SYSTEM

Description:

The work specified in this item consists of providing the design, construction, and installation of complete conduit, wiring, and power distribution equipment and controls for all lighting and power circuits associated with the Design-Builder's Proposal and all minimum requirements specified herein. The work to be performed includes the following items and all incidental items necessary to complete the work:

- A. Providing interior and exterior lighting and associated controls in and on the bridge, including nautical and aerial navigational lights on the bridge; maintenance lights inside the bridge; path lights on the pedestrian walkway on the bridge; and aesthetic lighting to accent the bridge.
- B. Providing receptacles throughout the bridge to be used for maintenance activities.
- C. Providing multi-duct conduit and junction boxes for weather sensor pucks and future ITMS communications.

All electrical systems and associated work required in accordance with the *University of Delaware Bridge Monitoring Program* Performance Specification included in Part 3 of the Contract Documents shall be considered extra work and will be negotiated between the Design-Builder and the Department upon award of the Contract.

General:

RELATED DOCUMENTS:

- A. The Indicative Plans from Contract #25-073-02 included in Part 6 of the Contract Documents as referenced within this Specification.
- B. Delaware Department of Transportation (DelDOT) "Standard Specifications for Road and Bridge Construction" dated August 2001.
 - 1. Section 745: Conduits (non-metallic or galvanized)
 - 2. Section 747: Cabinet Bases
 - 3. Section 603: Bar Reinforcement
 - 4. Section 812: Portland Cement Concrete
- C. Delaware Department of Transportation Standard Construction Details.
- D. American Society for Testing Materials (ANSI)
- E. National Electrical Manufacturers Association (NEMA):
 - 1. ICS 4: Standards for Terminal Blocks

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- 2. KS 1: Standards for Disconnect Switches
- 3. PB 1.1: Standards for Panel Boards
- F. National Fire Protection Association (NFPA):
 - 1. NFPA 70: National Electrical Code (NEC)

ACRONYMS:

- A. PVC: Polyvinyl Chloride
- B. UL: Underwriter Laboratories, Inc.
- C. NEC: National Electric Code
- D. GFCI: Ground Fault Circuit Interrupt
- J. LED: Light Emitting Diode
- K. ITMS: Intelligent Transportation Management Systems
- L. RGS: Rigid Galvanized Steel

DEFINITIONS:

Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

SUBMITTALS:

- A. All working drawings and/or shop drawings pertaining to work completed under this item shall be prepared and submitted to the Department's Project Manager for review and comment a minimum of 30 Calendar Days prior to beginning the associated work. Drawings shall be submitted, reviewed, and approved by the Design QC Manager in accordance with Part 2 – DB Section 111 of the Contract Documents. Work completed without previously submitting all relevant drawings shall be subject to removal and reinstallation at the discretion of the Department's Project Manager.
- B. Shop drawings shall include, but not be limited to:
 - 1. Shop drawings shall show materials, finishes, metal gauges, overall and detail dimensions, electrical and mechanical connections, fastener, fittings, welds, provisions for work of others, and similar information.
 - 2. All Electrical Equipment
 - 3. Luminaires

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- A. Shop drawings shall indicate complete details of the luminaire, not limited to but including manufacturer's catalog numbers for sockets, ballasts, diffusers, lenses, switches and type of wiring. Adjustable luminaires shall indicate focusing and locking devices. A note confirming specific UL listing shall be included.
 - B. Catalog sheets, brochures and similar material shall not be accepted in lieu of shop drawings unless specifically authorized by the Department's Project Manager.
 - C. Prior to the installation of any luminaire, a full size sample of the fixture shall be submitted to the Department's Project Manager for approval. Luminaires shall not be installed without the Department Project Manager's approval of the sample, unless otherwise directed.
- 4. Locations of ground rods, connectors, cables, etc., and details of connections, terminations and access points.
 - 5. Procedures and equipment for testing resistance and electrical continuity.
 - 6. Utility hanger system for mounting of all electrical equipment and conduits.
 - 7. Complete conduit and sleeve layout, verifying that conduit and sleeve locations do not conflict with proposed bridge components.
 - 8. Details for installation of the aesthetic lighting and path lighting.
- C. Photometric data, developed by an independent laboratory, shall be provided by the Design-Builder at no additional cost to the Department.
 - E. Submit a detailed plan of the proposed methods of and scheduling of the overall systems and equipment-testing program at least 30 calendar days prior to initiating the testing program.
 - F. Provide National Electric Code Inspection and certification of the jurisdictional authorities.
 - G. Certifications
 - 1. Certified test reports verifying that ground resistance of each ground grid when installed and each ground bus where connected to the ground grid does not exceed specifications.

QUALITY ASSURANCE:

- A. All electrical work shall be performed and all materials provided shall be in accordance with the NEC. The NEC shall be the minimum requirements for the electrical work and if there is a conflict between the requirements specified in the Contract Documents and the code, the more stringent requirement will apply as determined and approved by the Department's Project Manager.
- B. Unless otherwise indicated, provide electrical materials and equipment that are the standard product of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's design. When two or more units of the same class of material and equipment are required, these units shall be the product of the same manufacturer.

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- C. Workmanship and materials shall be guaranteed for a minimum period of two (2) years from the date of Final Acceptance of the Work. Installation shall be in strict accordance with manufacturer's specifications and instructions. All items shall be in satisfactory operating conditions before acceptance by Owner.
- D. Materials are to be handled in such a manner as to preserve their quality and acceptability for work.

COORDINATION:

- A. Coordinate with other sections of the Specifications to ensure proper scheduling for delivery and installation of the work specified herein. Coordinate with other sections to ensure that proper provisions are made for the installation of the work specified herein.
- B. Sequence, coordinate, and integrate installation of electrical materials and equipment for efficient flow of the Work.
- C. Coordinate construction of all electrical components with all authorities having jurisdiction within project limits and adjacent development.
- D. Coordinate electrical service connections to components furnished by utility companies.
- E. Coordinate slots, inserts, sleeves, and openings with general construction work and arrange in bridge structure during progress of construction to facilitate the electrical installations that follow. Set inserts and sleeves in poured-in-place concrete and other structural components as they are constructed. Drilling of concrete shall be avoided where possible.
- F. The Design-Builder shall coordinate installation of large electrical equipment requiring positioning during bridge construction.
- G. The Design-Builder shall provide and secure all electrical inspections as required and pay for the same. The Design-Builder shall obtain at his expense all necessary permits and certificates as required.
- H. The Design-Builder shall make all necessary provisions throughout the site to receive the work as construction progresses and shall furnish and install adequate backing, supports, inserts, and anchor bolts for the hanging and support of all electrical fixtures, conduit, panelboards and switches.

REGULATORY REQUIREMENTS:

- A. Conform to all applicable UL and electrical codes.
- B. All city, state, and national standards shall apply.

DELIVERY, STORAGE, AND HANDLING

- A. Deliver to site and properly store, protect, and handle products at site.
- B. Deliver products to site in sealed and labeled packages; Design-Builder's QC Manager to inspect to verify acceptability.

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- C. All products delivered to the site shall be made available to the Department for Quality Assurance inspections prior to installation.

OPERATING AND MAINTENANCE INSTRUCTIONS:

- A. Upon completion of all work and tests, prepare a Maintenance Manual for all Bridge Electrical Systems in accordance with the *Inspection, Maintenance and Construction Requirements Performance Specification*. The Design-Builder shall instruct the Owner's representative(s) in the operation, adjustment, and maintenance of all electrical systems and equipment.
- B. Instruction shall be provided as requested by the Department's Project Manager, and divided into multiple sessions (minimum of two). Sessions shall be held at a time and length specified by the Department's Project Manager.
- C. The Design-Builder's instructor shall be factory trained and thoroughly familiar with all parts of the system or equipment on which he is to give instruction.

Materials:

GENERAL:

- A. All electrical materials and equipment shall be new, shall carry a UL label when such material, equipment and/or system are of a type or class listed by the Underwriters Laboratories, Inc., and shall be suitable for the conditions and duties imposed on them. If a UL label is not available from the manufacturer, when requested or required by the local authority having jurisdiction, an approved electrical testing company in accordance with NEC shall test the equipment. The Design-Builder shall submit to the Department's Project Manager data indicating compliance with standards prior to installation. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.
- B. All component parts of each item of equipment or device shall bear the manufacturer's nameplate, giving the name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate maintenance or replacement. The nameplate of a subcontractor or distributor will not be acceptable.
- C. Any deviations from size and/or type of material specified herein shall be submitted to the Department's Project Manager for approval.

ELECTRICAL CONDUIT AND FITTINGS:

- A. Materials shall conform to the requirements of Delaware Standard Specifications, Section 745.02.
- B. Conduit shall be sized in accordance with the requirements of the NEC. Minimum size shall be 3/4 inch.
- C. All conduit shall be UL approved and shall be suitable for marine environment use.
- D. All conduit and fittings shall be water-tight.

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- E. Conduit installed for Conectiv from the switchgear to the transformer(s) shall be PVC schedule 40 and be gray in color.
- F. PVC schedule 40 shall meet the requirements of UL-651.
- G. Flexible conduits shall be UL listed, liquid-tight, PVC covered hot dip galvanized steel.
- H. Multi Duct conduit shall consist of outer duct and inner duct conduit. The outer duct conduit shall be 4" high density polyethylene (HDPE) schedule 40 or SDR-13.5 smooth wall conduit with permanently pre-lubricated lining, meeting ASTM D247, ASTM D3-35 and NEMA TC7 specifications. Inner duct conduit shall be 1" HDPE ribbed duct.
- I. Fittings shall be of the same material and finish as the raceways and shall meet requirements of UL-514 and ANSI C80.4. Threaded connectors shall be used for all rigid metal conduits.
- J. Conduit Expansion Fittings
 - 1. Conduit expansion fittings shall be installed where conduits cross expansion joints in the structure or where otherwise required by the NEC. All fittings shall be of the same material as conduit raceway.
 - 2. Conduit couplings shall be capable of accommodating a minimum of 125% of the anticipated design movements at all joints resulting from expansion, contraction, creep, shrinkage, and/or deflection.
 - 3. Expansion fittings shall provide for grounding continuity as required by NEC. Bonding straps shall be of sufficient length to allow for full expansion.
 - 4. Expansion joints shall be rated UL 514.
- K. Sleeves
 - 1. Provide sleeves wherever electrical and communications conduit is required to penetrate bridge members.
 - 2. Inside diameter of sleeves shall be at least ½ inch larger than the outside diameter of conduit. Sleeves shall be installed to provide at least ¼ inch space all around the conduit.
 - 3. The Design-Builder shall provide shop drawing detailing the size and location of sleeves in each bridge segment.

BOXES, ENCLOSURES, AND CABINETS:

- A. Each box shall have sufficient volume to accommodate the number of conductors in the box, or sufficient dimensions to accommodate the size of conduit entry, in accordance with the NEC.
- B. Junction boxes inside the bridge shall be of the non-metallic type and be rated NEMA 4X. Drill and tap boxes for conduit openings.
- C. ITMS junction boxes shall be 24" x 12" x 6" deep and shall be accessible from the northbound and

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southbound outside roadway shoulders.

- D. Hinged or screw cover enclosures inside the bridge shall have continuous or separate hinge covers held closed by screws or flush latch.
- E. Panel board enclosures inside the bridge shall be stainless steel boxes with removable interior panel and removable front. Panel board enclosures shall have a hinged door in front cover with flush latch and concealed hinge and a key latch to match panel boards.
- F. Panels for mounting electrical components shall be minimum 14-gauge steel.
- G. Enclosures outside the bridge including, but not limited to, the junction boxes for ITMS conduit installed in traffic barriers and the main bridge distribution panel board enclosure shall be NEMA 4X, stainless steel.

ELECTRICAL CABLE, WIRE AND CONNECTORS:

- A. Conductors shall be copper, 98 percent conductivity, soft annealed copper meeting requirements of ASTM B33.
- B. Conductors No. 8 AWG and larger shall be stranded.
- C. Wire and cable shall be delivered to the job site in full coils or reels, each bearing a tag containing the UL approval stamp, name of manufacturer, trade name, code, type of wire, and month and year of manufacture.
- D. All wire(s) to be used in this contract shall be manufactured in conformance with the National Electric Code, insulated for 600 volts, and be of the type THHN/THWN.
- E. Wires and cables for maximum 600 VAC power circuits and control circuits shall be THHN/THWN. The insulating tape shall be of the self-bonding type.
- F. The jacket type shall be of the waterproof type.
- G. The Design-Builder shall use soapstone powder, or approved substitute, as lubricant for wire pulling.
- H. The Design-Builder shall provide a sealing type of waterproof compound for painting of rubber tape.
- I. Splices shall be mechanically secured by means of a standard tinned copper pressure type connector. Splice connectors for No. 10 AWG and smaller gauge solid conductors shall be insulated pressure twist-on nut type. Splice connectors for No. 8 AWG and larger gauge conductors shall be split bolt or compression type for making parallel or butt splices. Provide companion performed plastic insulating covers or tape equivalent to conductor insulation.
- J. Provide solderless terminal lugs for stranded and multiple solid conductors at connection to terminals or use UL listed crimp tool compression style lugs.
- K. Wire and cable shall have the following information surface printed at regular intervals throughout

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their entire length:

1. Manufacturer or trade name
2. Size of conductor
3. Type of insulation
4. Voltage classification
5. Color coding
6. Color coding shall be provided throughout the entire network for service, feeder, branch, control and low energy signal circuit conductors. Conductors shall have factory impregnated color throughout their entire length. Phase taping is not permitted. Color shall be green for grounding conductors, and white or gray for neutrals. The color of conductors shall be as follows:

240/120V Three Phase System:

PHASE A - black;
PHASE B - orange;
PHASE C - blue/red;
NEUTRAL - white;
GROUND - green.

240/120V Single Phase System:

PHASE A - black;
PHASE B - red;
PHASE C - n/a;
NEUTRAL - white;
GROUND - green.

GROUNDING:

- A. Conductors shall be copper, 98 percent conductivity, soft annealed copper meeting requirements of ASTM B33.
- B. Ground rods shall be sectional; segments shall be 0.75 inches in diameter and 10 feet in length with a steel core and copper jacket. Ground rods shall be of sufficient length to obtain a resistance to ground not to exceed 25 ohms. Ground rods shall be UL approved and supplied with clamps for connecting the grounding conductor to the rod. Quantity of ground rods shall be as required to obtain the specified ground resistance. Ground wire shall be exothermically welded to ground rods.
- C. Grounding electrode conductors shall be insulated copper conductor. Size shall be in accordance with NEC Table 250-66.
- D. Equipment grounding conductor shall be sized in accordance with NEC article 250-122.
- E. Furnish an equipment grounding conductor to provide a continuous and effective grounding of all equipment throughout the entire electrical system. Extend ground conductor runs individually to the ground bus of the panel board.

CONCRETE FOUNDATIONS:

- A. Concrete for foundations shall have a minimum compressive strength at 28 days of 3000 psi.
- B. Anchor bolts for cabinet bases shall be cast into concrete foundations. Drilling and grouting of

anchor bolts into concrete foundations shall not be permitted.

LUMINAIRES, LAMPS AND LIGHTING STRUCTURES:

A. Luminaire Construction

1. All luminaires shall be constructed, wired, and installed in compliance with all applicable National, State and Local Codes. Unless otherwise specified, each luminaire shall be listed by the Underwriters' Laboratories as suitable for application and location shown and shall conform to any additional regulations necessary to obtain approval for use in locations shown. If Underwriters' Laboratories listing of luminaire is waived, all electrical components shall be UL recognized.
2. Internal wiring of luminaires shall contain a minimum number of splices and all splices shall be made with approved connectors. Wiring and connectors shall be suitable for the current, voltage and temperature to which they will be subjected.
3. Luminaires shall be constructed with the minimum possible number of joints. Joints shall be made only by means of approved welded, brazed, screwed, or bolted construction methods. Soldered joints shall not be acceptable. No self tapping screws, bled metal tapping methods, or rivets shall be employed for fastening any parts which must be removed to gain access to electrical components requiring service or replacement, or for fastening any electrical component or support for same.
4. Ferrous metal parts, and supports of luminaires other than parts manufactured out of stainless steel, shall be completely rust-proofed after fabrication and before finishing coatings are applied. Mounting frames and all screws, bolts, nuts, and other fastening or latching hardware shall be zinc, cadmium, or equivalent plated unless otherwise specified.
5. Non-ferrous metal, cast or extruded parts of luminaires shall be close grained, sound and free from imperfections or discolorations. Cast or extruded parts shall be rigid, true to pattern, and of ample weight and thickness. Parts to be visible after installation on job shall be properly fitted, filed, ground, buffed, and chased to provide finished surfaces and joints free of imperfections. Finished thickness of all cast parts shall not be less than 1/8 inch.
6. Where anodized aluminum finishes are required, the aluminum shall be surface treated before anodizing. The final finish shall be uniform and even in appearance and free from surface imperfections. Color of all visible parts shall match.
7. Prior to painting, all parts shall receive proper cleaning and etched surface preparation to assure paint adherence and durability. Finish shall be uniform, even in appearance and free from runs and surface imperfections.
8. Luminaires shall be suitably sealed and/or gasketed to prevent access of moisture into electrical components or enclosing diffusers, lenses, or globes.
9. Unpainted aluminum parts of luminaires shall be anodized to protect against corrosion.
10. Where luminaires require porcelain enameled finish, such finish shall be free of crazing, cracking, and orange peeling and shall meet or exceed RLM standards in all respects.

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Porcelain coating shall be not less than 7.5 mils thick. Reflective surfaces shall be white, non yellowing, and with minimum reflectance of 85 percent.

11. Where stainless steel or non ferrous metal surfaces (other than reflectors) are to remain unpainted, or where steel surfaces are to be electroplated, unless otherwise specified, they shall be coated with a baked on clear lacquer. Where aluminum surfaces are anodized, the clear lacquer coating may be omitted.
12. Reflectors shall be free of ripples, tool marks and other surface imperfections.
13. Sockets for all luminaires shall be suitable for the specified lamps and shall be set so that lamps are positioned in an optically correct relationship to lenses, reflectors, baffles, etc.
14. Face trims fabricated in pieces for rectangular or square luminaires shall have mitered corners, continuously welded and smoothed before finishing. Lapping of trim metal shall not be acceptable.
15. Glass used for lenses, refractors, or diffusers shall be high impact and high heat resistant. Prisms or other optical configurations shall be formed sharp and true.
16. High intensity discharge lamp luminaires shall conform to the following:
 - a. Screw base sockets shall have porcelain body with nickel plated bronze screw shell suitably attached and adequately reinforced to prevent tearing or distorting the shell when inserting or removing lamp. Sockets shall be rated minimum 660 watt, 250 volt or 600 volt (as required) for medium base and 1500 watt, 600 volt for mogul base.
 - b. Ballasts and matched capacitors shall be supplied suitable for the electrical characteristics of the supply circuits to which they are connected and for operating the specified lamps. Minimum power factor shall be 90 percent. They shall be UL recognized and rated suitable for installed operating temperatures.
 - c. Ballasts and capacitors mounted remote from luminaires shall be located and wired in accordance with the specific ballast manufacturer's recommendation.
 - d. Ballasts for outdoor use shall be equipped with weatherproof leads and capable of starting and sustaining the lamp arc down to the lowest outdoor temperatures encountered.

E. LED Navigation Lights:

1. Navigation lights shall be furnished and installed by the Design-Builder in accordance with Section 4.6.3 of the *Inspection, Maintenance and Construction Requirements* Performance Specification included in Part 3 of the Contract Documents.
2. Navigation lights shall be wired for LED lamps (green or red as specified) capable of

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operating at 120V. Lamps shall be vibration resistant and have a life of 100,000 hours.

3. Lamp housing shall be cast bronze.
4. All joints shall be sealed with weatherproof gaskets and non-hardening silicon sealer.
5. Lamp hardware shall be stainless steel.
6. Access shall be provided for service equipment inside the fixture head.
7. The lens shall be of permanent, rigid, heat-resistant glass, 8-inch diameter (177 mm I.D.) standard marine fresnel type.
8. The lens shall be cushioned with shock absorbing gaskets to absorb direct impact and reduce damage to the lens.
9. Navigation lights to mark the edge of channel shall have a 180 degree red lens (channel margin light). Navigation lights to mark the center of the channel shall have a 360 degree green lens (channel center light). Each set of three (3) navigational lights shall be supplied with a backup power supply system.
10. Navigational lights shall meet all requirements of the U.S. Coast Guard and other regulatory bodies.
11. Manufacturer of the navigation lights shall have a minimum of five (5) years experience in the manufacture of navigation lights and shall make available replacement parts for ten (10) years. The Design-Builder shall submit to the Department for approval documentation of the manufacturer's experience.
12. All navigation lights shall be individually inspected at time of final assembly and test.
13. Each navigation light shall be tagged "ACCEPTED" upon completion of inspection and a final inspection check list shall be included in the navigation light for validation of meeting internal Quality Assurance standards.

F. LED Navigation Lights Back-up Power Supply

1. Provide efficient, heavy duty, voltage and frequency controlled, auto-switching, emergency power source for navigation lights with an integrated heavy duty battery charger/regulator.
2. Electrical enclosure for power supply and batters shall be compression molded, flame-retardant, fiberglass reinforced polyester. Enclosure shall be chemically resistant to corrosive atmospheres.
3. The cover shall be removable from the enclosure and be padlockable with quarter turn door latches.
4. Enclosure shall be vented to provide adequate cooling in the power supply enclosure and ventilation of excess gasses in the battery enclosure.

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5. Switching power supply shall be capable of a maximum sustained output of 2000 watts with a regulated output of 120 VAC with hardwire outlets. Upon failure of commercial power, the unit shall automatically switch over to an external battery source, and continue to supply voltage and frequency controlled 120 VAC, 60 Hz power to the navigation lights for as long as battery power is available.
6. Power supply shall sense low voltages on commercial power and switch over to the battery supply when needed. A built-in five second delay shall protect connected equipment when utility AC power returns by waiting five seconds for rolling over voltages to subside before reconnecting to utility power.
7. DC fuses shall be supplied to protect against overload during battery operation and accidentally reverse polarity during battery connection.
8. A remote module connector shall be standard on all power supplies; it shall allow for remote "ON/OFF" control as well as indicator light monitoring from a point distant from the power supply.
9. Two batteries and a weather-proof enclosure shall be supplied. The batteries shall be 12V, 115 amp-hour valve regulated lead acid batteries.

G. Aerial Beacon and Controller:

1. Aerial beacons shall be furnished and installed by the Design-Builder in accordance with Section 4.6.3 of the *Inspection, Maintenance and Construction Requirements* Performance Specification included in Part 3 of the Contract Documents.
2. The aerial beacon shall be a dual white/red flashing medium intensity strobe that meets all requirements of the Federal Aviation Administration's (FAA) Advisory Circular 150/5345-43.
3. A power supply control cabinet, photocell, and strobe cable shall be provided with the aerial beacon.
4. Horizontal Coverage: 360°
5. Vertical Beam: 3° Min.
6. Fresnel Optics: 320 mm Lense
7. Lamp Description: 1 - Xenon flashtube and an array of LED's
8. Effective Candelas: 20,000 +/- 25% (day); 2,000 +/- 25% (night)
9. No. of flashes/minute: 40 (day) / 22 (night) +/- 2 FPM
10. Flashhead Dimensions: 28 in. x 17 ½ in. (approx.)
11. Flashhead Material: Acrylic

13. Operating Voltage: 120V

H. Maintenance Lights

1. Maintenance lights shall be furnished and installed by the Design-Builder in accordance with Section 4.7.1 of the *Inspection, Maintenance and Construction Requirements* Performance Specification included in Part 3 of the Contract Documents.

I. Aesthetic Lighting

1. Aesthetic lighting shall be designed, furnished, and installed by the Design-Builder in accordance with Section 4.8 of the *Inspection, Maintenance and Construction Requirements* Performance Specification included in Part 3 of the Contract Documents and shall be fully suited for use in a marine environment.

2. The aesthetic lighting mounting system shall include a mechanism for adjusting, aiming and locking the tilt and direction of the luminaire.

3. The luminaire system shall include a vibration dampening system to ensure the safe, continuous operation of the lighting.

4. The primary lens shall be impact and heat resistant. A water-tight system shall be provided to eliminate condensation and prevent the intrusion of dirt and moisture within the light module and lens.

5. All exposed hardware shall be marine-grade stainless steel or corrosion-free composite materials.

6. The lighting system shall be capable of fully functioning when are temperatures are between -20° F and 160° F.



7. Luminaire shall be IP-66 U.L. listed for protection against water. All hardware such as, but not limited to, hinges, latches, springs, nuts, screws, washers, pins and other similar parts shall be made of marine grade stainless steel which is inherently corrosion-proof in this application. All hinges and latches shall be made to withstand the vibrations and winds encountered in this application. All joints shall be gasketed to be watertight.

8. The luminaire and ballast enclosures shall each bear a nameplate or other type of indelible and aesthetically acceptable marking that shall identify it as to type, catalog number, manufacturer, wattage and voltage.

J. Path Lights

1. Pedestrian pathway luminaire suitable for use in a marine environment shall be furnished and installed by the Design-Builder. Luminaires shall be impact and heat resistant and safe for use near pedestrians.

2. The lamp cover shall be sealed, but still allow for easy re-lamping.

2. The lamp cover shall be sealed, but still allow for easy re-lamping.
3. The luminaire and ballast enclosures shall each bear a nameplate or other type of indelible and aesthetically acceptable marking that shall identify it as to type, catalog number, manufacturer, wattage and voltage.

K. Replacement Units

1. Additional lighting units and/or replacement bulbs shall be furnished to the Department in accordance with Section 2.5 of the *Warranty Requirements* Performance Specification included in Part 3 of the Contract Documents. The Design-Builder shall coordinate with the Department's Project Manager for delivery of the lighting units to the Department, which will maintain the lighting units for storage. Lighting units shall be packaged or bundled appropriately in order to protect the units during storage.

ELECTRICAL CONTROL DEVICES

A. Timer for Aesthetic Lighting and Path Lights

1. Control for aesthetic lighting and path lights shall be digital 365-day astronomical timers with holiday and seasonal scheduling. Operating voltage shall be 120V. Timers shall be programmed to turn on at dusk and off at dawn unless otherwise directed by the Department.
2. The controller shall program in AM/PM format with one-minute resolution. The display shall be of LCD type. The controller shall be capable of 99 set points and separate scheduling for each day of the week. The controller shall have 365-day holiday capabilities with 24 single dates and 4 seasons of unlimited duration. Different daily schedules shall be programmable within each season. The controller shall have Daylight Savings time and automatic Leap Year correction. The controller shall be astronomic with 1 to 99 minutes +/- offset from Sunrise or Sunset. The unit shall have a NEMA Type 3R indoor/outdoor enclosure. The controller shall have permanent schedule retention for up to 40 years and a 30-day backup for real time using field replaceable 9V lithium battery. The controller shall be capable of manual override ON or OFF to the next scheduled event using one button.

C. Photoelectric Controls

1. A photocell shall be provided and installed with the aerial beacon and controller.
2. The photocell shall be in a sealed unit.
3. All necessary mounting hardware shall be furnished by the Design-Builder.

D. Switches

1. Electric switches shall have three terminals used to control a circuit from two different locations or four terminals used to control a circuit from two or more locations.

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2. Switches shall be specification grade and have a non-metallic enclosure.
3. All switches shall be labeled with a name plate as to identify the lighting areas that the switch controls.
4. Switches shall be provided at all entry points to voided structure elements, at a minimum.

ELECTRICAL DISTRIBUTION EQUIPMENT

A. Contactors

1. Contactors shall be of the current ratings and number of poles specified in the Design-Builder's Electrical Plans. Contactors shall be held by permanent magnets.
2. Contactors shall be fully rated for all classes of load to 600 volts AC and shall have an interrupting rating of 600 percent of rated current.
3. Contactors shall be rated for ballast lighting loads.
4. A switch or astronomic timer shall actuate the control coil. Contactors actuated by an astronomic timer shall be electrically held.

B. Circuit Breakers

1. Circuit breakers shall be molded case type having a minimum rating of 10,000 amp interrupting capacity (AIC) and be quick make, quick break, thermal magnetic, trip indicating, and have common trip on all multiple breakers with internal tie mechanism.
2. For circuit breaker frame sizes 125-amp and smaller, bolt-on circuit breakers shall be used.
3. The circuit breakers shall have the current and voltage ratings and number of poles as specified in the Design-Builder's Electrical Plans, and shall be treated to resist fungus and be ambiently compensated for the enclosure and proximity to adjacent breakers.
4. Circuit breakers in panel boards shall conform to Federal Specification W-C-375 and shall be bolted to copper busses.

C. Panel Boards

1. Panel boards shall conform to Federal Specification W-P-115 and shall be suitable for operation on the voltage and type service specified in the Design-Builder's Electrical Plans. They shall be UL listed and labeled.
2. Panel boards shall be equipped with the number and size of circuit breakers specified by the Design-Builder.
3. Bus ratings shall be as specified by the Design-Builder.
4. Lugs shall be compression style, suitable for number, size, trip ratings, and conductor materials.

5. Panel boards in the bridge electrical control room shall be NEMA 3R, 225 Amp, 120/240V, 3-phase, 4-wire, 42 circuit panel boards with a 200 amp main circuit breaker. Panel boards shall have a copper bus, lockable door and shall be surface mount type.
6. Bridge Service Panel
 - a. The main bridge distribution panel shall be suitable for use as service equipment. The size and amperage shall be as specified by the Design-Builder. The branch circuit breakers shall be the size and amperage as specified by the Design-Builder and be suitable to service the distribution panels located within the bridge.
 - b. The main bridge service panel shall be mounted in a NEMA 4X pad mounted double door padlockable enclosure. Size shall be as specified by the Design-Builder.
 - c. Panel boards shall have a copper bus, lockable door and shall be surface mount type.
7. Terminal Blocks shall be NEMA ICS 4, UL listed.

D. Receptacles

1. Receptacles for use by bridge maintenance personnel shall be GFCI duplex receptacles, rated 125 Volts, 20 amp, 3-wire with integral ground fault current interrupter and weatherproof while-in-use cover.
2. GFCI receptacles shall detect and trip at a current leakage of 6 milli-amperes and shall have front mounted test and reset buttons. GFCI receptacles shall conform to UL Standards 943, Class A and NEC requirements for ground fault protection.
3. Receptacles shall be mounted in a rugged, die-cast aluminum NEMA 3R box rated suitable for wet locations. Box shall have a powder coated, corrosion-resistant finish.

E. Transformers

1. The Design-Builder shall coordinate with Conectiv and determine the number, size, and location of transformers to be provided. Transformers and pads shall be supplied and installed by Conectiv.
2. The Design-Builder shall contact the Conectiv representative specified in the Utility Statement included in Part 5 of the Contract Documents to coordinate the installation of the transformer and conduits.
3. The Design-Builder shall furnish and install 4 inch Schedule 40 PVC Conduit (gray in color) for the primary electric service.
4. Conectiv shall supply and install primary electric cable.
5. The Design-Builder shall furnish and install all conduit and cable for secondary electric

services.

6. The Design-Builder shall furnish all required secondary conductor termination hardware.

F. Meter Socket

1. Meter pan shall be furnished and installed by the Design-Builder and shall be approved by the Utility Company.
2. Electric meter shall be mounted to the exterior of the bridge main service panel enclosure.

UTILITY HANGERS

A. The Design-Builder shall use a utility hanger system, as needed, to support conduits, boxes, luminaires, and all other electrical equipment. The utility hanger system shall consist of cast-in-place concrete inserts, metal framing members and accessories as required for mounting/supporting equipment.

B. The load and spacing on each hanger and/or insert shall not exceed the nominal resistance for any component of the support system, including the concrete and inserts that hold the support system. The Design-Builder shall submit structural calculations with the Working Drawings for the utility hanger system. The calculations may include, but are not limited to, a description of the design criteria, stress and deflection analysis, selection of framing members. The Design-Builder shall submit all shop/assembly drawings necessary to completely install the utility hanger system in compliance with the Contract Documents. The Design-Builder shall submit all pertinent manufacturers published data, including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns.

C. Concrete Inserts

1. Concrete inserts shall provide the minimum nominal resistances indicated on the Working Drawings. To inhibit concrete seepage, all inserts shall be provided with closure strips and end caps or foam filler. Anchors shall be spaced according to manufacturer's recommendations based on factored loads.
2. Manufacturer's standard brackets, inserts, and accessories designed for use with continuous concrete inserts may be used. Insert length and spacing shall accommodate all conduit sizes and equipment in the area as required by the NEC.

D. Supplementary Structural Supports

1. The Design-Builder shall provide supplementary structural supports and accessories as required, including, but not limited to, metal framing members, clamps, brackets, hanger rods, nuts and fittings.
2. Hangers and supports shall be sized to fit the outside diameter of conduit.

E. Material and Finish

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1. Utility hangers shall be protected against corrosion and shall have all sharp burrs removed

F. Quality Assurance

1. The Design-Builder shall submit to the Department for approval proof that manufacturer has a minimum of 5 years experience in manufacturing metal framing systems of the types required. The manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.

WEATHER SENSOR PUCKS

- A. The Design-Builder shall provide all 4" multi-duct ITMS conduit as shown on Contract #25-073-02 Plan Sheet B-601 Plans to service the weather sensor pucks. Multi-duct conduit shall be provided over the entire bridge length on both the east and west sides.
- B. Weather Sensor Pucks and wiring shall be furnished and installed by others.

Construction:

GENERAL

- A. All equipment installations shall conform to NEC, local utility company requirements, and State and local laws and ordinances governing the work. All electrical work shall be accomplished under the direct supervision of a master electrician. All work performed shall be performed under the supervision of a master electrician. The Design-Builder shall obtain and pay for all permits, licenses and inspection fees.
- B. The Design-Builder shall furnish all labor, material, instruments, fuel, and power required to perform all necessary tests. All tests shall be to the complete satisfaction of the Department's Project Manager. All defective materials and/or workmanship discovered as a result of these tests shall be removed and replaced at the Design-Builder's expense and the test repeated.
- C. Install raceways, fittings, boxes, and cabinets free from direct contact with reinforcing steel.
- D. Provide fasteners, anchor bolts, anchorage items and supports as required to insure proper and rigid alignment. Attach equipment with stainless steel fasteners sized according to size and weight of equipment and thickness of supporting surfaces.
- E. Make metallic conduit electrically and mechanically continuous and ground as required. Conduits shall be continuous between outlets, boxes, cabinets, and panels and shall enter and be secured to each box. Provide ground conductors in each conduit run.
- F. Stored materials, even though approved before storage, may again be inspected by the Department prior to their use in work. Stored materials shall be located so as to facilitate their prompt inspection.

ELECTRICAL CONDUIT AND FITTINGS

- A. Construction methods shall conform to the following Delaware Standard Specifications Subsections:

Under existing pavement, PVC	745.03 (b)
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Under new pavement, galvanized and PVC

745.03 (c)

- B. For underground installations, when multiple conduits are required, the Design-Builder shall install all conduits at the same time as the initial installation. Additional conduits may be stacked one on top of the other, side by side or in a matrix. The orientation shall be at the Design-Builder's discretion, but conduits shall not twist around one another. Conduits installed in the same slot, trench, or bore shall remain oriented the same in relation to one another throughout the conduit run.
- C. Bends
1. Make changes in direction with bends and fittings. Field-made bend and offsets shall be made with a hand bender or conduit-bending machine.
 2. Bending of conduits with a pipe tree or vise is prohibited. Flattened, dented, or deformed conduits are not permitted. Remove and replace the damaged conduits with new undamaged material.
 3. Conduit runs shall have no more than the equivalent of three 90-degree bends or total 270 degrees of bend. Pull boxes shall be provided where shown on the Design-Builder's Electrical Plans and as required to meet the above requirement.
- D. Connections
1. Conduit runs shall be made with as few couplings as standard length will permit.
 2. Rigid steel conduit connections shall be threaded. Field cut threads of galvanized conduit shall be painted with an approved galvanizing repair paint prior to assembly.
 3. Nonmetallic conduit shall be connected by a solvent welding process.
- E. Conduit Terminations
1. Pull boxes or conduit bodies shall be used at conduit terminations.
 2. Conduits terminating in cast iron junction boxes shall be threaded into hubs with bonding screws furnished and installed on the interior of the box.
 3. Conduits terminating in junction boxes without hubs shall be secured with two lock nuts with an insulated grounding bushing furnished and installed.
 4. Conduits terminating at concrete foundations and junction wells shall be secured as specified by the Design-Builder.
 5. All ends of unused conduit shall be capped.
- F. Cleaning and Capping
1. Prior to installation of conductors in any run, the conduit shall be checked for cleanliness and all obstructions removed. Each conduit run and all fittings shall be cleaned of all debris by a pull through mandrel type device inserted in the presence of the Design-Builder's

Construction QC Manager.

2. All ends of conduits shall be capped by use of a manufactured cap or plug. Prior to the installation of wiring, manufactured caps or plug shall be removed and an insulated bonding bushing for galvanized rigid conduit or bell end fitting for PVC conduit installed.
3. Repair cuts, nicks and abrasions or replace damaged conduits as directed by the Design-Builder's Construction QC Manager.

G. Pull Wire

1. After installation, all conduits shall have a pull wire or cord installed. Pull wire or cord shall be made of corrosion resistant material with a minimum breaking strength of 200 lb.

H. Exposed Conduit

1. Exposed conduit runs shall be parallel to, or at right angles to, walls, slabs, etc.
2. Conduit shall be located to minimize accumulation of dirt.
3. Conduit shall be attached to steel, concrete, masonry, or timber by straps, clamps or hangers of an approved type made of stainless steel or galvanized malleable iron. Conduit shall be attached to utility hangers inside the bridge.
4. Spacing of attachments shall be per NEC conduit support requirements or as specified in the Design-Builder's Plans.
5. Conduit shall be installed in such a manner as to avoid all obstructions and to preserve head room and keep openings and passageways clear.

I. Expansion Joints

1. Where conduits cross expansion joints in the structure, or where otherwise specified, expansion joint fittings shall be of the type that assures electrical continuity across the joint.
2. Expansion joints shall be installed in such a manner as to allow equalized movement for both expansion in hot weather and contraction in cold weather. Therefore the temperature at the time of installation shall be considered in the nominal positioning of the joint in the conduit and allowance for movement shall favor the opposite season.
3. Fittings and strap clamps shall be securely tightened and sufficient length shall be allowed for temperature movement.
4. Two or more expansion fitting may be placed in series with one another where required.

J. Multi-Duct Conduit

1. If a pull line is not already pre-installed in the conduit, Design-Builder shall jet in a pull line in new conduit prior to pulling inner duct. Design-Builder shall rod existing conduit to ensure that it is free of any obstructions before installing a pull line and pulling inner duct.

2. If a pull line is not already pre-installed in the inner duct, Design-Builder shall jet in a pull line in each inner duct after installing the inner duct. When installing more than one, inner ducts shall all be pulled in together and kept parallel with no twisting or tangling.
3. The pulling procedure and lubricant shall be as recommended by the manufacturer.
4. No splicing of inner duct shall be permitted between junction wells.
5. All runs must be continuous and unbroken

K. Sleeves

1. Set sleeves in cast-in-place concrete components as they are constructed, prior to concrete pour.

BOXES, ENCLOSURES, AND CABINETS

- A. Install enclosures at indicated or approved locations in accordance with manufacturer's instructions and at convenient operating height such that unless shown otherwise, no manually operable device will be within 18 inches of the floor or higher than 6 ½ feet above the floor.
- B. Adjust straight and plumb and fasten enclosures securely in place. Align securely and independently fasten each section of multi-section enclosures. Inside the bridge, install all enclosures, boxes, and cabinets on structural channel systems, such as strut.
- C. Junction boxes for the multi-duct ITMS conduit shall be provided at a maximum spacing of 500 feet. ITMS junction boxes shall be accessible from the outside roadway shoulder in both the northbound and southbound directions on the bridge.
- D. ITMS junction boxes shall be provided at mid-span of the main span of the bridge in both the east and west traffic barriers.

ELECTRICAL CABLE, WIRE, AND CONNECTORS

- A. The Design-Builder shall provide adequate equipment satisfactory to the Department's Project Manager for installation of wire; and shall pull all wire through conduits in a manner which will not overstress, or stretch any wire, and shall use precautions so as not to score, cut, twist, or damage the insulation and/or the jacket.
- B. In pulling the wire into conduits, where the strain on the wires is likely to be excessive, the Design-Builder shall use soapstone powder as lubricant.
- C. Without exception, all wires in junction or fuse boxes, transformer bases, and service panels shall be provided with a sufficient slack; and shall be arranged in a neat and orderly manner.
- D. After wires have been installed, and pending permanent connection or splicing, the end of each wire shall be carefully sealed using rubber tape, and painted with a sealing type of waterproof compound.

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- E. All wiring shall be furnished to give a neat and orderly appearance. Wires shall be supported on cable rack assemblies in all junction wells and junction well foundations. Wires in distribution cabinets shall be neatly arranged and laced with cable ties.
- F. Where two or more wires occupy the same conduit, they shall be drawn in together and be kept parallel to each other by means of a pulling head. Phase legs shall be arranged circumferentially and in sequence around neutral wires.
- G. Wires shall be spliced in junction wells or junction boxes as previously described. Splices shall then be wrapped with half-lapped layers of insulating tape installed in opposite directions. Several layers of half-lapped jacket tape shall be applied over the insulating tape. Two coats of waterproofing sealant shall be applied over the complete splice.
- H. The Design-Builder shall install complete raceway system and clear debris and moisture before conductor installation. Provide sufficient slack in conductors. Conductors shall be identified by circuit number at all pull and junction boxes. Conductors terminating at terminal blocks shall be identified with numbers and/or letters identical to the circuit or control identification.
- I. Conductor Identification
 - 1. Power conductors terminating in the NEMA enclosure shall be identified at each end and in intervening junction and pull boxes. Where feeder conductors pass through a common box, tag the feeder to indicate the electrical characteristics and circuit number for terminals and on exposed portions of conductors within pull and junction boxes.
 - 2. Wire markers shall be clop sleeve or sleeve type, made of PVC, nylon, or delrin, white in color, with black letters impressed in the material. On wire too large for the standard sleeve sizes, sleeve type markers shall be used, inserted on a cable tie and the tie then installed around the wire.
- J. Check all wires for continuity and identification by means of a D.C. test device with bell or buzzer or by means of battery operated phones before terminal connections are made.
- K. Perform all insulation resistance tests on wiring after splices have been made but prior to making final terminations. Perform the tests with disconnecting devices in the open position to include only the circuits to be tested.
- L. Perform insulation resistance tests on all feeders and subfeeders. This includes all cables to the final points of distribution (panel boards, and other incidental items). Measure and record the insulation resistance for each phase conductor to ground.
- M. Perform the tests by utilizing a megger insulation tester with a full range scale from 0 to 200 megohms and using 1000 volts D.C. The minimum acceptable reading on any feeder is 20 megohms.

ELECTRICAL IDENTIFICATION

- A. Identify and label each piece of equipment and conductor. Develop a schedule for labels showing the text of each as shown on the Drawings, schedules and by the nature of the system. In the absence of specific data, the Design-Builder shall develop text from the nature of the service or system and

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submit for approval by the Department's Project Manager. The text shall be arranged to produce a legible comprehensive identification system.

- B. Path lights shall be labeled with the bridge segment identification inside the pedestrian railing post as well as at the junction box inside the bridge.
- C. Switches shall be labeled with a name plate identifying the section of bridge lighting that the switch operates.

GROUNDING

- A. Unless otherwise specified, ground all non-current carrying metallic parts of electrical equipment and the neutral of all wiring systems in accordance with the NEC and other applicable codes. Where equipment contains a ground bus, extend and connect grounding conductors to that bus. Run ground conductors inside conduits enclosing the power conductors.
- B. **Metallic Enclosures**
 - 1. Bond the grounding conductors to metallic enclosures at each end and to all intermediate metallic enclosures.
 - 2. Make connections of grounding conductors to circuits 20 amps or above by a solderless terminal and a 5/16" bolt tapped to the equipment housing.
 - 3. Ground connections to smaller equipment grounding system with groundings clips mounted directly on the box or with 3/8" machine screws.
 - 4. Remove all paint, dirt or other surface covering at grounding conductor connection points so that good metal-to-metal contact is made.
 - 5. Test metallic conduit and raceways, equipment enclosures, metallic cable troughs, fences, handrailings, metallic structures and light standards for continuity to grounding system.
- C. **Non-Metallic Enclosures**
 - 1. One or more equipment grounding conductors brought into a non-metallic box shall be arranged so that a connection can be made to any fitting, device, switch, etc.
 - 2. Grounding terminals shall be of the solderless type and approved as pressure-terminal connectors recognized for the wire size used.
- D. **Ground Rods**
 - 1. Test each ground rod to measure the earth resistance and report results to the Department's Project Manager. Tests must be conducted before the ground wire is permanently attached. Follow manufacturer's recommendations for measuring earth's resistance to ground.
 - 2. The resistance must be less than 25 ohms. If the resistance is greater, then an additional ground rod(s) must be driven, temporarily connected to the first and retested.

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3. Ground rods shall be joined to grounding wire by an exothermic weld after successful testing. The weld and exposed cable shall be painted with two coats of insulating varnish.

CONCRETE FOUNDATIONS

- A. Non-standard bases shall be designed by the Design-Builder and depicted on the Electrical Plans. The actual bases shall conform to the dimensions shown on the Electrical Plans.
- B. Provide fasteners, anchor bolts, anchorage items and supports as required to ensure proper and rigid alignment. Attach equipment with fasteners sized according to size and weight of equipment and thickness of supporting surfaces.
- C. Anchor bolts shall be plumb. Suitable templates for setting anchor bolts shall be accurately placed and left in place until the concrete has attained its initial set.
- D. All concrete shall be mixed, handled, placed, cured, and tested in accordance with all applicable requirements.
- E. It is the intent that all foundations be poured against existing, undisturbed earth. Where the existing ground, however, will not retain its shape during excavating operations, or if the excavation should show any tendency to cave-in before pouring the foundation, a sleeve or form shall be provided to retain the earth and receive the concrete. Sleeves or forms shall be of the required size and shall be carefully placed.
- F. Exercise care during concrete pour operations to avoid movement or displacement of reinforcing cage or template-set anchor bolt template.
- G. Precast concrete caps will not be permitted. The entire case shall be placed as a unit, forming a one-piece monolithic concrete structure.
- H. No portion of the form or sleeve shall be left above the finished grade after concrete has cured.
- I. Conduits entering the base must enter only in the designated area. A minimum distance of 1 inch shall be maintained between conduits and a minimum distance of 2 inches between conduits and the ground rods. A minimum of 10 feet of the ground rod shall be driven into undisturbed soil. The grounding conductor shall run in a 3/4 inch RGS sleeve into the enclosure.

UTILITY HANGERS

- A. Utility hangers and concrete inserts shall be installed in accordance with manufacturer's recommendations and with recognized industry practices.
- B. The Design-Builder shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections are completed.
- C. Installation shall be accomplished by a fully trained manufacturer authorized installer. During installation, it shall be the responsibility of the Design-Builder to protect this work from damage. Upon completion of installation, the Design-Builder is responsible for protecting the work from damage during the remainder of construction on the project.

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- D. Inserts shall be of a type which will not interfere with reinforcing or post-tensioning devices as shown on the Plans and which will not displace excessive amounts of structural concrete.
- E. Plan, layout, and coordinate setting of inserts prior to concrete pour. Conduit support locations shall be as required by the NEC and as detailed in Shop Drawings.
- F. Suitable concrete inserts for conduit and equipment hangers shall be set and properly located for all conduit and equipment to be suspended from concrete construction.

LUMINAIRES, LAMPS, AND LIGHTING STRUCTURES

A. General

- 1. Luminaires shall be installed complete with all equipment, materials, parts, attachments, devices hardware, hangers, cables, supports, channels, frames, and brackets necessary to make a safe, complete and fully operative installation. Manufacturer of each luminaire shall supply complete installation instructions including diagrams, illustrations, etc. The Design-Builder shall install in strict conformance with such instructions.
 - 2. Luminaires, when installed, shall be set true and be free of light leaks, warps, dents or other irregularities.
 - 3. Supports for luminaires shall be adequate for the weight of the luminaires. Where necessary, the Design-Builder shall provide extra supports from the structure at no additional cost.
 - 4. The Design-Builder shall provide manpower and tools for final focusing, at no additional cost to the Owner, of all adjustable luminaires, including such focusing as may be necessary after regular working hours. This includes, but is not limited to, the focusing of all adjustable luminaires in the tie beam. Such focusing must be completed to the satisfaction of the Department's Project Manager.
 - 5. Blemished, damaged, or unsatisfactory luminaires shall be replaced in manner satisfactory to the Department's Project Manager.
- B. After installation has been completed and prior to the performance test, refractors and reflectors shall be cleaned with a product approved by the manufacturer.
 - C. Navigation lights sets shall be installed on the east and west sides of the bridge and in accordance with the manufacturer's recommendations and instructions. A back-up power supply shall be installed for each navigational light.
 - D. The aerial beacon and controller shall be installed at the apex of the bridge or the top of pylons and in accordance with the manufacturer's recommendations and instructions and FAA requirements.
 - E. The maintenance lights shall be installed throughout the bridge according to the Design-Builder's Plans and in accordance with the manufacturer's recommendations and instructions.
 - F. Aesthetic lighting shall be installed according to the Design-Builder's Plans and in accordance with manufacturer's recommendations and instructions.



Path lights shall be installed along the length of the bridge such that the lighting fixtures do not in any way interfere with the intended function of the pathway or railing. Path lights shall be installed according to the Design-Builder's Plans and in accordance with manufacturer's recommendations and instructions.

- H. Check all lighting circuits for proper operation. Check lighting controls for proper operation.
- I. Whenever practicable, test lighting systems at the same time that the distribution panel board or switchboard is tested.

ELECTRICAL CONTROL DEVICES

A. Timers

1. Timers for bridge lighting shall be installed in the electrical room in the bridge.
2. Timers shall be mounted to a metal framing system as indicated on the Design-Builder's Plans.
3. All timers shall be installed in accordance with manufacturer's recommendations and instructions.

- B. The aerial beacon photocell shall be installed in accordance with manufacturer's recommendations and instructions.

ELECTRICAL DISTRIBUTION EQUIPMENT

A. Panel Boards

1. Install panel boards and accessories according to NEMA PB 1.1.
2. Comply with mounting and anchoring requirements specified by the Design-Builder in the Electrical Plans.
3. Mount plumb and rigid without distortion of box.
4. Install overcurrent protective devices and controllers.
5. Set field-adjustable switches and circuit breaker trip ranges.
6. Install filler plates in unused spaces.
7. Arrange conductors in gutters into groups and bundle with wire ties after completing load balancing.

B. Receptacles

1. Receptacles inside the bridge shall be mounted as shown by the Design-Builder in the Electrical Plans.

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2. Connect receptacles to branch circuits using pigtails that are not less than 6 inches in length.
3. When conductors larger than No. 12 AWG are installed on 20 Amp circuits, splice No. 12 AWG pigtails for device connections. Where required, use a terminal block to tap down to a No. 12 AWG.

C. Transformers

1. Conectiv shall install the transformer and transformer pad at the location indicated.
2. The Design-Builder shall stub conduit at the transformer and at the switchgear (service location).
3. The Design-Builder shall furnish and install sufficient slack in the secondary conductors at the transformer for termination.
4. The Design-Builder shall furnish all required secondary conductor termination hardware for Conectiv.
6. Conectiv shall install the conductor terminators and terminate all conductors in the transformer.
7. Conectiv shall furnish and install primary electric.

D. Temporary Power

1. Should the Design-Builder deem temporary power necessary to aid in ease of construction, he shall be responsible for all coordination and costs associated with temporary power connections from the utility.

WEATHER SENSOR PUCKS

- A. The Design-Builder shall install all ITMS multi-duct conduit as detailed on Contract #25-073-02 Plan Sheet B-601 for the weather sensor pucks.
- B. Weather sensor pucks and associated wiring will be provided and installed by others.

TRENCHING AND BACKFILLING

- A. Trenches shall be excavated in accordance with the DelDOT Standard Specifications and in accordance with the NEC.
- B. In areas where conduit is trenched, a detector tape shall be placed in the trench at a depth of 6" below finished grade. The color of the tape shall be red. The tape shall be imprinted with a continuous warning message that reads "CAUTION: ELECTRICAL LINE BURIED BELOW" repeated every 36". The tape shall be inductively and conductively traceable using a standard pipe and cable-locating device.
- C. The trench shall be backfilled and compacted. Material used for backfill shall be free of topsoil, organic, frozen or other undesirable material. Spaces to be backfilled shall be kept free of trash and

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shall be cleaned before backfill is placed. All backfill shall be compacted in layers not exceeding 6" loose thickness. Compaction shall be done with mechanical or vibratory compaction equipment to obtain at least 92% of maximum density and moisture content within 2% of optimum.

- D. For work outside of the new construction area, restore grass, sidewalk and road to existing conditions upon completion of conduit installation.

THIS PAGE FOR SEQUENCING PURPOSES ONLY

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763503 - TRAINEE

Description:

The item shall consist of providing training in the construction crafts in accordance with the requirements stated in the General Notices of this proposal under the Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246). The Design-Builder shall submit the training program(s) for review and approval prior to start of field work.

The Department will supplement the cost to the Design-Builder at a fixed rate of \$.80 per hour toward the hourly rate of the trainee. Payment will be made based on the hours reflected in the Certified Payroll Reports for the hours the employee is engaged in the activities covered by the Department approved training program.

NE - 8/25/06

**763508 Project Control System Development Plan (CPM Schedule)
763509 CPM Schedule Updates and/or Revised Updates**

Progress schedules will be required for this contract. Progress schedules shall utilize the Critical Path Method (CPM). Attention is directed to the requirements of DB Section 105 as related to cooperation by the Design-Builder. Nothing in these special provisions shall be construed as relieving the Design-Builder from the responsibilities specified in DB Section 107, "Legal Relations and responsibility to the Public". All schedules are required to reflect a reasonable plan to execute the contract scope of work (both the design and the construction). The Design-Builder shall be solely responsible for the content of the schedule and the execution of all contract requirements.

The provisions in DB Section 108-2.1, "Progress Schedules" shall not apply.

DEFINITIONS

The following definitions apply to this section "Progress Schedule (Critical Path Method):"

- A. Activity: Any task or portion of a project, which takes time to complete.
- B. Baseline Schedule: The initial CPM schedule representing the Design-Builder's original work plan, as accepted by the Department.
- C. Controlling Operation: The activity considered at the time by the Department, within that series of activities defined as the critical path, which if delayed or prolonged, will delay the time of completion of the contract.
- D. Critical Path: The series of activities, which determines the earliest completion of the contract (Forecast Completion Date). This is the longest path of activities having the least amount of float.
- E. Critical Path Method: A mathematical calculation to determine the earliest completion of the contract represented by a graphic representation of the sequence of activities that shows the interrelationships and interdependencies of the elements composing a project.
- F. Contract Completion Date: The current extended date for completion of the contract shown on the most recent CPM update reviewed and accepted by the Department.
- G. Early Completion Time: The difference in time between the current contract completion date and the Design-Builder's scheduled early forecast completion date as shown on the accepted baseline schedule, or schedule updates and revisions.
- H. Float: The amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any activity or group of activities in the network.
- I. Scheduled Completion Date: The completion date of the last scheduled work activity identified on the critical path.
- J. Free Float: The amount of time an activity can be delayed before affecting a subsequent activity.
- K. Hammock Activity: An activity added to the network to span an existing group of activities for summarizing purposes.
- L. Milestone: A marker in a network, which is typically used to mark a point in time or denote the beginning or end of a sequence of activities. A milestone has zero duration, but will otherwise function in the network as if it were an activity.
- M. Revision: A change in the future portion of the schedule that modifies logic, adds or deletes activities, or alters activities, sequences, or durations.
- N. Tabular Listing: A report showing schedule activities, their relationships, durations, scheduled and actual dates, and float.

- O. Total Float: The amount of time that an activity may be delayed without affecting the total project duration of the critical path.
- P. Update Schedule: The modification of the CPM progress schedule through a regular review to incorporate actual progress to date by activity and to reflect the current plan to complete the project.
- Q. Time Scaled Logic Diagram: A schematic display of the logical relationships of project activities, drawn from left to right to reflect project chronology with the positioning and length of the activity representing its duration.
- R. Bar Chart (Gantt Chart): A graphic display of scheduled-related information, activities or other project elements are listed down the left side of the chart, dates are shown across the top, and activity durations are shown as date-placed horizontal bars.
- S. Near Critical Path: A path having 30 days or less of total float.
- T. Delay: The time period during which some part of the construction project has been extended beyond what was originally planned due to unanticipated circumstances. A delay occurs when the respective activity or group of activities, requiring additional time, impacts the completion of the successor construction activity and also extend the scheduled contract completion date.
- U. Data Date: The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."
- V. Narrative Report: .A document submitted with each schedule that discusses topics related to project progress and scheduling.
- W. Department Owned Float Activity: The activity documenting time saved on the critical path by actions of the Department. It is the last activity prior to the scheduled completion date.
- X. Time Impact Analysis: A schedule and narrative report developed specifically to demonstrate what effect a proposed change or delay has on the current scheduled completion date.

The Department will schedule and conduct a Preconstruction Scheduling Conference with the Design-Builder's Project Manager and Construction Scheduler within seven days after the proposer has received the contract for execution. At this meeting, the requirements of this section of the special provision will be reviewed with the Design-Builder. The Design-Builder shall be prepared to discuss its schedule methodology, proposed sequence of operations, the activity identification system for labeling all work activities, the schedule file numbering system, calendars, etc.. The Department will submit a scheduling shell project on electronic medium, displaying an activity code dictionary consisting of fields populated with Department's scheduling codes, filters, layouts, report formats, contract milestones, and a resource dictionary. The Design-Builder shall utilize these codes, filters, layouts, etc. and may add other codes as necessary to group and organize the work activities. Periodically the Department may request the Design-Builder to utilize additional filters, layouts or activity codes to be able to further group or summarize work activities.

Also, the Department and the Design-Builder shall review the requirements for all design and construction submittals applicable to the contract and discuss their respective preparation and review durations. All submittals and reviews are to be reflected on the Interim Baseline Schedule and the Baseline Schedule.

GENERAL SCHEDULE ITEMS

The following items are applicable to all schedules:

- A. Activity identification numbers for deleted activities are not to be reused. Added activities shall be assigned a new and unique activity identification number.
- B. Activity descriptions are not to be revised when the scope of the activity is changed. The existing activity shall be deleted and a new activity shall be added.
- C. When forecasting new durations for activities that have not started, the original duration field shall be revised.
- D. All Resource requirements shall be included for all new design and construction activities.
- E. All activities shall have durations of not more than 20 days and not less than one day unless permitted otherwise by the Department.
- F. All activities in the schedule, with the exception of the first and last activities, shall have a minimum of one predecessor and a minimum of one successor.
- G. Negative lags shall not be assigned for any activity relationships.
- H. All out of sequence activities identified on the scheduling and leveling report shall be reviewed and their relationships either verified or changed.
- I. The Design-Builder shall not add job inefficiencies or weather days to a project calendar without prior approval by the Department.
- J. Offsite fabrication and material/equipment delivery activities shall be sufficiently detailed to allow monitoring of schedule progress.
- K. The Design-Builder shall provide to the Department two copies of all schedules on electronic medium, together with printed copies of the network diagrams or bar charts and tabular reports described under "Project Schedule Reports", and the Schedule Narrative Report.

The Department's review and acceptance of schedules shall not waive any contract requirements, shall not imply that the schedules are reasonable in all aspects or that if followed they will result in timely completion of the project, and shall not relieve the Design-Builder of any obligation hereunder or responsibility for submitting complete and accurate information. Schedules that are rejected shall be corrected by the Design-Builder and resubmitted to the Department within 5 days of notification by the Department, at which time a new review will begin.

Errors or omissions on schedules shall not relieve the Design-Builder from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been reviewed and accepted by the Department, either the Design-Builder or the Department discover that any aspect of the schedule has an error or omission, it shall be corrected by the Design-Builder on the next update schedule.

INTERIM BASELINE SCHEDULE

Within 15 days after approval of the contract, the Design-Builder shall submit to the Department an Interim Baseline Project Schedule which will serve as the progress schedule for the first 120 days of the project, or until the Baseline Schedule is accepted, whichever is sooner. The Interim Baseline Schedule shall utilize the critical path method of scheduling. The Interim Baseline Schedule shall depict how the Design-Builder plans to perform the work for the first 120 days of the contract. Additionally, the interim Baseline Schedule shall show all required submittals, working drawings, and review periods, and shall provide for all permits, and other non-work activities necessary to begin the work. The Design-Builder shall also submit a Summary Schedule, reflecting the duration of the contract, grouped by major areas of the project identified by the scheduling codes provided in the DeIDOT scheduling codes or as defined by the Department. This summary schedule is for information purposes only and is to be used as a reference until the Baseline Schedule is accepted. It is understood that as the design of this project will not have been completed at the time of the submission of the Interim Baseline Schedule, a detailed construction

schedule can not be provided. For the early schedule submittals the Design-Builder shall show construction activities in general categories of work. Then, as the design is completed, the Design-Builder shall provide the required schedule details for the specific construction activities.

The interim Baseline Schedule shall include the data files used to generate the schedule on electronic medium.

The Department shall be allowed 10 days to review the schedule and to provide comments, including the Design-Builder's application of the supplied activity codes. All comments are to be implemented into the Baseline Schedule. Re-submittal of the Interim Baseline Schedule is not required. Late review of the interim Baseline Schedule shall not restrain the submittal of the Baseline Schedule. No contract payments shall be made to the Design-Builder until an interim Baseline Schedule is submitted in accordance with the above requirements.

BASELINE SCHEDULE

Within 90 days, after execution of the contract, the Design-Builder shall submit to the Department a Baseline Project Schedule including the incorporation of all comments provided to the Interim Baseline Schedule. The Baseline Schedule shall have a data date of the day prior to the first day of work day of the contract. The schedule shall not include any actual start dates, actual finish dates, or constraint dates (except for Contract Milestone dates) and activities scheduled to start or finish between the data date and the run date shall reflect dates that can be attained. The Baseline Schedule shall meet interim milestone dates, contract milestone dates, stage construction requirements, internal time constraints, show logical sequence of activities, and must not extend beyond the number of days or the completion date originally provided for in the contract.

All task activities shall be assigned to a project calendar. Each calendar shall identify a workweek, and holidays. Different calendars shall be used for work activities that occur on different work schedules. Activities for the preparation and the review of submittals: offsite fabrication, and material/equipment deliveries are to be assigned to the same calendar unless approved by the Department. All non-activity periods for Environmental work restrictions shall be identified with the appropriate calendars. A minimum of seven (7) calendars shall be used and the first seven (7) shall be ordered and entitled as follows: 1) Full Schedule, 2) Winter Condition, 3) Concrete Paving, 4) Asphalt Base, 5) Asphalt Surface, 6) Asphalt Superpave, 7) Environmental.

The Baseline CPM Schedule submitted by the Design-Builder shall have a sufficient number of activities to assure adequate planning of the project and to permit monitoring and evaluation of progress and the analysis of time impacts. The Baseline Schedule shall depict how the Design-Builder plans to complete all design and construction work involved, and shall show all activities that define the critical path. Multiple critical paths and near-critical paths shall be kept to a minimum, as determined by the Department.

Department-owned float shall be considered a resource for the exclusive use of the State. The Department may accrue Department owned float by the early completion of review of any type of required submittal when it saves time on the critical path. The Department will document Department-owned float by directing the Design-Builder to update the Department-owned float activity on the next schedule update. The Design-Builder shall include a log of the action on the Department-owned float activity and include a discussion of the actions in the narrative report. The Department may use Department-owned float to mitigate past or future State delays by offsetting potential time extensions.

The Design-Builder shall be responsible for assuring that all work sequences are logical and the network shows a coordinated plan for complete performance of all design and construction work. Failure of the Design-Builder to include any element of work required for the performance of the contract in the network shall not relieve the Design-Builder from completing all work within the time limit specified for completion of the contract. If the Design-Builder fails to define any element of work, activity or logic, the Design-Builder in the next monthly update or revision of the schedule shall correct it.

The Baseline Schedule shall be supplemented with resource allocations for every task activity to a level of detail that facilitates report generation based on labor craft and equipment class for the Design-Builder and subcontractors.

The Design-Builder shall optimize labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not over committed in concurrent activities. The Design-Builder shall not create hammock activities for the purpose of resources loading. The Baseline Schedule shall not attribute negative float to any activity.

Along with the baseline progress schedule, the Design-Builder shall also submit to the Department time-scaled resource histograms of the labor crafts and equipment to be utilized on the contract.

Each schedule submitted to the Department will comply with all limits imposed by the contract, with all specified intermediate milestone and contract completion dates, and with all constraints, restraints or sequences included in the contract. The degree of detail shall include factors including but not limited to:

- A. Physical breakdown of the project:
- B. Contract milestones and completion dates, substantial completion dates, constraints, restraints, sequences of work shown in the contract, the planned substantial completion date, and the final completion date:
- C. Type of work to be performed, the sequences, and the major subconsultants and subcontractors involved:
- D. All purchases, submittals, submittal reviews, manufacture, fabrication, tests, delivery, and installation activities for all major materials and equipment:
- E. Preparation, submittal and approval of shop and working drawings and material samples, showing time, as specified elsewhere, for the Department's review:
- F. Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors, railroads, and utilities as shown on the plans or specified in the specifications:
- G. Identification of each and every utility relocation and interface as a separate activity, including activity description and responsibility coding that identifies the type of utility and the name of the utility company involved:
- H. Actual tests, submission of test reports, and approval of test results:
- I. All start-up, testing, training, and assistance required under the contract:
- J. Punchlist and final clean-up:
- K. Identification of any manpower, material, or equipment restrictions, as well as any activity requiring unusual shift work such as double shifts, 6-day weeks, specified overtime, or work times other than regular days or hours:
- L. Identification of each and every ramp closing and opening event as a separate one day activity, including designation by activity coding and description that it is a north-bound, south-bound, east-bound, west-bound, and entry or exit ramp activity:
- M. Separate resources graphs for the Design-Builder's labor, equipment and critical path labor with an accompanying analysis of each and explanation for any variances:

- N. Equipment and labor shall be differentiated by a cost account code within the resource dictionary.
- O. State owned float as the last activity in the schedule, at the end of which is the Scheduled Completion Date.

The Department will be allowed 30 days to review and accept or reject the baseline project schedule submitted. Rejected schedules shall be resubmitted to the Department within 5 days, at which time a new 15-day review period by the Department will begin.

PROJECT SCHEDULE REPORTS

Schedules submitted to the Department including Interim Baseline, Baseline, and update schedules shall include time scaled network diagrams or bar charts in a layout format requested by the Department. The network diagrams or bar charts submitted to the Department shall also be accompanied by four computer-generated mathematical analysis tabular reports for each activity included in the project schedule. The reports (8.5" x 11" size) shall include a network diagram report showing the activity columns only, a predecessor and successor report, a resource report (Interim Baseline and Baseline Schedules), and a scheduling and leveling calculation report. The network diagram reports shall include, at a minimum, the following for each activity:

- A. Activity number and description:
- B. Activity codes:
- C. Original, actual and remaining durations;
- D. Early start date (by calendar date):
- E. Early finish date (by calendar date);
- F. Actual start date (by calendar date);
- G. Actual finish date (by calendar date):
- H. Late start date (by calendar date);
- I. Late finish date (by calendar date):
- J. Identify activity calendar ID:
- K. Total Float and Free Float, in work days: and
- L. Percentage complete.

Network diagrams or bar charts shall be sorted and grouped in a format requested by the Department reflecting the project breakdown per the Department activity codes. They shall show a continuous flow of information from left to right per the project sorting and grouping codes; e.g., project milestones, submittals sub-grouped by description, and the construction activities sub-grouped by the scope breakdown structure. The primary paths of criticality shall be clearly and graphically identified on the diagrams or charts. The network diagram or bar chart shall be prepared on E-size sheets (36" x 48"), shall have a title block in the lower right-hand corner, and a timeline on each page. Exceptions to the size of the network sheets and the use of computer graphics to generate the network or bar charts shall be subject to the approval of the Department.

Schedule network diagrams the tabular reports shall be submitted to the Department for acceptance in the following quantities:

- A. 2 sets of the Network Diagrams or Bar Charts:
- B. 2 copies of the tabular reports (8.5" x 11" size): and
- C. 2 copies on electronic medium, each with a backup of the current schedule file.

WEEKLY SCHEDULE MEETINGS

The Department and the Design-Builder shall hold weekly, or as determined by the Department, scheduling meetings to address any long-term schedule issues, and to discuss any relevant technical issues. The Design-Builder shall develop a rolling 4-week schedule identifying the previous week worked and a 3-week look ahead. It shall provide sufficient detail to include the actual and planned activities of the Design-Builder and all the subcontractors for offsite and construction activities, addressing all activities to be performed and to identify issues requiring engineering action or input.

Each activity in the 4-week rolling schedule should be identified by an associated CPM schedule activity ID numbering system. This schedule should not be hand written. The Design-Builder shall utilize a schedule layout as acceptable to the Department. The schedule shall be electronically submitted to the Department one day prior to the scheduled meeting date.

MONTHLY CASH FLOW REPORTS

The Design-Builder shall allocate a portion of the lump sum cost to the appropriate schedule activities. The total of all activity costs shall equal the total contract price. This information shall be sufficient to generate a monthly cash flow report showing the anticipated monthly contract progress payments. The format for the report shall be acceptable to the Department. Actual Progress Payments shall be made in accordance with DB Section 109, "Lump Sum Price, Progress and Payment".

MONTHLY UPDATE SCHEDULES

The Design-Builder shall submit a monthly update Schedule to the Department once in each month within 5 days of the data date. The proposed update schedule prepared by the Design-Builder shall include all information available as of the 20th day of the month, or other data date as established by the Department. A detailed list of all proposed schedule changes such as logic, duration, lead/lag, forecast completion date, additions and deletions shall be submitted with the update.

The Monthly Update Schedule submitted to the Department will be accompanied by a Schedule Narrative Report. The report shall describe the physical progress during the report period, plans for continuing the work during the forthcoming report period, actions planned to correct any negative float, and an explanation of potential delays or problems and their estimated impact on performance, milestone completion dates, forecast completion date, and the overall project completion date. In addition, alternatives for possible schedule recovery, to mitigate any potential delay or cost increases shall be included for consideration by the Department. The report shall follow the outline set forth below:

Design-Builder's Schedule Narrative Report Outline:

- A. Design-Builder's Transmittal Letter:
- B. Work completed during the period:
- C. Description of the current critical path:
- D. Description of current problem areas:
- E. Current and anticipated delays:
 - 1. Cause of the delay:
 - 2. Corrective action and schedule adjustments to correct the delay: and
 - 3. Impact of the delay on other activities, milestones, and completion dates:
- F. Changes in design or construction sequences:
- G. Pending items and status thereof:
 - 1. Permits;

- 2. Change Orders:
- 3. Time Extensions: and
- 4. Non-Compliance Notices:
- 5. Notice of Potential Claims:
- H. Contract completion date(s) status:
 - 1. Ahead of schedule and number of days: and
 - 2. Behind schedule and number of days: and
- I. Include updated Network Diagram and Reports.
- J. Response to Previous Schedule Comments

Portions of the network diagram on which all activities are complete need not be reprinted and submitted in subsequent updates. However, the submitted schedule and the related reports shall constitute a clear record of progress of the work from award of contract to final completion.

On a date determined by the Department, the Design-Builder shall meet with the Department to review the monthly schedule update. At the monthly progress meeting, the Design-Builder and the Department shall review the updated schedule and shall discuss the contents of the Narrative Report. The Department will be allowed 10 days after the meeting to review and accept or reject the update schedule submitted. Rejected schedules shall be resubmitted to the Department within 5 days, at which time a new 5-day review period by the Department will begin. All efforts shall be made between the Department and the Design-Builder to complete the review and the acceptance process prior to the next update schedule data date. To expedite the process, a second meeting between the Department and the Design-Builder may be held.

SCHEDULE REVISIONS

If the Design-Builder desires to make a change to the accepted schedule, the Design-Builder shall request permission from the Department in writing, stating the reasons for the change, and proposed revisions to activities, logic and duration. The Design-Builder shall submit for acceptance an analysis showing the effect of the revisions on the entire project. The analysis shall include:

- A. An updated schedule not including the revisions. The schedule shall have a data date just prior to implementing the proposed revisions and includes a project completion date:
- B. A revised schedule that includes the proposed revisions. The schedule will have the same data date as the updated schedule and include a project completion date:
- C. The Design-Builder should add resources for all new activities, also adjust resources for those activities that their remaining duration were changed:
- D. A narrative explanation of the revisions and their impact to the schedule:
- E. Computer files of the updated schedule and the revised schedule sequentially numbered or renamed for archive (record) purposes.

The Department will provide a response within 10 days to Design-Builder's proposed schedule revisions.

Within 15 days, the Design-Builder shall submit a revised CPM network for approval when requested by the Department, or when any of the following occurs:

- A. There is a significant change in the Design-Builder's operations that will affect the critical path:
- B. The current updated schedule indicates that the contract progress is 2 weeks or more behind the planned schedule, as determined by the Department: or

- C. The Department determines that a previously accepted or anticipated change will impact the critical path, milestone or completion dates, contract progress, or work by other contractors.

The Department shall be allowed 10 days to review and accept or reject a schedule revision. Rejected schedule revisions shall be revised and resubmitted to the Department within 10 days, at which time a new 10-day review period by the Department will begin. Only upon acceptance of a change by the Department shall it be reflected in the next schedule update submitted by the Design-Builder. The revised schedule shall also include a narrative explanation of the revisions and their impact to the schedule.

TIME IMPACT ANALYSIS

When the Design-Builder requests a time adjustment due to contract change orders or delayed activities or if the Design-Builder or the Department considers that a previously accepted or anticipated change will impact the critical path or contract progress, the Design-Builder shall submit to the Department a written Time Impact Analysis illustrating the impact of each change or delay to the current contract completion date or milestone completion date, utilizing the current accepted schedule. Each Time impact Analysis shall include a schedule update (an accepted schedule with a data date within the previous month of the event) reflecting the "before conditions", and schedule revision reflecting the "after condition", both with the same data dates, demonstrating how the Design-Builder proposes to incorporate the change order or delay into the current schedule. The schedule revision shall include the sequence of activities and any revisions to the existing activities to demonstrate the impact of the delay, or change into the schedule. The Time Impact Analysis shall also include proposed mitigation measures or work arounds including but not limited to alternate work calendars, re-sequencing of other activities, or performing work activities out-of-sequence to minimize the impact of the change order or the delayed activities.

Each Time Impact Analysis shall demonstrate the estimated or actual time impact based on the events of delay, the estimated or actual date of the contract change order work performance, the status of the design and/or construction at that point in time, and the event time computation of all activities affected by the change or delay. The event times used in the analysis shall be those included in the latest update of the current schedule in effect at the time the change or delay was encountered.

Time extensions will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total or remaining float along the critical path of activities from the time of actual delay, or from the time the contract change order work is performed. Mitigation measures shall be included in the analysis. The Time Impact Analysis shall also consider the use of Department-owned float as a mitigation measure. Time extensions will not be granted nor will delay damages be paid unless:

- A. The delay is beyond the control and without the fault or negligence of the Design-Builder and its subconsultants, subcontractors or suppliers, at any tier; and
- B. The delays extend the actual performance of the work beyond the current established contract completion date.
- C. The delay impacts a fabrication or construction activity – delays to the Design-Builder's submittal or shop drawing process must impact a successor fabrication or construction activities. The Time Impact Analysis shall be based on the impact to fabrication or construction activities.

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 The Design-Builder shall designate the number of adverse weather days in the chart as "non-work" days in their baseline schedule. Time extensions for extreme weather conditions, if appropriate, shall be based on the following chart: 

 **Table 1: Monthly anticipated adverse weather delay based on a seven (7) calendar day week:**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12	10	5	5	4	2	4	3	4	3	2	6

 The above table is developed based on the daily weather report log as maintained by the Material and Research Section. Severe/adverse weather is defined as daily precipitation equal to or exceeding 0.25 inches and/or maximum daily temperature not exceeding 32 degrees F as recorded at the weather station located on site. Allowances for unsuitable wind condition will be made on a case-by-case basis. The Design-Builder shall submit justification to the Department for the maximum sustained wind speed he can work in based on his means and methods for a particular activity. Once approved, this will become the threshold that time extensions are measured against. It is expected that the Design-Builder's wind threshold will vary with construction activity; therefore, more than one submission may be required.

 The Design-Builder shall make immediate written notification to the Department's Project Manager for each occurrence of any day that is unsuitable for prosecuting those items of work shown on the current CPM schedule. Time extensions will be granted only if the activity(s) representing the scheduled construction operations is on the critical path or becomes the critical path. When a scheduled activity(s) becomes the critical path, the allowable days for time extension will be reduced by days the activity(s) was not on the critical path. Inability to prosecute work not shown as activities in progress on the most recent CPM schedule will not be considered when determining time extensions. The Department's Project Manager will have the final decision as to the number of calendar days the Design-Builder's work was limited to because of adverse weather.

Time Impact Analysis shall be submitted within 15 days after the delay occurs or after initiation of the contract change order. The schedule files will be submitted on electronic medium along with the Time Impact Analysis, which shall include a narrative description of the delay, its impact on contract completion or milestone dates and proposed mitigation measures. Mitigation measures utilized to minimize the impact of the change order or delay shall include but are not limited to work arounds, re-sequencing of work, alternate work calendars, increased resources, expedited procurement and use of State owned float.

A response to each Time Impact Analysis by the Department will be made within 15 days after receipt of the Time Impact Analysis. The Department's review shall utilize actual data unless it is appropriate to use estimated data. Resolution of each Time impact Analysis by the Department shall be completed after all effects of the disruption are documented, which may include mitigation measures. A copy of the Time impact Analysis accepted by the Department shall be returned to the Design-Builder and the accepted schedule revisions illustrating the impact of the contract change orders or delays shall be incorporated into the project schedule during the first update after acceptance. Until such time that the Design-Builder provides the analysis, the Department may, at their option, construct and utilize the project as-built schedule or other method to determine adjustments in contract time.

FINAL SCHEDULE UPDATE

Within 15 days after the acceptance of the contract by the Department, the Design-Builder shall submit a final update of the schedule with actual start and actual finish dates for all activities. This schedule submission shall be accompanied by a certification, signed by an officer of the company and the Design-

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Builder's Project Manager stating "To the best of my knowledge, the enclosed final update of the project schedule reflects the actual start and completion dates of the activities contained herein."

SOFTWARE

CPM software shall be Primavera Project Planner, version 3.1 or later and schedule analysis software should be Claim Digger or equivalent.

The computer software furnished shall be compatible with that used by the Design-Builder for the production of the CPM progress schedule required by the Contract, and shall include original instruction manuals and other documentation normally provided with the software.

The Design-Builder shall furnish, install, set up, maintain and repair the computer software ready for use at a location determined by the Department. The software shall be installed and ready for use within 30 days of the contract award. The Design-Builder shall provide 24 hours of formal training for up to four (4) people selected by the Department, in the use of the hardware and software to include schedule analysis, reporting, and resource and cost allocations. An authorized vendor of Primavera Project Planner shall perform the training.

All software furnished shall remain the property of the Design-Builder and shall be removed by the Design-Builder upon acceptance of the contract when no claims involving contract progress are pending. When claims involving contract progress are pending, computer software shall not be removed until the final estimate has been submitted to the Design-Builder.

PAYMENT

Progress schedule (critical path) will be paid for as part of the lump sum price per the requirements of DB Section 109, "Lump Sum Price, Progress and Payment". The Design-Builder shall establish a Project Component (PC) for the progress schedule (critical path) which shall include full compensation for all labor, materials (including computer hardware and software), tools, equipment, and incidentals; and for doing all the work involved in preparing, furnishing, updating and revising CPM progress schedules.

Payments for progress schedule (critical path) PC will be made as follows:

- A. Interim baseline schedule accepted, then 10 percent payment for progress schedule (critical path) PC will be made.
- B. Baseline schedule accepted, then 10 percent payment for progress schedule (critical path) PC will be made.
- C. Monthly update schedules accepted, then an equal payment for each month will be made not to exceed a cumulative total of 75 percent payment for progress schedule (critical path) PC.
- D. Final schedule update accepted, then 5 percent payment for progress schedule (critical path) PC will be made.

The Department will retain an amount equal to \$50,000 for each estimate period in which the Design-Builder fails to conform to the provisions of this section, including failure to submit an interim baseline, baseline, revised or updated CPM schedule conforming to the requirements of this section, as determined by the Department. Retentions for failure to submit acceptable CPM schedules shall be in addition to all other retentions provided for in the contract. The retention for failure to submit acceptable CPM schedules will be released for payment on the next monthly estimate for partial payment following the date that acceptable CPM schedules are submitted to the Department.

763588 - MAINTENANCE OF TRAFFIC

Description:

This item shall be used for construction activities that require traffic control, but will be performed outside the physical limits or time frames of the maintenance of traffic plans provided for the roadway contract.

All requirements of the traffic manual "Delaware Traffic Controls for Streets & Highways Construction, Maintenance, Utility & Emergency Operations (latest edition with all revisions made up to the date of Advertisement of this project and from hereon shall be addressed as the Traffic Manual) shall apply for all traffic control devices. Any, and all, control, direction, management and maintenance of traffic shall be performed in accordance with the requirements of the Traffic Manual, and notes on the Plans.

Materials and Construction Methods:

The Contractor and all of the Contractor's subcontractors working on this project shall submit to the Construction Engineer a traffic control Plan for the Department's approval before the start of work. The time restrictions as listed in the "Notice to Contractors" shall be applicable.

The Contractor shall be responsible for all traffic control devices except as specifically noted above, and shall perform all work in a manner that will insure the least practicable obstruction to traffic consistent with safety. Advanced coordination with the Department and other Contractors working in the area is required so there is no conflict or overlap with other maintenance of traffic set-ups in the area of work.

The Contractor shall provide and maintain ingress and egress for each property abutting the construction area and each property located between the diversion points of any detour and the actual construction site. Construction activities which may temporarily or otherwise interfere with property access shall be coordinated in advance with the affected property owners.

The Contractor shall conduct construction operations in a manner which will minimize delays to traffic, and shall meet the following requirements:

1. The flagger(s) shall direct the flow of traffic in concert with the traffic signals in construction areas to avoid queuing, unless active work prohibits such action.
2. When a lane adjacent to an open lane is closed to travel, the traffic control devices shall be set 2 feet (0.61 m) into the closed lane from the edge of the open lane, unless an uncured patch exists or actual work is being performed closer to the open lane.
3. Lanes shall not be closed unless construction activity requiring lane closure is taking place, or will take place within an hour; lanes shall be reopened immediately upon completion of the work. The Contractor shall conduct construction operations in a manner so as to minimize disruption to traffic during peak hours and periods of heavy flow. The Department reserves the right to stop or change the Contractor's operations, if in the opinion of the Engineer, such operations are unnecessary at that time or if they can be conducted in a less impactful manner.

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4. Work in the vicinity of traffic signals, shall be scheduled to minimize the time during which the signal is operated without detectors, and approval of the Engineer shall be required for such schedule.

It is required that all traffic control work and related items shall either be performed entirely by the Contractor's own organization, or totally subcontracted. Maintenance of equipment shall not be subject to this requirement.

At the end of each work day, the Contractor shall correct all pavement edge drop-offs within 10 feet (3 m) of a travel lane to result in a drop-off of no more than 2 inches (50 mm). This corrective work shall be accomplished with Temporary Roadway Material (TRM) unless an alternate method is specified in the Plans. All ruts and potholes shall be filled with TRM by the end of each work day. If temporary elimination of a drop-off hazard cannot be accomplished, then the area should be properly marked and protected with traffic control devices such as temporary barricades, warning signs, flashing lights, etc. as required; the payment for TRM materials and the traffic control devices shall be made under the respective items of the Contract.

All the operations shall be properly signed with notice of "Pavement Drop-Off" and/or "Uneven Pavement".

All construction signs and barricades shall meet the applicable standards for reflectorization as required in the Traffic Manual.

When specified on the Plans, the Contractor shall be required to have an American Traffic Safety Services Association (ATSSA) certified traffic control supervisor on the project. The ATSSA certified traffic control supervisor's sole responsibility will be the maintenance of traffic on the project. This responsibility shall include the installation, operation, maintenance and service of traffic control devices. Also included is the keeping of a daily log to record maintenance of traffic activities i.e. number and location of traffic control devices; and times of installation, changes, and repairs to traffic control devices. He/she shall also serve as the liaison with the Department concerning the Contractor's maintenance of traffic.

All cost for providing the services of an ATSSA certified traffic control supervisor shall be included in this item.

Certification:

Temporary traffic control devices used on all highways open to the public in this State shall be crashworthy in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350 and the memorandum issued August 28, 1998 by The USDOT Federal Highway Administration **Information:** Crash Tested Work Zone Traffic Control Devices. It is the requirement of the Department that such certification be submitted for traffic control devices used on **all** projects, not just those involving the National Highway System.

In brief, certification of compliance with NCHRP report 350 is required for the following categories of traffic control devices:

Category I contains small and lightweight channelizing and delineating control devices which includes cones, tubular markers, flexible delineator post and drums, all without any accessories or

attachments.

Category II includes traffic control devices that are not expected to produce significant vehicular velocity changes to impacting vehicles. These devices which shall weigh 45 kg or less, include Type I, II and III barricades, portable sign supports with signs, and intrusion alarms. Also included are drums, cones, and vertical panels with accessories or attachments.

Category III includes traffic control devices that are expected to cause significant vehicular velocity changes to impacting vehicles. These devices which weigh more than 45 kg include temporary barrier, temporary impact attenuators, and truck-mounted attenuators.

Category IV includes portable or trailer-mounted devices such as arrow panels, variable message signs, temporary traffic signals and temporary area lighting.

The requirements for certification are as follows:

Category I - All devices shall be certified as conforming to NCHRP Report 350 criteria.

Category II - All new devices shall be certified as conforming to NCHRP Report 350 criteria.

Category III - All new temporary barrier devices shall be certified as conforming to NCHRP Report 350 criteria.

Category IV - Certification of compliance to NCHRP Report 350 criteria is not required.

For DelDOT administered projects the certification shall be submitted to the Engineer prior to installation or use of traffic control devices. For Category I devices, the manufacturer or contractor may self-certify that the devices meet NCHRP-350 criteria. For Category II and Category III devices, the Contractor shall supply the Federal Highway Administration's NCHRP-350 acceptance letter for each type of device.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

APPENDIX A - PART 4

SUPPLEMENTAL SPECIFICATIONS

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SUPPLEMENTAL SPECIFICATIONS APPLICABLE TO THIS CONTRACT ONLY

Subsection 109.01 Measurement of Quantities.

Delete the Section in its entirety and replace with the following:

Items of work completed under the Contract will not be separately measured. The Contract is "Lump Sum" and as such payment will be made according to the percentage of completion during each payment estimate cycle of the project. References to Measurement and Basis of Payment of items of work elsewhere in the Standard Specifications, Supplemental Specifications, and Special Provisions are deleted from the Contract.

Subsection 109.02 Scope of Payment.

Delete the first and second paragraphs in their entirety.

**SUPPLEMENTAL SPECIFICATIONS
REVISIONS AND CORRECTIONS
TO THE
AUGUST 2001
STANDARD SPECIFICATIONS¹**

(Revised May 15, 2006)

¹ The Contractor shall make himself aware of these revisions and corrections (Supplemental Specifications), and apply them to the **applicable item(s)** of this contract.

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Supplemental Specifications to the August 2001 Standard Specifications

Supplemental Specifications Approved by Committee

Subsection 101.78 Subcontractor. (3/18/2004)

Modify the second paragraph as follows:

Exceptions to this definition are suppliers limited to delivering and depositing, but not incorporating material, suppliers of services that transport material, and the work performed which does not advance the completion of the Contract and is not considered as an item of work.

Subsection 101.79 Substantial Completion. (3/18/2004)

Modify the sentence as follows:

The point at which all Contract items are complete as deemed by the Department excluding any warranties or vegetation growth.

Subsection 102.07 Irregular Proposals. (5/15/2006)

Modify Paragraph B. as follows:

- B. There are unauthorized additions, interlineations, conditional bids, or irregularities of any kind that may tend to make the proposal incomplete, indefinite, or ambiguous.

Delete paragraph G.

Modify Paragraph I. as follows:

- I. The Contractor fails to provide a proposal guaranty.

Subsection 104.04 Accident Notification. (5/15/2006)

Modify the paragraph as follows:

Notify the Transportation Management Center (T.M.C.) at 659-2400 and Engineer concerning any accidents.

Subsection 105.04 Plans and Working Drawings. (5/15/2006)

Modify the 4th paragraph as follows:

Working drawings for concrete structures shall provide such details as are required for successful prosecution of the work. These shall include plans for items such as falsework, bracing, sheeting, shoring, cofferdams, formwork, masonry layout diagrams and bending diagrams for reinforcing steel.

Subsection 105.06 Coordination of the Plans, Standard Specifications, Supplemental Specifications, and Special Provisions. (5/15/2006)

Modify and renumber the following:

1. General Notices
2. Pay Units in Bid Proposal Forms
3. Plans
4. Cross Sections
5. Special Provisions
6. Supplemental Specifications
7. Standard Construction Details
8. Standard Specifications

Subsection 105.13 Maintenance During Construction. (3/18/2004)

Add the following:

The contractor shall mow all grass and weeds within the limits of the Contract, as directed by the Engineer, up to 4 times a year to a height in compliance with subsection 107.01.

Subsection 105.20 Project Acceptance. (3/18/2004)

Modify the first paragraph as follows:

Final acceptance will not occur until completion of the Project in accordance with Subsection 101.16. The Contract time will be stopped at substantial completion.

Subsection 106.09 Disposal of Unacceptable Materials. (5/15/2006)

Modify the paragraph as follows:

All waste materials removed by earthwork operations shall become the property of the Contractor and shall be removed from the Project or otherwise disposed of as specified. Unless specific disposal sites are designated on the Plans, the Contractor shall procure disposal sites. Such disposal sites shall be submitted to and approved by the Engineer. If the contract is federally funded or Federally permitted, the Engineer will submit the proposed site to the State Historic Preservation Office for their approval prior to utilization by the Contractor. No areas that are designated as wetlands will be permitted for use as disposal sites. The submittal shall include a plan of the disposal area, proposed sediment and erosion control devices, existing and proposed final contours, and proposed security measures. All permit requirements such as those required by the Department of Natural Resources and Environmental Control (DNREC) and the U.S. Army Corps of Engineers shall be met by the Contractor when preparing and utilizing off-site disposal areas. The Contractor shall submit a similar proposal for use of designated disposal sites if such detail is not included in the Contract documents. Costs for preparing these plans are incidental to Section 201. For disposal sites designated on the Plans, payment will be made separately under applicable bid items for all necessary erosion and sediment controls, seeding, and mulching. For Contractor-procured disposal sites, such costs are incidental to Section 201. The Department will not consider any delays or monetary claims of any nature resulting from the Contractor's failure or difficulty in finding the necessary disposal sites.

Subsection 107.04 Contractor's Responsibility for Utility Property and Services. (5/15/2006)

Modify the 3rd paragraph as follows:

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Fire hydrants on or adjacent to the highway shall be kept accessible to fire apparatus at all times and no material or obstruction shall be placed within 15' (4.5 m) of any such hydrant. Work shall be left entirely accessible at all points to fire apparatus at all times. Whenever any work is done in the area of a fire hydrant or whenever a fire hydrant is relocated or installed, the center of the hose outlet shall be a minimum of 18 in. (457 mm) above the final grade directly beneath the hose outlet.

Subsection 107.09 Protection and Restoration of Property. (5/15/2006)

Modify the 4th sentence in the first paragraph as follows:

The Contractor shall not injure or destroy trees or shrubs outside the limits of construction, nor remove or cut them without proper authority.

Subsection 108.01 Subletting of Contract. (3/18/2004)

Modify the second paragraph as follows:

If the Contractor to whom a contract is awarded proposes to subcontract any part of the work, the scope and value of the work to be done by the subcontractor shall be outlined. The cost of materials to be used by the subcontractor shall be outlined. The cost of materials to be used by the subcontractor shall be included in the value of the subcontracted work. A subcontractor shall not subcontract further a portion of the work intended to be done by the original subcontractor without the express written permission of the Engineer. In granting such permission, the Engineer shall ensure that the subcontractor seeking to subcontract the work to be performed by another shall nonetheless perform with its own organization work amounting to not less than 50% of the total subcontracted bid price.

Subsection 108.09 Schedule of Liquidated Damages. (5/15/2006)

————— Update table with these new numbers.

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Schedule of Liquidated Damages			
Awarded Contract Value		Daily Charge	
For More Than	To and Including	Work Day	Calendar Day
\$ 0	\$ 25,000	\$ 380.00	\$ 275.00
25,000	50,000	400.00	290.00
50,000	100,000	540.00	390.00
100,000	500,000	840.00	600.00
500,000	1,000,000	1,090.00	780.00
1,000,000	2,000,000	1,350.00	960.00
2,000,000	5,000,000	1,410.00	1,010.00
5,000,000	10,000,000	1,590.00	1,130.00
10,000,000	15,000,000	2,510.00	1,790.00
15,000,000	20,000,000	4,180.00	2,990.00
20,000,000	25,000,000	5,850.00	4,180.00
25,000,000	30,000,000	7,520.00	5,370.00
30,000,000	35,000,000	9,190.00	6,570.00
35,000,000	Over	10,870.00	7,760.00

Subsection 109.04 Payment for Differing Site Conditions, Major Changes, Extra Work, and Force Account. D.8. Subcontracting. (5/15/2006)

Modify the paragraph as follows:

Should an agreed price involve work to be performed by a Subcontractor, then the Prime Contractor's total allowable mark-up on the Subcontracted portion of work shall not exceed 10% of the Subcontractor's proposed price. The Prime Contractor shall, upon request by the Department, submit documentation substantiating the Subcontractor's proposed price.

Subsection 201.03 Trees and Roadside Amenities Designated to Remain. (5/15/2006)

Modify the subsection title as shown above and modify the paragraph as follows:

The Engineer shall designate such trees, shrubbery, plants and roadside amenities, such as signs, light posts, or other improvements, which are not to be removed, and the Contractor shall protect them from any damage. If any such shrubbery, plants or roadside amenities are damaged, they shall be replaced or repaired. Any trees that are designated to remain that are damaged shall be evaluated by a certified tree surgeon and the contractor shall follow their recommendations to repair or for replacement of the trees. Branches of trees overhanging the roadbed shall be properly trimmed to maintain a clearance

height of 20' (6 m), unless otherwise directed. All pruning shall be performed in accordance with the International Society of Arboriculture's Current Tree Pruning Guidelines, Publication ISBN 1-881956-07-5, and as illustrated on the Standard Construction Details.

Subsection 201.10 Basis of Payment. (5/15/2006)

Modify the 1st paragraph as follows:

The quantity of clearing and grubbing will be paid for at the Contract lump sum. Price and payment will constitute full compensation for replacement of suitable material below required depth that was cleared and grubbed; for furnishing and compacting approved material to fill all depressions; for protecting trees, shrubbery, plants and other roadside amenities that are designated to remain, for replacement or repair of damaged trees, shrubbery, plants or other roadside amenities that are designated to remain; for disposal; and for all labor, equipment, tools, and incidentals required to complete the work.

Subsection 302.02 Materials. (5/15/2006)

Modify the paragraph as follows:

The material used to construct graded aggregate base course shall conform to the requirements of Section 821. Crushed portland cement concrete may be used as graded aggregate base course, Type B, provided it conforms to the requirements of Section 821.

Subsection 302.04 Placement. Subpart (c) Performance. (5/15/2006)

Delete the first sentence in the 2nd paragraph as follows:

Compaction of graded aggregate Type B shall continue until each layer is thoroughly and uniformly compacted to 98% or more of the laboratory maximum density obtained on a sample of the same material. If the material is too coarse to use the test methods listed below, compaction shall continue until there is no movement of the material under the compaction equipment.

Subsection 601.07 Hardware. (3/18/2004)

Modify the first paragraph as follows:

Machine bolts, drift pins, dowels, nuts, washers, lag screws, and nails shall conform to the requirements of ASTM A307 Grade A.

Modify the first sentence of the second paragraph as follows:

Machine bolts shall have a hex head and nut, unless otherwise specified and shall conform to the requirements of ASTM A307, Grade A.

Subsection 602.17 Finishing Concrete Surfaces, (b) Ordinary Surface Finish. (5/15/2006)

Modify the 2nd sentence as follows:

On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects shall be thoroughly cleaned, saturated with water, and carefully pointed and trued with mortar mixed in the proportion of one part portland cement to three parts fine

aggregate.

Subsection 612.05 Excavation. (3/18/2004)

Delete the entire paragraph and insert the following:

The trench in which the pipe is laid shall be excavated to the required depth in accordance with Section 208 and the Standard Construction Details.

Subsection 612.06 Bedding of Pipe. (3/18/2004)

Delete the entire paragraph and insert the following:

Unless noted otherwise, all pipes shall receive a Class C bedding as shown on the Standard Construction Details.

Subsection 612.11 Basis of Payment. (3/18/2004)

Modify the second sentence of the first paragraph as follows:

Price and payment will constitute full compensation for furnishing, hauling, and installing pipe; for all cribbing or foundation treatment (Class C bedding) necessary to prevent settlement; for all shoring and sheeting; for the replacement of any pipe which is not true in alignment or which shows any settlement after laying; and for all material, labor, equipment, tools, and incidentals required to complete the work.

Modify the first sentence of the second paragraph as follows:

For round pipe under 24" (600 mm) nominal inside diameter, and elliptical pipe under 24" (600 mm) nominal inside horizontal dimension, the excavation (excluding rock), Class C bedding, backfill, and backfilling will be included in the price for this work.

Modify the last paragraph as follows:

Payment for excavation and replacement of unsuitable material encountered below the Class C bedding will be provided for under Section 208.

Subsection 614.11 Basis of Payment. (3/18/2004)

Modify the second sentence of the first paragraph as follows:

Price and payment will constitute full compensation for furnishing, hauling, and installing pipe; for all cribbing or foundation treatment (Class C bedding) necessary to prevent settlement; for all shoring and sheeting; for the replacement of any pipe which is not in true alignment or which shows any detrimental settlement after laying; for coating if required; and for all material, labor, equipment, tools, and incidentals required to complete the work.

Modify the first sentence of the second paragraph as follows:

For pipe under 24" (600 mm) nominal inside diameter and arch pipe under 24" (600 mm) nominal inside horizontal dimension, the excavation (excluding rock), Class C bedding, backfill, and

backfilling will be included in the price of this work.

Modify the last paragraph as follows:

Payment for excavation and replacement of unsuitable material encountered below the Class C bedding will be provided for under Section 208.

Subsection 617.02 Materials. (5/15/2006)

Add the following sentence:

Reinforced concrete flared end sections shall be Class III for all types and class of pipes unless otherwise noted in the Plans.

Subsection 619.11 Test Piles. (3/18/2004)

In paragraph (a) (7) modify the second sentence as follows:

However, in no case shall the pile be driven to exceed 240 blows per 12" (300 mm) or 20 blows per 1" (25 mm) of driving for 3 consecutive inches (75 mm).

Subsection 619.12 Driving Production Piles. (3/18/2004)

In paragraph (5) modify the first sentence as follows:

In no case shall production piles be driven to exceed 240 blows per 12 inches (300 mm) or 20 blows per 1" (25 mm) for 3 consecutive inches (75 mm).

Subsection 623.07 Non-Shrink Grout. (3/18/2004)

Delete the entire paragraph and replace with the following:

Non-shrink grout shall conform to ASTM C1107, Grade C with one modification. The minimum 24-hour strength shall be increased to 5.0 KSI. The sampling and testing procedures of ASTM C1107 need not be changed.

Section 701 - Curb and Integral Curb and Gutter (5/15/2006)

Section 701 of the Standard Specifications is replaced with the following:

701.01 Description. This work consists of constructing curbs and integral curbs and gutters on a prepared foundation using either fixed forms or slip forms.

MATERIALS.

701.02 Portland Cement Concrete. Portland cement concrete shall conform to the requirements of Section 812, Class B for either fixed-form work or slip-form work.

701.03 Liquid Membrane Curing Compounds. Liquid membrane curing compound shall comply with Subsection 812.02 (i), (1) Curing Materials.

701.04 Preformed Expansion Joint Material. Preformed cork expansion joint material shall be 1/2" (13 mm) nominal thickness and conform to the requirements of Subsection 808.06.

701.05 Bituminous Joint Sealant. Bituminous joint sealant when needed for longitudinal joints as noted on C-1 and P-2 of the Standard Construction Details shall conform to the requirements of Subsection 808.04 (c).

CONSTRUCTION METHODS.

701.06 Preparation of Foundation. The foundation shall be prepared at the required grade to accommodate the elevations, dimensions, and details shown on the Plans. Grades shall be checked to ensure the drainage is adequate to prevent ponding. Existing subgrade shall be compacted until the surface is firm and unyielding. All unsuitable material shall be removed and replaced with approved material. Graded Aggregate Base Course Type B, (GABC) meeting the requirements of Subsection 302.02 shall be used unless otherwise directed. GABC shall be compacted with water as required in Subsection 302.04 except no spreader box will be required. Where rock is encountered, the grade shall be excavated to 6" (150 mm) below the bottom of the curb and integral curb and gutter and backfilled with GABC.

701.07 Fixed Forms. Fixed forms shall be of wood or metal and shall extend the full depth of the concrete. Composite material forms may be used for radii work. Forms shall be straight, free from warp greater than 1/8" in 10' (3 mm in 3 m), and of sufficient strength to resist the pressure of the concrete, and shall not displace more than 1/4" in 10' (3 mm in 3 m) from the vertical or horizontal plane. Forms shall remain in both horizontal and vertical alignment until their removal. Forms shall be clean and coated with an approved form release agent before concrete is placed. Divider plates shall be 1/8" thick metal.

701.08 Slip-Forming. Slip forming may be used provided that only approved equipment is used and the surface adjacent to the curb is firm and unyielding to support the weight of the machine.

701.09 Placing Concrete. The concrete shall be placed on a moist foundation, wetting the foundation if necessary. The concrete shall then be consolidated to eliminate air voids and worked sufficiently to bring mortar to the surface. The surface shall be struck off to the required contour and finished smooth and even with an approved float.

Limitations on placing concrete during hot or cold weather shall be as specified in Subsection 501.04.

701.10 Joints. Expansion joints shall be formed using templates or saw cut at no greater than 160' (49 m) intervals. Joints must be cut or formed vertically to the full depth of the curb to allow full contact of the expansion material with the entire surface. Additional expansion joints shall be constructed at each end of radii and at both sides of all structures or obstructions.

Contraction joints shall be constructed at 10' (3m) intervals. If not templated, all surfaces, front, top and back shall be tooled or saw cut to a minimum depth of 1" (25 mm) and a minimum width of 1/8" (3 mm). Saw cutting shall be done as soon as the concrete has sufficiently set or no more than 16 hours from the time of placement of the concrete to avoid shrinkage cracking. Any curb showing shrinkage cracks shall be removed and replaced at no cost to the Department.

When constructed adjacent to concrete pavement, joints shall coincide with joints in the pavement. When sidewalk is behind the curb all joints shall be in alignment and the expansion joints in the curb shall coincide with expansion joints in the sidewalk.

When curb is placed adjacent to Portland Cement Concrete pavement the curb or pavement shall be formed or tooled to allow sealing as shown in the Standard Construction Details C-1 and P-2.

701.11 Finishing. A wood or magnesium float shall be used to rub the surface smooth while the concrete is still green. Front and back edges of the curb shall be rounded to a 1/4" (6 mm) radius. A steel trowel finish shall next be applied, and finally a soft dampened brush shall be used longitudinally along the surface. Finishing shall be performed to a depth of 2" (50 mm) below the proposed pavement surface elevation.

Before the concrete is given the final finish, the flow line of the gutter shall be checked to ensure positive drainage. Vertical alignment shall match adjacent surfaces such as curbs and drainage inlets. Any deviations in the flow line of more than 1/8" in 10' (3 mm in 3 m) shall be corrected. Irregularities in grade or alignment of the front and back edges of the curb shall not exceed 1/4" in 10' (6 mm in 3 m).

The ends of all curbs shall be transitioned to be flush with the pavement at a ratio of twelve to one (12:1). All approach and exit ends of median island and curb shall also be transitioned flush with the pavement at a ratio of twelve to one (12:1). Triangular (pork chop) island curb shall have all corners transitioned flush with pavement at a slope of four to one (4:1).

701.12 Removal of Forms. Forms may be removed as soon as concrete has hardened sufficiently. Rear and side forms shall not be removed for at least 12 hours. Fill all defects with mortar conforming to the requirements of Section 611. Surfaces exposed after 12 hours but prior to 72 hours, shall be cured using materials specified in Section 812 or immediately backfilled. Fill all defects with mortar mixed in the proportion of one part portland cement to three parts fine aggregate.

701.13 Curing. Within 30 minutes of the completion of finishing to any portion of the concrete work and prior to any dehydration of the concrete surface, all exposed concrete surfaces shall be cured according to Section 501 for a period of no less than five days. The curb may be opened to traffic prior to the expiration of the five-day cure period if compressive strengths of the representative cores taken by the Department indicate that the strength of the concrete exceeds 2000 psi (14 Mpa). Any additional surfaces exposed prior to the expiration of the five-day cure period, by removing forms for example, shall be immediately cured to the same requirements for the remainder of the five-day period. Formwork that is allowed to remain in place and eliminate the need to cure the respective surfaces must remain tight against the surface to prevent drying of the concrete surface.

The application rate shall be not more than 200 ft²/gal (4.9 m²/L). During the curing period, pedestrian and vehicular traffic shall not disturb newly completed curb or integral curb and gutter other than as noted above.

701.14 Method of Measurement. The quantity of portland cement concrete curb and integral curb and gutter will be measured as the number of linear feet (linear meters) along the front face of the finished curb. Any curb showing cracks shall be replaced in sections that have a minimum length of 10' (3 m), at no cost to the Department.

701.15 Basis of Payment. The quantity of portland cement concrete curb and integral curb and gutter will be paid for at the Contract price per linear foot (linear meter). Price and payment will constitute full compensation for excavating (unless it is included in the excavation for the roadway box and paid for under Section 202), furnishing, and placing all materials; for forming, placing, finishing, and curing concrete; for backfilling, compacting, and disposing of surplus materials; for rounding curb edges, for

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sealing joints; and for all labor, equipment, tools, and incidentals required to complete the work. Grade Aggregate Base Course will be measured and paid for under Section 302. Isolated rock removal shall be paid for under Section 206 unless already removed and included within Section 205.

Subsection 705.09 Curing. (5/15/2006)

Modify the sentence as follows:

Concrete shall be cured according to Section 501 for a period of 72 hours. The sidewalk shall not be opened to pedestrian traffic for 72 hours. Vehicular traffic shall not be permitted until after 5 days.

Subsection 705.12 Basis of Payment. (5/15/2006)

Add the following sentence:

Curb ramps constructed along the new P.C.C. sidewalk shall be incidental to the sidewalk item in this Section 705-Portland Cement Concrete Sidewalk.

Subsection 708.05 – Frames. (3/18/2004)

Add the following paragraph:

Frames for drainage grates fabricated from structural steel that meets or exceeds requirements of AASHTO M 270 Grade 36 or ASTM A 36 will also be acceptable. Such frames shall be fabricated from ½” (minimum thickness) stock, provide a 1 ¼” lip for support of the grate, have a 2” depth to accommodate a 2” thick grate, and have a bottom width of 4”. Tolerances shall be + 1/8”, -0”. All cutting and welding shall be done in accordance with applicable portions of Subsection 826.12 by certified welders. The fabricated frame shall be hot dip galvanized in accordance with AASHTO M 111 (ASTM A 123) with a minimum of 2 ounces per square foot of zinc coating.

Subsection 708.06 Gratings. (3/18/2004)

Add the following paragraph:

Gratings for drainage inlets fabricated from structural steel that meets or exceed requirements of AASHTO M 270 or ASTM A 36 capable of HS-25 load rating will also be acceptable. Grates shall be of the Type 1, 2, or 3 style as shown in the Standard Construction Details. Type 1 shall have 1” x 2” perimeter bars. Type 2 and 3 shall have 3/4” x 2” perimeter bars. Type 1, 2, and 3 shall have ½” x 2” internal bars. Grating spacers shall be flush with the top surface of the grate. Tolerances shall be + 1/8”, -0”. All cutting and welding shall be done in accordance with applicable portions of Subsection 812.12 by certified welders. The fabricated grate shall be hot dip galvanized in accordance with AASHTO M 111 (ASTM A 123) with a minimum of 2 ounces per square foot of zinc coating.

Subsection 708.10 Precast and Cast-In-Place Drainage Inlets and Manholes. (5/15/2006)

Modify the subsection title as shown above and modify the 1st paragraph as follows:

Precast and Cast-In-Place drainage inlets and manholes shall be constructed as shown on the Standard Construction Details. Cast-In-Place construction shall be used for drainage structures that tie into existing pipes and structures unless the Engineer approves the use of Precast. Shop drawings are not required for drainage inlets and manholes that match the Standard Construction Details. Shop drawing

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and design calculations, signed and sealed by a professional engineer, registered in the State of Delaware, shall be submitted for approval for all drainage structures that differ from the Standard Construction Details.

Subsection 708.13 Inlet and Outlet Pipes. (5/15/2006)

Modify the third sentence as follows:

Any space between the pipe and the walls of the drainage inlet shall be filled with non-shrink grout conforming to the requirements of ASTM C1107 with a strength of 5000 psi.

Subsection 715.03 Perforated, Corrugated Polyethylene Tubing (CPT). (5/15/2006)

Delete the entire paragraph and replace with the following:

Perforated, CPT shall conform to the requirements of AASHTO M252.

Subsection 715.04 Stone. (3/18/2004)

Modify the first sentence as follows:

Stone for backfill shall conform to the requirements of Section 813, Delaware No. 57.

Subsection Section 715.07 – Video Inspection. (3/18/2004)

Delete the first sentence. Insert the following two sentences:

The entire underdrain system shall be videoed prior to the Project's final inspection. The Contractor may video the underdrain system prior to the placement of the final surface course over the area of the underdrain. If guardrail is placed within 3' (.9 m) from the underdrain, that section shall be videoed after installation of the guardrail.

Section 720 Galvanized Steel Beam Guardrail. (5/15/2006)

Change "Reflectorized Washers" to "Guardrail Reflectors".

Subsection 720.05 Basis of Payment. (5/15/2006)

After the third sentence, add the following sentences:

When specified in the Plans to place/replace or salvage individual elements of guardrail, and an item is listed for those items, then those individual components will be measured/paid as the number of each component under their respective bid item. When installing new guardrail, paid by the linear foot, these items are incidental to guardrail.

Section 725 Guardrail-to-Barrier Connection (Approach and Exit Types). (5/15/2006)

Change "Reflectorized Washers" to "Guardrail Reflectors".

Section 726 Guardrail End Treatment. (5/15/2006)

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Change “Reflectorized Washers” to “Guardrail Reflectors”.

Subsection 732.02 Materials. (5/15/2006)

Modify the third paragraph as follows:

Topsoil shall have an acidity range of pH 6.0 to pH 6.5. If necessary, lime shall be incorporated into the topsoil to raise the acidity or a sulfur-based product shall be incorporated into the topsoil to lower the acidity. The rate shall be determined by the Engineer, and shall be accomplished prior to or at the time of seeding.

Subsection 732.10 Basis of Payment. (5/15/2006)

Modify the second sentence as follows:

Price and Payment will constitute full compensation for preparing the grade; for furnishing, hauling, and placing all materials, including necessary quantities of lime or sulfur; for maintaining topsoil, for loosening of the topsoil and subgrade to a total depth of 6” (150 mm); and for all labor, equipment, tools, and incidentals required to complete the work.

Subsection 746.03 Construction Methods. (3/18/2004)

Delete the last paragraph. Insert the following two sentences:

The concrete for pole bases shall be placed in accordance with the applicable requirements of Section 602. The bases shall be edged and have a broom finish.

Subsection 748.09 Application. (5/15/2006)

Add the following at the end of this subsection:

(f) Removal of Pavement Markings when they are not properly applied.

When it is necessary to remove pavement markings the following shall apply:

(1.) For paint and epoxy resin, shot/abrasive grit blasting or water blasting equipment shall be used.

(2.) For alkyd thermoplastic, in addition to the removal techniques discussed for paint and epoxy, burning or grinding equipment may be used.

The removal operation shall be performed in a manner that will not damage the pavement surface to a depth more than 1/8 inch. The contractor must satisfactorily demonstrate his/her proposed equipment and method of removal. Alternative equipment and methods will be considered if satisfactory results can be demonstrated.

The contractor shall collect and dispose of all shot/abrasive grit and pavement marking materials removed from the pavement surface. Washing or sweeping such materials to the roadside will not be permitted.

(3.) After removal of striping on bituminous concrete pavement, approved flat black paint or

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asphalt sealer shall be used to cover any exposed aggregate or embedded paint. Price and payment will also include payment for black paint or asphalt sealer.

760.04 Basis of Payment. (5/15/2006)

Modify the paragraph as follows:

The quantity of pavement-milling will be paid for at the Contract unit price per square yard per inch of depth (square meter per 25 millimeters of depth) or at the Contract unit price per square yard (square meter). Price and payment will constitute full compensation for milling or planing the existing pavement; for the cleanup of the hot mix or concrete residue wedge left from the milling operation including but not limited to along the curb line, adjacent to speed humps, across intersecting streets, around manholes, and at the beginning and ending points of the milling operation, for removing and disposing of the milled material; and for all labor, tools, equipment, and incidentals required to complete the work.

Subsection 808.02 Portland Cement Concrete Pavement. (5/15/2006)

Modify Subpart (a) as follows:

a. *Hot-Poured Joint Sealant.* Hot-poured joint sealant shall conform to AASHTO M 324(Type-IV) or AASHTO M 282.

Subsection 808.04 Portland Cement Concrete Structures. (5/15/2006)

Modify Subpart (c) as follows:

c. *Bituminous Joint Sealant.* Bituminous joint sealants may be hot applied conforming to AASHTO M 324 Type-I, or cold applied elastomeric sealant conforming to Federal Specification SS-S-200E (2), Type H.

Subsection 808.06 Portland Cement Concrete Curb and Integral Curb and Gutter. (5/15/2006)

Modify the 1st Sentence as follows:

Materials for portland cement concrete curb and integral curb and gutter shall be preformed expansion joint material of ½" (13 mm) nominal thickness and shall conform to the requirements of AASHTO M 153, Type II.

Subsection 812.04 Composition of Mix. (3/18/2004)

Add the following to the notes under Table 812-A:

Note 13: Concrete (all classes), which fails to reach full 28 day design strength (f_c') will be considered defective and will be evaluated in accordance with Subsection 602.25 Defective Work. Payment for the item with low strength concrete will be determined in accordance with Subsection 602.27 Basis of Payment (b) Price Adjustment for Low Strength Concrete.

Modify the statement in the bottom of box of Table 812-A as follows:

Notes 8, 9, 10, 11, and 13 refer to all classes of concrete. Note 12 refer to Class D concrete.

Section 814 – Timber Preservatives. (3/18/2004)

Delete Paragraph (a).

Subsection 821.01 Description. (5/15/2006)

Modify the paragraph as follows:

This material consists of coarse crushed stone, crushed slag fragments or portland cement concrete fragments. The Contractor shall certify that any recycled material, which is being proposed for use as graded aggregate, is neither hazardous nor toxic.

Subsection 821.03 Material Details. (c) Gradation. (5/15/2006)

Remove all references to graded aggregate, Type A (CR-1). Replace all of Subpart (c) Gradation with the following:

Sieve Size	WEIGHT PERCENT PASSING
	% Passing Type B
2 ½" (63.0 mm)	---
1 ½" (37.5 mm)	100
1" (25.0 mm)	---
¾" (19.0 mm)	50-95
No. 4 (4.75 mm)	20-50
No. 10 (2.00 mm)	15-40
No. 20 (850 um)	---
No. 100 (150 um)	2-20
No. 200 (75 um)	0-10

Materials. The graded aggregate shall meet the following properties:

Property	Range
Liquid Limit (T89) ¹	30 max
Plasticity Index (T90) ¹	4 max
Sand Equivalency ¹	25 min
Bituminous Concrete ²	5% max
Brick ²	5% max
Wood ²	0.1% max
Metals ²	0.1% max
Plaster ²	0.1% max
Deleterious materials ²	0.1% max
Los Angeles Abrasion	45% max

¹Minus 0.425 mm (No. 40) sieve material

²By weight

Once a stockpile of material has been tested and approved, no material shall be added to it until the stockpile is depleted.

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Subsection 828.02 (f) Guardrail Reflectors. (5/15/2006)

Change “Reflectorized Washers” to “Guardrail Reflectors”.

Modify the paragraph as follows:

Guardrail reflectors shall be fabricated from steel sheet plates conforming to the requirements of ASTM A-6, galvanized to ASTM A153. Retroreflectorized sheeting shall be AR-1000 (Type V) Abrasive resistant and shall be applied in accordance with Subsection 720.03.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

PART 5

**UTILITY AND RIGHT-OF-WAY
STATEMENTS**

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Delaware Department of Transportation

Verizon-DE, Inc.

The Company maintains aerial, underground and/or buried facilities within the project limits. The Company's maintains both copper and fiber optic facilities. The Company's fiber optic facilities are located on the existing bridge over the Indian River Inlet.

The Company maintains aerial facilities underbuilt on the transmission poles that are in conflict with Access Road C construction at approximately four (4) locations, as described under the Conectiv Power Delivery (Electric-Transmission) section.

The Company proposes to temporarily relocate the aerial facilities that are underbuilt on the transmission poles onto the new poles described under the Conectiv Power Delivery (Electric Transmission) section to accommodate the construction of Access Road C in advance of the permanent facility relocation.

The Company will require a total of twenty (20) calendar days to complete the proposed work following 21 calendar days advanced notice of completion of the electric transmission and electric distribution facility relocations.

THE ABOVE REFERENCED WORK HAS BEEN COMPLETED.

The Company maintains underground and direct buried facilities that are in conflict with the future bridge foundations, both north and south of the inlet. The Company's facilities will need to be temporarily relocated to predominately underground facilities.

The Company proposes to relocate the underground and direct buried facilities that are in conflict with the future bridge foundations, both north and south of the inlet in a predominately underground facility that will remain as a portion of the permanent facility relocation. The underground facility will be a manhole duct system and extend from a proposed manhole at approximately station 472+00 Baseline Construction SB SR 1, 40ft left where the Company's fiber optic facilities connect to existing facilities. The underground facility will then extend to the east, perpendicular to SR 1 to a proposed manhole at approximately station 272+00 Baseline Survey & Construction NB SR 1, 45ft right where the Company's copper facilities connect to existing facilities. The underground line continues along the east side of Access Road A to the existing services. The underground line also continues from the proposed manhole at approximately station 272+00 Baseline Survey & Construction NB SR 1, 45ft right under SR 1 to the Company's proposed crossing under the Indian River Inlet, terminating with a temporary connection to an existing pole located at approximately Station 311+70 Baseline Survey and Construction SR 1, 195ft left. The entire underground system with the exception of the temporary connection to the existing pole will remain as part of the permanent facility relocation. Upon completion of the proposed underground system, including all pulling, splicing, terminating of new cable, completion of new transition structures and completion of necessary hardware facilities, the Company will remove all cables from the aerial facilities, remove the Company's poles and abandon existing underground facilities.

The Company will require a total of approximately two hundred and seventy (270) non-consecutive calendar days to complete this work and the Company proposes to begin this work in advance of the State's contract.



THE ABOVE REFERENCED WORK HAS BEEN COMPLETED EXCEPT FOR THE PERMANENT TIE-IN TO THE NEW DELMARVA POWER POLE ON THE NORTHERN CORNER OF MARINA ROAD AND ACCESS ROAD C, AND AERIAL RELOCATION OF LINES THAT ARE CURRENTLY ON DELMARVA POWER POLES ALONG THE WEST SIDE OF ACCESS ROAD C. THE SCHEDULE FOR THE BORING WORK OPERATION AND

RELOCATION WORK IS NOT KNOWN. THE DESIGN-BUILDER SHALL BE PREPARED TO WORK AROUND THE EXISTING FACILITIES AND/OR ANY RELOCATION ACTIVITIES THROUGHOUT CONSTRUCTION.

THERE IS AN EXISTING VERIZON PEDESTAL ADJACENT TO SUSSEX ROAD 50A THAT NEEDS TO BE RELOCATED AS PART OF THE FUTURE PARK IMPROVEMENT CONTRACT.

Any additional modifications that may be necessary to the Company's facilities will be performed by the Company's forces during the project's construction. The time to complete any additional facility modifications will depend on the nature of the work and will be determined at that time.

Department of Natural Resources and Environmental Control (DNREC)(Water & Sanitary Sewer)

Any adjustments and/or relocations of the State's existing water or sanitary sewer facilities will be done by the State's Contractor in accordance with Sussex Shores Water Company's Standard Specifications (water) or Sussex County's Standard Specifications (sanitary sewer), as indicated on the plans and outlined elsewhere in the Special Provisions. The State's Contractor shall install the water and sanitary services as indicated within the contract documents.

THE ABOVE REFERENCED WORK HAS BEEN COMPLETED.

Sussex Shores Water Company

The Company maintains underground facilities with no apparent conflict to the proposed construction. Any additional modifications that may be necessary to the Company's facilities will be performed by the Company's forces during the project's construction.

THE ABOVE REFERENCED WORK HAS BEEN COMPLETED.

Sussex County (Sanitary Sewer)

Any adjustments and/or relocations of the County's existing sanitary sewer facilities will be done by the State's Contractor in accordance with the County's Standard Specifications, as indicated on the plans and outlined elsewhere in the Special Provisions. The State's Contractor shall install the sanitary services as indicated within the contract documents.

THE ABOVE REFERENCED WORK HAS BEEN COMPLETED.

GENERAL NOTES:

As-built plans for the work that has been completed to date are available as part of the contract documents.

- 1. THE UTILITIES AND THEIR CONTRACTORS DO NOT NORMALLY WORK ON WEEKENDS OR LEGAL HOLIDAYS!**
- 2. IT IS UNDERSTOOD AND AGREED THAT THE DESIGN-BUILDER HAS CONSIDERED IN HIS/HER PROPOSAL ALL PERMANENT AND TEMPORARY UTILITY APPURTENANCES IN THEIR PRESENT OR RELOCATED POSITIONS AS SHOWN ON THE PLANS OR DESCRIBED IN THE UTILITY STATEMENT AND/OR**

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ARE READILY DISCERNIBLE AND THAT NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR ANY DELAYS, INCONVENIENCE, OR DAMAGE SUSTAINED BY HIM/HER DUE TO ANY INTERFERENCE FROM THE SAID UTILITY FACILITIES AND APPURTENANCES OR THE OPERATION OF MOVING THEM, EXCEPT THAT THE DESIGN-BUILDER MAY BE GRANTED AN EQUITABLE EXTENSION OF TIME.

- 3. THE DESIGN-BUILDER IS RESPONSIBLE FOR THE SUPPORT AND PROTECTION OF ALL UTILITIES WHEN EXCAVATING.**
- 4. THE DESIGN-BUILDER IS RESPONSIBLE FOR ROUGH GRADING AS REQUIRED BY THE ROADWAY CONSTRUCTION PRIOR TO THE UTILITY COMPANY'S PLACING THEIR PROPOSED FACILITIES, UNLESS INDICATED ON THE PLANS AND/OR OUTLINED ELSEWHERE IN THESE SPECIFICATIONS.**
- 5. COORDINATION AND COOPERATION AMONG THE UTILITY COMPANIES AND THE DESIGN-BUILDER ARE OF PRIME IMPORTANCE. THEREFORE, THE DESIGN-BUILDER IS DIRECTED TO CONTACT THE FOLLOWING UTILITY COMPANY REPRESENTATIVES WITH ANY QUESTIONS REGARDING THIS WORK PRIOR TO SUBMITTING BIDS AND WORK SCHEDULES. PROPOSED WORK SCHEDULES SHALL REFLECT THE UTILITY COMPANIES' PROPOSED RELOCATIONS.**

Mr. Ray Rouault	Delmarva Power (Electric-Transmission)	302-454-5174
Mr. Guy Eberwine	Delmarva Power (Electric-Distribution)	302-934-3354
Mr. Bernie Fowler	Delmarva Power (Communications)	302-454-4239
Mr. Joe Longfellow	MediaCom	302-732-6600
Mr. David Williams	Verizon-DE, Inc.	610-280-5582
Mr. Britt Murray	Department of Natural Resources and Environmental Control (DNREC) (Water & Sanitary Sewer)	302-739-5284
Mr. Rodney Short	Sussex Shores Water Company	302-539-7611
Mr. Brad Hawkes	Sussex County (Sanitary Sewer)	302-855-7718

Delaware Department of Transportation

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
PO BOX 778
DOVER, DELAWARE 19905

CERTIFICATE OF RIGHT-OF-WAY STATUS

STATE PROJECT NO. 26-073-03

F.A.P. NO. BRHS050(14)

BRIDGE 3-156, INDIAN RIVER INLET BRIDGE REPLACEMENT

SUSSEX COUNTY

This is to certify that all project rights of way is currently available in accordance with the project right-of-way plans.

REAL ESTATE SECTION

/signature on file

Carol V. O'Donoghue
Assistant Chief Real Estate

September 22, 2006

Delaware Department of Transportation

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
PO BOX 778
DOVER, DELAWARE 19905

**UNIFORM RELOCATION ASSISTANCE AND REAL PROPERTY
ACQUISITIONS POLICIES ACT
49 CFR, PART 24
ASSISTANCE FOR DISPLACED FAMILIES AND BUSINESSES
AND
ASSISTANCE PAYMENTS**

FOR

STATE PROJECT NO. 26-073-03

F.A.P. NO. BRHS050(14)

BRIDGE 3-156, INDIAN RIVER INLET BRIDGE REPLACEMENT

SUSSEX COUNTY

This is to certify that there are no relocations involved on this subject project.

REAL ESTATE SECTION

/signature on file

Carol V. O'Donoghue
Assistant Chief Real Estate

September 22, 2006

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

PART 6

SCOPE OF SERVICES PACKAGE PLANS

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APPENDIX A – PLAN TYPES AND CATEGORIES

APPENDIX B – DIRECTIVE AND INDICATIVE PLANS

1.0 INTRODUCTION

This Part 6 – Scope of Services Package Plans contains the Scope of Services Package Plans created during the previous bridge design, the adjacent roadway approach contract, and the standard drawings of the Department and other stakeholders that shall be used for the Project. Applicable CADD files in electronic format on CD-ROMs (Compact Disc – Read Only Memory) are included in the Reference Documents.

The Scope of Services Package Plan types contained herein are categorized as directive plans. Directive plans are those plans that depict required elements and components of the Project within specifically defined parameters. The Design-Builder has limited or no latitude to adjust components, details, or limits shown on directive plans. Examples of directive plans include the following:

- A) Basic Project Configuration plans that depict the Basic Project Configuration within the limits defined in the Contract;
- B) Final Department-developed plans signed and sealed by a licensed engineer that represent the final design of a self-contained component of the overall Project, such as the roadway approaches. The Design-Builder has no responsibility for the design or construction of the component except for the interface between the Design-Builder’s Work and the adjacent Project component or element, unless otherwise specified in the Contract Documents; and
- C) Right-of-Way (ROW) plans that depict the limits of ROW or easements obtained or to be obtained by the Department.

2.0 PLAN TYPES AND CATEGORIES

The plan types and categories are shown in Appendix A to this Part 6 – Scope of Services Package Plans.

3.0 DIRECTIVE PLANS

The directive plans for this Project are contained in Appendix B to this Part 6 – Scope of Services Package Plans.

4.0 INDICATIVE PLANS

The indicative plans for the Project are contained in Appendix B to this Part 6 – Scope of Servives Package Plans.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
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State Contract # 26-073-03
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SCOPE OF SERVICES PACKAGE

PART 6 – APPENDIX A

PLAN TYPES AND CATEGORIES

Delaware Department of Transportation

Item	Date	Scope of Service Package Reference	Indicative or Directive
Final Construction Plans			
North and South Roadway Approaches (Contract #23-073-03)	Dec-04	Part 6	Directive for horizontal and vertical roadway geometrics, tie-in requirements for bridge, and approach roadway retaining wall locations. Also, directive for stationing references and convention.
Right-of-Way Plans			
Overall Project Location.	Dec-04	Part 6	Directive.
Final (Original) Bridge Plans			
Single-rib Concrete Arch Bridge Type (Contract #25-073-02)	Mar-05	Part 6	Directive for underclearance and typical roadway section. Indicative for utility provisions, foundation solutions, scour protection, aesthetic treatments, and all other applicable bridge features.

STATE OF DELAWARE



DEPARTMENT OF TRANSPORTATION

DESIGN-BUILD PROJECT

for

NEW INDIAN RIVER INLET BRIDGE

Replacement of Bridge 3-156,
SR1 over Indian River Inlet
State Contract # 26-073-03
Federal Contract # BRN-S050(14)

SCOPE OF SERVICES PACKAGE

PART 6 – APPENDIX B

DIRECTIVE AND INDICATIVE PLANS

TABLE OF CONTENTS

1.0 DIRECTIVE PLANS 1

2.0 INDICATIVE PLANS 1

1.0 DIRECTIVE PLANS

Applicable CADD files in electronic format on CD-ROMs (Compact Disc – Read Only Memory) are included in the Reference Documents for the following directive plans:

- A) Contract #23-073-03, BR 3-156 on SR 1 Over Indian River Inlet (Roadway and Approaches) Contract Drawings with Addendums and Revisions;
- B) Contract #23-073-03, BR 3-156 on SR 1 Over Indian River Inlet (Right-of-Way Plans); and
- C) Contract #25-073-02, BR 3-156 on SR 1 Over Indian River Inlet (Bridge Replacement) Non-Awarded Contract Drawings with Addendums.

2.0 INDICATIVE PLANS

Applicable CADD files in electronic format on CD-ROMs (Compact Disc – Read Only Memory) are included in the Reference Documents for the following indicative plans:

- A) Contract #25-073-02, BR 3-156 on SR 1 Over Indian River Inlet (Bridge Replacement) Non-Awarded Contract Drawings with Addendums.

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

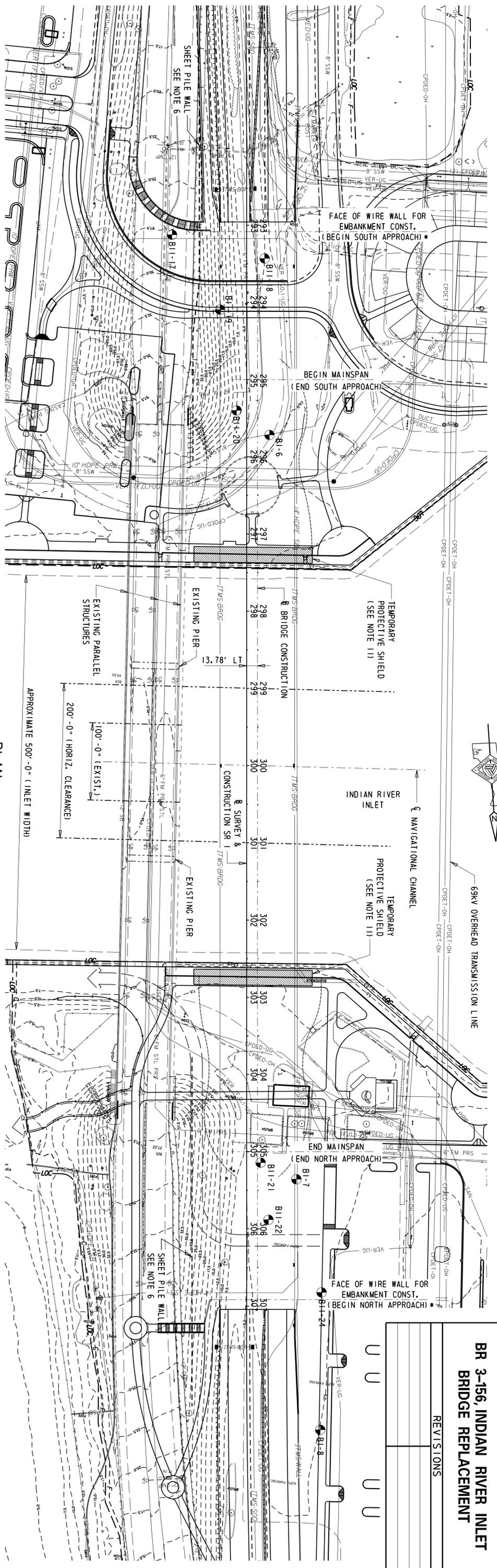
KEY PLAN AND ELEVATION

BR. 3 - 156

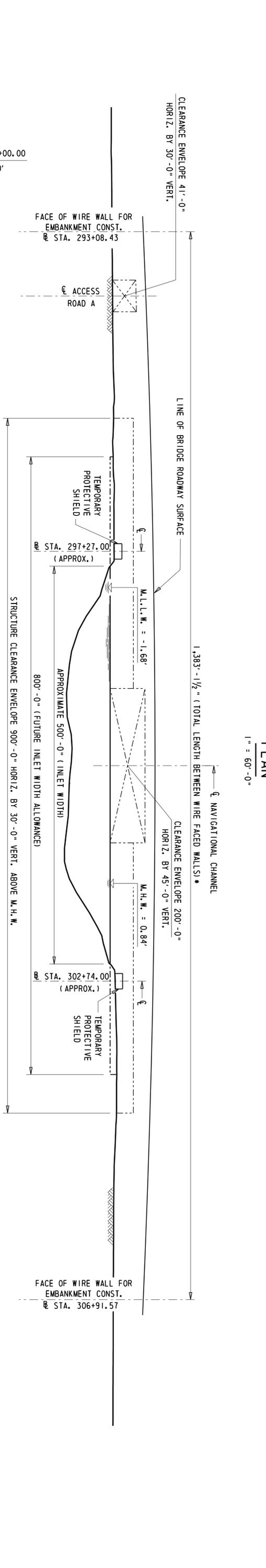
CONTRACT	COUNTY	FEDERAL AID PROJECT NO.	SHEET NO.	TOTAL SHEETS
26-073-03	SUSSEX	BR05-S050(91)B-002	B-002	B-003

BR 3-156, INDIAN RIVER INLET BRIDGE REPLACEMENT

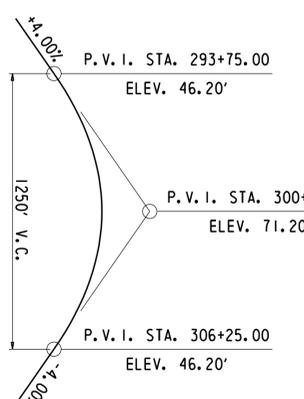
REVISIONS



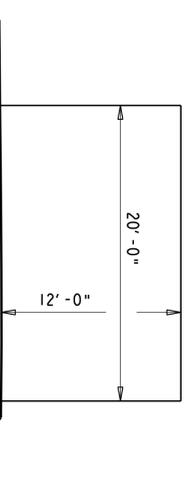
PLAN 1" = 60'-0"



ELEVATION 1" = 60'-0"



TEMPORARY PROTECTIVE SHIELD INSIDE CLEARANCE DIMENSIONS



- NOTES:
- ELEVATIONS FOR M.L.L.W. AND M.H.W. ARE GIVEN WITH RESPECT TO NAVD88 DATUM. NAVD88 DATUM ELEVATION 0.00'.
 - ALL ELEVATIONS GIVEN ARE ALONG THE SURVEY AND CONSTRUCTION SRI.
 - FOR ROADWAY IMPROVEMENT PLANS SEE REFERENCE DOCUMENTS - ROADWAY CONTRACT PLANS (CONTRACT #23-073-031).
 - FOR PARK IMPROVEMENT PLANS SEE REFERENCE DOCUMENTS - PARK CONTRACT PLANS (CONTRACT #25-073-031).
 - FOR MSE WALL DETAILS SEE ROADWAY CONTRACT PLANS.
 - FOR SHEET PILE WALL DETAILS SEE ROADWAY CONTRACT PLANS.
 - FOR SOIL BORING DATA SEE REFERENCE DOCUMENTS - BRIDGE CONTRACT PLANS (CONTRACT #25-073-021) SHEETS B-607 THROUGH B-627.
 - TOPO SHOWN ON THIS SHEET MAY NOT REFLECT ACTUAL CONDITIONS AT TIME OF BRIDGE DESIGN-BUILD CONTRACT ADVERTISEMENT.
 - THE DESIGN-BUILDER SHALL DETERMINE THE BRIDGE LIMITS. LOCATIONS SHOWN ONLY INDICATE THE EXISTING FACE OF WIRE WALLS FOR EMBANKMENT CONSTRUCTION. THE DESIGN-BUILDER MAY ADJUST THE EMBANKMENT WALL LIMITS WITHIN THE OVERALL PROJECT LIMITS SPECIFIED IN THE CONTRACT DOCUMENTS, PART I - APPENDIX A.
 - THE DESIGN-BUILDER SHALL FURNISH, ERECT AND MAINTAIN TEMPORARY PROTECTIVE SHIELDS FOR PEDESTRIAN ACCESS ALONG THE INDIAN RIVER INLET DURING CONSTRUCTION OF THE NEW INDIAN RIVER BRIDGE IN ACCORDANCE WITH THE TEMPORARY WORKS PERFORMANCE SPECIFICATION AND AS SHOWN SCHEMATICALLY ON THIS SHEET.

TRAFFIC RESTRICTIONS

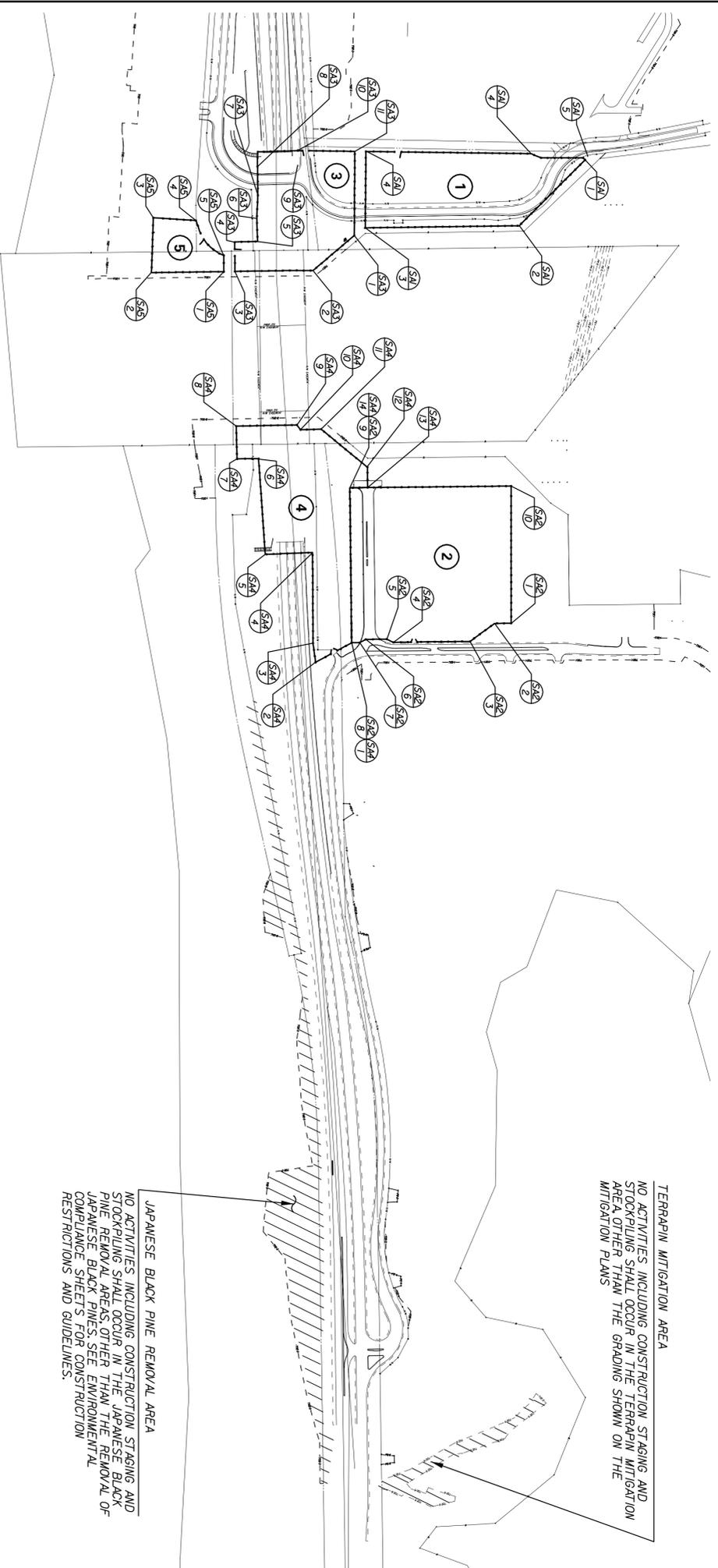
	MAY TO SEPTEMBER (MEMORIAL DAY TO LABOR DAY)		SEPTEMBER TO MAY (POST LABOR DAY TO PRE MEMORIAL DAY)	
	STATE ROUTE 1	PARK ACCESS ROADS	STATE ROUTE 1	PARK ACCESS ROADS
Monday	No Lane Closures Permitted	No Lane Closures Permitted	Anytime	Anytime
Tuesday through Thursday	Start 9 am End 3 pm	No Lane Closures Permitted	Anytime	Anytime
Friday	Start End	No Lane Closures Permitted	Anytime	Anytime
Saturday	Start End	No Lane Closures Permitted	Anytime	Anytime
Sunday	Start End	No Lane Closures Permitted	Anytime	Anytime

NOTE: THE TRAFFIC LANES ON SR 1 AND ON THE PARK ACCESS ROADS MAY BE REDUCED TO SINGLE LANES, ONE LANE IN EACH DIRECTION ON SR 1 AND ONE LANE WITH FLAGGER CONTROLLED MOVEMENTS ON THE PARK ACCESS ROADS, DURING THE HOURS DESIGNATED IN THE TRAFFIC RESTRICTION CHART ABOVE.

CONSTRUCTION MILESTONES

NOTE: ACTUAL DATES ASSOCIATED WITH EACH MILESTONE ACTIVITY SHALL BE DETERMINED BY THE ENGINEER FOR THE APPLICABLE ACTIVITIES IS INDICATED IN THE NOTICE TO CONTRACTORS IN THE SPECIAL PROVISIONS.

- **ROADWAY ITEMS TO BE COMPLETE PRIOR TO BRIDGE CONSTRUCTION (BY OTHERS):**
 DEMOLITION/RELOCATION OF PARK BUILDINGS:
 NORTH SHELTER HOUSE/SEWER PUMP STATION
 NORTH SHELTER
 SOUTH CONTACT STATION
 NORTH SIDE TEMPORARY PARKING LOT
 BATCH PLANT FENCING
 SET UP NOT FOR ROAD 50A DETOUR INCLUDING EXTENSION OF LEFT TURN LANE AT SR 3 INTERSECTION AND SIGNING
 EXCAVATION AND TIE-BACKS FOR THE TEMPORARY SUPPORT OF SR 1
- **ROADWAY ITEMS TO BE COMPLETE PRIOR TO MAY 30TH 2006 (BY OTHERS):**
 FRESH PONDS NORTH MITIGATION SITE
 TERRAPIN MITIGATION SITE
 SOUTH PARK RV EXPANSION
 SOUTH PARK TENT SITE EXPANSION
- **BRIDGE ITEMS TO BE COMPLETED AS A FIRST ORDER OF WORK:**
 NORTH AND SOUTH ABUTMENT FOUNDATION, FOOTINGS AND BACKWALL
- **ROADWAY ITEMS TO BE COMPLETE PRIOR TO MAIN SPAN SUPERSTRUCTURE ERECTION (BY OTHERS):**
 BRIDGE APPROACH ROADWAY EMBANKMENT, SURCHARGE, SETTLEMENT, SURCHARGE REMOVAL, PAYEMENT CONSTRUCTION UP TO AND INCLUDING HOT MIX TYPE B
- **ROADWAY ITEMS TO BE COMPLETE PRIOR TO BRIDGE OPENING (BY OTHERS):**
 SOUTHBOUND SR 1 ROADWAY TIE-INS INCLUDING GUARDRAIL, STRIPING, ETC. COMPLETE SAND BY-PASS ON BRIDGE AND THROUGH ABUTMENT MSE WALL FINAL FACING ON WEST SIDE WALLS ONLY
 CONNECTIV FACILITY INFRASTRUCTURE
 ROADWAY LANDSCAPING SHOWN THROUGH STAGE 2 PHASE E
- **BRIDGE ITEMS TO BE COMPLETE PRIOR TO BRIDGE OPENING:**
 BRIDGE OVERLAY AND APPROACH SLABS
 BRIDGE ELECTRICAL, INCLUDING BRIDGE LIGHTING
 BATCH PLANT REMOVED, RESTORE AND VACATE AREA 2
 DELTRAC SECURITY MEASURES
- **PARK ITEMS TO BE COMPLETE PRIOR TO BRIDGE OPENING (BY OTHERS):**
 NORTH PROMENADE OUTSIDE STAGING AREA 4
- **DEMOLITION ITEMS TO BE COMPLETE PRIOR TO BRIDGE OPENING:**
 DEMOLITION OF TEMPORARY TOWERS
- **60 DAYS AFTER BRIDGE OPENING:**
 BRIDGE CONTRACTOR RESTORES AND VACATES STAGING AREAS 3 AND 4 FOR PARK CONSTRUCTION
 ROADWAY CONTRACTOR REMOVES/RELOCATE FIELD OFFICE COMPLEX FOR PARK CONTRACTOR
- **ROADWAY ITEMS TO BE COMPLETE PRIOR TO BRIDGE DEMOLITION (BY OTHERS):**
 COMPLETE SAND BY-PASS SYSTEM SYSTEM RELOCATION
 ROADWAY CONTRACTOR RESTORES AND VACATES STAGING AREAS 5 FOR DEMOLITION CONTRACTOR
- **30 DAYS AFTER BRIDGE DEMOLITION (BY OTHERS):**
 DEMOLITION CONTRACTOR RESTORES AND VACATES STAGING AREA 5



**CONSTRUCTION PHASING
STAGING AREA AND MILESTONES**

GRAPHIC SCALE
250 125 0



BR. 3 - 156

CONTRACT	COUNTY	F.A.R. NO.	SHEET NO./TOTAL SHEETS
26-073-03	SUSSEX	BR03-50501.91	B-003 B-003

**BR 156 INDIAN RIVER INLET
BRIDGE REPLACEMENT**

REVISIONS

NO.	DATE	DESCRIPTION
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TERRAPIN MITIGATION AREA
 NO ACTIVITIES INCLUDING CONSTRUCTION STAGING AND STOCKPILING SHALL OCCUR IN THE TERRAPIN MITIGATION AREA OTHER THAN THE GRADING SHOWN ON THE MITIGATION PLANS

JAPANESE BLACK PINE REMOVAL AREA
 NO ACTIVITIES INCLUDING CONSTRUCTION STAGING AND STOCKPILING SHALL OCCUR IN THE JAPANESE BLACK PINE REMOVAL AREAS OTHER THAN THE REMOVAL OF JAPANESE BLACK PINES. SEE ENVIRONMENTAL COMPLIANCE SHEETS FOR CONSTRUCTION RESTRICTIONS AND GUIDELINES.

STAGING AREA ①

NO.	NORTHING	EASTING
S4H-1	75607	22087
S4I-2	75623	22135
S4J-3	75678	22191
S4K-4	75680	22095
S4L-5	75623	22082
S4M-6	75602	22080

NOTE: ROADWAY CONTRACTOR UPON COMPLETION OF STAGE 2, RESTORE AND VACATE FOR PARK CONTRACTOR. COORDINATE CONSTRUCTION OF ACCESS ROAD B THROUGH THIS AREA.

STAGING AREA ③

NO.	NORTHING	EASTING
S43-7	75682	22122
S43-2	75695	22156
S43-3	75723	22158
S43-4	75724	22184
S43-5	75765	22174
S43-6	75775	22191
S43-7	75778	22107
S43-8	75788	22100
S43-9	75704	22098
S43-10	75704	22093
S43-11	75684	22099

NOTE: BRIDGE CONTRACTOR UPON COMPLETION OF STAGE 2, PHASE E (BRIDGE OPENING), RESTORE AND VACATE FOR PARK AND ROADWAY CONTRACTORS. COORDINATE CONSTRUCTION OF ACCESS ROADS A AND B THROUGH THIS AREA.

STAGING AREA ②

NO.	NORTHING	EASTING
S4A-1	75613	22256
S4A-2	75696	22257
S4A-3	75627	22264
S4A-4	75652	22265
S4A-5	75657	22265
S4A-6	75652	22267
S4A-7	75667	22266
S4A-8	75670	22268
S4A-9	75675	22212
S4A-10	75680	22207

NOTE: BATCH PLANT AND VACATE UPON COMPLETION OF CONCRETE BARRIER FOR PARK AND ROADWAY CONTRACTORS. COORDINATE CONSTRUCTION OF ACCESS ROAD C THROUGH THIS AREA.

STAGING AREA ④

NO.	NORTHING	EASTING
S44-1	75670	22268
S44-2	75682	22271
S44-3	75683	22270
S44-4	75687	22237
S44-5	75703	22238
S44-6	75709	22205
S44-7	75710	22206
S44-8	75783	22194
S44-9	75696	22192
S44-10	75695	22193
S44-11	75687	22193
S44-12	75670	22205
S44-13	75693	22215
S44-14	75657	22212

NOTE: BRIDGE CONTRACTOR UPON COMPLETION OF STAGE 2, PHASE E (BRIDGE OPENING), RESTORE AND VACATE FOR PARK AND ROADWAY CONTRACTORS.

STAGING AREA ⑤

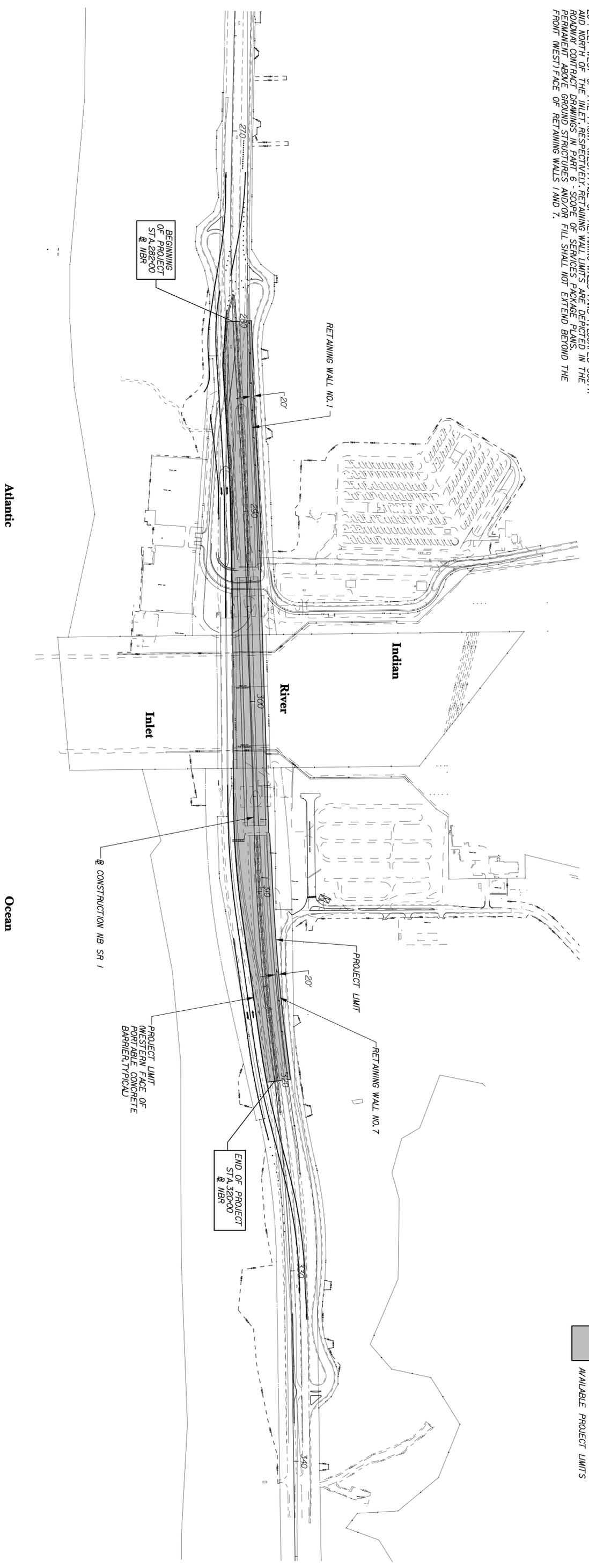
NO.	NORTHING	EASTING
S45-1	75726	22193
S45-2	75756	22149
S45-3	75756	22121
S45-4	75739	22127
S45-5	75782	22134

NOTE: ROADWAY CONTRACTOR UPON COMPLETION OF STAGE 2, PHASE E (BRIDGE OPENING), RESTORE AND VACATE FOR DEMO CONTRACTOR. UPON COMPLETION OF BRIDGE DEMOLITION, CONTRACTOR SHALL RESTORE AND VACATE FOR PARK CONTRACTOR.

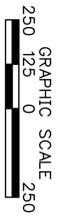
NOTE: THE STAGING AREA DRAWING IS TO BE USED TO DEFINE AVAILABLE STAGING AND SEQUENCING.

THE MAXIMUM AVAILABLE PROJECT TERMINI ARE AS FOLLOWS:

- A) BEGINNING OF PROJECT (BOP) - SOUTH OF THE INDIAN RIVER INLET ON STATE ROUTE 1 (SR 1) STATION 282+00 AS MEASURED ALONG THE BASELINE CONSTRUCTION NORTHBOUND SR 1 AND AS SHOWN ON THE PLANS FOR CONTRACT #23-07-03 IN PART 6 - SCOPE OF SERVICES PACKAGE PLANS; AND
 - B) END OF PROJECT (EOP) - NORTH OF THE INDIAN RIVER INLET ON SR 1 STATION 320+00 AS MEASURED ALONG THE BASELINE CONSTRUCTION NORTHBOUND SR 1 AND AS SHOWN ON THE PLANS FOR CONTRACT #23-07-03 IN PART 6 - SCOPE OF SERVICES PACKAGE PLANS.
- THE MAXIMUM LATERAL LIMITS ARE AS FOLLOWS:
- A) EASTERN LIMIT - THE EASTERN LIMITS OF DISTURBANCE SHALL NOT EXTEND BEYOND THE BACK (WESTERN) FACE OF THE PORTABLE CONCRETE BARRIER LOCATED ALONG THE WESTERN SHOULDER OF SOUTHBOUND SR 1, APPROACH ROADWAY STRUCTURES AND/OR FILL SHALL NOT EXTEND BEYOND THE ORIGINAL RETAINING WALL AND/OR EMBANKMENT LIMITS DEPICTED IN THE ROADWAY CONTRACT DRAWINGS (SEE PART 6 - SCOPE OF SERVICES PACKAGE PLANS).
 - B) WESTERN LIMITS - THE WESTERN LIMITS OF DISTURBANCE SHALL EXTEND NO MORE THAN 20 FEET WEST OF THE FRONT (WEST) FACE OF RETAINING WALLS 1 AND 7, LOCATED SOUTH AND NORTH OF THE INLET, RESPECTIVELY. RETAINING WALL LIMITS ARE DEPICTED IN THE ROADWAY CONTRACT DRAWINGS IN PART 6 - SCOPE OF SERVICES PACKAGE PLANS. PERMANENT ABOVE GROUND STRUCTURES AND/OR FILL SHALL NOT EXTEND BEYOND THE FRONT (WEST) FACE OF RETAINING WALLS 1 AND 7.



AVAILABLE PROJECT LIMITS



BR. 3-156

CONTRACT	COUNTY	F.A.P. NO.	SHEET NO./TOTAL SHEETS
26-073-03	SUSSEX	BRN-S050 (14)	B-004 B-004

BR 156 INDIAN RIVER INLET BRIDGE REPLACEMENT

REVISIONS

NO.	DATE	DESCRIPTION

AVAILABLE PROJECT LIMITS