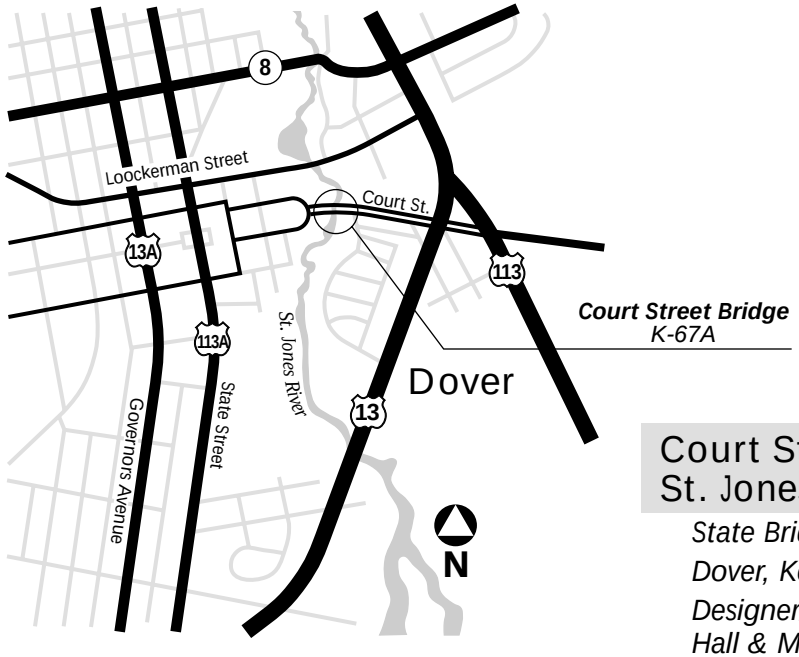
The previous bridge was a brick arch with stone spandrel walls. By 1956, when this photo was taken, the original parapets had been replaced by concrete parapets.

State Bridge K-67A (1956-57) is a reinforced concrete arch bridge with Colonial Revival architectural details. The bridge serves as an entry to the state capitol complex.

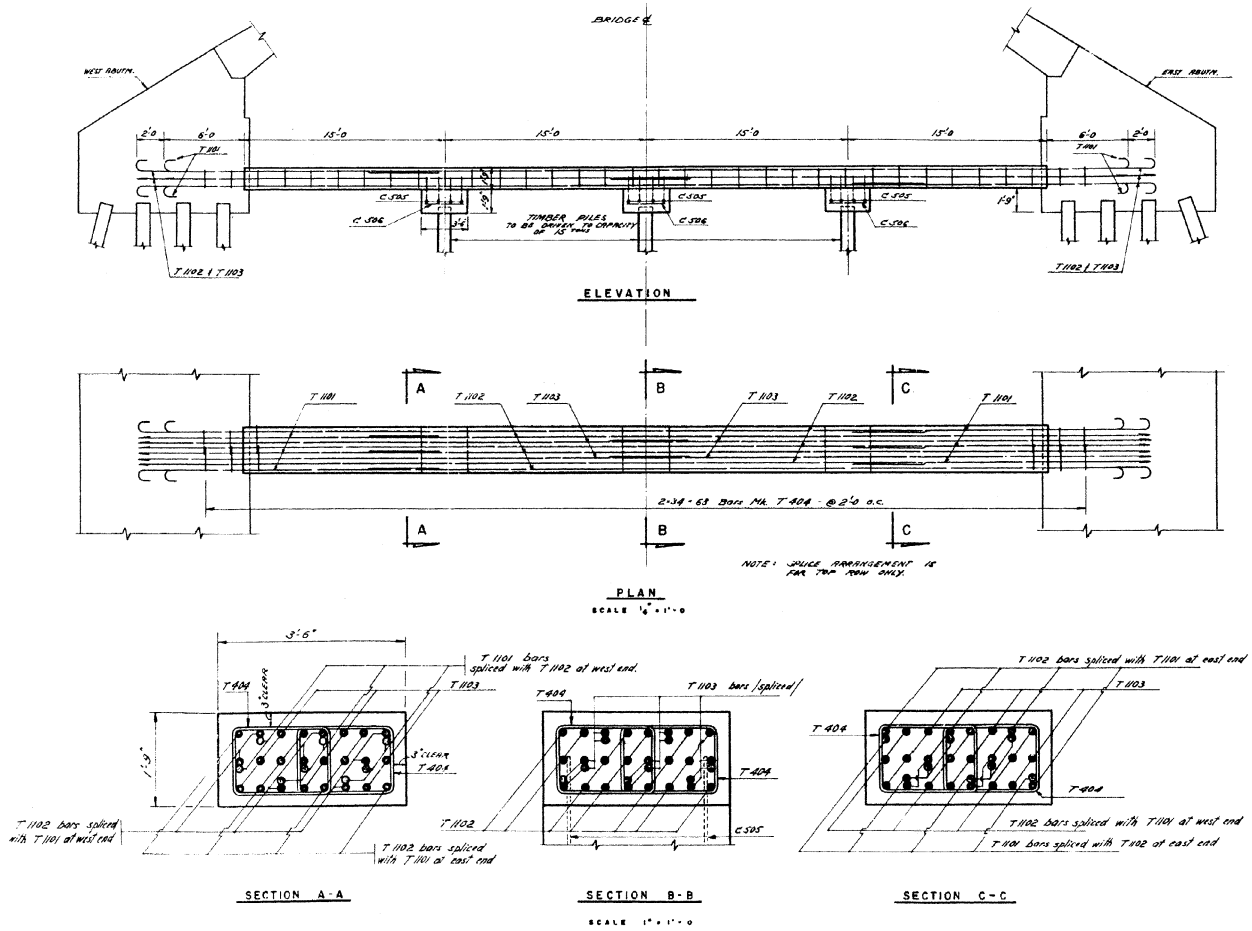


Court Street *(Road 67)* over St. Jones River

State Bridge K-67A
Dover, Kent County
Designer/Builder: Parsons, Brinckerhoff, Hall & MacDonald/James Julian Company

1956-57

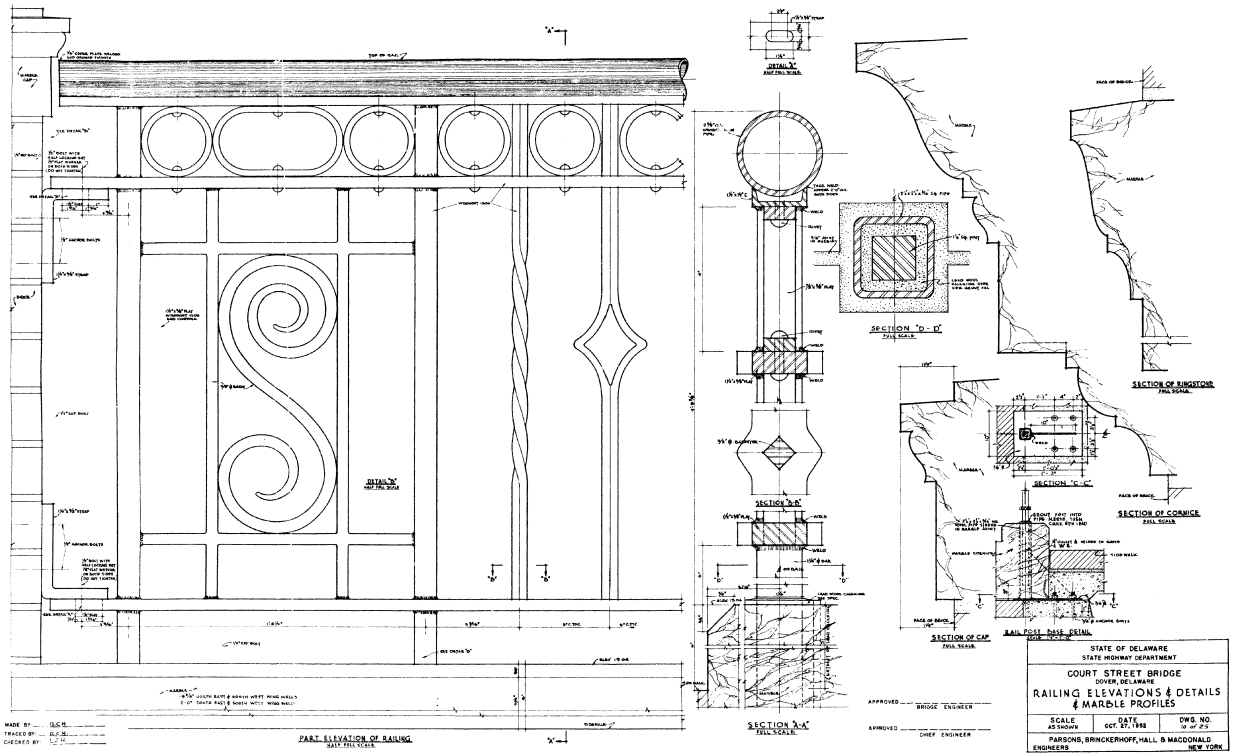
The Court Street bridge is a skewed, one span, 68'-long, reinforced concrete arch bridge with brick veneer spandrel walls and wingwalls, ornamental steel railings with brick posts with marble coping, limestone arch rings, and pilasters with stone arch pediments at the abutment corners. The 88'-wide bridge is an uncommon variation of a tied arch with six reinforced concrete ties spaced at approximately 15' intervals between opposing abutments.



Plans for State Bridge K-67A illustrate the placement of the ties under the stream. The ties resist the thrust of the arch against the abutments. They were an engineering solution to the problem of reducing the size and cost of the abutments given the foundation soil conditions.

The ties are under the stream and are founded on timber piles. The ties assist to reduce the thrust of the arch against the abutments, and according to construction documents were an engineering solution to the problem of reducing size and cost of the abutments given the foundation soil conditions.

The 1956-57 Court Street over St. Jones River bridge is a technologically significant architectonic, tied, reinforced concrete arch bridge. The arch bridge was designed in the Colonial-Revival style in keeping with the nearby state capitol complex. It is among the most significant bridges completed by the Delaware State Highway Department in the 1950s. Planning for the Court Street Bridge began in 1952 when the state highway department finished the Dover Bypass (US Route 13) and desired to construct a four-lane connecting road from the bypass to the state capitol complex. The department planned to widen Court Street and replace a narrow three-span brick arch bridge with stone spandrel walls that dated to circa 1900. The department engaged the consulting engineer firm of Parsons, Brinckerhoff,



Detail of iron railing for State Bridge K-67A.

Hall & MacDonald (PBH&M) to design a new bridge with instructions to pattern it in "the traditional style as manifested in the surrounding buildings." The department provided PBH&M with the plans for the Lookerman Street Bridge (State Bridge K-23A, 1934) and the Silver Lake Bridge (State Bridge K-3C, 1937) as models for the new bridge. Both the Lookerman and Silver Lake arch bridges had been built with Colonial Revival detailing designed by Wilmington architect E. William Martin. PBH&M used the same architectural motifs for the Court Street Bridge and copied the railings of the Legislative Hall.

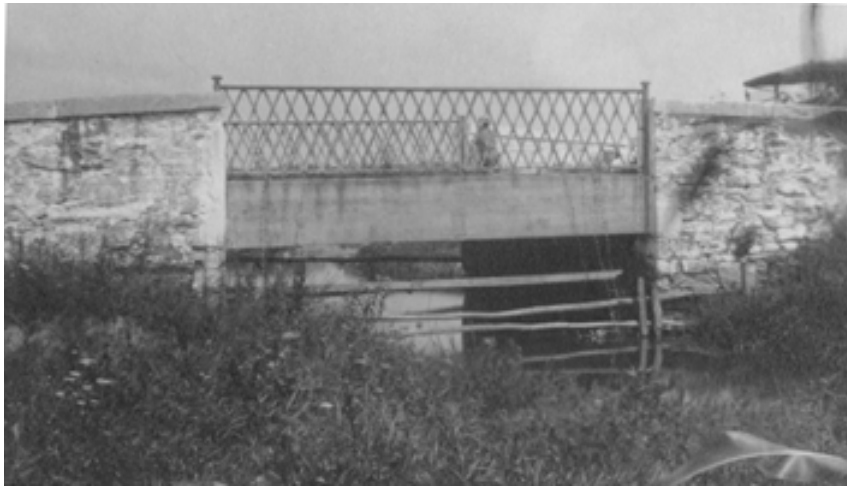
PBH&M bridge engineer Alfred Hedefine (1906-1981) noted in letters to the department that the Court Street crossing posed an engineering problem given the soft foundation conditions and the size of abutments needed to resist the thrust of an arch of the size and proportions proposed. A creative engineering solution was the addition of ties, thus, reducing the thrust to "near negligible proportions." Tied, reinforced concrete arches were not a new technology, having been built since the early 20th century. Tied arches, however, were used more frequently in a thru arch configuration (deck carried suspended below the arch, such as with State Bridge NC-246) rather than deck arch configuration (deck carried above the arch), as in the Court Street Bridge. Hedefine, noted as one of the mid-20th-century's leading bridge designers, was largely responsible for such important structures as the 1939 World's Fair Trylon and Perisphere; the Talmadge Bridge, Savannah, Georgia (1950-51); the Arthur Kill Bridge, Staten Island, New York (1959); the Newport Suspension Bridge, Newport, Rhode Island (1965-69); and, the Fremont Bridge, Portland, Oregon (1973).

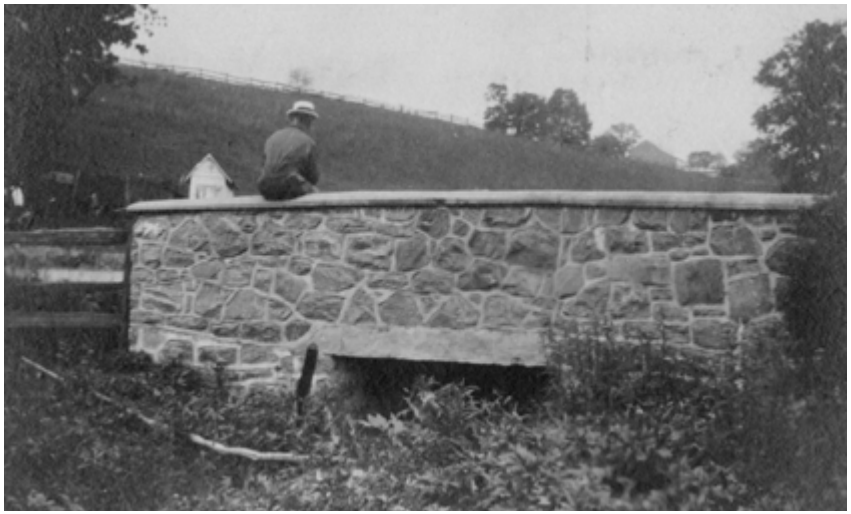
Although planned in 1952, construction of the Court Street bridge did not begin until mid-1956 when funds became available. The contractor for the bridge was James Julian Contracting Company of Elsmere. The bridge opened to traffic in late 1957.

Slab Bridges

Nationally, cast-in-place reinforced concrete slab bridges appeared in numbers about 1905. The oldest extant examples in Delaware date to the early 1910s. The slab bridge concentrates reinforcing steel, in the form of twisted or deformed rods, in the lower portion of the slab where tensile forces due to bending are greatest, and at the ends where shear is maximum. As with all other bridge types, the amount of steel and depth of the slab is predicated on its length and live-load capacity. Slab bridge technology has changed little from the 1910s to the present day.

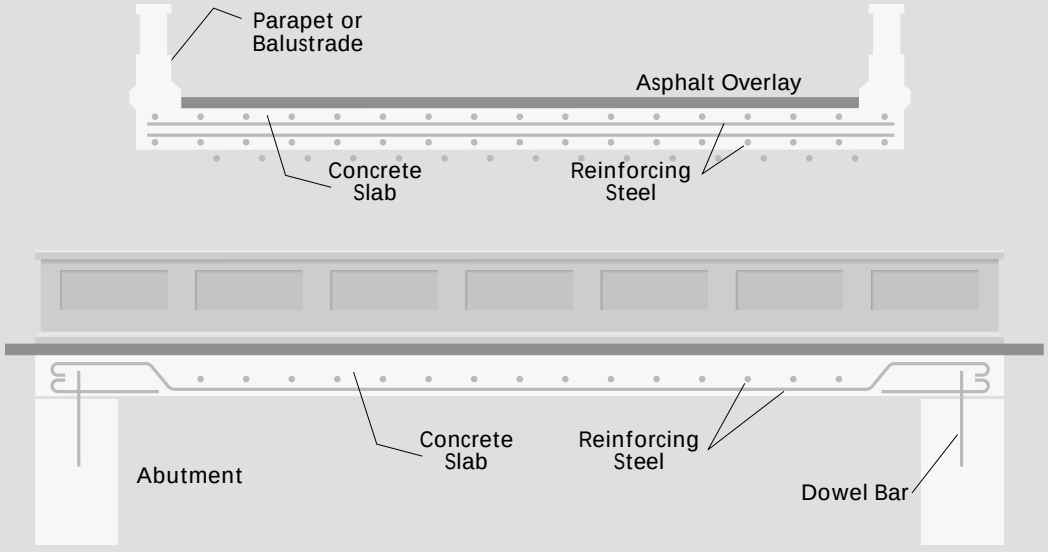
The slab bridge type was featured prominently in pre-World War I engineering journals and texts, federal Office of Public Roads (OPR) technical pamphlets, and concrete manufacturers' advertising. It appeared everywhere across the country at about the same time, and there were few variations. In Delaware, pre-World War I slab bridges, such as those built on the DuPont Highway, were less than 20' wide, and many have been subsequently replaced or widened. A noteworthy early example is the ca. 1915 SR 100 over Brandywine Creek Tributary bridge (State Bridge NC-76), which was widened and finished with stone parapets in 1932. During the 1920s, slab bridges were in use throughout the state in great numbers with more than 133 known examples in New Castle County alone. Only 46 of New Castle County's 133 slab bridges were over 10' long, illustrating how predominant and economical the





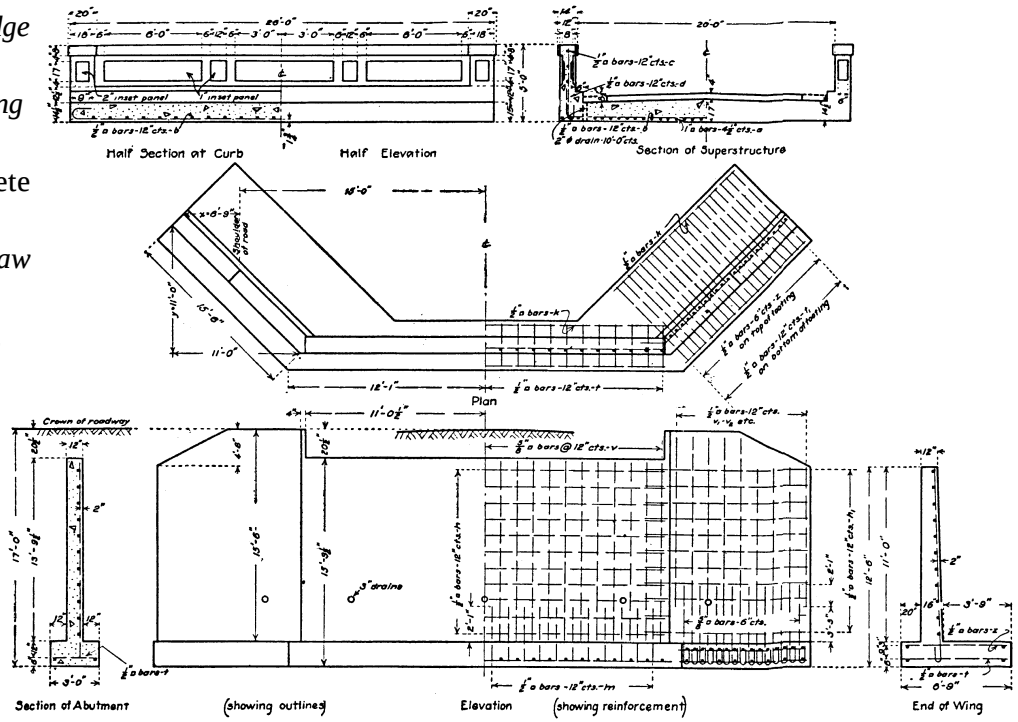
Reinforced concrete slab bridges began appearing in numbers on Delaware's roads in the first decade of the 20th century. Typical New Castle County examples were the slab bridge with lattice railings (top) near Green Springs, and this one with stone parapets on Brick Church Road (bottom).

Reinforced Concrete Slab Bridge



SECTION VIEWS

Standard slab bridge designs were featured in engineering textbooks, such as Reinforced Concrete and Masonry Structures *(McGraw Hill, 1924). Based on standard plans, slab bridges appeared everywhere across the nation at about the same time.*



bridge type was for the crossing of small creeks and seasonal streams.

From 1920 through the 1950s, there were few noteworthy changes in the slab bridge technology in Delaware. Some variations included the application of continuous designs achieving longer spans with an economy of material. An example of a continuous slab bridge is the 1941-42 High Street over Conrail bridge (State Bridge S-258) in Seaford. The slab is haunched achieving its greatest depth over the piers where the stresses are greatest. Other important examples of continuous slab design are the mushroom column-supported approach spans of the 1938 US Route 13 Business (State Bridge NC-686) and 1942 South Heald Street (State Bridge NC-684) over Conrail bridges.

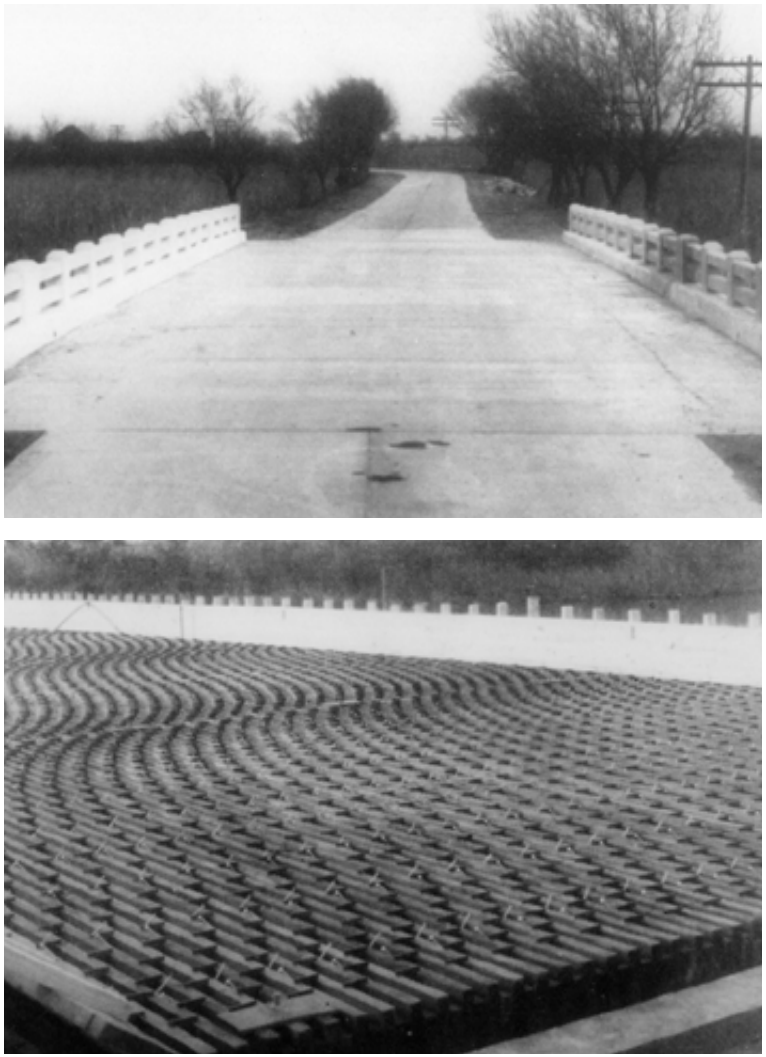
From 1936 to 1938, the Delaware State Highway Department experimented with composite concrete and wood slab bridges,

Reinforced Concrete Bridges

State Bridge K-9A, a composite timber and slab structure, on SR 6 over Love Creek was replaced in 1995. It was one of three similar bridges built by the state highway department in 1936-38 based on suggestions of the Wood Preservers' Association.

building three examples in the southern part of the state. The composite slab spans consist of nail-laminated 2" x 8" wood subdeck keyed with a 4" to 6" deep concrete slab. The bridges were built as experimental designs to test the economy and serviceability of the composite construction as suggested by a researcher with the American Wood Preservers' Association. At the time, the department considered the bridges "a new and very economical design," but no further examples were built in the state in the 1940s or 1950s. A small number of similar bridges are known to have been constructed in other parts of the country, and the design also was used with wharves and airplane hangar aprons, especially during World War II when the use of steel was restricted. Two composite slab bridges survive in Delaware (State Bridges S-446, and S-707), while the third (State Bridge K-9A) was replaced in 1995 due to a deteriorated wood substructure and subdeck.

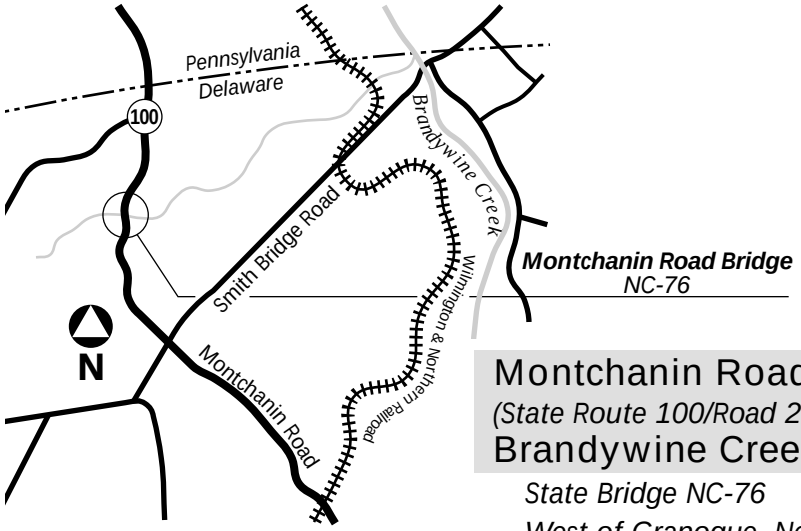
The Delaware Historic Bridge Survey features eleven slab bridges chosen for their historical or technological significance from the population of slab bridges. The bridges date from ca. 1915 to 1953 and represent, for the most part, the standard designs employed by state and county engineers over the period. Emphasis



These 1936 construction photos show the nail-laminated wood subdeck of State Bridge K-9A before (bottom) and after (top) placing the concrete.

State Bridge NC-76 represents a typical New Castle County slab bridge with stone parapets.

State Bridge NC-76 as it appeared in 1921.



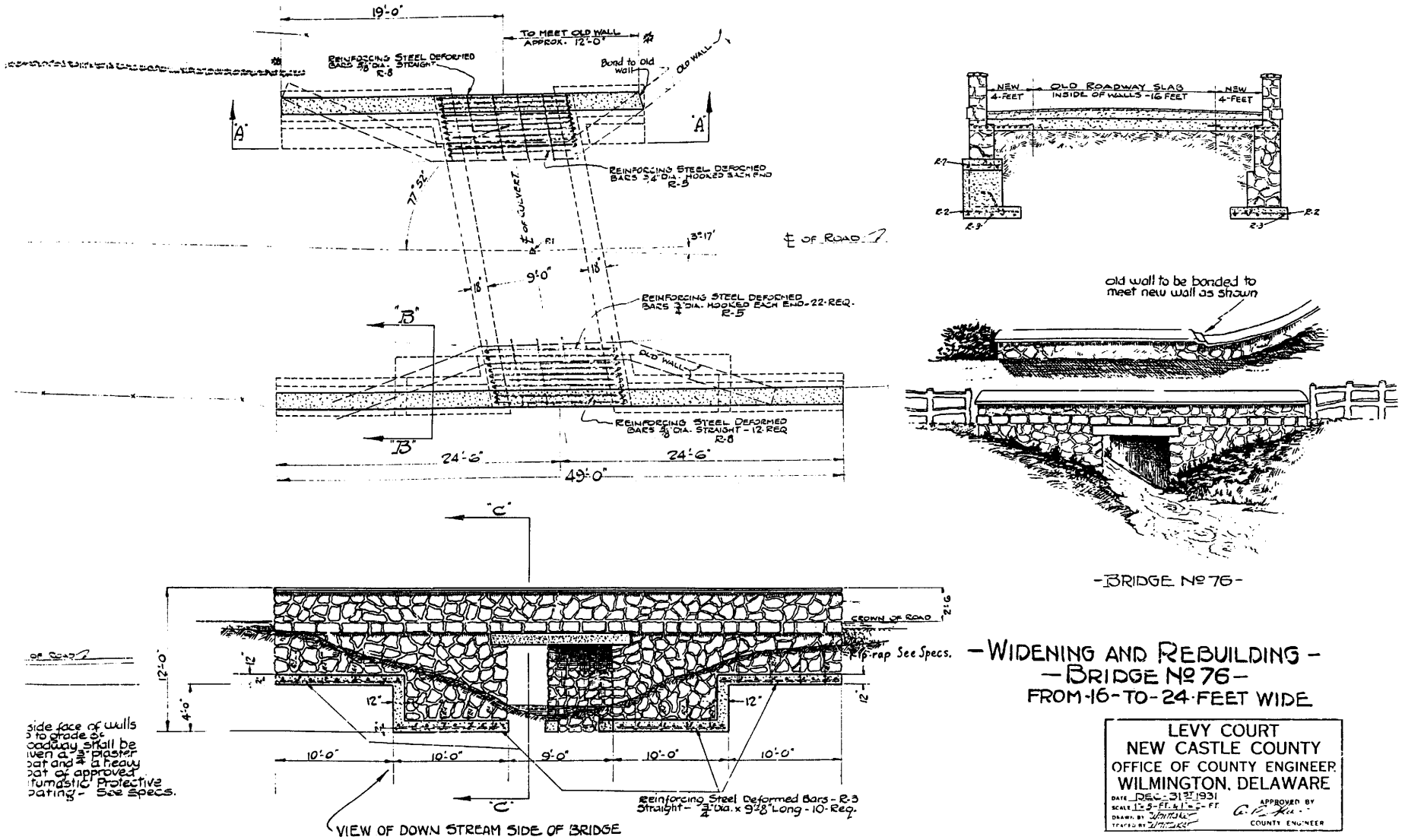
Montchanin Road
(State Route 100/Road 232) over
Brandywine Creek Tributary

State Bridge NC-76
West of Granogue, New Castle County
Designer/Builder: Unknown

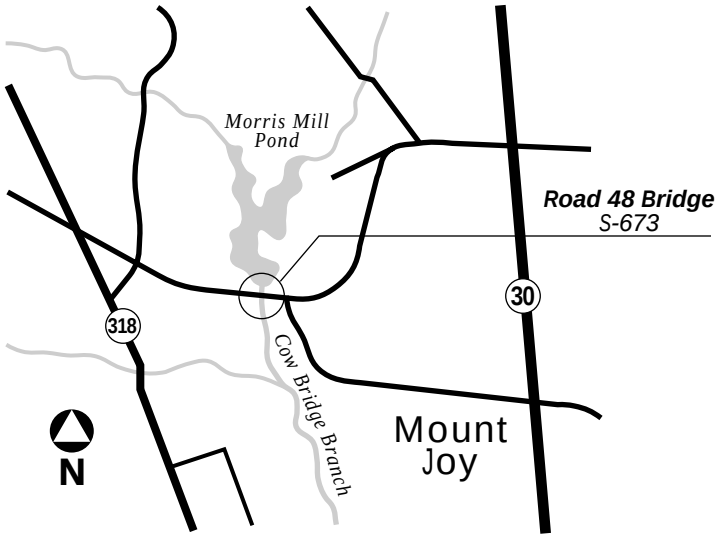
ca. 1915

has been placed on the most complete examples or those that offer later mid-20th-century improvements in economy of design and material, such as the application of continuous span designs. As with other concrete or steel girder bridges, some variety is found in the application of railings and aesthetic treatments, such as stone veneers or arched fascia. While a number of the historic slab bridges have custom-design railings, the vast majority of surviving slab bridges have railings handled in a formulaic manner. Paneled concrete parapets and plain concrete balustrades are very common in Delaware.

The Montchanin Road bridge is a one-span, 12'-long, reinforced concrete slab bridge. According to plans, the bridge was built approximately 16'-wide ca. 1915. It was widened in kind to its present 24' width by additions to both sides in 1932. The widening project included removal of the original railing treatment and replacement with rubble-masonry parapets. The original stone abutments were extended in kind. The original engineer and builder are unknown, but the 1932 widening project was designed by the New Castle County



Excerpts from 1931 drawings for widening State Bridge NC-76.



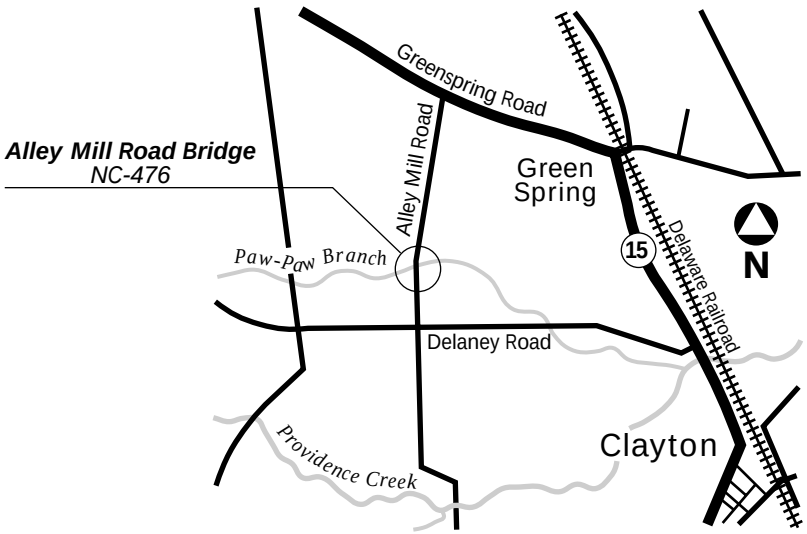
State Bridge S-673 represents a standard reinforced concrete slab bridge of the Delaware State Highway Department from 1932.

Road No. 48 over Cow Bridge Branch *(Morris Hill)*

State Bridge S-673
North of Millsboro, Sussex County
Designer/Builder: Delaware State Highway Department/Old Line Construction Company

1932

The State Road No. 48 bridge is a one-span, 26'-long, 27'-wide, reinforced concrete slab bridge supported on concrete abutments with flared wingwalls. The bridge is finished by concrete parapets with incised panels. The bridge was built in 1932 as part of a Delaware State Highway Engineer and undertaken by general contractors Hefflin and Kelly of Philadelphia. The Montchanin Road bridge is a complete example of a once-common type of New Castle County slab highway bridge finished with stone parapets, wingwalls, and substructure. A number of small concrete slab and steel girder spans in the county were faced with stone during the 1920s and 1930s in an effort by the county engineer to relate the bridges to their rural surroundings. The bridges made use of the native granite that had been used for centuries to build houses, walls, arch bridges, and other structures in northern New Castle County. The practice of stone facing was continued by State Bridge Engineer Arthur G. Livingston after 1935 when the state highway department took over bridge building and maintenance responsibilities from the counties. He believed that bridges "should conform as closely as possible to the surrounding country." The practice of stone facing reinforced concrete bridges continues to this day in northern New Castle County.



State Bridge NC-476 (1933) features two very common period aesthetic treatments; a slightly arched profile and custom concrete balustrades.

Department federal-aid project to improve the road between Stockley and Zoar Camp. Improvements included grading, a gravel surface, six 15" pipe culverts, and two bridges. The contract was awarded to the Old Line Construction Company of Chestertown, Maryland. The bridge is significant as a complete example of the standardized design by the department's bridge division that was used from the 1920s to the 1950s. The bridge was chosen from the large population of bridges of similar age and design based on its completeness.

Alley Mill Road *(Road 483)* over Paw-Paw Branch

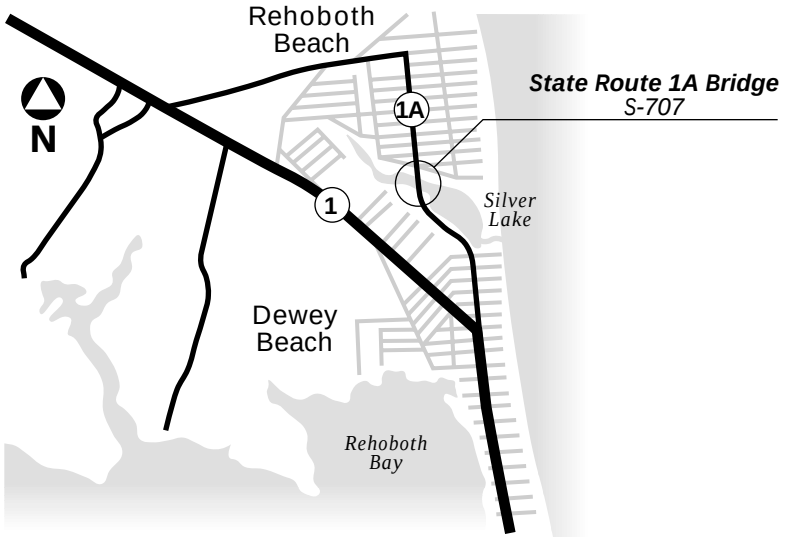
State Bridge NC-476
Northwest of Clayton, New Castle County
Designer/Builder: Unknown

1933

The Alley Mill Road bridge is a one-span, 22'-long, 22'-wide, reinforced concrete slab bridge supported on concrete abutments. The bridge has arched fascia and custom concrete balustrades. The U-shaped wingwalls are surmounted by plain concrete parapets. An inscription on the parapet dates the bridge to 1933, but plans are not located in DelDOT records. It is believed the bridge was built under the auspices of the New Castle County Levy Court. The bridge is a complete example of a bridge type that has been common in the state since the early 1910s. The bridge's designer employed two very common period aesthetic treatments: arched fascia and custom concrete balustrades.

State Bridge S-707 (1938) is a 13-span, 260'-long, composite wood and concrete slab bridge based on a design proposed by J. F. Seiler of the American Wood Preservers' Association. This photo was taken after DelDOT rehabilitated the bridge in 1995.

Silver Lake Bridge, as it appeared in the state highway department's 1938 Annual Report.

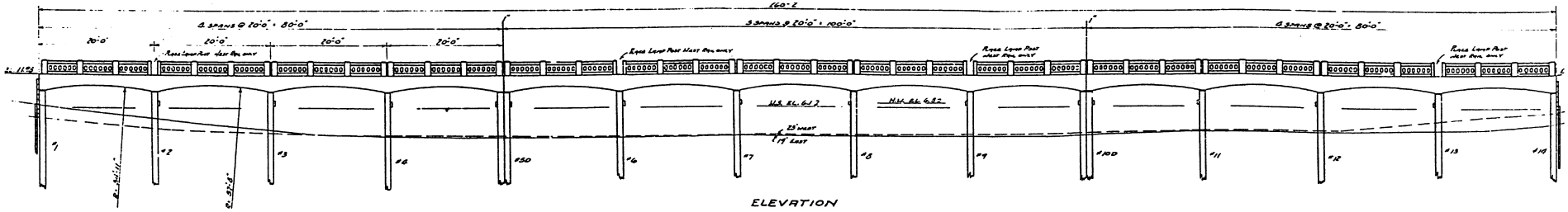


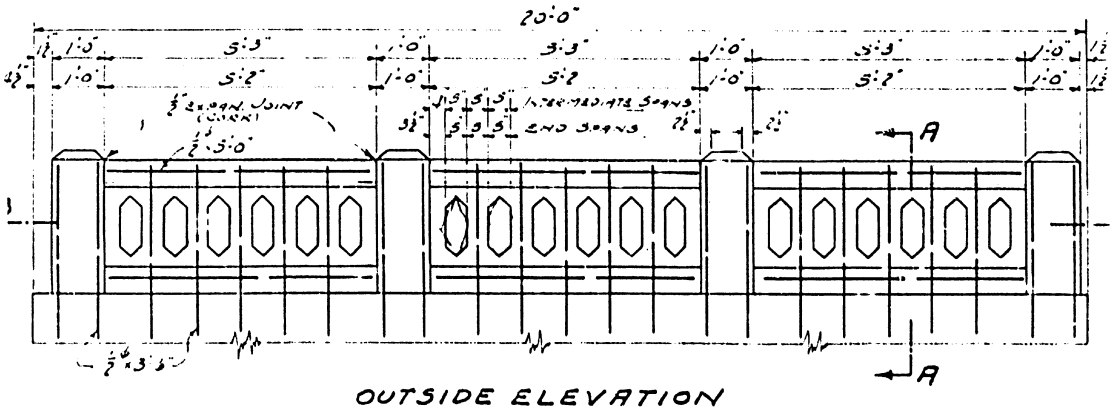
State Route 1A *(Road 50/SilverLake Bridge)* over Silver Lake

State Bridge S-707
Rehoboth, Sussex County
Designer/Builder: Delaware State Highway Department/E. F. Hammond

1938

The State Route 1A bridge (Silver Lake Bridge) is a 13-span, 260'-long, composite wood and concrete slab bridge. The slab consists of nail laminated 2" x 8" wood subdeck keyed with a 4" to 6" deep concrete slab. The bridge is handsomely detailed with arched concrete fascia beams and concrete balustrades with diamond pattern openings. It is supported on timber pile bent piers and





Elevation and details of balustrades from original 1937 drawings for State Bridge S-707.

abutments with timber bulkhead backwalls and wingwalls. In 1995, DelDOT rehabilitated the structure, sensitively replacing in-kind the concrete deck and wood subdeck adjacent to the abutments and expansion joints. The timber bulkhead at the abutments was replaced, as were selected split piles and caps of the timber bent piers. Luminares, which previously had been lost, were replaced with new luminaires matched as closely as possible to the original ones.

The Silver Lake Bridge is one of three bridges built between 1936 and 1938 by the Delaware State Highway Department as a test of the composite wood and concrete slab bridge type. The first bridge, completed in 1936, was State Bridge K-9A, which was replaced in 1995. The two extant examples, the Silver Lake Bridge and the Road 54 bridge (State Bridge S-445), were both completed in 1938.

Interest in concrete-timber composite structures began in the northwest United States in the early 1920s as an effort to combine the long-wearing quality of concrete with the low-cost of a timber. Early experiments by the City of Seattle and the University of Washington resulted in the construction of what is believed to have been the country's first composite structure, a type of T beam with timber stem and concrete slab deck, in 1924. The slab design upon which Delaware's three composite bridges were based was proposed by J. F. Seiler in the November 1933 issue of *Wood Preserving News*. Seiler was an engineer with the Service Bureau of the American Wood Preservers' Association and utilized the engineering laboratory of George Washington

University at Washington, D.C., to conduct his experiments. Seiler's objective was to combine wood and concrete into a low-cost, long-life structure that would fall in cost between that of an all-timber and reinforced-concrete structure, and that could be built with a minimum of skilled labor and special equipment.

Seiler's design used laminated timbers of alternating depths that would act as keys and increase the bonding surface area with the concrete. Each timber was laminated to the next with nails, creating a continuous solid deck of any desired width. The solid deck did not require additional formwork and was of sufficient strength on its own to carry the workers and equipment during the concrete pouring operation. The first bridge to be built according to the Seiler design was the Tampa-Clearwater Causeway across Old Tampa Bay, Florida, completed in 1934. The 3,500'-long structure consisted of 167 composite slab spans, each 20' in length, and a 110' bascule span. Over the next years, the composite slab type came into more general use for highway bridges, hangar aprons, wharves, piers, buildings, and platforms, and by 1943 similar composite wood-concrete structures were found in 12 states and Canada. The Oregon State Highway Department reported building more than 180 composite bridges, and the bridge type found use during World War II because of steel shortages. The bridge type continues in use; DelDOT built a composite wood-concrete slab bridge in Sussex County in 1984 (State Bridge S-235), the first known example the department had built since the late 1930s.

The construction of the Silver Lake Bridge in 1938 was part of a federal-aid project for the improvement of the road between Rehoboth and Bethany Beach. The bridge replaced a timber multi girder bridge, dating from 1928. According to DelDOT records, the bridge plans were prepared by the Delaware State Highway Department's Bridge Division under the direction of Arthur G. Livingston. Notes confirm that the design was based on Seiler's specifications. The contractor was E. F. Hammond of Delmar. The project was plagued by slow delivery of materials, and encountered a brief setback when a heavy windstorm blew the contractor's pile driver into the lake. The bridge and road project were a response to increased traffic to Delaware's beach resorts. The report noted "there are real possibilities of growth in population along the project, particularly as to summer residents. The growth in population will depend largely on the increase in popularity that beach life holds for the general public." The bridge's architectural treatment of arched fascia, balustrade, and luminaires were more elaborate than the other two 1936-38 composite slab bridges in rural locations, and the details were a direct response to the beach resort's residential setting.

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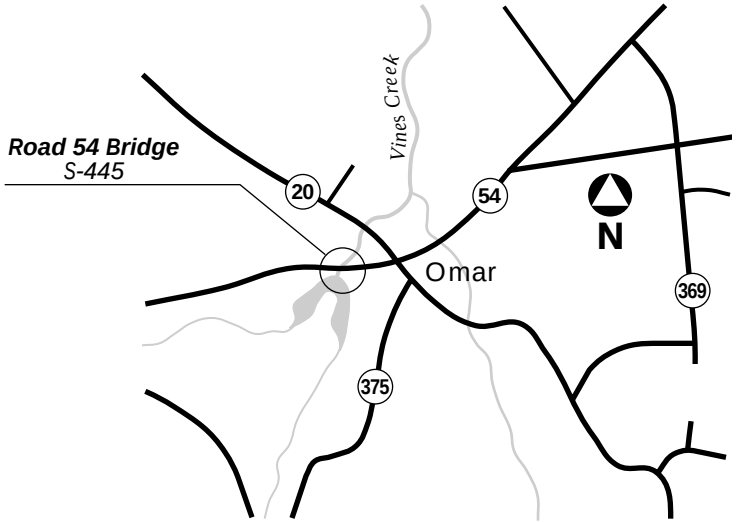


State Bridge S-445 (1938), one of two surviving composite timber and concrete slab bridges in Sussex County.

Road 54 *(Omar Bridge)* over Vines Creek

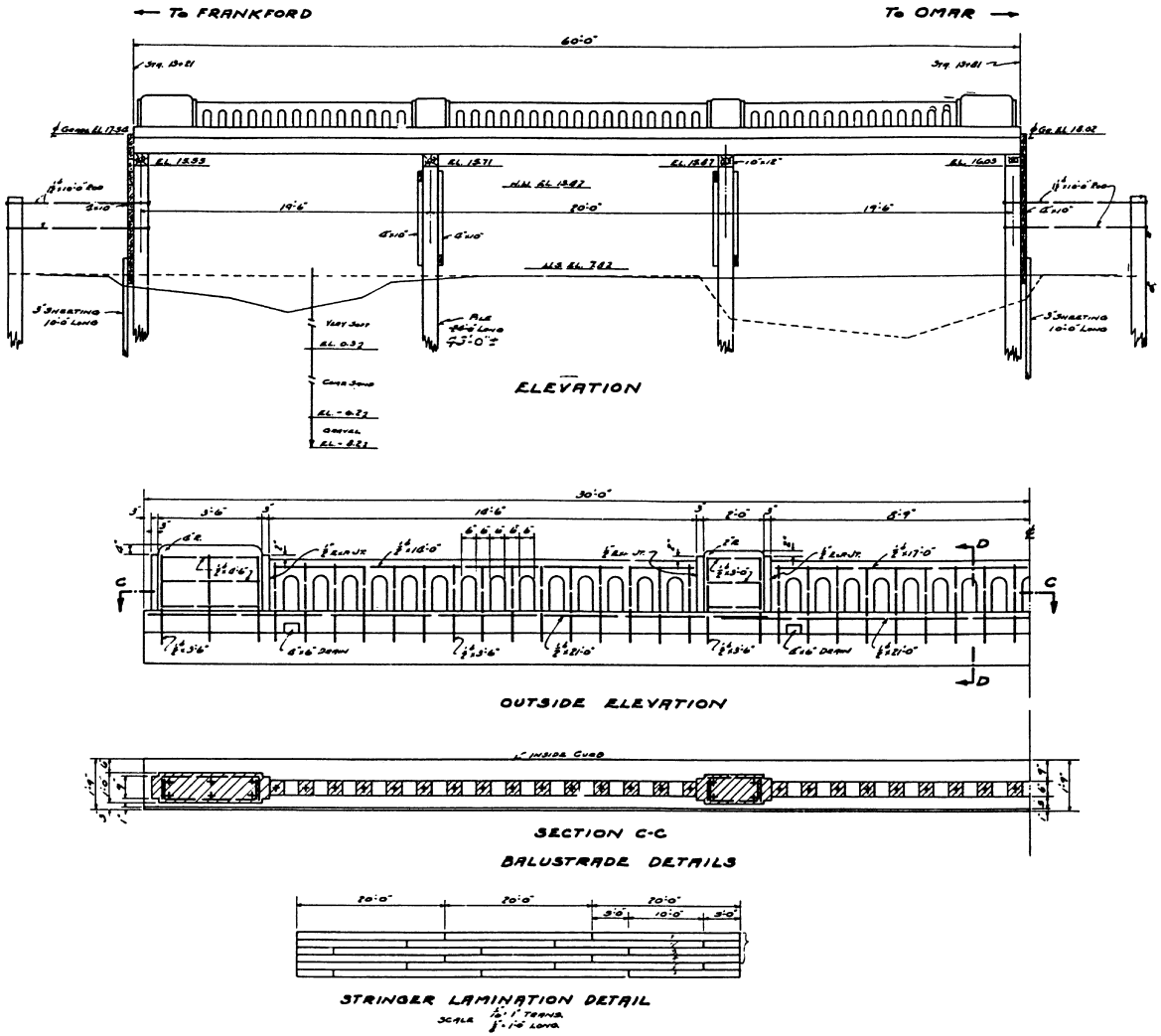
State Bridge S-445
Southeast of Dagsboro, Sussex County
Designer/Builder: Delaware State Highway Department/Old Line Construction Company

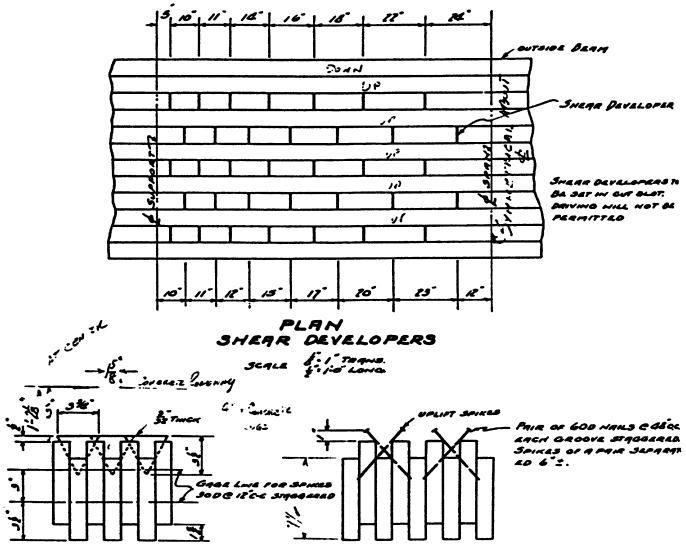
1938

The Road 54 bridge (Omar Bridge) is a three-span, 60'-long, 29.5'-wide, composite wood and concrete slab bridge supported on timber pile bents with crossbracing and bulkhead backwalls. The bridge is finished with concrete balustrades with stepped posts. The slab consists of nail-laminated 2" x 8" wood subdeck keyed with a 4" to 6" depth concrete slab.

Omar Bridge is historically and technologically significant as one of two extant composite wood and slab bridges in Delaware, the other is Silver Lake Bridge (State Bridge S-707). The bridge was designed in 1937-38 by the Delaware State Highway Department Bridge Division under the guidance of State Bridge Engineer Arthur G. Livingston, as one of three bridges testing the economy and serviceability of the new composite construction. The composite design was suggested by the experiments of J. F. Seiler, an engineer with the American Wood Preservers' Association. Seiler's published his idea for the design in the November 1933 issue of Wood Preservation magazine, and the first example of the design was in 1934 for the approach spans of a bascule bridge over Old Tampa Bay in Tampa, Florida (for more information of Seiler see State Bridge S-707). The wood and concrete composite technology illustrates the adaptation of materials to create economic bridge designs during the 20th century.

The Omar Bridge was built as part of a federal-aid project, replacing a previous bridge at this site. The Delaware State Highway Department awarded the contract to the Old





Elevation and details from original 1937 drawings for State Bridge S-445. Note the details for the wood subdeck with "shear developers" and "uplift spikes" designed to create a composite action between the wood and concrete (top right).

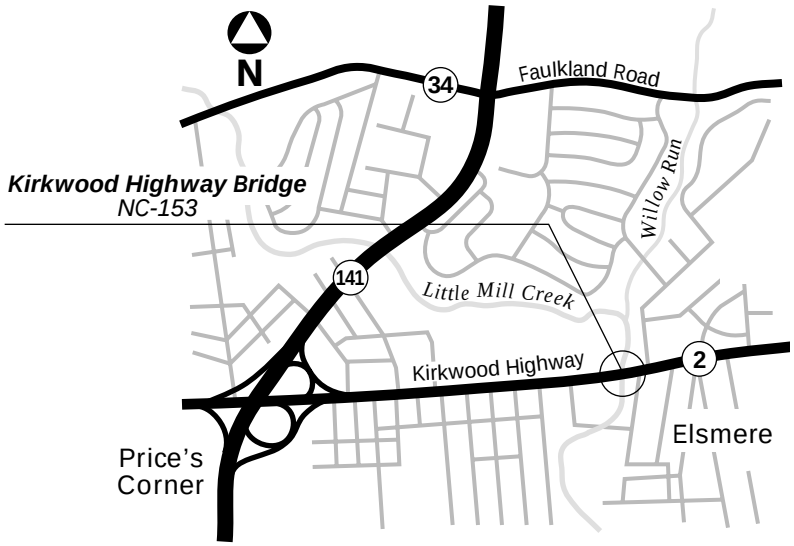
Line Construction Company of Chestertown, Maryland, which completed the bridge from March to September, 1938.

Kirkwood Highway *(State Route 2)* over Little Mill Creek

State Bridge NC-153
Elsmere, New Castle County
Designer/Builder: Delaware State Highway Department/J. A. Bader & Company

1938-39

The two-span, 37'-long, 95'-wide, reinforced concrete slab bridge carries the Kirkwood Highway, a four-lane highway



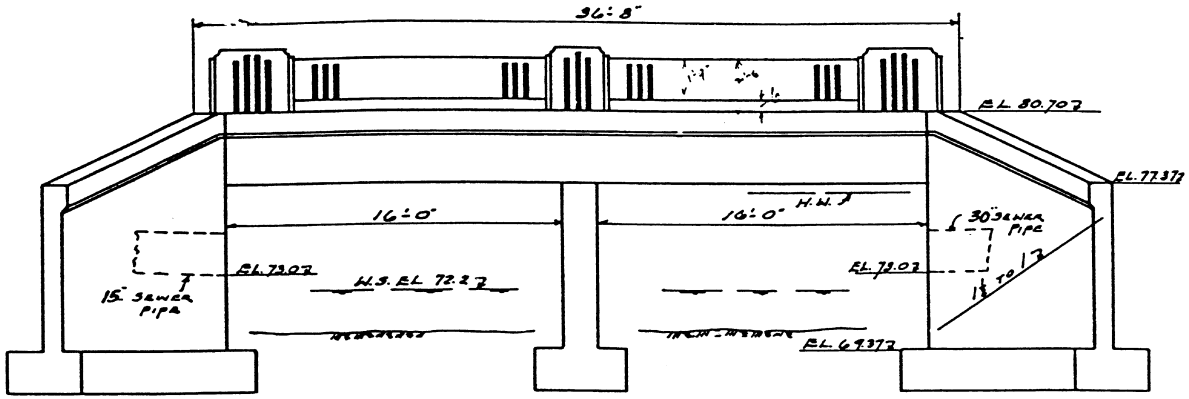
State Bridge NC-153 is a reinforced concrete slab bridge built as part of the Kirkwood Highway project in 1938-39.

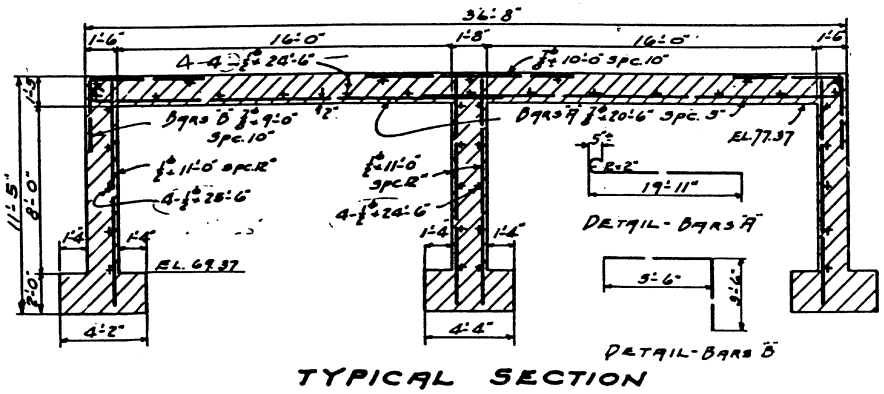
with grass median and two sidewalks, over Little Mill Creek in Elsmere. The bridge is finished with vertically scored concrete parapets and is supported on concrete pier and abutments with wingwalls.

The bridge is distinguished as a complete and unaltered example of the standard-design slab bridges built by the state highway department from the 1920s to the 1950s. The bridge was chosen from among the large population of similar bridges because of its multiple span and historic association with early efforts to dualize State Route 2 (Capital Trail), later renamed the Kirkwood Highway.

The bridge was part of federal-aid project for a dualized highway from Elsmere to Price's Corner in 1938-39. The project was the first section in a broader program of improvements to reconstruct 12.5 miles of State Route 2 from Wilmington to Newark. This program, which at the time was estimated to cost more than one-half million dollars, resulted in the relocation of the existing road, straightening alignments and bypassing congested sections. It was not completed until the early 1950s.

The contract for the Elsmere to Price's Corner section was awarded to the Allesandro Petrillo Company of Wilmington in July, 1938. The bridge work was subcontracted to J. A. Bader & Company, also of Wilmington. The Little Mill Creek bridge replaced a previous two-lane bridge. The south half of the replacement bridge was built before the previous bridge was removed, thus maintaining traffic flow during construction.





Drawings for State Bridge NC-153 illustrate the standard parapets (Type VIII in Delaware railing standard plans).

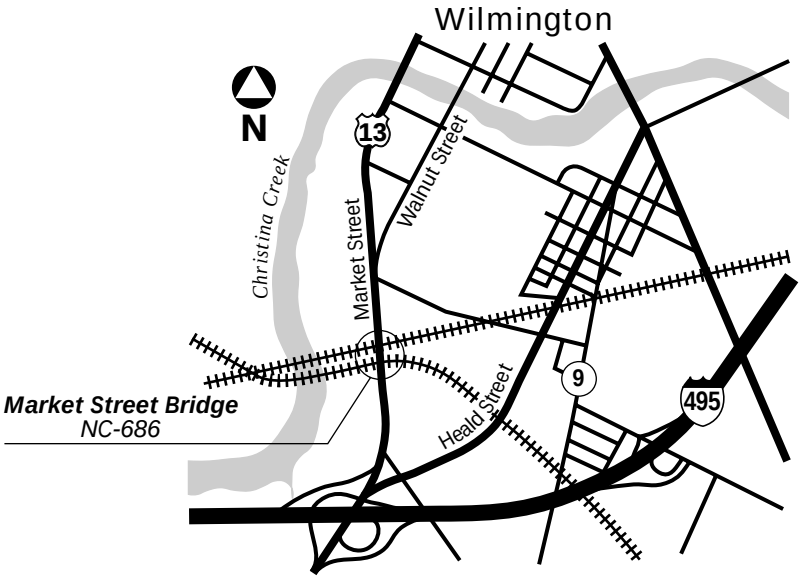
The bridge parapets are described as a standard "No. VIII solid type, concrete balustrade" in bridge plans. The bridge represents standard-design bridges of the period.

Market Street *(US Route 13 Business)* over Conrail and Ramp to US Route 13 Southbound

State Bridge NC-686
South of Wilmington, New Castle County
Designer/Builder: Delaware State Highway Department/J. A. Bader & Company

1938-40

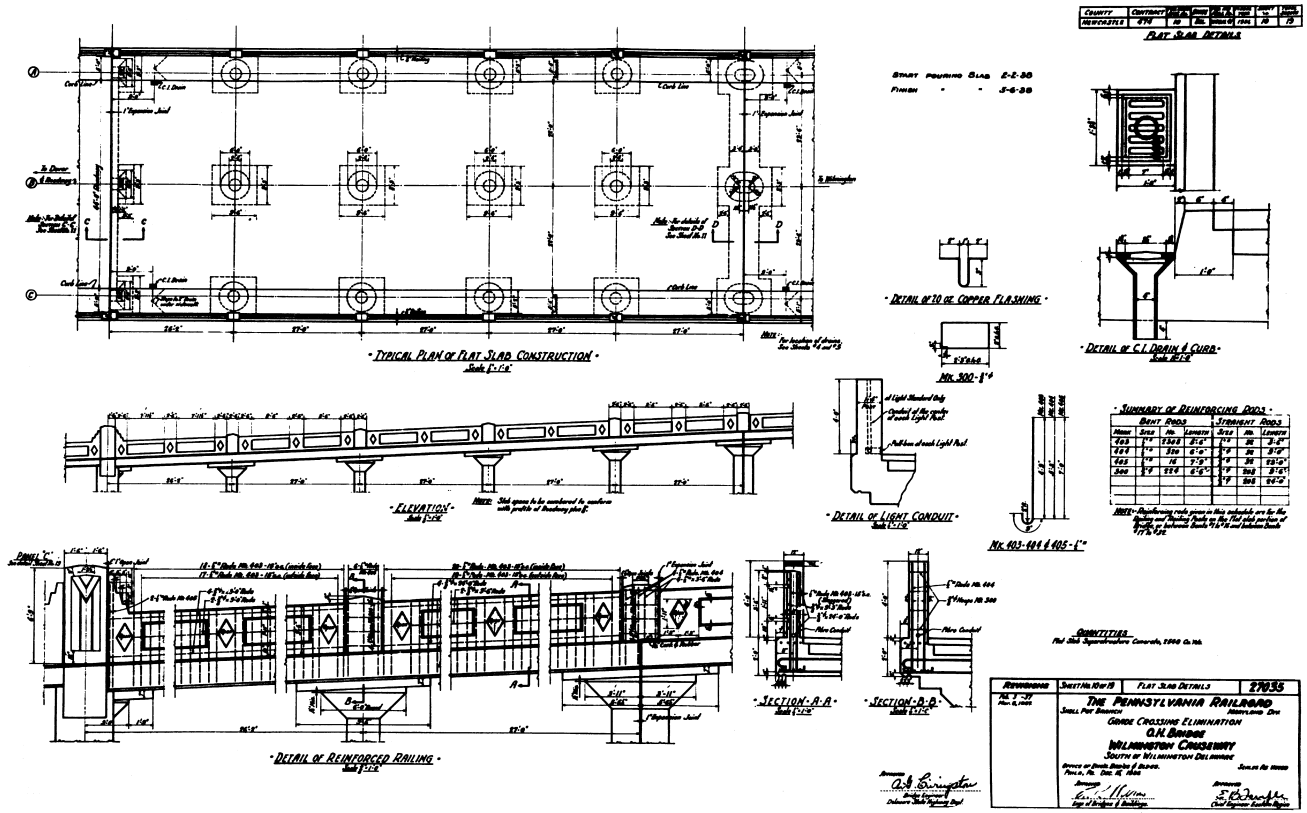
The Market Street overpass, also known as Conrail Bridge Number 0.55 on the Delaware River Extension, is a 31-span, 852'-long bridge that was built in 1938-40 to eliminate a dangerous crossing of secondary freight lines of both what was then the Pennsylvania and Reading railroads. The Reading's line has since been abandoned and removed, but the Pennsylvania's



The replacement parapets (1994) were done in a sensitive manner to preserve the Market Street overpass bridge's historic character.

line continues in use, serving local industry and business. The bridge consists of 30, reinforced concrete slab approach spans supported on mushroom columns. The original 39'-long steel multi girder main span over the railroad tracks was replaced with a prestressed concrete box beam span in 1994. The original Moderne-style parapets, which had deteriorated, were removed from the length of the bridge and replaced by new parapets of a lightweight concrete. The replacement parapets were finished with architectural details identical to the original, including diamond-shape tile mosaics. The alterations were done in a sensitive

State Bridge NC-686 (Market Street overpass), built in 1938-40 as a crossing of the Pennsylvania RR's Shellpot Branch.



Original plans for the architectural details of the Market Street overpass were used as a guide for replacement parapets in 1994. The original parapets, which had deteriorated, were removed from the bridge and replaced with a lightweight concrete.

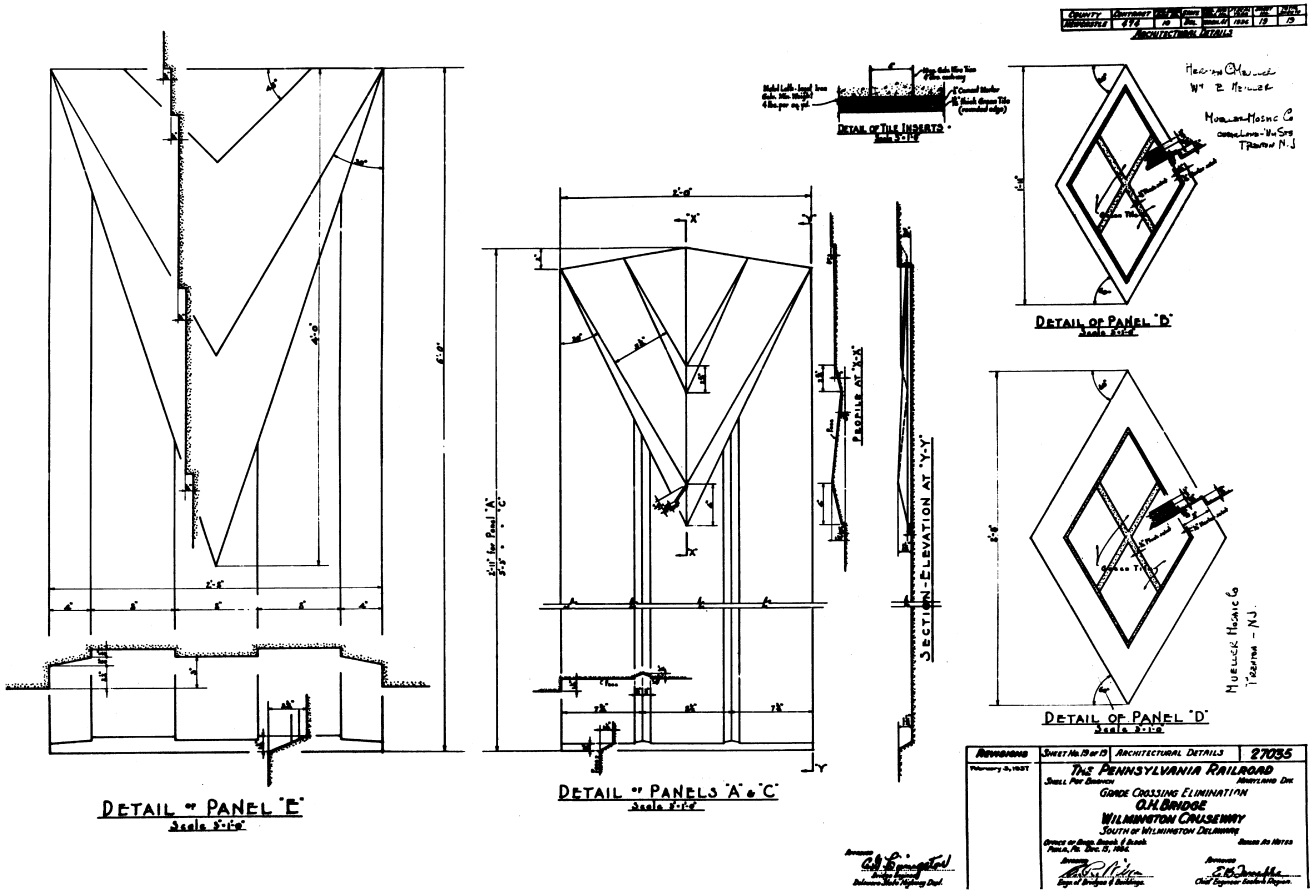
manner to preserve the historic character of the bridge. The technologically distinguished mushroom-column slab approach spans are unaltered except for the parapet replacement.

The Market Street overpass is noteworthy as one of two bridges in the state that have continuous slab spans supported by mushroom columns. The other is the nearby 1941-42 South Heald Street overpass (State Bridge NC-684). The mushroom column design was developed by engineer Claude A. P. Turner, who first used it for the Johnson-Bovey Building in Minneapolis in 1905-06. He received a patent in 1908. The mushroom column with its flared capital provided a conical spreading out of the cross-sectional area to reduce the concentration of shearing stress around where the slab meets the column. The economies of the mushroom-column slab construction were most obvious in the case of warehouses and factories where the design could be used to increase overhead space and reduce the number of interior columns and beams in comparison to other available framing techniques. The use of mushroom columns in bridge construction was never common. By the mid-20th century, mushroom column construction was on the wane as progress in the strength and placement of reinforced concrete had made the technique obsolete.

The 1938-40 Market Street overpass and the 1941-42 South Heald Street overpass are late applications of the mushroom column technology. State records do not provide information about why the design was chosen for these two locations, but the columns and continuous slab design probably provided greater clearance for automobile and trucks accessing the industrial areas along the railroad tracks. Both bridges

were built with financial assistance from a federal-aid grade crossing elimination program initiated nationwide in the mid 1930s. The cost of construction was born by the federal government with the state and railroad companies sharing responsibility for right-of-way acquisition. The general contractor for the Market Street overpass was J. A. Bader & Company of Wilmington.

Grade-crossing eliminations were an area of concern for both railroads and highway departments throughout the first half of the 20th century. In Delaware, the Pennsylvania Railroad raised its main line tracks through downtown Wilmington in 1901-07, thus lifting its own traffic out of the dangers and delays caused by autos, wagons, and pedestrians. Eliminating grade hazardous crossings was always a goal of the state highway department from its inception in 1917. State officials sought out the cooperation of the railroads wherever state highways crossed rail lines. Usually, adequate warning signs or realignment of the road was a preferred solution to building bridges, which were more costly, but as automobile traffic grew expanding the chances for railroad-automobile collisions, the state highway department with federal and state aid began more systematic construction of overhead bridges in the late 1920s. The grade-crossing elimination program continued through the 1950s.



Plans from State Bridge NC-686 illustrate the mushroom column design and decorative parapets.

State Bridge NC-504 is part of the dam and spillway to Silver Lake, south of Middletown. The steel gate frame with screw-operated gates is built into the upstream side of the bridge for regulating the lake's water level.

Silver Lake Road *(Road 442)* over Silver Lake Spillway

State Bridge NC-504
South of Middletown, New Castle County
Designer/Builder: Delaware State Highway Department/E. F. Hammond

1939

The Silver Lake Road bridge is a two-span, 26'-long, 20'-wide, reinforced concrete slab bridge supported on concrete abutments and pier. It is finished with paneled concrete parapets. A steel gate frame with screw-operated sluice gates is built into the upstream side of the bridge for regulating the water level of Silver Lake.

The Delaware State Highway Department's Bridge Division, under the direction of State Bridge Engineer Arthur G. Livingston, designed the Silver Lake Road bridge in 1939. It is the northernmost of two adjacent bridges over the Silver Lake spillway. The first bridge (State Bridge NC-407), an encased steel multi girder bridge with wood spillway gates, was built in 1934 by the New Castle County Levy Court. Twice it failed to prove adequate to the volume of discharges from the lake during floods, once in 1934 and again in 1938, which caused washouts of the earth dam. Bridge NC-504 offered greater capacity for flood control and was built as a state project after the state highway department had taken over maintenance of the crossing from the county in about 1935. Contractor for the bridge was E. F. Hammond of Delmar.

Silver Lake was a mill pond, and the roadway is carried by the earth dam that once impounded the water to power the mill. The combination of roadways with dams is not uncommon and has been practiced since at least the 19th century. In the early 20th century, the state took over many dams after rural mills closed, maintaining the dams and spillways for their roadways and bridges, as well as for their use in controlling water for irrigation and preventing floods. A number of examples of combination bridges and dam spillways are found throughout the state. The Silver Lake miller's house and mill still exist at the dam's northeast corner. The mill is no longer functional and has been converted to a residence. The lake has most recently been used by a private swimming club.

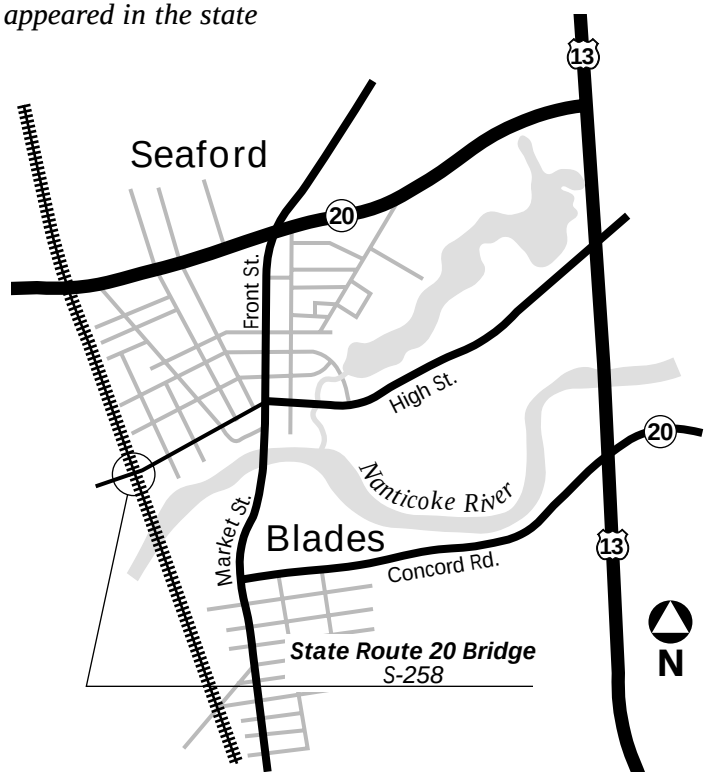
State Bridge S-258 (1941-42) in Seaford as it appeared in the state highway department's 1942 Annual Report.

High Street *(Road 536)* over Conrail (Delaware Railroad)

State Bridge S-258
Seaford, Sussex County
Designer/Builder: Delaware State Highway Department/J. A. Bader & Company

1941-42

The 1941-42 High Street bridge is an early and complete example of a continuous, variable-depth, reinforced concrete slab bridge. The three-span, 100'-long, continuous design achieved economy of material and provides an aesthetic design with its slightly arched fascia. The slab has the



Moderne-style decorative railings and concrete posts with light sconces, State Bridge S-258. Federal Bureau of Public Roads engineers who reviewed the projects called the railings "the best" of any major structure built in Delaware.

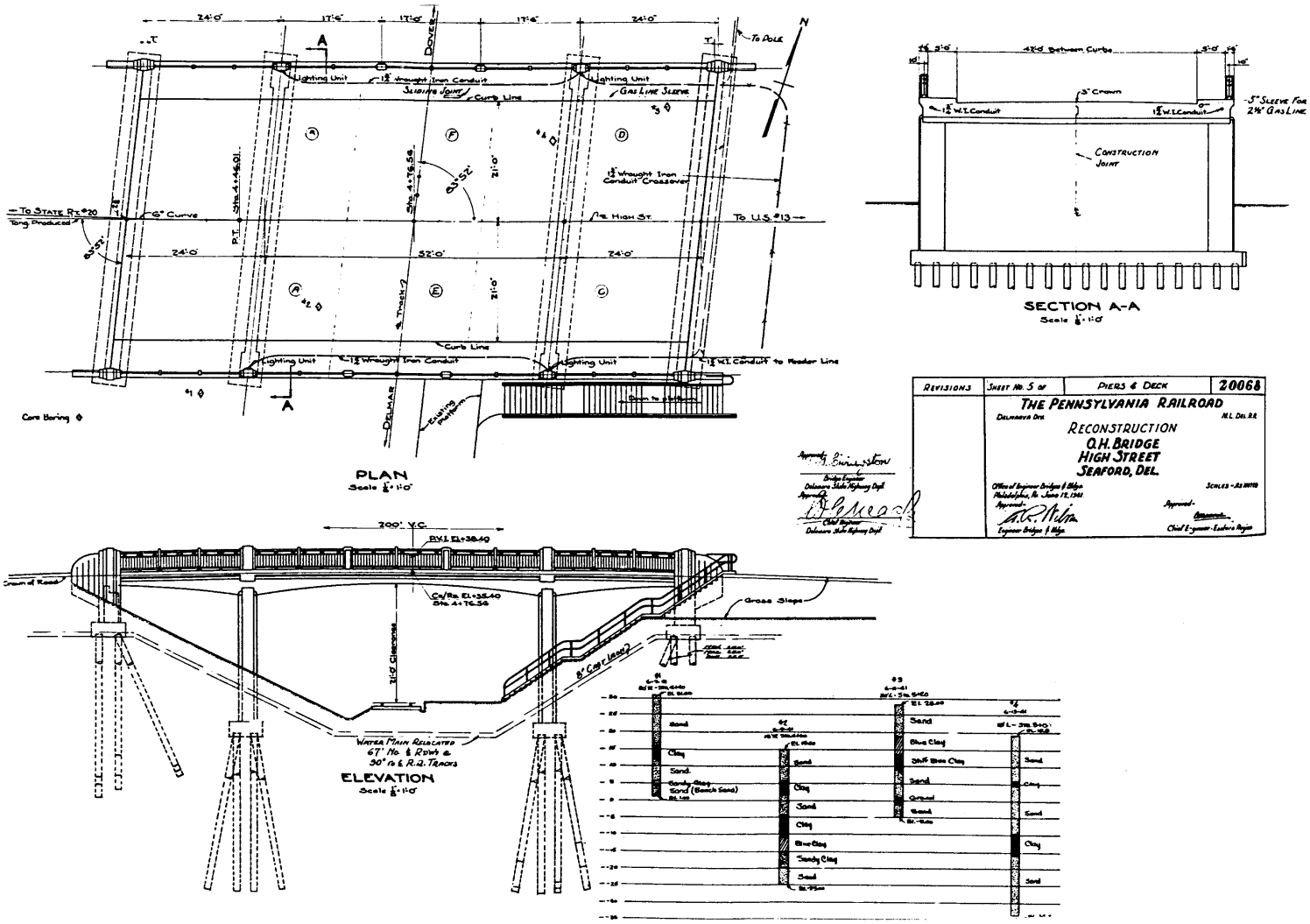
greatest depth over the piers where the negative moments are greatest. Continuous designs (spans designed to extend without joints over one or more intermediate supports) were increasingly popular for a variety of bridge types in the 1930s and 1940s because they offered economy of material over simply supported spans of comparable length. The bridge is finished with metal railings with diamond cutouts set between Moderne-style concrete posts with light sconces. The bridge is supported on concrete piers and abutments. Stairs with a metal pipe railing are located at the southeast corner of the bridge, leading to track level and providing access to the Seaford station located one block to the south.

The High Street bridge was built to replace a timber grade-crossing elimination bridge of the Delaware Railroad. The railroad, which opened its original line to Seaford in 1856 and continued south to Maryland in 1859, was operated as a division of the Pennsylvania Railroad beginning in 1901. It is believed that a bridge at this location crossed the railroad's cut from an early date.

The present bridge was built using funds from the federal grade-crossing elimination program, established in 1935 by the federal government to provide special funding for building new or replacing old highway-over-rail bridges. The program paid for more than 2,000 bridges throughout the nation from about 1935 to 1942. Grade-crossing eliminations were a prominent part of state highway improvement projects throughout the first half of the 20th century, usually with some funding or assistance provided by joint agreement of the railroads,

federal, and state governments. The federal program of the late 1930s and early 1940s was merely a financial supplement to an already ongoing effort to construct overpasses.

The High Street bridge was among several architectonic overpass bridges designed by State Bridge Engineer Arthur G. Livingston during his tenure from 1918 to 1948. The diamond motif (for the Diamond State) of the custom-design railings was one of Livingston's most popular motifs. The railings so impressed the federal Bureau of Public Roads inspecting engineer that he declared "the lines on the bridge curb and posts are the best of any major structure built in Delaware this past season."



Plan, elevation and section from original 1941 drawings, illustrate the continuous, variable depth design. State Bridge, S-258.