Delaware Department of Transportation
CADD Standards Manual

Delaware Department of Transportation
P.O. Box 778
Dover, Delaware 19903

TABLE OF CONTENTS

INTRODUCTION 4

ABOUT THIS MANUAL 4
DISTRIBUTION 4
REVISIONS AND UPDATES 5
TRADEMARKS 5

CHAPTER 1 - DELDOT CADD NETWORK 6

DELDOT SERVERS 6
TYPICAL DRIVE MAPPINGS 7
MICROSTATION V8 RESOURCES 8

CHAPTER 2 - DIRECTORY AND FILE NAMING 9

DIRECTORY NAMING 9
GENERAL FILE NAMING 10
DESIGN FILE NAMING 10
DESIGN FILE CATEGORIES 11
PLOT REQUEST FILE (PRF) NAMING 12
PLOT REQUEST FILE (PRF) CATEGORIES & REQUIRED PEN TABLE ATTACHMENTS 12
ELECTRONIC PLOT FILE (CAL) NAMING 14
ELECTRONIC PLOT FILE (CAL) CATEGORIES 14

CHAPTER 3 - DESIGN STANDARDS 15

SEED FILES 15
WORKING UNITS 15
GLOBAL ORIGIN 16
COORDINATE READOUT 17
DRAWING SCALE 17
COLORS 18
FONTS 19
TEXT 19
TEXT SIZE 20
TEXT LINE SPACING 21
TEXT STYLES 21
ELEMENT SYMBOLOGY & LINEAR PATTERNS 23
LEVEL ASSIGNMENTS 27
CELL LIBRARIES 28
MODELS 29
STRIP DESIGN FILES 29

DRAFT

CHAPTER 4 - REFERENCE FILES 31

SAVING RELATIVE PATH 31
COINCIDENT WORLD 32
TRUE SCALE 32
2D AND 3D DESIGN FILE REFERENCES 32

CHAPTER 5 - PLOTTING 33

PLOTTING SIZES 33
PLOTTING SOFTWARE & HARDWARE 33
LINE WIDTHS 33
PEN TABLES 34
PLOT REQUEST FILE (PRF) ATTRIBUTES 34

INDEX 36

DRAFT

Introduction

About This Manual

Computer Aided Drafting and Design (CADD) is the preferred method of preparing plans for the Delaware Department of Transportation (DelDOT). The requirements presented in this manual ensure that CADD files can be used by the entire project team (surveyors, planners, designers, reviewers and contractors) throughout all phases of project development.

DelDOT has adopted MicroStation and InRoads as its standard drafting and design software packages respectively. The standards referenced in this manual have been developed and tested using the following software versions:

MicroStation XM Edition – Version 08.09.04.51
InRoads XM Edition – Version 08.09.01.45
Microsoft Windows XP Professional – Version 2002 Service Pack 2

This manual supersedes all CADD standards previously published.

This manual is not a text book and does not exempt the professional from performing responsible engineering and/or surveying. It is intended to provide uniform procedures and standards for organizations that perform CADD related services for DelDOT. The professional shall have final responsibility for the accuracy of all input and output of computer based applications.

Distribution

This manual may be freely copied and distributed for the purpose of providing a consistent guide to the CADD requirements of the Delaware Department of Transportation. The manual can be downloaded from the Delaware Department of Transportation Design Resource Center (DRC) website at the following address:

http://www.deldot.gov/information/business/drc/cadd.shtml

CADD support files such as cell libraries, fonts, seed files, etc. can be downloaded from the Delaware Department of Transportation DRC website at the following address:

http://www.deldot.gov/information/business/drc/cadd.shtml

DRAFT

Revisions and Updates

This manual was developed through input from DelDOT staff and the consultant and construction community. The Transportation Solutions Division will develop and maintain procedures and standards for the Department's CADD related activities. CADD Manual holders are encouraged to submit comments and suggestions for improvements to the manual or DelDOT's CADD Standards. Any errors found should be brought to the attention of the DelDOT Transportation Solutions Section via an email to Michael Balbierer at the following address:

michael.balbierer@state.de.us

The Delaware Department of Transportation strives to stay current with state of the art trends in the market. However, impacts on project delivery schedules and resources necessary to provide future support for new features must be considered prior to any change.

Updating this manual is intended to be a continuous process and revisions will be issued periodically. Please check the Delaware Department of Transportation Design Resource Center website to ensure that you have the most up to date version of this manual.

Revisions to this manual after the initial release will be highlighted in yellow.

Trademarks

MicroStation and InRoads are registered trademarks of Bentley Systems, Incorporated. Other trade names, computer protocols and file formats mentioned in this manual are the trademarks of their respective owners. In no event will the appearance of any graphic, description of any graphic, picture, screen display or any other method of conveying meaning be considered to impair the rights of the respective owners.

DRAFT

Chapter 1
DelDOT CADD Network

DelDOT Servers

There are at least eight different servers within the Delaware Department of Transportation that are used for CADD files or resources. The uses of these servers are dictated primarily by the location of the user.

DOTASCADD01
❑ Equorum PlotStation Server – handles all Plot Request File (PRF) plot submission, regardless of output type (CAL, PDF, or hard copy). ❑ IIS Web Server – Falcon SVP and internal CADD support pages.

DOTASCADD02
❑ Archive Storage – Archived CAL files. ❑ Printing Storage – CAL files for print. ❑ InterPLOT Server – all plots submitted through IPLOT must be sent through a printer/plotter attached to this server.

DOTASCADD03
❑ Active design contracts.

DOTSAN01
❑ Main storage location for all CADD resource files.

DOTSAN02
❑ Digital ortho-photography files.

DOTFSND01
❑ CADD resource files, updated hourly from DOTSAN01

DOTFSSD01
❑ CADD resource files, updated hourly from DOTSAN01

DOTFSTMC01
❑ CADD resource files, updated hourly from DOTSAN01

DRAFT

Typical Drive Mappings

Drive Letter	Drive Mapping and Description
G:\	User location dependant: **\\dotsan01\groups** - Dover offices, some TMC users. **\\dotfsnd01\groups** - North and Canal District users. **\\dotfssd01\groups** - South District users. **\\dotfstmc01\groups** - TMC users. **G:\CADD\msv8** - is the official location of all MicroStation V8 resources, department wide. See **MicroStation V8 Resources** section below for an expanded list of resources located in this directory.
K:\	**\\dotascadd02\archive_documents** Location for all archived plans.
M:\	**\\dotascadd02\dms_server** Program directory for Falcon client software.
O:\	**\\dotsan02\apps** **O:\Orthophotography** contains the digital ortho-photography files that can be referenced into MicroStation V8.
R:\	**\\dotsan01\groups\cadd\resources** Old MicroStation resource directory. Will remain intact for MSvJ interoperability.
T:\	**\\dotascadd01\equorum** Temporary digital print storage. Files that are more than seven days old will be automatically purged from this directory. **T:\cal\<your_username>** - Location of CAL files. **T:\PDF*<BW/Color/Greyscale>*** - Location of PDF files depending on plot driver used, BW/Color/Greyscale.
U:\	**\\dotsan01\users\<*your_name*>** Location of user specific files. By design, access to user specific files has been restricted to the specific user and the OIT system administrator.
V:\	**\\dotascadd02\contract\<*contract_number*>** Location of active contract CAL files.
Y:\	**\\dotascadd03\cadd** ***Y:\<County>\<Road_Number>\<Section>\<Contract_Number>*** - Location of active contract files. A more detailed description on contract folder setup is found in **Chapter 2 – Directory Naming**.

DRAFT

MicroStation V8 Resources

MicroStation V8 resources are located in the **G:\CADD\msv8** folder. References of "msvj" or "pre_msv8" within the directory structure pertain to the design file level structure of 1-63. There are no MicroStation vJ resources located in this directory structure. More information on these resources can be found in **Chapter 4 – DelDOT Resources**.

Folder Name	Folder Description/Contents
G	\\dotsan01\groups
CADD	CADD Resources
msv8	MicroStation V8 References
Cells	Cell Libraries (New Level Structure)
pre_msv8	Cell Libraries (1-63 Level Structure)
dgnlib	MicroStation DGNLibraries (Levels, Text Styles, Menus, etc)
Fonts	Font Resource Files (MicroStation Format)
shx	AutoCAD Font Files
ttf	TrueType Font Files
InRoads	General InRoads Files (New Level Structure)
pre_msv8	General InRoads Files (1-63 Level Structure)
mdlapps	MDL Applications
Pen Tables	Plotting Pen Tables
References	General Reference Files (New Level Structure)
pre_msv8	General Reference Files (1-63 Level Structure)
Seed	MicroStation Seed Files
Survey	InRoads Survey Files (New Level Structure)
pre_msv8	InRoads Survey Files (1-63 Level Structure)
VBA	Visual Basic Application Files for MicroStation

DRAFT

Chapter 2
Directory and File Naming

Specific guidelines have been established for the naming of contract directories and files. These guidelines must be followed to ensure that programs relying on this naming structure function correctly. This naming structure also ensures the efficient sharing and transfer of information between DelDOT staff, consultant staff and contractors. This chapter outlines the comprehensive naming convention for graphic and associated files used in the CADD environment which shall be used for all projects.

Directory Naming

The home directories for DelDOT personnel are located on the U-Drive at the following address: \\dotsan01\users\. This directory is used for storing miscellaneous work files that do not pertain to construction projects.

Project specific working directories for all construction projects are located on the Y-Drive at the following address: \\dotascadd03\cadd\. The main project directory is labeled with the construction contract number with subdirectories created under this main directory using the follow naming convention.

Folder Name	Folder Description
Y	Y-Drive
Sussex	County Location
014	Maintenance Road Number
Road	Department Management Section
2001303	Main Project Directory (Contract #)
Correspondence	Project Specific Correspondence
InRoads	InRoads Data Files
Cogo	Cogo Data Files & Reports
Dtm	Digital Terrain Model Files
Photos	Project Specific Photos
Plans	MicroStation Design Files (.DGN)
Plot	Construction Plan Plot Files
RWPlot	Right-of-Way Plot Files
Survey	Files Created by Survey Section
XSPlot	Cross Section Plot Files

DRAFT

General File Naming

Standard file name extensions for information submitted to or exchanged with the Delaware Department of Transportation (DelDOT) shall be as follows:

File Type	Extension
MicroStation Design Files	.dgn
MicroStation Cell Libraries	.cel
MicroStation Resource Files	.rsc
InRoads Preference Files	.xin
InRoads COGO Data Files (Input Files)	.dat
InRoads COGO Report Files (Output Files)	.rpt
InRoads Digital Terrain Model (DTM) Files	.dtm
eQuorum Plot Request Files (PRF)	.prf
Electronic Plot Submission Files	.cal
Adobe Acrobat Files	.pdf
Microsoft Word Documents	.doc
Microsoft Excel Worksheets	.xls

Spaces or special keyboard characters shall not be used in the file name. Special characters are **~`!@#$%^&*):(-+=”\}|{;][’>.<?,/**. For file types not listed above, the default file extension defined by the software shall be used.

Design File Naming

Design file names shall use the following convention:

A	B	
CP	03	.dgn
FS	00	.dgn

A. This portion of the file name is established by using the two letter standard corresponding to the desired design file category listed on the next page.

B. This portion describes the number/type of a design file. Strip files (files that encompass the entire length of a design) should be denoted with a **00**. Sheet files should start with **01** and sequentially increase for each sheet of the same category.

DRAFT

Design File Categories

Category	Description
AB	Bridge Abutment Details
AR	Arch Bridge Details
AL	Alignment Layouts †
AS	Bridge Approach Slab Details
BD	Bridge Bearing Details
BM	Bridge Beam Details
BO	Boring Log
BR	Reinforcing Bar Summary
CO	Bridge Composite Details
CP	Construction Plan Sheet *
	Construction Plans
	Grades & Geometric Plans
	Signing, Signing and Conduit Plans
	Right of Way Plans
	Utility Relocation Plans
	Lighting Plans
	Landscaping Plans
	Environmental Compliance Plans
CS	Construction Sequence/Phasing †
CT	Bridge Camber Table
CU	Culvert Details
DI	Display / Presentation
DK	Bridge Deck Plan
DP	Detour Plan
DT	Miscellaneous Details
EX	Expansion Joint
FD	Finished Bridge Deck Elevations
FR	Bridge Framing Plan
FS	Field Survey/Existing Topography †
FT	Bridge Footing Plan
HV	Horizontal and Vertical Control
HW	Bridge Headwall Details
HY	Hydrology / Drainage Areas †
IS	Index Sheet
LG	Legend Sheet
LI	Lighting Strip File †
LS	Landscaping Details

Category	Description
MD	Model File
PA	Bridge Parapet Details
PC	Proposed Construction File †
PE	Bridge Plan and Elevation
PF	Profiles
PL	Bridge Pile Details
PN	General & Project Notes
PR	Bridge Pier Details
QS	Quantity Summary
RA	Bridge Rail Details
RB	Right-of-Way Metes and Bounds
RD	Retaining Wall Details
RF	Bridge Rigid Frame Details
RH	Bridge Rehabilitation Details
RM	Right-of-Way Mosaic
RT	Right-of-Way Tabulation
RW	Right of Way File †
SB	Project Sheet Border
SF	Shape File (Shading) †
SG	Signalization Plan
SH	Bridge Sheetpile Details
SP	Bridge Slope Protection Details
SR	Structure Removal
ST	Bridge Special Structure Details
SW	Storm Water Management
TD	Bridge Timber Structure Details
TC	Construction Title Sheet
TR	Right-of-Way Title Sheet
TS	Typical Sections
UT	Utilities †
WD	Bridge Wick Drain Layout Sheet
WK	Work File (Miscellaneous Line Work)
WW	Bridge Wingwall Details
XS	Cross Sections
* =	Multiple plan sheets are generated from this design file.
† =	Design file encompasses the entire project area (Strip File).

DRAFT

Plot Request File (PRF) Naming

Plot Request File (PRF) names shall use the following convention:

A	B	
001	TC	.prf
012	CD	.prf

A. This portion of the file name denotes the sheet number of the contract set that the PRF file corresponds to. This number shall be three characters in length.

B. This portion of the file name is established by using the two letter standard corresponding to the desired plot request file category listed below.

Plot Request File (PRF) Categories & Required Pen Table Attachments

Category	Plot Request File (PRF) Description	Pen Table Name
AB	Bridge Abutment Details	
AR	Arch Bridge Details	
AS	Bridge Approach Slab Details	
BD	Bridge Bearing Details	
BM	Bridge Beam Details	
BO	Boring Log	
BR	Reinforcing Bar Summary	
CO	Bridge Composite Details	
CP	Construction Plan Sheet	CP.TBL
CS	Construction Sequence (Phasing)	CS.TBL
CT	Bridge Camber Table	
CU	Culvert Details	
DI	Display / Presentation	DI.TBL
DK	Bridge Deck Plan	
DP	Detour Plan	
DR	Proposed Drainage	
DT	Miscellaneous Details	DT.TBL
EC	Environmental Compliance	EC.TBL
EX	Expansion Joint	
FD	Finished Bridge Deck Elevations	
FR	Bridge Framing Plan	
FT	Bridge Footing Plan	
GG	Grades and Geometrics	GG.TBL
HV	Horizontal and Vertical Control	
HW	Bridge Headwall Details	
IS	Index Sheet	
LG	Legend Sheet	LG.TBL

DRAFT

Category	Plot Request File (PRF) Description	Pen Table Name
LI	Lighting	
LS	Landscaping	
PA	Bridge Parapet Details	
PC	Proposed Construction	CD.TBL
PE	Bridge Plan and Elevation	
PF	Profiles	
PL	Bridge Pile Details	
PN	General & Project Notes	
PR	Bridge Pier Details	
QS	Quantity Summary	
RA	Bridge Rail Details	
RB	Right-of-Way Metes and Bounds	
RD	Retaining Wall Details	
RF	Bridge Rigid Frame Details	
RH	Bridge Rehabilitation Details	
RM	Right-of-Way Mosaic	
RN	Right-of-Way Notes and Legend	GN.TBL
RT	Right-of-Way Tabulation	
RW	Right of Way	RW.TBL
SB	Project Sheet Border	
SE	Super-elevation Diagrams & Charts	
SF	Shape File (Shading)	
SG	Signalization Plan	SG.TBL
SH	Bridge Sheetpile Details	
SP	Bridge Slope Protection Details	
SR	Structure Removal	
SS	Signing and Striping	SS.TBL
ST	Bridge Special Structure Details	
SW	Storm Water Management	
TD	Bridge Timber Structure Details	
TC	Construction Title Sheet	TC.TBL
TR	Right-of-Way Title Sheet	RW.TBL
TS	Typical Sections	DT.TBL
UT	Utilities	UT.TBL
WD	Bridge Wick Drain Layout Sheet	
WW	Bridge Wingwall Details	
XS	Cross Sections	XS.TBL

DRAFT

Electronic Plot File (CAL) Naming

Electronic Plot File (CAL) names shall use the following convention:

A	B	
CD	001	.cal
RW	012	.cal

A. This portion of the file name is established by using the two letter standard corresponding to the desired electronic plot file category listed below.

B. This portion of the file name denotes the sheet number of the contract set that the CAL file corresponds to. This number shall be three characters in length.

Electronic Plot File (CAL) Categories

Category	Description
CD	Construction Plan Set
RW	Right-of-Way Plan Set
XS	Cross Section Set

DRAFT

Chapter 3
Design Standards

This chapter provides details about the Delaware Department of Transportation (DelDOT) standard CADD settings, including standard seed files, design files settings and reference file settings. This chapter also provides guidance on the preparation of Addendums, Plan Revisions and As-Built drawings.

Seed Files

MicroStation uses a seed file to create all design files. A seed file is a template in which standard parameters are set. Seed files do not typically contain elements, but, like other design files they do contain settings like working units and view configurations. Using a standard, customized seed file helps maintain uniformity and keeps the user from having to adjust design file settings each time a file is created.

The following two dimensional (2D) and three dimensional (3D) seed files are available on the Delaware Department of Transportation's Design Resource Center (DRC) website:

Dimension	Seed File Name
2D	deldot_seed2d_th.dgn deldot_seed2d_in.dgn
3D	deldot_seed3d_th.dgn deldot_seed3d_in.dgn

Note: The MicroStation configuration variable **MS_DESIGNSEED** is used to define the default seed file.

Working Units

MicroStation allows the user draw in real world units such as feet, inches, meters, etc. These real world units are called working units. Working units are expressed as Master Units (the largest units in common use in a design file, such as feet) and fractional Sub Units (such as tenths or inches).

The default definition for the foot in MicroStation V8 is the International Foot. The Delaware State Plane Coordinate System upon which all DelDOT roadway design jobs are based is measured in U.S. Survey Feet. Therefore, DelDOT uses the U.S. Survey Foot definition, **and not the International Foot**, as the standard Master Unit.

International Feet ⇨ 1 foot = 0.3048000 meters

U.S. Survey Feet ⇨ 1 foot = 1200/3937 meters ≈ 0.3048006 meters

DRAFT

DelDOT has developed a standard unit definition file, ***deldot_units.def***, to define the U.S. Survey Foot as the standard Master Unit. This file can be obtained from the Delaware Department of Transportation's Design Resource Center (DRC) website.

MicroStation design files used in plan preparation shall use the following standard working units as defined in the DelDOT seed files and in ***deldot_units.def***.

Unit Names	Label
Master Unit: Survey Feet	'
Sub Unit: SF Tenths	th

The DelDOT seed files have been created with the standard working units described above and with a standard resolution setting of 10,000 per meter. These settings shall not be changed by the user.

Note: The MicroStation configuration variable **MS_CUSTOMUNITDEF** is used to specify the active unit definition file.

Global Origin

Elements in the design file are created by placing data points. Each data point placed in the design plane has associated X (Easting), Y (Northing) and Z (Elevation, 3D files only) positions or coordinates. This design is simply a Cartesian coordinate system upon which the design model lies.

In the DelDOT seed files, the point called the Global Origin is set to the design plane's exact center and assigned the coordinates 0,0 (2D files) and 0,0,0 (3D files). The Global Origin as defined in the DelDOT seed files should never be changed by the user for DelDOT projects.

Note: Each element placed in a design file shall be geographically correct relative to the Delaware State Plane Coordinate system. Horizontal coordinates shall be based on the North American Datum of 1983 (NAD83). Vertical elevations shall be based on the North American Vertical Datum of 1988 (NAVD88).

DRAFT

Coordinate Readout

The coordinate readout settings that are delivered in the DelDOT standard seed files are shown in Figure 1.

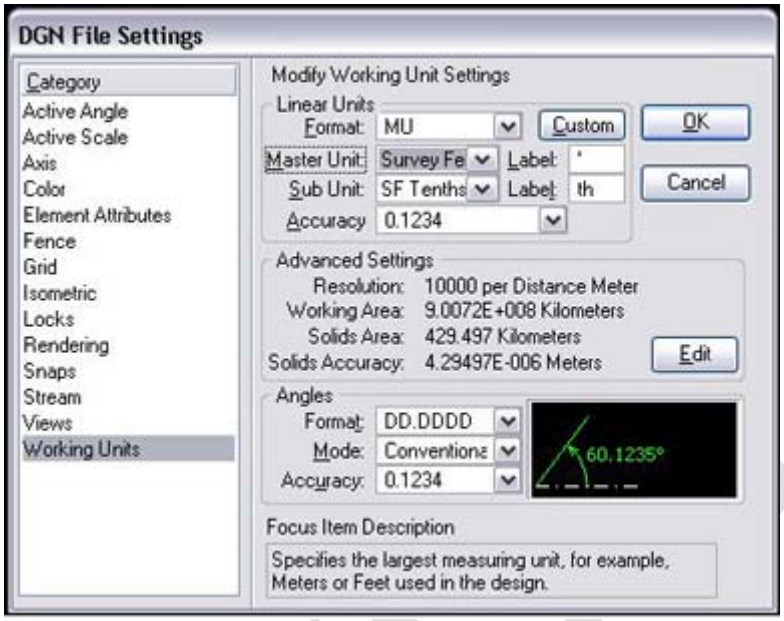

Figure 1: Coordinate Readout Settings

Drawing Scale

One of the key features of the new CADD Standards is the use of the drawing scale, which is displayed along the top of the MicroStation window. Drawing scale may be changed by selecting the appropriate scale factor from the **Drawing Scale** dialog box. The scale factor is stored with the file.

Note: The **Drawing Scale** dialog box can be activated by entering **dialog drawingscale open** in the MicroStation Key-In command line.

All scale dependant drawing elements such as text, cells and linestyles have been redefined in the new CADD Standards at a unit scale of 1:1. These elements are then scaled up or down by the drawing scale factor when it is selected from the barmenu. This helps maintain consistency of scale-dependant drawing features, regardless of the scale being used.

Colors

Standard colors are specified to ensure consistency and to enable users to easily identify plan elements in shared files.

Each element in a MicroStation design file is assigned a color number. MicroStation reads a color table to determine the correct color display for the color number. The DelDOT standard color table, deldot_color.tbl, can be obtained from the Delaware Department of Transportation's Design Resource Center (DRC) website.

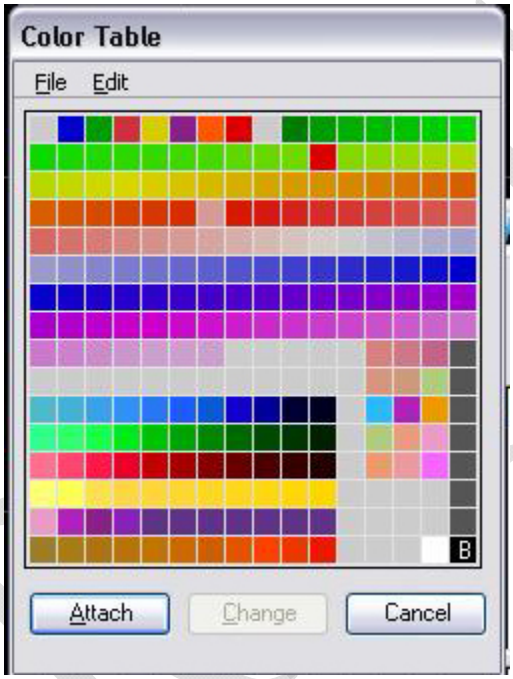

Figure 2: DelDOT Color Table

Note: The MicroStation configuration variable **MS_DEFCTBL** is used to specify the active color table.

Fonts

DelDOT has defined several standard fonts for use on all plans. It is important to use these fonts so that the final plotted version matches the electronic version of the file. Only the fonts provided by DelDOT (listed below) are acceptable for use on DelDOT plans. True Type fonts shall not be used on DelDOT plan sets.

The standard DelDOT font resource files that are listed below can be obtained from the Delaware Department of Transportation's Design Resource Center (DRC) website.

Note: The MicroStation configuration variable **MS_SYMBRSC** is used to specify the font library.

DelDOT uses the following fonts in the preparation of the plan set:

Font Name	Default/Modified *	Use
DelDOT 61 (1)	Modified	Existing Labeling
DelDOT 62 (5)	Modified	Existing Labeling, Details and Bridge Plans
DelDOT 63 (23)	Modified	Proposed Labeling
DelDOT 64 (25)	Modified	Schedule Data Fields
DelDOT 65 (90)	Modified	Surveying Features
DelDOT 66 (80)	Modified	Standard Construction Details
DelDOT 103	Default	
DelDOT 109	Default	
DelDOT 110	Default	
DelDOT 113	Default	
DelDOT 114	Default	
DelDOT 117	Default	Title Sheet Block

* "Default" fonts are unmodified or default fonts that are packaged within MicroStation and "Modified" fonts are fonts that have been modified by DelDOT for use in plan preparation.

Text

In general, all text placed in a design file is placed on the same level as the element that is being annotated.

Only upper case text shall be used with the text justification set to left-center, except for property ownership information on plan sheets, which is center-center justified.

Text is generally placed on plan sheets so that the bottom of the text is aligned with the bottom or right edges of the sheet border. When text rotation is required for element labeling, follow the examples in Figure 3 for direction and position of text at various rotation angles.

DRAFT

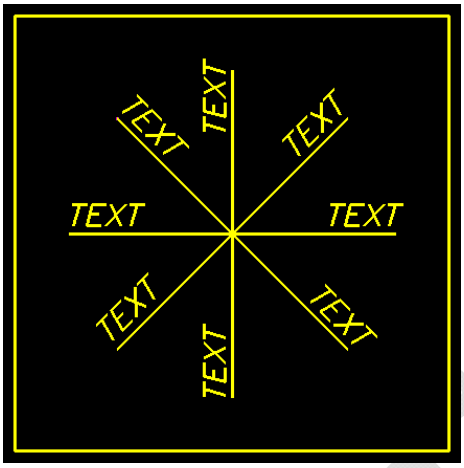

Figure 3: Text Rotation Examples

Text Size

Standard text sizes have been defined to ensure uniform legibility of all plan sheets. Standard text size refers to the size of the text on the finished plot, not the text size in the design file. The correct design file text size is dependent upon the intended plot scale. DelDOT standard text sizes are defined as shown in the following table:

Type of Text	Text Size	Text Weight	Font Name
Plan Sheets			
Existing Labeling	0.1000”	0	DelDOT 61 (1)
Proposed Labeling	0.125” (1/8”)	2	DelDOT 63 (23)
Title Block	0.250” (1/4”)	0	DelDOT 117
Sheet Description	0.1875” (3/16”)	0	DelDOT 117
Identifier Text	0.125” (1/8”)	2	DelDOT 63 (23)
Match Line Text	0.250” (1/4”)	0	DelDOT 117
Profile Axis Text	0.125” (1/8”)	2	DelDOT 63 (23)
Schedule Headers	0.1875” (3/16”)	0	DelDOT 117
Schedule Column Headers	0.125” (1/8”)	2	DelDOT 64 (25)
Schedule Data Entry Box	0.125” (1/8”)	2	DelDOT 64 (25)
Detail Sheets			
Title Block	0.250” (1/4”)	0	DelDOT 117
Titles	0.250” (1/4”)	4	DelDOT 62 (5)
Sub-titles	0.1875” (3/16”)	3	DelDOT 62 (5)
Dimensions	0.125” (1/8”)	2	DelDOT 62 (5)
General Text	0.125” (1/8”)	2	DelDOT 62 (5)

DRAFT

To calculate text sizes used in a MicroStation design file for various scaled plan sheets use this method:

(Text Size) x (Plotting Scale) = Design File Text Size
Example: .125 inch x 30 ft/inch = 3.75 feet

Text sizes smaller than 0.100" are not acceptable.

Text Line Spacing

In general, text line spacing should be two-thirds the text height. The spacing between lines on general notes and paragraphs is equal to the minimum text size.

Text Styles

A MicroStation Text Style is a saved set of text parameters such as font type, text width, text height, color, etc. Text styles enable the user to place text in a consistent and automated manner. The Delaware Department of Transportation's standard text styles are defined in a MicroStation DGN Library, ***deldot_textstyles.dgnlib***, which can be obtained from the Delaware Department of Transportation's Design Resource Center (DRC) website.

Note: The MicroStation configuration variable **MS_DGNLIB** is used to attach the deldot_styles.dgnlib file.

The "Type of Text" items listed above in the Text Size section have been configured in the ***deldot_styles.dgnlib*** file for use on DelDOT plans. The active text style should be selected in MicroStation prior to placing text. Select the **Place Text** command to access the following dialog:

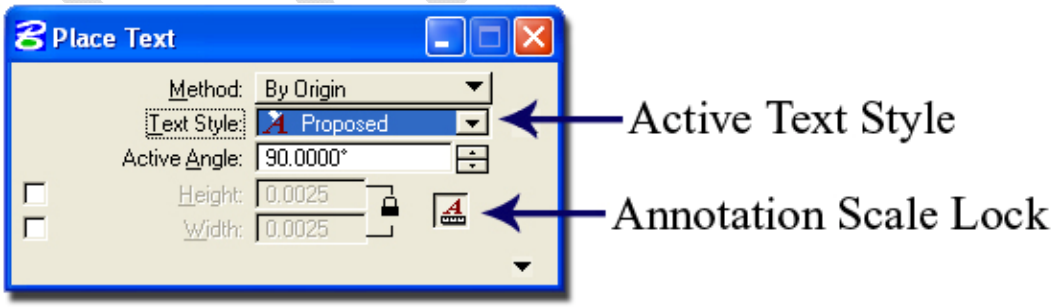

Figure 4: Selecting Text Styles

Selecting a Text Style will set the text appropriate for a 1:1 plot. To place text for other plotting scales, users can automatically set the text size by setting the MicroStation Annotation Scale prior to placing text. To change the Annotation Scale choose **File > Models**, then select **Edit Model Properties** to access the following dialog:

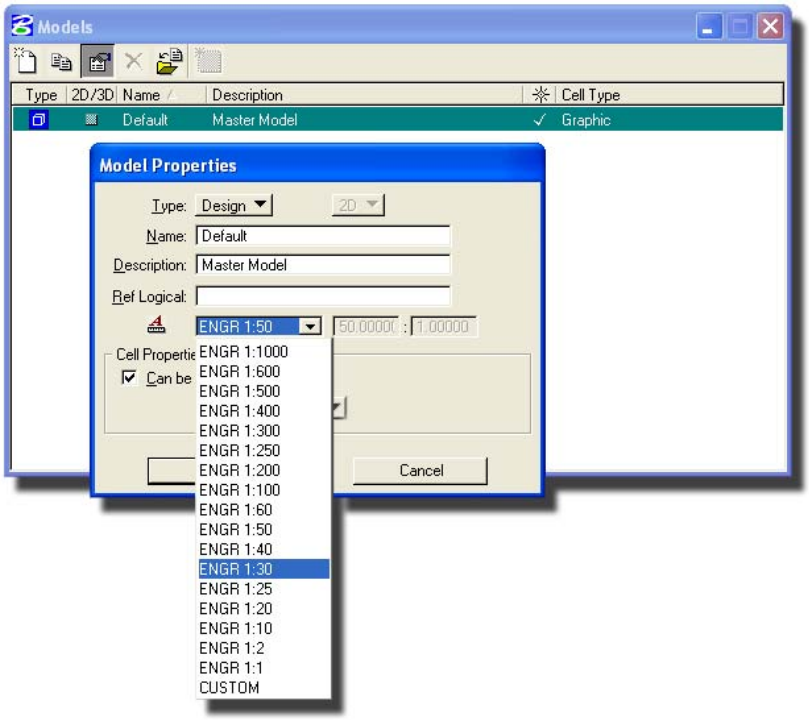

Figure 5: Selecting Annotation Scale

The list of available annotation scales is defined in the DelDOT standard scale file, ***deldot_scales.def***, which can be obtained from the Delaware Department of Transportation's Design Resource Center (DRC) website.

Note: The MicroStation configuration variable **MS_CUSTOMSCALEDEF** is used to assign the scale definition file.

The following annotation scales have been defined in the ***deldot_scales.def*** file:

Name	Scale
Full Size 1=1	1:1
ENGR 1:2	2:1
ENGR 1:5	5:1
ENGR 1:10	10:1
ENGR 1:20	20:1
ENGR 1:25	25:1
ENGR 1:30	30:1
ENGR 1:40	40:1
ENGR 1:50	50:1
ENGR 1:60	60:1
ENGR 1:100	100:1
ENGR 1:200	200:1
ENGR 1:250	250:1
ENGR 1:300	300:1
ENGR 1:400	400:1
ENGR 1:500	500:1

Name	Scale
ENGR 1:600	600:1
ENGR 1:1000	1000:1
ARCH 1/32 : 1	32:1
ARCH 1/16 : 1	16:1
ARCH 1/8 : 1	8:1
ARCH 3/16 : 1	16:3
ARCH 1/4 : 1	4:1
ARCH 3/8 : 1	8:3
ARCH 1/2 : 1	2:1
ARCH 3/4 : 1	4:3
ARCH 1 ½ : 1	2:3
ARCH 3 : 1	1:3
ARCH 6 : 1	1:6
ARCH 12 : 1	1:12

Architectural scales are used for annotating bridge details and occasionally Roadway details. Engineering scales shall be used for all Roadway sheets and for Bridge plan view sheets.

Recommended sheet scales are listed in the following table:

Sheet Type	Scale
Plan Sheet – Urban	ENGR 1:30
Plan Sheet – Rural	ENGR 1:50
Plan Sheet – Bridge	ENGR 1:30
Profile – Horizontal	Match Plan Sheet Scale
Profile – Vertical	10 Times the Horizontal Scale
Typical Sections	ENGR 1:5
Detail Sheets	Architectural Scales
Cross Sections	ENGR 1:5

In order to apply the annotation scale to a Text Style, you must toggle on the **Annotation Scale Lock** in the **Place Text** dialog box before placing the text. The Annotation Scale Lock can be seen in Figure 3.

Note: It is important to remember that Text Styles do not set the Level or Weight for text placement. The text will be placed on the active level with the active weight.

Element Symbology & Linear Patterns

Element symbology is used to differentiate how elements are displayed in the design file and on the plotted sheet. There are eight default line styles (0-7) and thirty two line weights (0-31) available in MicroStation. In general, existing topographical features are displayed at a weight of zero (0) and proposed construction features are displayed at a weight of two (2).

At this time DelDOT does not use custom line styles and makes use of linear patterns instead. Users shall not create custom line styles for use on DelDOT plan sheets.

Standard element symbology values for plan graphics are specified for each plan sheet type in the following tables:

Feature Description	Level	Color	Style	Weight	Cell Name	Cell Library
Base Plan / Survey Information						
Baseline Layout - Existing	1	3	0	0		
Brick Wall	5	5	0	0	BRICK	FS.cel
Curb Edges	3	6	0	0		
Ditch Centerline	4	1	0	0	DITCH	FS.cel
Drainage Pipes (Double Line)	6	1	2	0		
Fence - Chainlink or Stranded	5	0	0	0	WRF	FS.cel

DRAFT

Feature Description	Level	Color	Style	Weight	Cell Name	Cell Library
Fence - Stockade or Split Rail	5	0	0	0	WDF	FS.cel
Guardrail - Steel Beam	8	0	0	0	SBGR	FS.cel
Guardrail - Wire Rope	8	0	0	0	WRGR	FS.cel
Hedge Row or Thicket	4	2	0	0	HEDGE	FS.cel
Houses	13	6	0	5		
Marsh Boundary	4	2	0	0	MARSH	FS.cel
Match Lines	1	3	0	4		
Minor Residential Structures (Porches, Sheds, etc.))	13	6	0	3		
Roadside Features - Manmade	5	0	0	0		
Roadside Features - Natural	4	1	0	0		
Pavement Edge Lines - Concrete	3	6	0	0		
Pavement Edge Lines - Flexible	2	6	3	0		
Pavement Edge Lines - Gravel/Stone	2	6	3	0		
Railroad Tracks	13	0	0	0	RR	FS.cel
Riprap Linear Pattern	6	1	0	0	RIPLINE	FS.cel
Stone Wall	5	0	0	0	STONE	FS.cel
Wetlands Boundary	4	2	0	0	WL	FS.cel
Woods Line Boundary	4	2	0	0	WOODS	FS.cel
Profile Information						
Axis (Horizontal & Vertical)	9	2	0	2		
Bridges or Culverts	6	1	2	0		
Existing Drainage Structures	6	1	5	0		
Existing Drainage Pipes	6	1	2	0		
Grid - Horizontal	9	0	1	0		
Grid - Vertical	9	0	1	0		
Proposed Vertical Alignment	49	1	0	2		
Original Ground	9	3	3	0		
Utility Information						
Existing Underground - Electric	16	3	0	0		
Existing Underground - Gas, Oil or Petroleum	16	4	0	0		
Existing Underground - Communications, Alarm or Signal	16	6	0	0		
Existing Underground - Potable Water	16	1	0	0		
Existing Underground - Reclaimed Water or Irrigation	16	5	0	0		

DRAFT

Feature Description	Level	Color	Style	Weight	Cell Name	Cell Library
Existing Underground - Sewer & Drain Lines	16	2	0	0		
Proposed Underground - Electric	18	3	0	2		
Proposed Underground - Gas, Oil or Petroleum	18	4	0	2		
Proposed Underground - Communications, Alarm or Signal	18	6	0	2		
Proposed Underground - Potable Water	18	1	0	2		
Proposed Underground - Reclaimed Water or Irrigation	18	5	0	2		
Proposed Underground - Sewer & Drain Lines	18	2	0	2		
Signing, Striping and Conduit Information						
Conduits	23	6	0	3		
Stop Bars	22	0	0	14		
Striping - Edge Line	22	0	0	6		
Striping - Center Lines	22	4	0	6		
Striping - 10' Stripe & 30' Skip	22	0	0	6	LS1030	SS.cel
Striping - 2' Stripe & 6' Skip	22	0	0	6	LS0206	SS.cel
Striping - 3' Stripe & 9' Skip	22	0	0	6	LS0309	SS.cel
Right-of-Way Information						
Existing Right-of-Way Line	27	5	0	0	ERW	RW.cel
Existing Easement Line	27	5	3	0	RW_EE	RW.cel
Permanent Easement Line	30	0	3	2	PPE	RW.cel
Proposed Denial of Access Line	29	5	0	2	PDA	RW.cel
Proposed R/W Baseline	29	5	0	2		
Proposed R/W-DA Line	29	5	0	2	PRWDA	RW.cel
Proposed Right of Way Line	29	5	0	2	PRW	RW.cel
Proposed Temporary Construction Easement Line	30	0	3	2	PTCE	RW.cel
Construction Phasing, MOT & Erosion Control Information (Level 33 is Default level, elements should be placed on Phase Specific level)						
Barrier, Portable Concrete Safety	33	2	0	2	CSB	CS.cel
Contours - Existing Major	41	0	2	1		
Contours - Existing Minor	41	0	2	0		
Contours - Proposed Major	42	2	0	3		
Contours - Proposed Minor	42	2	0	1		
Drum @ 25 MPH Spacing	33	6	0	2	D25	CS.cel
Drum @ 30 MPH Spacing	33	6	0	2	D30	CS.cel

DRAFT

Feature Description	Level	Color	Style	Weight	Cell Name	Cell Library
Drum @ 35 MPH Spacing	33	6	0	2	D35	CS.cel
Drum @ 40 MPH Spacing	33	6	0	2	D40	CS.cel
Drum @ 45 MPH Spacing	33	6	0	2	D45	CS.cel
Drum @ 50+ MPH Spacing	33	6	0	2	D50	CS.cel
Earth Dike	33	1	0	2	ED	CS.cel
Erosion Control Blanket (Area Pattern)	33	1	0	2	ECB	CS.cel
Perimeter Dike/Swale	33	1	0	2	PDS	CS.cel
Riprap Ditch Lining (Area Pattern)	33	1	0	2	RRD	CS.cel
Silt Fence	33	1	0	2	SF	CS.cel
Silt Fence - Reinforced	33	1	0	2	RSF	CS.cel
Temporary Striping	33	0	0	3		
Temporary Swale	33	1	0	2	TS	CS.cel
Construction Plan Information						
Barrier, Concrete Safety (F Shape)	48	3	0	1	B1	CP.cel
Biofiltration Swale/Ditch Centerline	46	1	0	2	BFS	CP.cel
Clear Zone	15	0	3	2	CZ	CP.cel
Construction Baseline	43	3	0	2		
Ditch Centerline/PDGA	46	1	0	2	DITCH	CP.cel
Drainage Pipes	46	1	0	6		
Fencing - Steel	51	0	0	2	FENCE1	CP.cel
Fencing - Wood	51	0	0	2	FENCE2	CP.cel
Horizontal Clearance	15	0	3	2	HC	CP.cel
Identifier Leader Lines	47	1	0	2		
Limit of Construction	50	0	5	2	LOC	CP.cel
P.C.C. Curb, Type 1	45	3	0	1	CURB1	CP.cel
P.C.C. Curb, Type 2	45	3	0	1	CURB2	CP.cel
P.C.C. Curb, Type 3	45	3	0	1	CURB3	CP.cel
P.C.C. Integral Curb & Gutter, Type 1	45	3	0	1	CAG1	CP.cel
P.C.C. Integral Curb & Gutter, Type 2	45	3	0	1	CAG2	CP.cel
P.C.C. Integral Curb & Gutter, Type 3	45	3	0	1	CAG3	CP.cel
P.C.C. Integral Curb & Gutter, Type 4	45	3	0	1	CAG4	CP.cel
P.C.C. Sidewalk (Area Pattern)	45	3	0	2	SW	CP.cel
Pavement Edges	44	3	0	2		
Riprap (Area Pattern)	46	1	0	2	RIPRAP	CP.cel

DRAFT

Feature Description	Level	Color	Style	Weight	Cell Name	Cell Library
Steel Beam Guardrail - Type 2	48	4	0	2	GR2	CP.cel
Steel Beam Guardrail - Types 1 & 3	48	4	0	2	GR1	CP.cel
Underdrain	46	1	0	2	UD1	CP.cel
Vertical Alignment	49	1	0	2		
Grades & Geometric Information						
Geometric Data	54	4	0	2		
Geometric Layout Lines	54	4	0	2		
Miscellaneous Information						
DTM Triangles – Existing	58	2	0	0		
DTM Triangles – Proposed	60	4	0	0		

Level Assignments

To maintain uniformity among different drawing files, it is essential that an organized leveling system be utilized. MicroStation V8 permits data to be organized in any fashion on an unlimited number of levels. The Delaware Department of Transportation has developed a standard set of levels to be used with all design files submitted to or exchanged with the Department.

The Department has recently finalized its new level system. Currently, you may find the new level system **here** to view for reference until a suitable means to display all the data can be found to directly insert into this manual.

DelDOT's standard levels are defined in a MicroStation DGN Library, ***deldot_levels.dgnlib***, which can be obtained from the Delaware Department of Transportation's Design Resource Center (DRC) website.

Note: The MicroStation configuration variable **MS_DGNLIBLIST** is used to attach the DGNLIB file.

Users shall not create their own levels for use in any design files submitted or exchanged with DelDOT.

DRAFT

Cell Libraries

A cell is a complex element composed of a group of primary elements or other complex elements. Cells are stored in a cell library. For plan consistency it is advantageous to create cells for items that will be repeatedly placed in a design file.

The following cell libraries are available on the Delaware Department of Transportation Design Resource Center (DRC) website to facilitate the drawing of commonly used symbols and sheet borders as described below:

Cell Library	Description
CP.cel	Cells used for proposed construction sheets.
CS.cel	Cells used for construction sequencing & erosion control sheets.
FS.cel	Cells used for existing topographical features.
GG.cel	Cells used for grades and geometric sheets.
LS.cel	Cells used for landscaping sheets.
RW.cel	Cells used for right-of-way sheets.
SB.cel	Cells used for title sheets and overall sheet information.
SG.cel	Cells used for signalization sheets.
SS.cel	Cells used for signing and markings sheets.
TS.cel	Cells used for typical section and cross section sheets.

Appendix A contains a detailed listing of the cells that are contained in each of the cell libraries listed above.

Most of the cells created in the DelDOT cell libraries have been created as *graphic cells*. The symbology (color, line style, line weight and level) of a *graphic cell* is determined when it is created. When *graphic cells* are placed, they are level-independent, i.e., they keep the settings that were active when they were created. A few cells have been created as *point cells* where appropriate. A *point cell* takes on the active symbology set in the file at the time it is placed.

Many of the cells in the DelDOT cell libraries have been defined using real world dimensions (i.e. barriers, curbs, guardrails, etc.). These cells should always be placed in the design file with a scale factor of 1. Other cells have been defined to represent the location of a plan view feature but not the actual size of the element (i.e. utility poles, mail boxes, valves, etc.). These cells are intended to be placed in the design file using a scale factor equivalent to the plan sheet plotting scale.

DRAFT

Models

Each MicroStation V8 design file is composed of one or more Models. A model is a separate drawing area with its own set of view parameters, reference file attachments, etc., stored within the DGN file. Models can be either two-dimensional (2D) or three-dimensional (3D).

When reference files are attached, users must select the appropriate model within the referenced design file. References are attached to the currently active model within the active design file.

Strip Design Files

Strip design files are used to draw existing and proposed plan view information for the entire length of the project for both Roadway and Bridge projects. All strip file information shall be drawn in an individual MicroStation design file and not combined into one design file as separate design models.

The location and dimensions of all plan view strip file information shall be drawn using real world dimensions at 1:1 scale; however, cell scales and text annotation should be set for the intended plotting scale of the plan as previously detailed in this chapter.

For Roadway projects, a minimum of three plan view strip design files are required:

- One containing the existing topographical information, typically from ground survey or aerial mapping (FS.dgn).
- A second containing the existing and proposed Right-of-Way information (RW.dgn).
- A third containing the proposed construction information (PC.dgn)

DRAFT

Plan view information may be separated into multiple discipline-specific strip design files as listed below:

Allowable Plan View Strip Design Files
Alignment Layout (AL.dgn)
Construction Sequence & Phasing (CS.dgn)
Field Survey/ Existing Topography (FS.dgn)
Hydrology/Drainage Areas (HY.dgn)
Proposed Construction (PC.dgn)
Right-of-Way (RW.dgn)
Shape File for Shading (SF.dgn)
Utilities (UT.dgn)

A strip design file is also used for profiles and cross section graphics. Unlike plan view strip files, profile and cross section strip design files shall contain both existing and proposed information in one file.

The profile strip design file may be used to display all of the profiles for the entire project in one file. It is not necessary to create separate profile strip design files for each alignment. Profiles should always be displayed in their own strip design file and never combined with any other strip design file (Ex: Never display profiles in the proposed construction strip design file).

The cross section strip file may be used to display all of the cross sections for the entire project in one file. It is not necessary to create separate cross section strip design files for each alignment. Cross sections should always be displayed in their own strip design file and never combined with any other strip design file.

DRAFT

Chapter 4
Reference Files

Reference files are used to display the contents of one or more MicroStation design files within the active design file.

The most common use of reference files is to display Strip Design File (Ex: field survey file (fs.dgn)) information in construction plan sheet design files (cp01.dgn) to generate the various plan sheets used on a typical DelDOT roadway project.

Reference files are also used to display the entire contents of one design file in another strip design file to facilitate the design process (Ex: The entire contents of the field survey design file (fs.dgn) is referenced into the proposed construction design file (pc.dgn) so that the entire corridor can be viewed at one time during the design process).

Saving Relative Path

When attaching reference files to active design files it is recommended that the user enable the **Save Relative Path** check box (See Figure 6). This feature stores the directory location of the reference file relative to the directory of the active design file, thereby promoting the portability of the project directory.

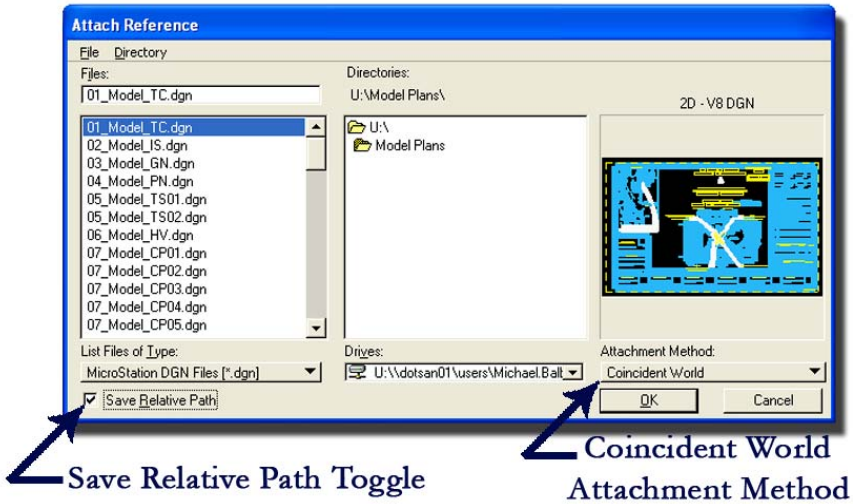

Figure 6: Reference File Attachment Settings

Note: This setting has replaced the **Save Full Path** feature from previous version of MicroStation. MicroStation V8 searches for reference file attachments in the following order:
- Active Directory
- Relative Path Directory
- MS_RFDIR Directory
- Full Path Directory

Coincident World

When attaching reference files to active design files it is recommended that the user select the **Coincident World** attachment method to insure that the global origins of referenced files are adjusted to the global origin of the active file, when attached. See Figure 6 for location of the **Attachment Method** drop down list.

True Scale

When attaching reference files to active design files it is recommended that the user enable the **True Scale** check box (See Figure 7). This feature adjusts the reference files **Units of Resolution** if they are different from the active design file.

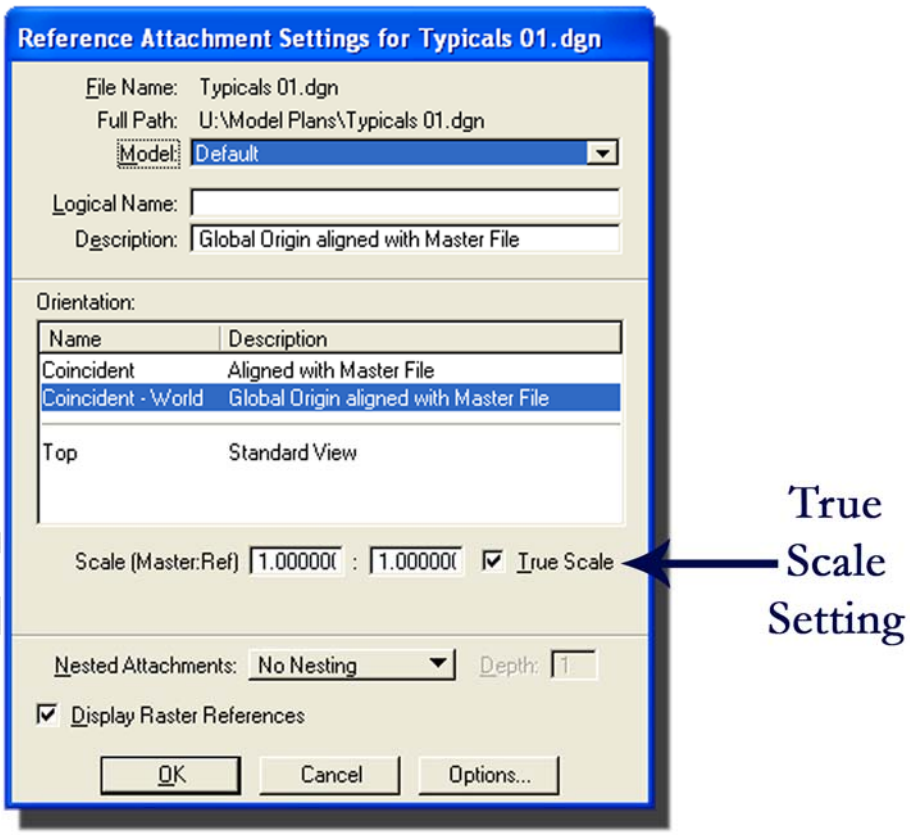

Figure 7: True Scale Setting

2D and 3D Design File References

MicroStation V8 allows cross referencing of 2D files and 3D files into one another. In previous versions of MicroStation this feature was not available, so 3D files were copied and converted to 2D files so references could be made to 2D files. This is no longer required, so 3D files should not be copied and converted to 2D, thus eliminating duplicate information.

Chapter 5
Plotting

One of the primary reasons for following the requirements listed in the CADD Standards Manual is to enable the creation of uniform plot sets. Inevitably when plotting issues occur it is because the requirements listed in this manual were not followed. Therefore, strict adherence to these requirements must be maintained to insure consistent and uniform plots.

Plotting Sizes

The Delaware Department of Transportation produces plan sets in the following sizes:

- Full Size: 34" x 22"
- Half-Size: 17" x 11"

Plotting Software & Hardware

The Delaware Department of Transportation uses the following software and hardware package to generate full size and half-size plan sets:

- Software Application: eQuorum PRF Generator for MicroStation, Version 8.8.37
- Plotter: Oce 860 Plotter

Line Widths

The Delaware Department of Transportation uses pen tables that are applied to the graphical elements when the design file is plotted. This can be thought of as a type of filter. The pen tables map MicroStation line weights to specific pen sizes or thicknesses and apply these thicknesses to the elements as they are plotted.

An example would be mapping all elements whose WT=0 to 0.005-inch thickness and WT=1 to a 0.013-inch thickness to differentiate the design file element's weights on the plotted sheet. Line thicknesses should be plotted as shown in the table below:

Element Weight	Thickness (Approximate Inches)
WT=0	0.005"
WT=1	0.013"
WT=2	0.018"
WT=3	0.023"
WT=4	0.028"
WT=5	0.033"

DRAFT

Element Weight	Thickness (Approximate Inches)
WT=6	0.038"
WT=7	0.043"
WT=8	0.048"

Due to the variation in plotting accuracy of various printers, the thickness' shown in the table above can be modified as deemed necessary to achieve the desired results.

Pen Tables

As previously mentioned under the section on Line Widths, DelDOT uses Pen Tables during the plotting process. The Pen Tables have been developed for the various types of sheets the user may encounter on each project, and are listed along with the corresponding Plot Request File (PRF) under the **Plot Request File (PRF) Naming** section of Chapter 2. These Pen Tables are available on the Delaware Department of Transportation Design Resource Center (DRC).

Plot Request File (PRF) Attributes

The following MicroStation **View Attributes** are always turned on when creating Plot Request Files: **Fill, Line Styles, Patterns, Styles and Text**.

The following MicroStation **View Attributes** are generally turned off when creating Plot Request Files: **Data Fields and Text Nodes.**

Plot Request Files are created with specific levels turned on and off to correctly generate the final output. The following table lists the levels that should be turned on for each plan sheet type.

Sheet Type	Levels Turned On
Title Sheet	1-62
Notes & Legend	1-62
Base Plans	1-9, 11-17, 27-28, 62
Public Display Plans	1-9, 13, 15, 17, 22, 24, 27-30, 43-46, 48-53, 62
Construction Plan	1-13, 15-17, 24, 27-30, 43-50, 53, 62
Grades & Geometric	1-3, 6-7, 9, 13, 43-46, 49, 54-55, 62
Construction Phasing, M.O.T.	1-6, 8-9, 13, 27, 29-30, 33 (Plus phase specific level)
Signing, Striping and Conduit Plans	1-3, 7, 9, 15-17, 21-24, 26-27, 29-30, 43-45, 49, 62
Right-of-Way Plan	1-9, 11-13, 16-17, 24, 27-32, 43, 45, 49-51, 62
Utility Relocation Plans	1-9, 11, 13, 15-20, 27, 29-30, 41, 43, 45-46, 49, 62
Cross Sections	1-62
Signalization Plans	1-6, 8-9, 11-13, 21-27, 29-30, 43-45, 50

DRAFT

CAL File Requirements

The Delaware Department of Transportation requires final plotting and viewing files for contract plans to be 200 dpi CAL Type 1 raster images.

DRAFT

Index

2

2D and 3D Design File References 36

A

About This Manual 4
Annotation Scale Lock.....23
Appendix A.....32

C

Cell Libraries 32
Chapter 1.....6
Coincident World.....36
color table 18
Colors.....18
Coordinate Readout 17

D

Delaware State Plane Coordinate System 15
DelDOT Servers 6
deldot_font.rsc, ...19
deldot_levels.dgnlib 27
deldot_scales.def 22
deldot_styles.dgnlib 21
deldotunits.def 16
Design File Categories 11
Design File Naming 10
Design Standards 15
Digital ortho-photography files.....6
Directory and File Naming 9
Directory Naming 9
Distribution 4
DOTASCADD01.....6
DOTASCADD02.....6
DOTASCADD03.....6
DOTFSND01.....6
DOTFSSD01.....6
DOTFSTMC01 6
DOTSAN01 6
DOTSAN02 6
Drawing Scale.....17

E

Electronic Plot File (CAL) Categories 14
Electronic Plot File (CAL) Naming..... 14
Element Symbology & Linear Patterns 23
Equorum PlotStation Server 6

F

Falcon SVP 6
Fonts..... 19

G

General File Naming 10
Global Origin 16
graphic cells 32

I

IIS Web Server 6
InterPLOT Server 6
Introduction 4

L

Level Assignments 27
Line Widths 37

M

MicroStation V8 Resources..... 8
Models..... 2, 21, 33
MS_CUSTOMSCALEDEF 22
MS_CUSTOMUNITDEF 16
MS_DEFCTBL 18
MS_DESIGNSEED 15
MS_DGNLIB..... 21
MS_DGNLIBLIST 28
MS_RFDIR Directory 35
MS_SYMBRSC 19

N

North American Datum of 1983 (NAD83)..... 16
North American Vertical Datum of 1988 (NAVD88)
..... 16

DRAFT

P

Pen Tables....38
Place Text....21
Plot Request File (PRF) Attributes....38
Plot Request File (PRF) Categories....12
Plot Request File (PRF) Naming....12
Plotting....37
Plotting Sizes....37
Full Size....37
Half-Size....37
Plotting Software & Hardware....37
point cells....32
ProSoft Training....6

R

Reference Files....35
Revisions and Updates....5

S

Saving Relative Path....35
Seed Files....15
Strip Design Files....2, 33

T

Table of Contents....2
Text....19
Text Line Spacing....21
Text Size....20
Text Styles....21
Trademarks....5
True Scale....36
Typical Drive Mappings....7

U

U.S. Survey Feet....15

W

Working Units....15

DRAFT