

**Preface by Natalie Barnhart, Chief Engineer**

It gives me great pleasure to introduce the Delaware Department of Transportation CADD Standards Manual: 2010 Edition. A great deal of work and coordination with representatives from DelDOT and the consulting community went into this manual's development. This cooperative effort was a key factor in completing the manual.

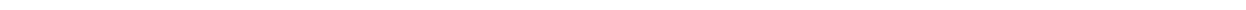
This latest edition of the DelDOT CADD Standards outlines the best practices you must follow for all DelDOT related engineering work, whether you work at DelDOT and produce CADD drawings, or are a consultant responsible for design drawing deliverables for DelDOT projects.

These Standards and associated support files such as seed files, cell libraries and Menu Bar are also available online at the Delaware Department of Transportation's Design Resource Center (DelDOT DRC).

The standards have been developed to assist you and should be considered a living document that will evolve over time to better serve you. Should you have any questions, concerns or suggestions for improving the content, feel free to contact Michael Balbierer at [michael.balbierer@state.de.us](mailto:michael.balbierer@state.de.us).

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## **Introduction**

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### **About This Manual**

Computer Aided Drafting and Design (CADD) is the preferred method of preparing contract plans for the Delaware Department of Transportation (DelDOT). The standardization 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 and delivery.

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 08.09.04.88

InRoads XM Edition – Version 08.09.03.06

Microsoft Windows XP Professional x64 Edition– Version 2003 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 surveying and/or engineering. 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 DelDOT CADD requirements. The manual can be downloaded from the Delaware Department of Transportation Design Resource Center (DelDOT 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 DelDOT DRC website at the following address:

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

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## **Revisions and Updates**

This manual was developed through input from DelDOT staff, as well as the consultant and construction communities. DelDOT's Division of Transportation Solutions (DOTS) 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](mailto:michael.balbierer@state.de.us)

DelDOT strives to stay current with state of the art trends in the market. However, impacts on project delivery schedules and resources necessary to provide 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 DelDOT DRC website to ensure that you have the most up to date version of this manual.

It is intended that 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.

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# Chapter 1 - DelDOT CADD Network

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## DelDOT Servers

There are at least eight different servers within DelDOT that are used for CADD files and supporting resources. The uses of these servers are dictated primarily by the location of the user and are listed in the following table.

<b>Server Name</b>	<b>Primary Use of Server</b>
DOTASCADD01	eQuorum PlotStation Server – handles all Plot Request File (PRF) plot submissions, regardless of output type (CAL, PDF, or hard copy).
DOTASCADD02	InterPLOT Server – all plots submitted through IPLOT must be sent through a printer or plotter attached to this server.  IIS Web Server – Falcon SVP and internal CADD support pages.
DOTASCADD03	Active design contracts. Archive Storage – Archived CAL files. Printing Storage – CAL files for print.
DOTSAN01	Main storage location for all CADD resource files.
DOTSAN02	Digital orthophotography files.
DOTFSND01	North District CADD resource files, updated hourly from DOTSAN01.
DOTFSSD01	South District CADD resource files, updated hourly from DOTSAN01.
DOTFSTMC01	Traffic Management Center (TMC) CADD resource files, updated hourly from DOTSAN01.

## Typical Drive Mappings

Drive Letter	Drive Mapping and Description
G:\	<p>User location dependant:</p> <p><a href="#">\\dotsan01\groups</a> - Dover offices, some TMC users.  <a href="#">\\dotfsnd01\groups</a> - North and Canal District users.  <a href="#">\\dotfssd01\groups</a> - South District users.  <a href="#">\\dotfstmc01\groups</a> - TMC users.</p> <p><a href="#">G:\CADD\msv8</a> - is the official location of all MicroStation XM resources, department wide. See <b>MicroStation XM Resource Locations</b> section for an expanded list of resources located in this directory.</p>
K:\	<p><a href="#">\\dotascadd03\cadd\archive documents</a>                      Location for all archived plans.</p>
M:\	<p><a href="#">\\dotascadd03\cadd\dms server</a>                      Program directory for Falcon client software.</p>
O:\	<p><a href="#">\\dotsan02\apps</a>  <a href="#">O:\Orthophotography</a> contains the digital orthophotography files that can be referenced into MicroStation XM.</p>
R:\	<p><a href="#">\\dotsan01\groups\cadd\resources</a>                      Old MicroStation resource directory. Will remain intact for MicroStation Version J interoperability.</p>
T:\	<p><a href="#">\\dotascadd03\cadd\plots</a>                      Temporary digital print storage. Files that are more than seven days old will be automatically purged from this directory.</p> <p><a href="#">T:\Equorum\cal\&lt;your_username&gt;</a> - Location of CAL files.  <a href="#">T:\Equorum\pdf\&lt;bw/color&gt;</a> - Location of PDF files depending on plot driver used, BW or Color.</p>
U:\	<p><a href="#">\\dotsan01 or dotfsdov02\users\&lt;your name&gt;</a>                      Location of user specific files. By design, access to user specific files has been restricted to the specific user and the OIT system administrator.</p>
V:\	<p><a href="#">\\dotascadd03\active contracts\&lt;contract number&gt;</a>                      Location of active contract CAL files.</p>
Y:\	<p><a href="#">\\dotascadd03\Cadd\Active_Designs</a>  <a href="#">Y:\&lt;County&gt;\&lt;Road_Number&gt;\&lt;Section&gt;\&lt;Contract_Number&gt;</a> Location of active contract files. A more detailed description on contract folder setup is found in <b>Chapter 2 – Directory Naming</b>.</p>

## **MicroStation XM Resource Locations**

MicroStation XM 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 Version J resources located in this directory structure.

<b>Folder Name</b>	<b>Folder Description/Contents</b>
 G	\\dotsan01\groups
 CADD	CADD Resources
 msv8	MicroStation XM References
 Cells	Cell Library Main Folder
 NCS	National CAD Standards Architectural Cells
 pre_msv8	Cell Libraries (1-63 Level Structure)
 ProjDev	Cell Libraries (New Level Structure)
 dgnlib	MicroStation DGN Libraries (Levels, Templates, etc.)
 Fonts	MicroStation Font Resource Files
 shx	AutoCAD Font Files
 ttf	TrueType Font Files
 InRoads	General InRoads Files (New Level Structure)
 pre_msv8	General InRoads Files (1-63 Level Structure)
 XML Data	XML and XSL Reporting Files
 mdlapps	MDL Applications
 Pen Tables	Plotting Pen Tables
 References	General Reference Files (New Level Structure)
 Maps	County Maps, District Maps and Signal Maps
 pre_msv8	General Reference Files (1-63 Level Structure)
 ProjDev	General Reference Files (New Level Structure)
 Seed	MicroStation Seed Files
 NCS	National CAD Standards Seed Files
 Survey	Survey Main Folder
 pre_msv8	InRoads Survey Files (1-63 Level Structure)
 VBA	Visual Basic Application Files for MicroStation

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## Chapter 2 - Directory and File Naming

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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 all project files used in the CADD environment.

### Directory Naming

Project specific working directories for all construction projects are located on the Y-Drive at the following address: \\dotascadd03\cadd\active\_designs\. 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/Contents
 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 (Un-Edited Copies)
 XSPlot	Cross Section Plot Files

## **General File Naming**

Standard file name extensions for information submitted to or exchanged with DelDOT shall be as follows:

<b>File Type</b>	<b>Extension</b>
MicroStation Design Files	.dgn
MicroStation Cell Libraries	.cel
MicroStation Resource Files	.rsc
InRoads Preference Files	.xin
InRoads COGO Data Files (Input Files)	.dat or .ics
InRoads COGO Report Files (Output Files)	.rpt
InRoads Digital Terrain Model Files	.dtm
eQuorum Plot Request Files	.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**

MicroStation design file names shall use the following convention:

<b><u>A</u></b>	<b><u>B</u></b>	
<u>CP</u>	<u>03</u>	.dgn
<u>FS</u>	<u>00</u>	.dgn

- A. This portion of the file name is established by using the two letter standard corresponding to the desired design file category listed in the section entitled **Design File & Plot Request File (PRF) Categories**.
- B. This portion of the file name 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.

**Design File & Plot Request File (PRF) Categories**

<b>Description</b>	<b>Design File Category</b>	<b>PRF Category</b>	<b>Pen Table</b>
Alignment Layouts †	AL	AL	-
Arch Bridge Details	AR	AR	-
Boring Log	BO	BO	-
Bridge Abutment Details	AB	AB	-
Bridge Approach Slab Details	AS	AS	-
Bridge Beam Details	BM	BM	-
Bridge Bearing Details	BB	BB	-
Bridge Camber Table	CT	CT	-
Bridge Composite Details	CO	CO	-
Bridge Deck Plan	DK	DK	-
Bridge Footing Plan	FT	FT	-
Bridge Framing Plan	FR	FR	-
Bridge Headwall Details	HW	HW	-
Bridge Parapet Details	PA	PA	-
Bridge Pier Details	PR	PR	-
Bridge Pile Details	PL	PL	-
Bridge Plan and Elevation	PE	PE	-
Bridge Rail Details	RA	RA	-
Bridge Rehabilitation Details	RH	RH	-
Bridge Rigid Frame Details	RF	RF	-
Bridge Sheet Pile Details	SH	SH	-
Bridge Slope Protection Details	SP	SP	-
Bridge Special Structure Details	ST	ST	-
Bridge Timber Structure Details	TD	TD	-
Bridge Wick Drain Layout Sheet	WD	WD	-
Bridge Wingwall Details	WW	WW	-
Construction Plan Sheet *	CP	CP	-
Construction Plans	-	CP	CP.TBL
Environmental Compliance Plans	-	EC	EC.TBL
Grades & Geometric Plans	-	GG	GG.TBL
Landscaping Plans	-	LS	LS.TBL
Lighting Plans	-	LI	-
Right of Way Plans	-	RW	RW.TBL
Signing, Signing and Conduit Plans	-	SS	SS.TBL
Utility Relocation Plans	-	UT	UT.TBL
Construction Sequence/Phasing †	CS	CS	CS.TBL

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<b>Description</b>	<b>Design File Category</b>	<b>PRF Category</b>	<b>Pen Table</b>
Construction Title Sheet	TC	TC	TC.TBL
Cross Sections	XS	XS	XS.TBL
Culvert Details	CU	CU	-
Detour Plan	DP	DP	DP.TBL
Display / Presentation	DI	DI	-
Expansion Joint	EX	EX	-
Field Survey/Existing Topography †	FS	FS	-
Finished Bridge Deck Elevations	FD	FD	-
General & Project Notes	PN	PN	PN.TBL
Horizontal and Vertical Control	HV	HV	-
Hydrology / Drainage Areas †	HY	HY	-
Index Sheet	IS	IS	-
Landscaping Details	LS	LS	LS.TBL
Legend Sheet (Construction & Right-of-Way Plans)	LG	LG	LG.TBL
Lighting †	LI	LI	-
Miscellaneous Details	DT	DT	DT.TBL
Model File	MD	MD	-
Profiles	PF	PF	PF.TBL
Project Sheet Border	SB	SB	-
Proposed Construction †	PC	-	-
Reinforcing Bar Summary	BR	BR	BR.TBL
Retaining Wall Details	RD	RD	-
Right of Way †	RW	RW	-
Right-of-Way Metes and Bounds	RB	RB	-
Right-of-Way Mosaic	RM	RM	-
Right-of-Way Tabulation	RT	RT	-
Right-of-Way Title Sheet	TR	TR	-
Shape / Shading File †	SF	SF	-
Signalization Plan	SG	SG	SG.TBL
Storm Water Management	SW	SW	-
Structure Removal	SR	SR	-
Superelevation Diagrams & Charts	SE	-	-
Typical Sections	TS	TS	TS.TBL
Utilities †	UT	UT	-
Work File (Miscellaneous Line Work)	WK	WK	-

† = Design file encompasses the entire project area (Strip Design File).

\* = Multiple plan sheets are generated from this design file.

## **Plot Request File (PRF) Naming**

eQuorum plot request file names shall use the following convention:

<b><u>A</u></b>	<b><u>B</u></b>	
<u>001</u>	<u>TC</u>	.prf
<u>012</u>	<u>CP</u>	.prf

- A. This portion of the file name denotes the sheet number of the contract set that the plot request file is generating. 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 in the section entitled **Design File & Plot Request File (PRF) Categories**.

## **Electronic Plot File (CAL) Naming**

Electronic plot file names shall use the following convention:

<b><u>A</u></b>	<b><u>B</u></b>	
<u>CD</u>	<u>001</u>	.cal
<u>RW</u>	<u>012</u>	.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.
  - CD = Construction Plan Set
  - RW = Right-of-Way Plan Set
  - XS = Cross Section Set
- B. This portion of the file name denotes the corresponding sheet number of the contract set that is being generated by the CAL file. This number shall be three characters in length.

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## Chapter 3 - Design Standards

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This chapter provides details about the DelDOT standard CADD settings, including:

- Seed Files
- Working Units
- Global Origins
- Coordinate Readouts
- Drawing and Annotation Scales
- Colors
- Fonts
- Text and Text Styles
- Element Symbolology
- Level Assignments
- Cell Libraries
- Models
- Strip Design Files

### Seed Files

MicroStation uses a seed file to create all design files. A seed file is a template in which standard design file parameters are set. Seed files do not typically contain elements, but similar to design files they contain file settings such as global origin, 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 DelDOT DRC website and shall be used in the preparation of plans for submission to DelDOT. Unless otherwise directed the “deldot\_seed2d\_in.dgn” and “deldot\_seed3d\_in.dgn” files are to be used for structural details only.

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 to draw in real world units such as feet, inches, meters, etc. These real world units are called working units. Working units are expressed in 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 XM is the International Foot. The Delaware State Plane Coordinate System upon which all DelDOT roadway and bridge design projects 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 ✓✓

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 DelDOT 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 the *deldot\_units.def* file.

Unit Description	Value	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 distance meter. These settings shall not be changed by the user.

Note: The MicroStation configuration variable <b>MS_CUSTOMUNITDEF</b> is used to specify the active unit definition file.
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## Global Origin

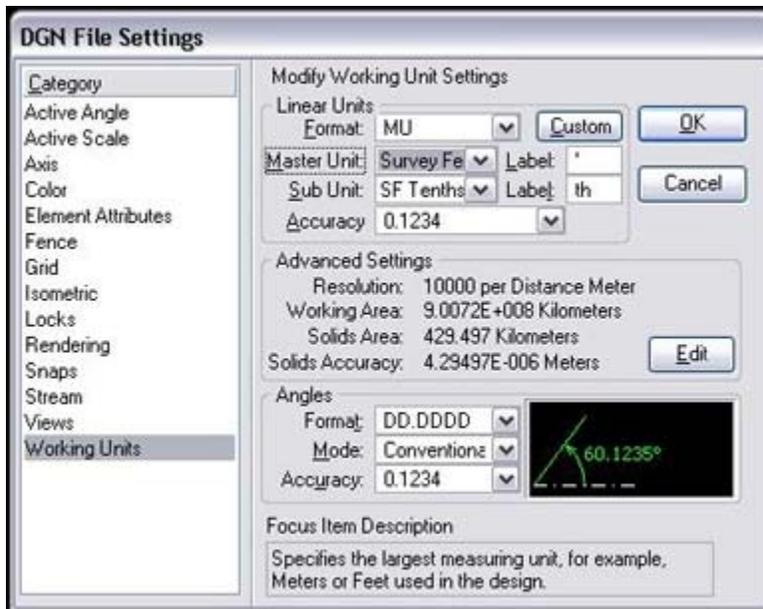
Elements in the design file are created by placing data points. Each data point placed in the design file has associated X (Easting), Y (Northing) and Z (Elevation, 3D files only) positions or coordinates.

In the DelDOT seed files, the point called the Global Origin is set to the design files 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).

## Coordinate Readout

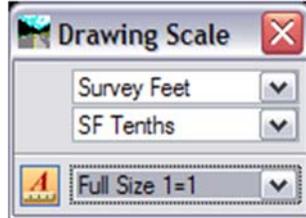
The coordinate readout settings that are delivered in the DelDOT standard seed files are shown in Figure 1. As mentioned previously in the section entitled **Working Units**, the DelDOT seed files are created with the resolution equal to 10,000 per Distance Meter. This setting shall not be changed by the user.



**Figure 1: Coordinate Readout Settings**

## Drawing Scale

The **Drawing Scale** dialog box allows the scale of a drawing to be changed at any time by selecting the appropriate scale factor from the **Drawing Scale** dialog box. When selected, the scale factor is stored within the design file and affects the scale dependent items such as text, cells and line styles.



**Figure 2 : Drawing Scale Settings**

All of the scale dependant drawing elements such as text, cells and line styles have been redefined in the new CADD Standards at a unit scale of 1:1. These elements are then automatically scaled up or down by the drawing scale factor as they are selected from the DelDOT Menu Bar. This helps maintain consistency of scale-dependant drawing features, regardless of the scale being used.

Note: The **Drawing Scale** dialog box can be activated by entering **dialog drawingscale open** in the MicroStation Key-In command line. The Drawing Scale dialog box can also be activated by choosing **DelDOT Common > Set Model Scale/Working Units** from the **DelDOT Menu Bar**.

The standard DelDOT drawing / annotation scales used in the preparation of DelDOT plan sets are defined in the *deldot\_scales.def file*, and can be obtained from the DelDOT DRC website.

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

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

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The following drawing / annotation scales have been defined in the *deldot\_scales.def* file:

<b>Engineering</b>	<b>Scale</b>
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 1:120	120:1
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
ENGR 1:600	600:1
ENGR 1:1000	1000:1

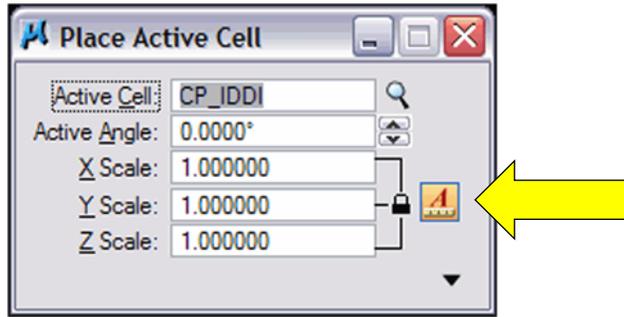
<b>Architectural</b>	<b>Scale</b>
Full Size 1=1	1:1
ARCH 1/32 : 1	32:1
ARCH 1/16 : 1	16:1
ARCH 3/32 : 1	32:3
ARCH 1/8 : 1	8:1
ARCH 3/16 : 1	16:3
ARCH 1/4 : 1	4:1
ARCH 3/8 : 1	8:3
ARCH 1/2 : 1	2:1
ARCH 3/4 : 1	4:3
ARCH 1 ½ : 1	2:3
ARCH 3 : 1	1:3
ARCH 6 : 1	1:6
ARCH 12 : 1	1:12

Recommended sheet scales are listed in the following table:

<b>Sheet Type</b>	<b>Scale</b>
Plan Sheet – Urban	ENGR 1:30
Plan Sheet – Rural Check with DelDOT Project Manager prior to utilizing this scale.	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

## Annotation Scale

The Annotation Scale lock found on the dialog boxes for text, cells and line styles provides control for the size of elements as they are placed in the design file. As elements are placed into a design file, they should be placed with the Annotation Scale Lock set to on. Enabling the Annotation Scale Lock at the time elements are placed within the design file allows for automatic rescaling of these items if the design file drawing scale is modified in the future.

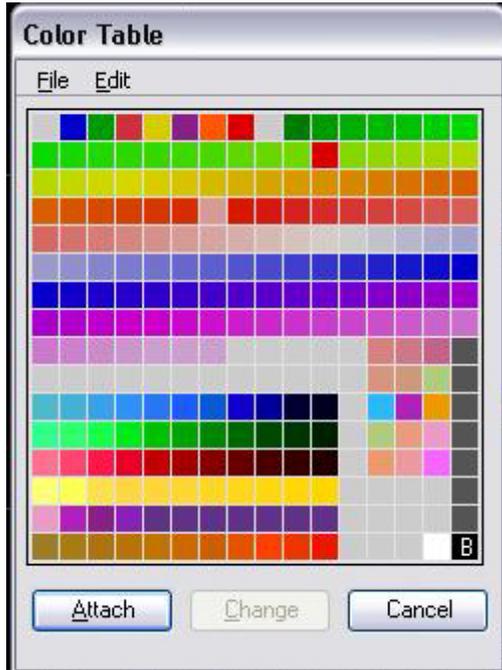


**Figure 3 : Annotation Scale Lock with Cells**

The standard DelDOT annotation scales used in the preparation of DelDOT plan sets are defined in the *deldot\_scales.def* file, and can be obtained from the DelDOT DRC website.

## Colors

Each element in a MicroStation design file is assigned a color number to ensure consistency and allow users to easily identify plan elements in shared files. MicroStation reads a color table to determine the correct color display for a particular color number. The DelDOT standard color table, *deldot\_color.tbl*, can be obtained from the DelDOT DRC website.



**Figure 4: 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 of the plans matches the electronic display version of the file. Only the fonts provided by DelDOT (listed below) are acceptable for use on plans prepared for DelDOT. The use of True Type fonts is not permitted on plans prepared for DelDOT.

**Note: Due to plotting issues involving filled fonts such as DelDOT\_117 within MicroStation XM, filled text should be placed at a weight of “8” to ensure proper plotting. DelDOT pen tables have been set up to correctly render these fonts as filled when they reside on levels with shapes not requiring fill.**

Note: The MicroStation configuration variable **MS\_SYMBRSC** is used to specify the font library.

The standard DelDOT fonts used in the preparation of DelDOT plan sets are listed below and can be obtained from the DelDOT DRC website.

<b>Font Name</b>	<b>Default/Modified *</b>	<b>General Use</b>
DelDOT_61 (1)	Modified	Existing Labeling
DelDOT_62 (5)	Modified	Construction Details
DelDOT_63 (23)	Modified	Proposed Labeling
DelDOT_64 (25)	Modified	Schedule Data Fields
DelDOT_66 (80)	Modified	Standard Construction Details (SCD)
DelDOT_103	Default	Mapping
DelDOT_109	Default	Mapping
DelDOT_110	Default	Mapping
DelDOT_113	Default	Mapping
DelDOT_114	Default	Mapping
DelDOT_117	Default	Title Sheet Block

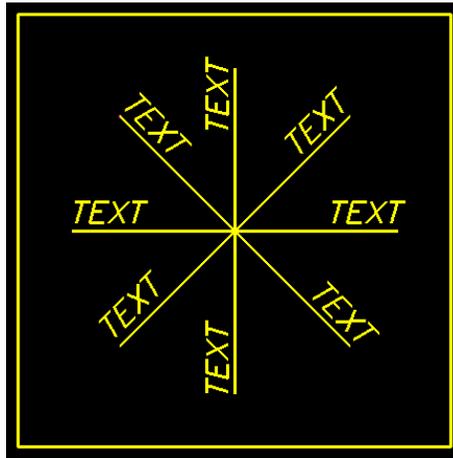
\* “Default” fonts are default or unmodified fonts that are shipped with MicroStation and “Modified” fonts are fonts that have been modified by DelDOT for use in plan preparation.

## Text

In general, all text placed in a design file is placed on the same level as the element that is being annotated. All text is typically placed in the sheet design file and not in a strip design file. The only exception to this would be the annotation of alignment stationing or other text that has been created by InRoads.

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. For additional text justification information see the section entitled **Text Size**.

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 element labeling requires text rotation, follow the examples in Figure 5 for direction and position of text at the various rotation angles.



**Figure 5: Text Rotation Examples**

## Text Line Spacing

In general, text line spacing of multiples lines of text should equal two-thirds ( $2/3$ ) the text height. The spacing between paragraphs or individual notes should be equal to the text height being used in the paragraph or note.

**Text Size**

Standard text sizes have been defined to ensure uniform legibility of all plan sheets. The standard text sizes listed below refers to the size of the text on the finished full size 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:

<b>Type of Text</b>	<b>Text Height</b>	<b>Text Width</b>	<b>Text Weight</b>	<b>Text Just.</b>	<b>Font Name</b>
<b>Plan Sheets</b>					
Existing Labeling	0.100"	0.100"	0	LC	DelDOT_61 (1)
Proposed Labeling	0.125"	0.125"	2	LC	DelDOT_63 (23)
Identifier	0.125"	0.125"	2	CC	DelDOT_63 (23)
Match Line	0.250"	0.250"	8	CC	DelDOT_117
Roadway Names	0.125"	0.125"	8	CC	DelDOT_117
Schedule - Titles	0.1875"	0.1875"	8	CC	DelDOT_117
Schedule - Column Header	0.125"	0.125"	2	CC	DelDOT_64 (25)
Schedule - Data Entry	0.125"	0.125"	2	CC	DelDOT_64 (25)
<b>Detail Sheets</b>					
Titles	0.250"	0.200"	4	CC	DelDOT_62 (5)
Sub-Titles	0.1875"	0.150"	3	CC	DelDOT_62 (5)
Dimensions	0.125"	0.100"	2	CC	DelDOT_62 (5)
General Text	0.125"	0.100"	2	LC	DelDOT_62 (5)
<b>Sheet Borders</b>					
Project Title	0.250"	0.250"	8	CC	DelDOT_117
Sheet Description	0.1875"	0.1875"	8	CC	DelDOT_117

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

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

Note: Text sizes smaller than 0.100" are not permitted on plans prepared for DelDOT. Text output generated from InRoads is handled by the preferences established in the DelDOT InRoads XM file (*deldot\_0809.xin*). This file can be obtained from the DelDOT DRC website.

## Text Styles

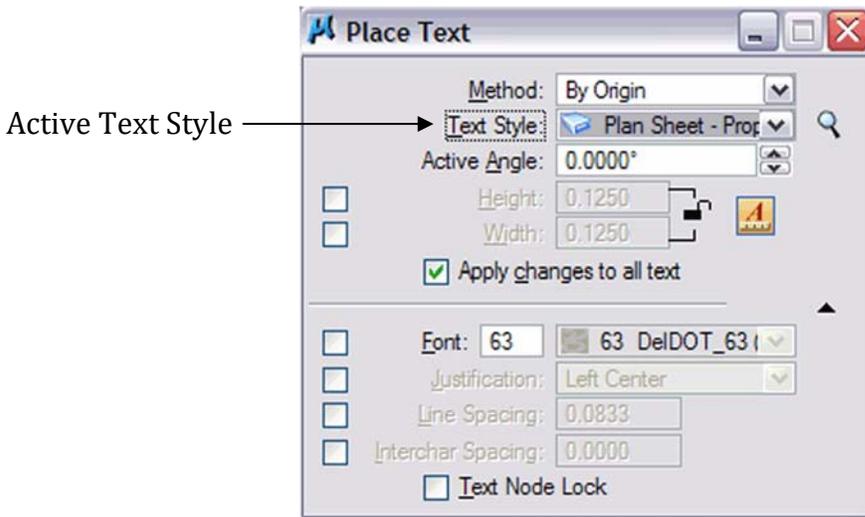
A MicroStation **Text Style** is a set of text parameters such as font type, text width, text height, color, etc that have been saved for repeated use. Text styles enable the user to place text in a consistent and automated manner.

The standard DelDOT text styles used in the preparation of DelDOT plan sets are defined in the *deldot\_textstyles.dgnlib* MicroStation DGN Library, and can be obtained from the DelDOT DRC website.

Note: The MicroStation configuration variable **MS\_DGNLIBLIST** is used to attach the *deldot\_textstyles.dgnlib* resource file.

The various “**Type of Text**” items listed on the previous page have been preconfigured in the *deldot\_textstyles.dgnlib* file for use on plans prepared for DelDOT.

To ensure proper text settings, the active text style should be selected prior to placing text. Also, the Annotation Scale Lock should be on to ensure that the text is being placed at the proper size for the intended drawing scale.



**Figure 6: Selecting Text Styles**

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

## Element Symbology

Each element placed into a MicroStation design file contains a specific setting or attribute for its level, color, line style and weight. The collection of these element attributes is referred to as an element's symbology. Element symbology is used to differentiate how elements are displayed in the design file and on the final plotted sheet.

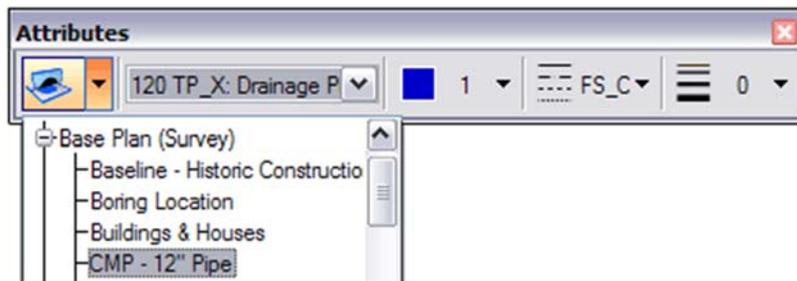
By default, there are an unlimited number of MicroStation levels that can be utilized in each design file. DelDOT has defined a specific set of level assignments that are to be utilized in the preparation of DelDOT plan sets.

As mentioned in the section entitled **Colors**, each element in a MicroStation design file is assigned a specific color number to ensure consistency and allow users to easily identify plan elements in shared files.

By default, there are eight line styles (0-7) available in MicroStation. DelDOT has begun the use of customized line styles to replace previously used linear patterns. Some examples of these custom line styles are fences, ditch lines, guardrail, woods lines, etc.

There are thirty two default 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).

To ensure correct element symbology while placing graphics in a design file, DelDOT has defined standard element symbology settings. These settings can be accessed through the **Attributes** toolbar as shown in Figure 7.



**Figure 7: Attributes Toolbar**

A full listing of the standard element symbology values for plan graphics are available for each plan sheet type in the tables included in **Appendix A: DelDOT MicroStation Element Symbology**.

DelDOT's standard element symbology settings are defined in a MicroStation DGN Library, *deldot\_templates.dgnlib*, which can be obtained from the DelDOT DRC website.

## **Level Assignments**

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

The Department has expanded its level system from the previous 1-63 system to a virtually limitless level system. The DelDOT level system has not been included in the main text of this chapter due to its dynamic nature and instead can be found in **Appendix B: DelDOT Level Assignments**.

As mentioned in the section entitled **Element Symbology**, CADD users preparing contract plans for DelDOT are encouraged to use the Attributes Toolbar to insure that plan graphics are being placed with the correct element symbology, including the correct level. Placing plan graphics via the drop down menu system found in the DelDOT Menu Bar also insures the correct placement of element symbology.

DelDOT's standard levels are defined in a MicroStation DGN Library, ***deldot\_levels.dgnlib***, which can be obtained from the DelDOT 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 to or exchanged with DelDOT. If you would like to request additional levels be added to the DelDOT level structure system please contact Michael Balbierer at [michael.balbierer@state.de.us](mailto:michael.balbierer@state.de.us).

## Cell Libraries

A cell is a complex element composed of a group of primary elements or other complex elements. Common cell types are grouped in cell libraries. 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 DelDOT DRC website to facilitate the drawing of commonly used symbols and sheet borders as described below:

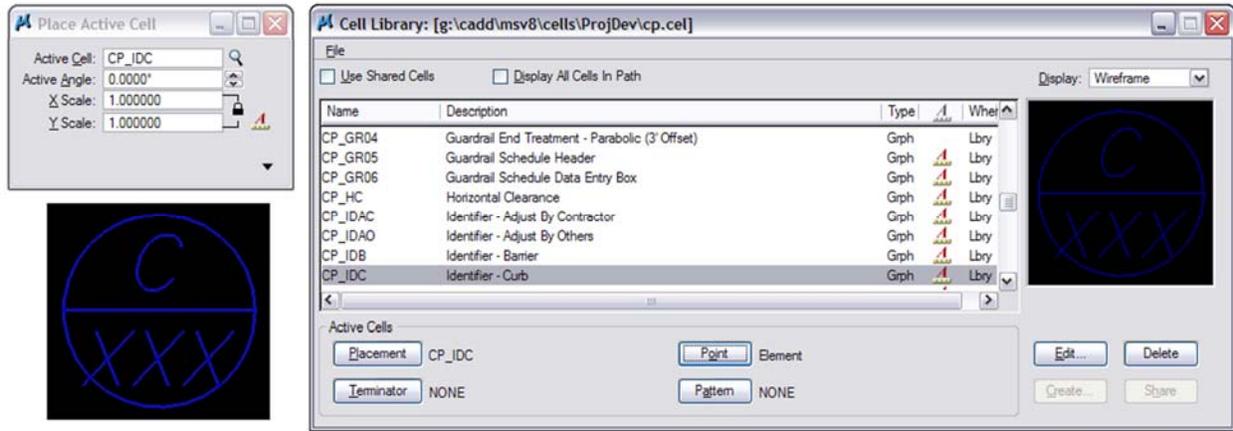
<b>Cell Library</b>	<b>Description</b>
CP.cel	Cells used for proposed construction sheets.
CS.cel	Cells used for construction sequencing & erosion control sheets.
DP.cel	Cells used for detour plans.
EC.cel	Cells used for environmental compliance sheets.
FS.cel	Cells used for existing topographical features.
GG.cel	Cells used for grades and geometric sheets.
GO.cel	Cells used for displaying geotechnical information.
HV.cel	Cells used for horizontal and vertical control sheets.
LI.cel	Cells used for lighting sheets.
LS.cel	Cells used for landscaping sheets.
PN.cel	Cells used for notes sheet (Project Notes).
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.
UT.cel	Cells used for utility sheets.

**Appendix C: DelDOT Cell Libraries** contains a detailed listing of the cells that are contained within each of the cell libraries listed above.

Most of the cells created in the DelDOT cell libraries have been created as **graphic cells**. The cell symbology (level, color, line style, and weight) 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 design file at the time it is placed. An example of a **point cell** is the line terminator arrow head (FS\_ARO).

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. Real world dimension cells are easily identified in the cell library palette by the missing **Annotation Scale** (“A”) icon, such as in the case for cell CP\_GR04: Guardrail End Treatment – Parabolic in Figure 8.

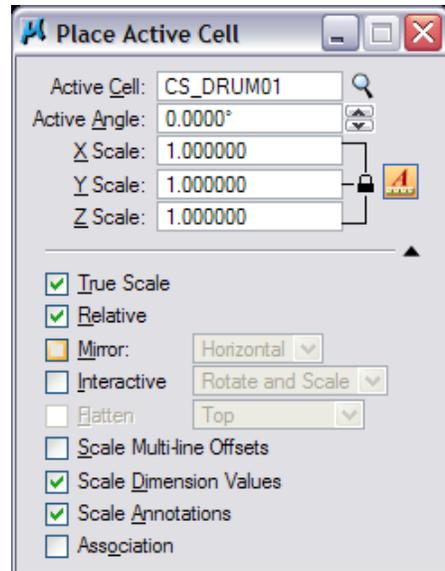
Other cells have been defined to represent the location of a plan view feature but not the actual size of the element (i.e. utility poles, mail boxes, valves, etc.). These cells are intended to be placed in the design file using the annotation/drawing scale factor which is equivalent to the intended plan sheet plotting scale.



**Figure 8: Place Active Cell Palette, Cell Library Palette and Cell Placement**

There are occasions where it may be necessary to override a cell’s symbology, such as the cell’s level at time of placement. An example of this would be the placement of maintenance of traffic (MOT) items on specific MOT Phase levels (Ex. Phase 1, Phase 2, etc.).

In this case cells are to be placed with the Relative toggle turned on as shown in Figure 9. It is essential to verify that the intended level is the active level prior to the cell’s placement.



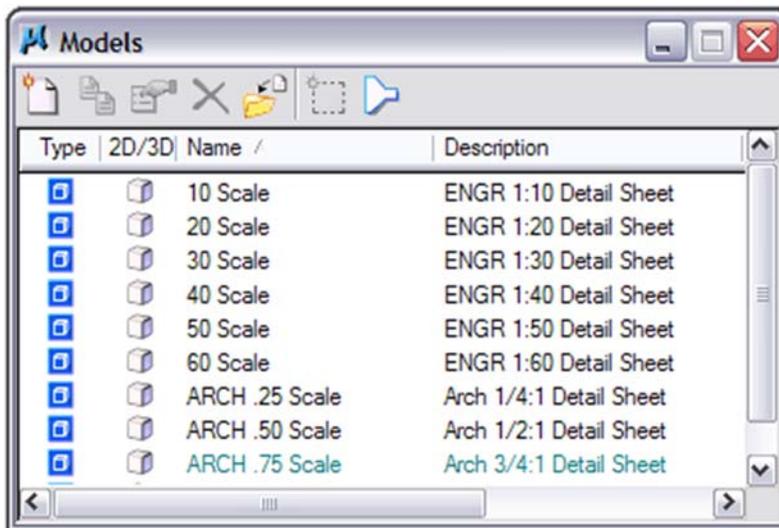
**Figure 9: Relative Toggle**

## Models

Each MicroStation XM 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 a single MicroStation Design file. Models can be either two-dimensional (2D) or three-dimensional (3D).

The most common use of models is in the creation of detail sheets. Construction details can be drawn at true scale in the scale specific model (Ex: 20 Scale), and annotated at that specific drawing or annotation scale. The multi-scale details can then be referenced into a single scale master detail sheet for printing purposes.

When multi-scale reference files are attached, users must be sure to select the appropriately scaled model within the referenced design file. As references are attached to design file, they are attached to active model within the active design file.



**Figure 10: Models Palette**

## **Strip Design Files**

Design files that encompass the entire limits of a project are referred to as **strip design files** and are used to create existing and proposed plan view graphics that will encompass the entire length of the project for both Roadway and Bridge projects. All strip file information shall be created as individual MicroStation design files 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 four (4) plan view strip design files are required:

- FS.dgn – this file contains the existing topographical ground survey information.
- RW.dgn – this file contains the existing and proposed right-of-way information.
- AL.dgn – this file contains the construction alignment information.
- PC.dgn – this file contains the proposed construction information.

<b>Strip Design File Name</b>	<b>Strip Design File Description / Contents</b>
AL00.dgn	Construction alignment layout information.
CS00.dgn	Construction sequence and phasing information.
FS00.dgn	Field survey / existing topography information.
HY00.dgn	Hydrology and drainage information.
LI00.dgn	Lighting information.
PC00.dgn	Proposed construction information.
RW00.dgn	Right-of-way information, existing and proposed.
SF00.dgn	Shape file for shading.
UT00.dgn	Utilities information, existing and proposed.

A strip design file is also used for profiles and cross section graphics. Unlike plan view strip design 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

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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.

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## Chapter 4 - DelDOT Menu Bar

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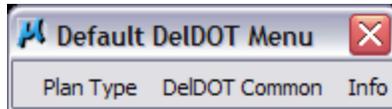
To ensure consistency and uniformity while placing graphics into a MicroStation design file, DelDOT has developed a custom menu bar that makes use of the BARMENU MDL application. This custom menu bar is referred to as the **DelDOT Menu Bar** and is generally used to define the standard symbology (level, color, line style and weight) for all elements contained within a file.

This chapter provides details about the DelDOT Menu Bar settings, including:

- Menu Layout
- Plan Types
- Common Tools
- Info Resources

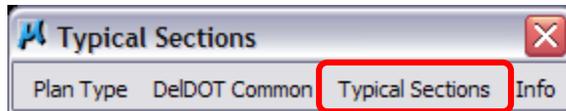
### Menu Layout

The DelDOT Menu Bar contains a minimum of three drop down menus. The **Plan Type**, **DelDOT Common** and **Info** menus are static menus and contain the same content regardless of the plan sheet type that has been selected.



**Figure 11 - Default DelDOT Menu Bar**

The fourth drop down menu is discipline or sheet specific and is either populated automatically upon opening a design file, provided the design file follows the DelDOT naming convention established earlier in this manual, or set manually by the user as needed. Ex: TS.dgn will add the Typical Sections menus and tools to the DelDOT Menu Bar as shown in Figure 12.



**Figure 12: DelDOT Menu Bar Set for Typical Sections Sheets.**

## **Plan Type**

As discussed in **Chapter Two – Directory and File Naming**, DelDOT strongly encourages the use of the two character design file naming convention. The DelDOT Menu Bar application utilizes this file naming convention to automatically populate the information in the discipline specific drop down menus.

It is also possible to manually select a discipline specific menu from the **Plan Type** drop down menu. A listing of the plan types and descriptions is provided below. Bridge specific sheet types have been grouped together under the **Bridge Specific Sheets** category in the **Plan Type** drop down menu.

<b>Plan Type Abbreviation</b>	<b>Plan Type Description</b>
AR	Arch Bridge Details
BO	Boring Log
AB	Bridge Abutment Details
AS	Bridge Approach Slab Details
BM	Bridge Beam Details
BD	Bridge Bearing Details
CT	Bridge Camber Table
CO	Bridge Composite Details
DK	Bridge Deck Plan
FT	Bridge Footing Plan
FR	Bridge Framing Plan
HW	Bridge Headwall Details
PA	Bridge Parapet Details
PR	Bridge Pier Details
PL	Bridge Pile Details
PE	Bridge Plan and Elevation
RA	Bridge Rail Details
RH	Bridge Rehabilitation Details
RF	Bridge Rigid Frame Details
SH	Bridge Sheet Pile Details
SP	Bridge Slope Protection Details
ST	Bridge Special Structure Details
TD	Bridge Timber Structure Details
WD	Bridge Wick Drain Layout Sheet
WW	Bridge Wingwall Details
CP	Construction Plans
EC	Environmental Compliance Plans

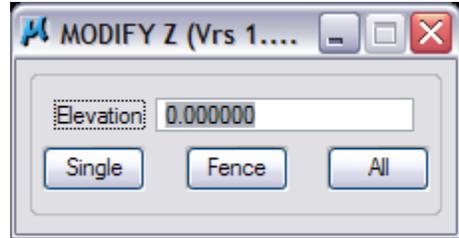
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<b>Plan Type Abbreviation</b>	<b>Plan Type Description</b>
GG	Grades & Geometric Plans
LS	Landscaping Plans
LI	Lighting Plans
SS	Signing, Signing and Conduit Plans
CS	Construction Sequence/Phasing
TC	Construction Title Sheet
XS	Cross Sections
CU	Culvert Details
DP	Detour Plan
DI	Display / Presentation
EX	Expansion Joint
FS	Field Survey/Existing Topography
FD	Finished Bridge Deck Elevations
PN	General & Project Notes
HV	Horizontal and Vertical Control
IS	Index Sheet
LS	Landscaping Details
LI	Lighting
DT	Miscellaneous Details
MD	Model File
PF	Profiles
SB	Project Sheet Border
PC	Proposed Construction
BR	Reinforcing Bar Summary
RD	Retaining Wall Details
RW	Right of Way
RB	Right-of-Way Metes and Bounds
RM	Right-of-Way Mosaic
RT	Right-of-Way Tabulation
TR	Right-of-Way Title Sheet
SF	Shape / Shading File
SG	Signalization Plan
SD	Standard Construction Details
SW	Storm Water Management
SR	Structure Removal
TS	Typical Sections
UT	Utilities

## DelDOT Common Menu

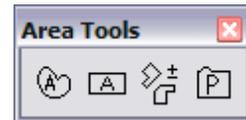
**Set Element Elevation** – this tool provides the user with the ability to move a single element, elements contained by a fence or all elements within the design file to a user defined elevation.

- **Load ModZ** = loads the **MODIFY Z** application for the first time during the MicroStation session.
- **Unload ModZ** = unloads or closes the **MODIFY Z** application from MicroStation. Note: Dismissing the dialog box by selecting the close icon (red “X”), does not unload this application. To reuse the **MODIFY Z** application after dismissing the dialog box the user must choose the **Unload ModZ** tool from the menu.



**Area Tools** – this menu item displays the **Area Tools** palette which contains the following tools:

- Measure Area and Place Area Text
- Place Area with Text
- Area Calculator
- Area Tool Parameters



**Civil Tools** – this menu item displays the **Civil/Site Tools** palette which contains the following tools:

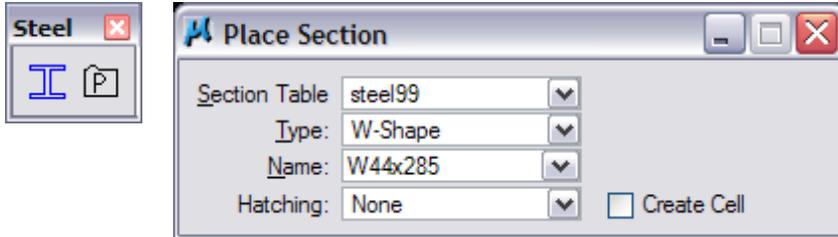
- Place Contour
- Label Contour
- Place Breakline
- Place Coordinate
- Modify Contour
- Set Element Elevation
- Place Spot Elevation
- Place Composite Curve
- Civil Tools Settings



**Info Snap** – this menu allows the user to either turn on or turn off the MicroStation InfoSnap settings.

**Pipe Cut Symbol** – this menu allows the user to either turn on or turn off the pipe cut symbol used when creating details.

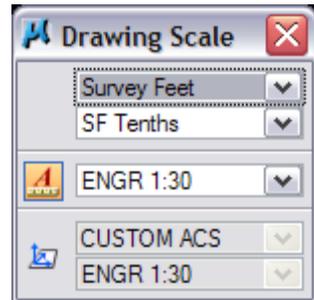
**Place Steel Section** – this menu allows the user to select steel section for insertion into drawing or detail. Shapes included are W-Shape, S-Shape, HP-Shape, M-Shape, Structural Tubing, etc.



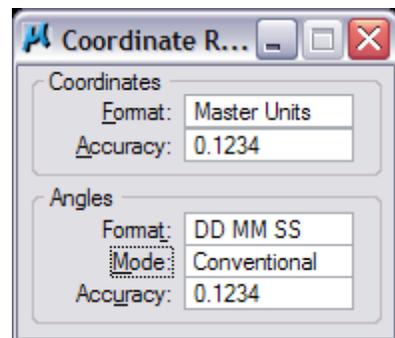
**Start InRoads** – this menu allows the user to launch InRoads, InRoads Site, InRoads Storm & Sanitary or InRoads Survey directly from within an active MicroStation session.

**Start AutoTrack** - this menu allows the user to launch AutoTrack directly from within an active MicroStation session.

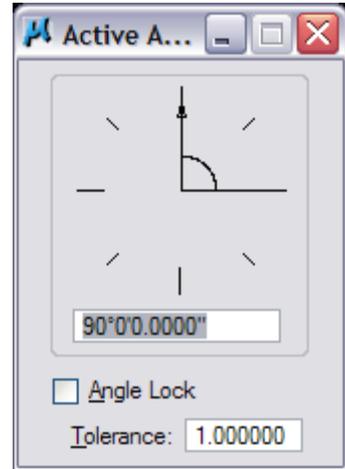
**Set Model Scale/Working Units** – this item activates the **Drawing Scale** palette where the user can set the Working Units (Master & Sub units) and the active Model or Drawing Scale. The Annotation Scale Lock can be toggled on or off from this palette as well.



**Coordinate Readout** – this item activates the **Coordinate Readout** palette where the user can set the Coordinate Format, Coordinate Accuracy, Angle Format, Angle Mode and Angle Accuracy.



**Set Active Angle** – this item allows the user to set the active angle within the design file by one of three methods: By 2 Points, By 3 Points or By Dialog.



**Set Active Elevation = 0** – this menu item sets the view's active depth to an elevation of 0.0000. This menu item performs the same function as typing "az=0" into the MicroStation Key-In line.

**Reset View Depth** – this menu item sets the view display depth to -10000, 10000. This menu item performs the same function as typing "dp=-10000,10000" into the MicroStation Key-In line.

**Level Display** – this menu item activates the **Level Display** palette. This menu item performs the same function as selecting the **CTRL+E** shortcut

**Change Level** – this menu item activates the **Change Level** palette which enables the user to either turn a level off or isolate the level so it is the only level on, by selecting an element on the affected level.

**All Levels ON** – this menu item allows the user to turn on all of the MicroStation design file levels for **All Views** or a specific view. This menu item performs the same function as right-clicking in the **Level Display** window and selecting **All On** from the pop-up palette.

**All Levels OFF** – this menu item allows the user to turn off all of the MicroStation design file levels for **All Views** or a specific view. This menu item performs the same function as right-clicking in the **Level Display** window and selecting **All Off** from the pop-up palette.

**View Attributes** – this menu item allows the user to toggle on or off the following view attribute settings:

- Area Fill
- Data Fields
- Dimensions
- Dynamics
- Fast Cells
- Fast Curves
- Fast Font
- Grid
- Level Symbology
- Line Weight
- Pattern
- Text
- Text Nodes

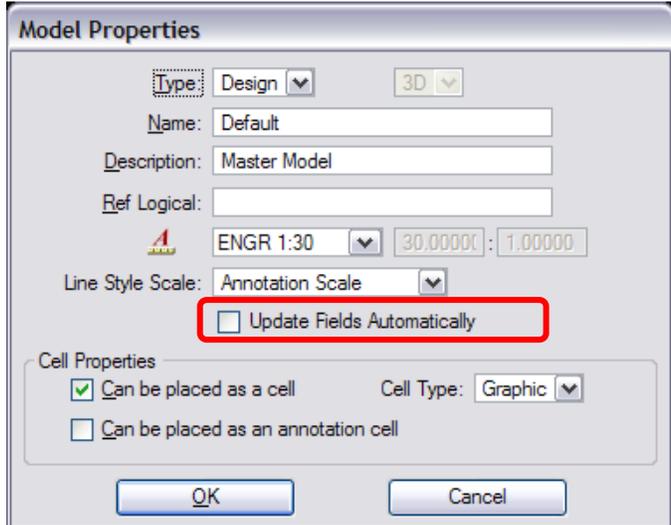
**Set Highlight** – this menu item allows the user to select from one of the eight element selection highlight colors.

**Change Element Direction** – this menu item allows the user to reverse the direction of an element from that in which it was originally drawn.

**Shift LineStyle** – this menu item allows the user to shift or slide the linestyle elements along the length of the linear element.

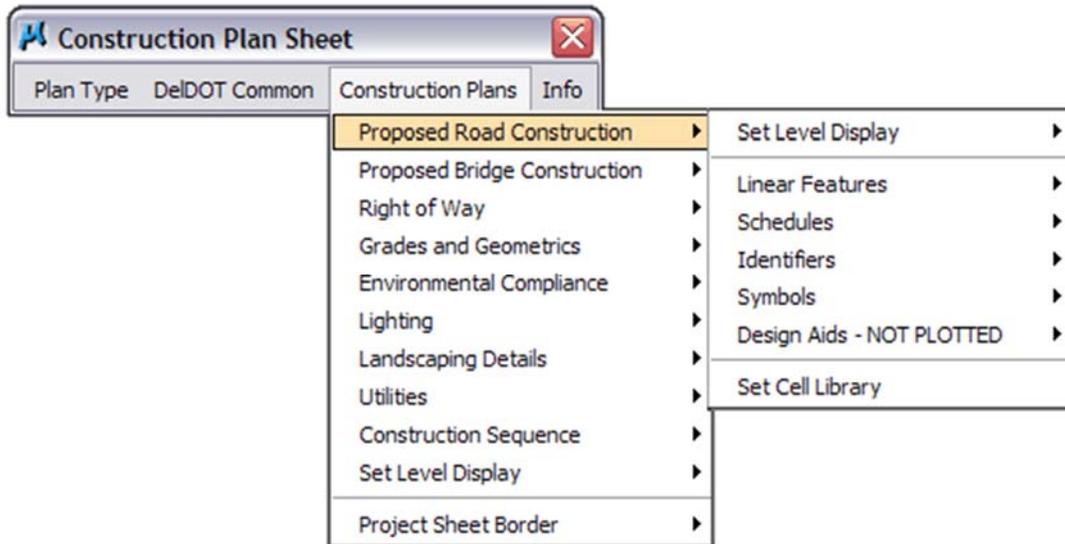
**AutoLocate Toggle**– this menu item allows the user to toggle on or off the AccuSnap AutoLocate feature. Using the AutoLocate feature allows the user to hover over an element to highlight or select the element without having to actually click-select the element.

**Update Fields** – this menu item allows the user to update the various fields within a MicroStation design file on demand, instead of keeping the **Update Fields Automatically** model property toggled on. Leaving this field toggled on will increase the time it takes to open up the design file and is not recommended.



## Plan Type Specific Menus

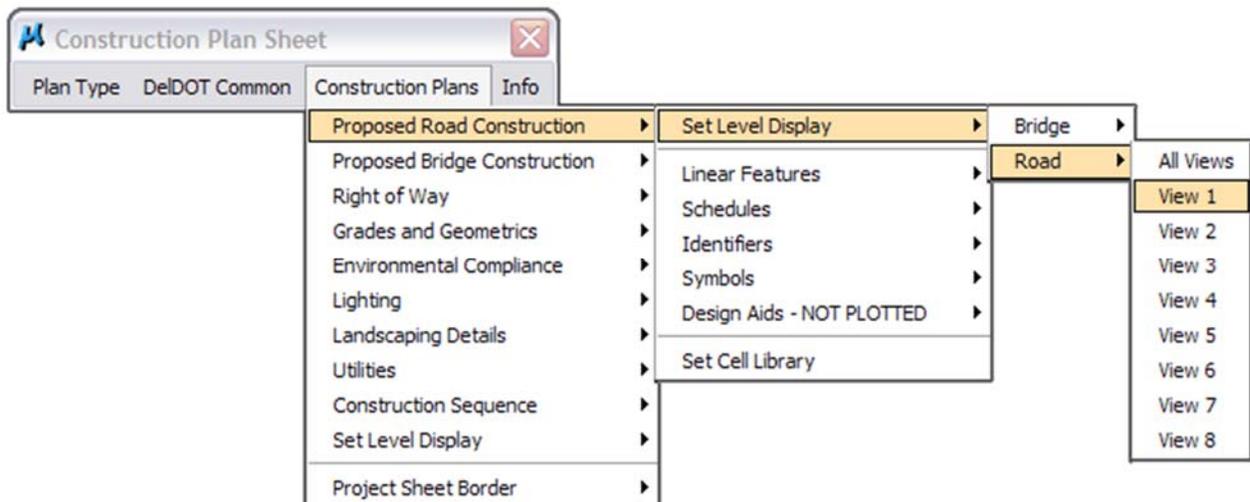
As mentioned under the Menu Layout section of this chapter, depending on the name of the active design file, the DelDOT Menu Bar will automatically populate a drop down menu for the discipline specific sheet type. This discipline specific drop down menu contains tools and settings that were developed for that particular sheet type to improve consistency and uniformity between plan sets.



**Figure 13 - DelDOT Menu Bar Set Up for CP - Construction Plans Plan Type**

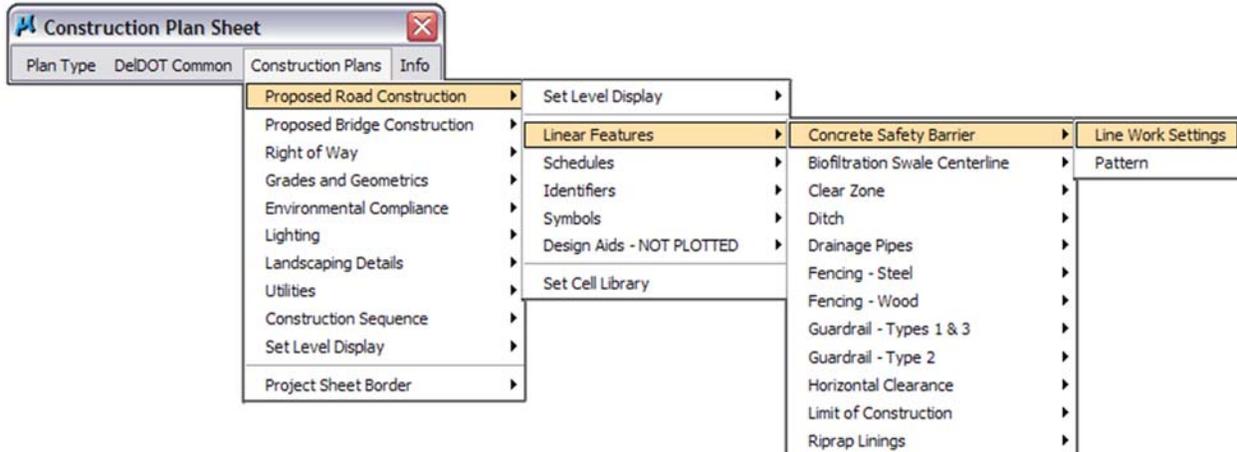
The following component groups are found in most of the discipline specific menus:

**Set Level Display** – this menu item allows the user to set the level display for either an individual view or all of the views. The view level settings are determined by a VBA macro that utilizes the `deldot_levels.xls` file to determine which levels should be on or off for a particular sheet type.

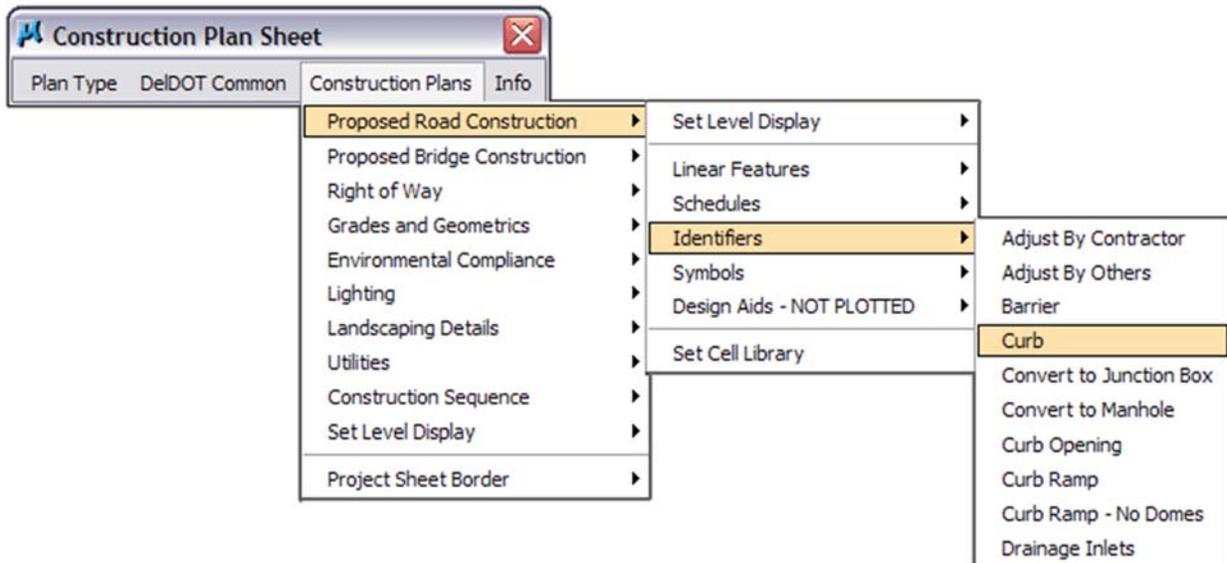


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**Linear Features** – this menu item contains element symbology settings (level, color, style and weight) for most of the graphical elements that are placed within a design file. The settings under these menu items are determined by the MicroStation Active Element Templates, and will not work correctly if the deldot\_templates.dgnlib file has not been added to the MicroStation configuration.

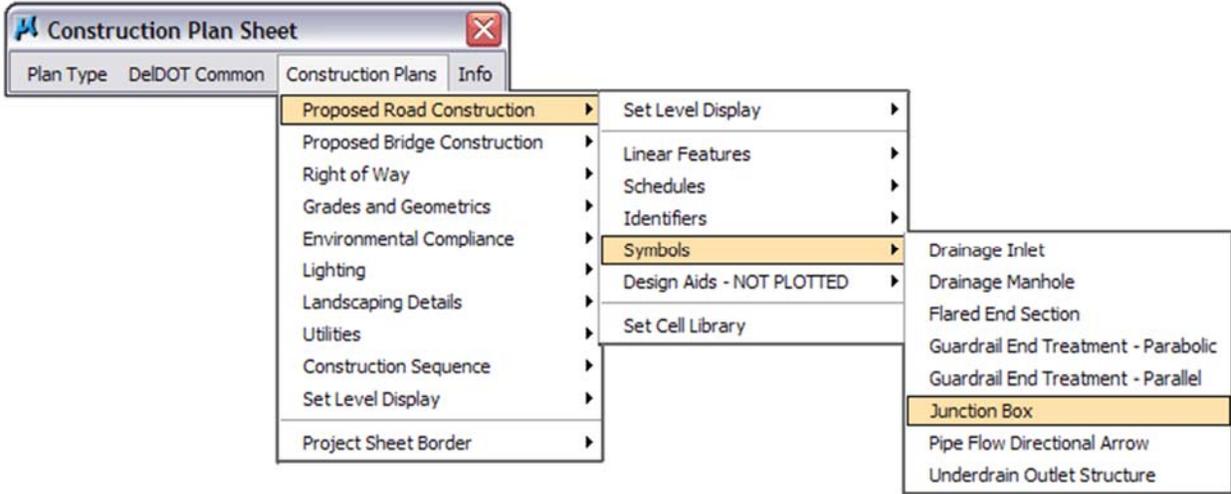


**Identifiers** – this menu item contains a listing of all of the identifiers that are used for a particular sheet type.

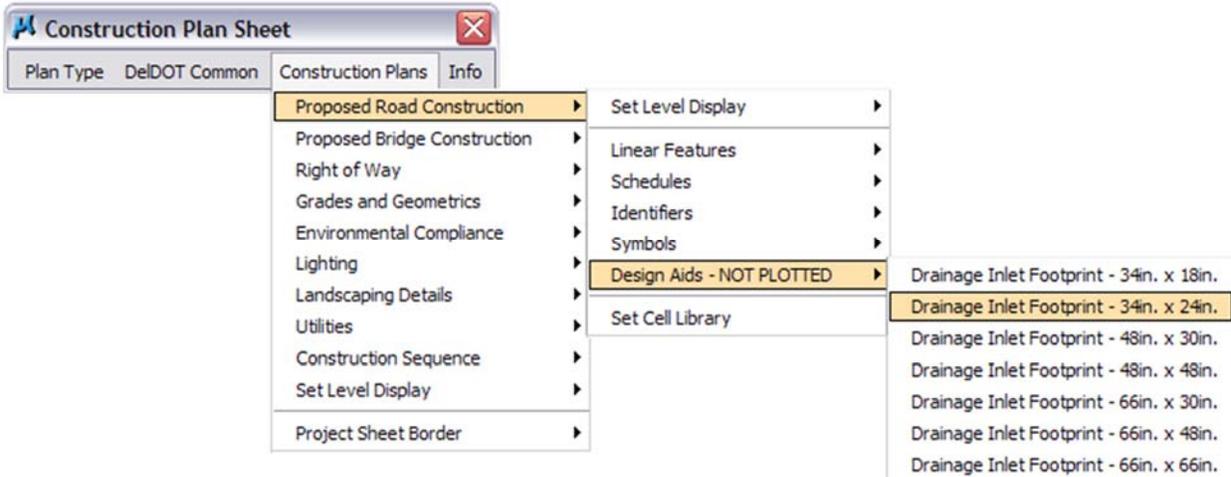


**DelDOT CADD Standards Manual**

**Symbols** – this menu item contains a listing of all of the symbols/cells that are used for a particular sheet type.



**Design Aids** – this menu item contains a listing of design aids that may be used for a particular sheet type.



## **Info**

**DelDOT Design Resource Center** – this menu item links directly to the Delaware Department of Transportation’s Design Resource Center (DelDOT DRC) website home page.

**DelDOT CADD Standards Manual** – this menu item links directly to the most current version of the Delaware Department of Transportation’s CADD Standards Manual.

**DelDOT Levels** – this menu item links directly to the deldot\_levels.xls workbook where users can view the current level assignments and level display settings.

**Bentley Communities** – this menu item links directly to the Bentley BE Communities website home page where users can find additional help, discussion forums, and tips for all of the Bentley products.

**Bentley Discussion Groups** – this menu item links directly to the archived Bentley Discussion Groups website where users can perform searches for additional help on all of the Bentley products.

**Bentley ETS – OnLine Training** – this menu item links directly to the Bentley Learn Server website home page where users can search through the OnDemand eLearning Courses for training materials on all of the Bentley products. A user ID and password is required to access the training information.

**Bentley OnLine Feature Tips** – this menu item links directly to the Bentley Learn Server Feature Tips and Product Demonstrations home page where users can view Feature Tips for all of the Bentley Products.

**Bentley Software Documentation** – this menu item links directly to the Bentley Public Documentation Archive where the user can view the user’s manuals, training guides and references for all of the Bentley products.

## Chapter 5 - Reference Files

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

The most common use of reference files is the display of strip design files such as the field survey file (fs00.dgn) into the construction plan sheet design files (cp01.dgn) to generate the various plan sheets used on a typical DelDOT project.

Reference files are also used to display the entire contents of one strip design file into another strip design file to facilitate the design process (Ex: The entire contents of the field survey design file (fs00.dgn) is referenced into the proposed construction design file (pc00.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** feature check box. 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.

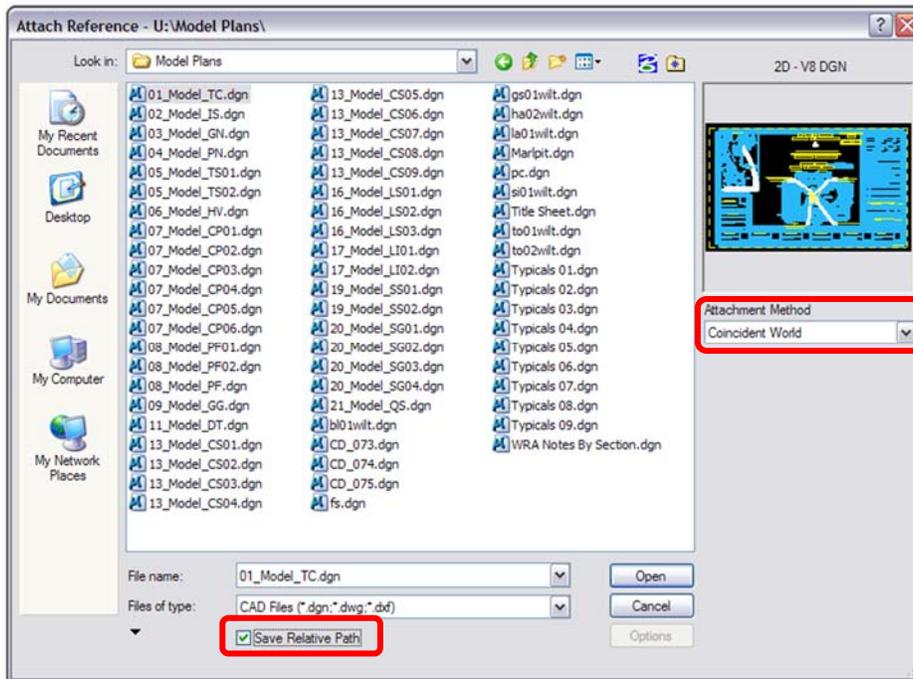


Figure 14: Attach Reference

Note: The **Save Relative Path** setting has replaced the **Save Full Path** feature from previous version of MicroStation. MicroStation XM searches for reference file attachments in the following order:

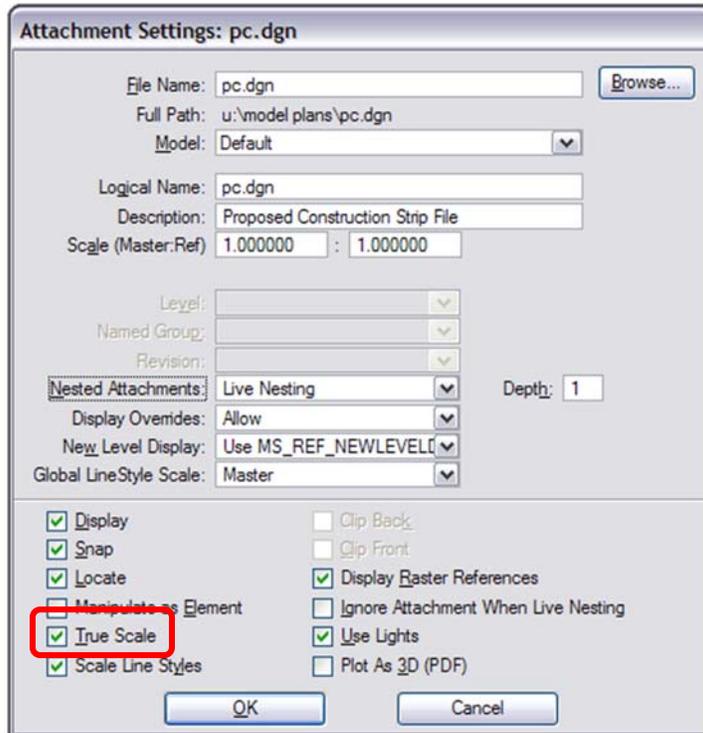
- Active Directory
- Relative Path Directory
- MS\_RFDIR Directory
- Full Path Directory

## 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 10 for the 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 15). This feature adjusts the reference files **Units of Resolution** if they are different from the active design file.



**Figure 15: Attachment Settings & True Scale**

## **2D and 3D Design File References**

MicroStation XM 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.

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## **Chapter 6 - Raster Manager**

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Raster files are used to display the contents of one or more image files into the active design file. MicroStation supports the attachment of several types of image files, the most common being the .jpg, .tiff, and .img raster image types.

The most common use of raster files is the display of aerial imagery into design files as a background for planning, design and presentation purposes. It is also possible to attach scanned paper archived plan sheets into the active design files through the use of the Raster Manager.

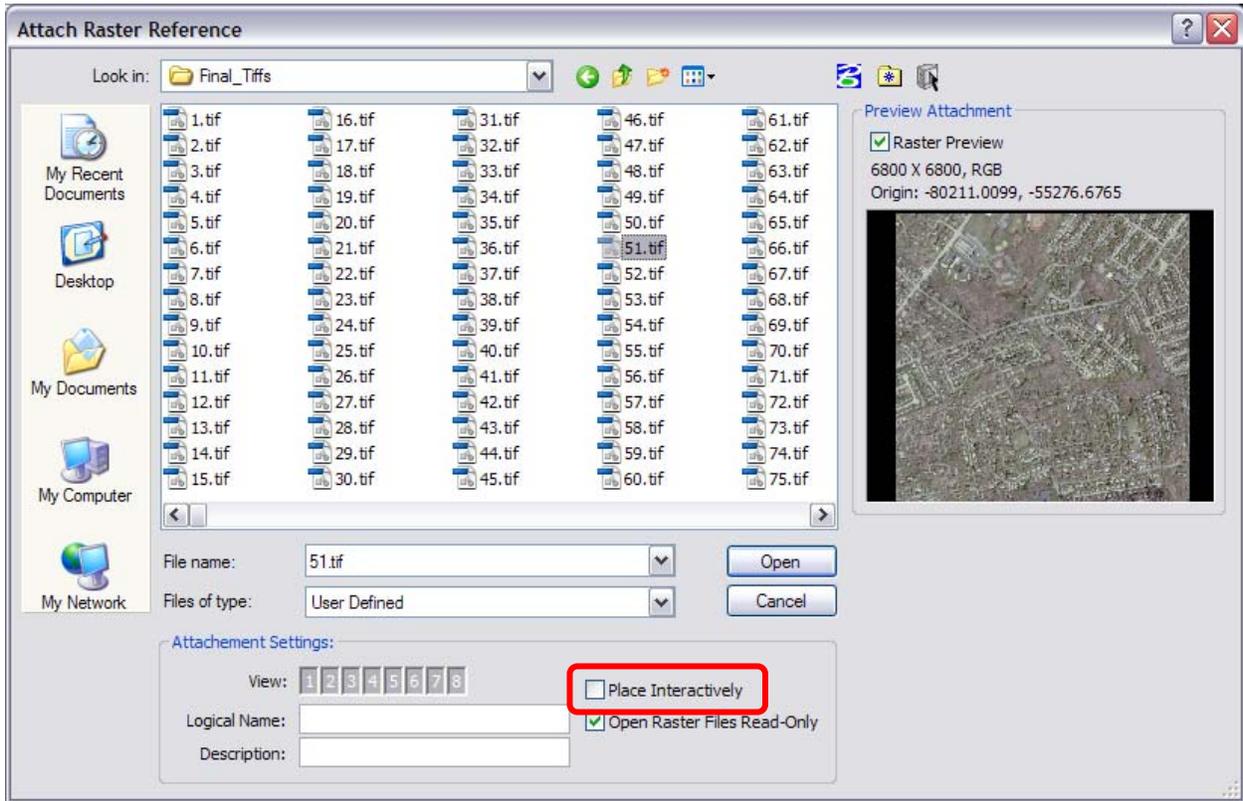
### **Aerial Imagery**

DelDOT maintains copies of aerial imagery files for the entire State of Delaware on the OIT Server located at \\dotsan02\apps\orthophotography. This server contains imagery files for the following years and file types:

- 1937 – Grayscale images.
- 1992 – Grayscale and infrared images.
- 1997 – Grayscale images.
- 2002 – High and low resolution grayscale and infrared files.
- 2007 – High resolution color files.

## Place Interactively

In most instances when attaching the aerial imagery files mentioned above to active design files it is recommended that the user leave the **Place Interactively** attachment method unselected to insure that the aerial file maintains the proper geographical position.



## Attaching Aerial Imagery for Presentation Purposes

In cases where the aerial imagery files located at [\\dotsan02\apps\orthophotography](#) are going to be used for presentation purposes it is recommended that the user follow the workflow list below when making the aerial file attachment.

- 1) Open the aerial file using Adobe Photoshop and convert the file to a .jpg format file. This conversion will reduce the image file from 250MB to approximately 35MB and will improve the overall speed of MicroStation when the file is attached.

Note: When attaching 1 to 2 image files to MicroStation, an **Image Quality** setting of “12 – Maximum” is recommended when converting the image files to .jpg format. If more than 2 image files are to be attached, the **Image Quality** may be reduced to improve the overall speed of MicroStation.

- 2) As part of the conversion process listed in step 1, the geographical location of the aerial image file has been modified. To insure proper placement of the converted file at time of attachment it is recommended that the user attach the original .tif file located in [\\dotsan02\apps\orthophotography](#) to establish the correct location of the image file.
- 3) Once the original image file has been attached, and the true geographical location has been established, the converted file can be attached. The key to insuring the converted file is attached correctly is selecting the **Place Interactively** attachment method at time of attachment. With this toggle turned on the user will be prompted to “**Enter Origin**” and “**Enter Corner**” for the raster attachment. At these prompts, tentative to one corner of the origin file boundary and then the opposite corner to set the limits.

Following this workflow will improve the speed and efficiency of MicroStation as well as allow for the use of the Active Element Transparency, which will not work correctly with large raster file attachments.

## **Chapter 7 - Plotting**

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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**

DelDOT produces plan sets in the following sizes:

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

### **Plotting Software & Hardware**

DelDOT uses the following software and hardware packages to generate full size and half-size plan sets:

- Software Application: eQuorum PRF Generator for MicroStation, Version 9.1.49
- Plotter: OCE 860 Plotter

## **Line Widths**

DelDOT 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 weight is 0 to 0.005-inch thickness and all elements whose weight is 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 following table.

<b>Element Weight</b>	<b>Thickness (Approximate Inches)</b>
WT = 0	0.005"
WT = 1	0.013"
WT = 2	0.018"
WT = 3	0.023"
WT = 4	0.028"
WT = 5	0.033"
WT = 6	0.038"
WT = 7	0.043"
WT = 8	0.048"

Due to the variations 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 **Design File & Plot Request File (PRF) Categories** section of Chapter 2.

The following pen tables are available on the DelDOT DRC website.

<b>Pen Table Name</b>	<b>Pen Table Use</b>
br.tbl	Plotting of Reinforcing Bar Summary sheets.
cp.tbl	Plotting of Construction Plan sheets.
cs.tbl	Plotting of Construction Phasing, MOT & Erosion Control sheets.
dp.tbl	Plotting of Detour Plan sheets.
dt.tbl	Plotting of Construction Detail sheets.
ec.tbl	Plotting of Environmental Compliance sheets.
gg.tbl	Plotting of Grades and Geometrics sheets
lg.tbl	Plotting of Legend sheets.
ls.tbl	Plotting of Landscaping sheets.
pf.tbl	Plotting of Profile sheets.
pn.tbl	Plotting of Notes sheet.
rw.tbl	Plotting of Right-of-Way sheets.
sg.tbl	Plotting of Signalization sheets.
ss.tbl	Plotting of Signing, Striping and Conduits sheets.
tc.tbl	Plotting of Construction Title sheets.
tr.tbl	Plotting of Right-of-Way Title sheets.
ts.tbl	Plotting of Typical Sections sheets.
ut.tbl	Plotting of Utility Relocation sheets.
xs.tbl	Plotting of Cross Section sheets.

## **Plot Request File (PRF) Attributes**

To ensure consistent plotting output the following MicroStation **View Attributes** should always be turned on when creating Plot Request Files: **Fill, Line Styles, Line Weights, Patterns and Text.**

The following MicroStation **View Attributes** should always be 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 (Plot, PDF, Cal, etc.). In previous versions of MicroStation where the 1 thru 63 level system was used it was relatively easy to list the levels that were to be displayed for each of the various sheet types (Ex: Construction Plans versus Grades & Geometric Plans).

Due to the limitless number of available levels in MicroStation XM and the dynamic nature of the display of each of these levels, DelDOT has opted to use the **DelDOT Menu Bar** to correctly handle the display of levels for each sheet type.

As mentioned in **Chapter 4 – DelDOT Menu Bar**, the settings contained in the DelDOT Menu Bar for each of the various sheet types is determined by the data contained within the *deldot\_levels.xls* file which is available on the DelDOT DRC website.

## **CAL File Requirements**

DelDOT requires that all contract plan sheet files generated for submission to the Department, whether for plotting or viewing purposes, be **200 dpi CAL Type 1** raster images. To ensure consistent plotting quality DelDOT will not accept CAL files that utilize different dots per inch (dpi) settings.

## Creating A Plot Request File (PRF)

Plot Request Files (PRFs) are used to generate either a paper copy or electronic copy of a project sheet file, via the use of the eQuorum Plotting application. To generate a PRF file, follow the workflow and settings listed below.

- Open the MicroStation design file that contains the graphics you would like to plot.
- Place a fence around the graphics or sheet border that is to be plotted.
- Choose **Applications > eQuorum Plotting > PRF Generator** from the MicroStation Menu Bar, and enter the following information into their respective fields.

The screenshot shows the 'eQuorum PRF Generator for MicroStation' dialog box. The title bar indicates the version is 9.1.49. The 'Active Cfg:' field is set to 'CONFIG DEFAULT'. The 'PRF Name:' field contains 'U:\Engineering Instructions\Details.prf'. The 'Queue:' field is empty. The 'Plotter:' field is set to 'CAL\_S\_PLANS'. The 'Pen Table:' field is set to 'G:\CADD\msv8\Pen Tables\Equorum\200DPI.d'. The 'Accounting:', 'Project:', and 'User:' fields are empty. The 'User:' field contains the text 'michael.balbierer'. The 'Plot Size Information' section includes 'Units: IN (Inch)', 'Copies: 0', 'Scale: 30', and 'Rotation: 0.000000'. The 'Size:' field is set to '10.10'. The 'Customization Options' section has 'View Number: F' checked and 'Named Views:' empty. The 'Creation Options' section has 'Create PRE' and 'Create+Submit PRF' buttons.

**PRF Name:** Enter the name of the PRF file and path where the PRF file will reside. Recommended PRF file naming conventions can be found in Chapter 2.

**Queue:** Leave this setting as “default”.

**Plotter:** Select the “CAL\_S\_PLANS” option from the plotter list.

**Pen Table:** Select the appropriate pen table for the type of sheet you are plotting (Ex: dt.tbl for plotting a detail sheet).

**Size:** Enter the sheet width, in inches, and then a comma (Ex: 34, ) and the height value will be filled in automatically.

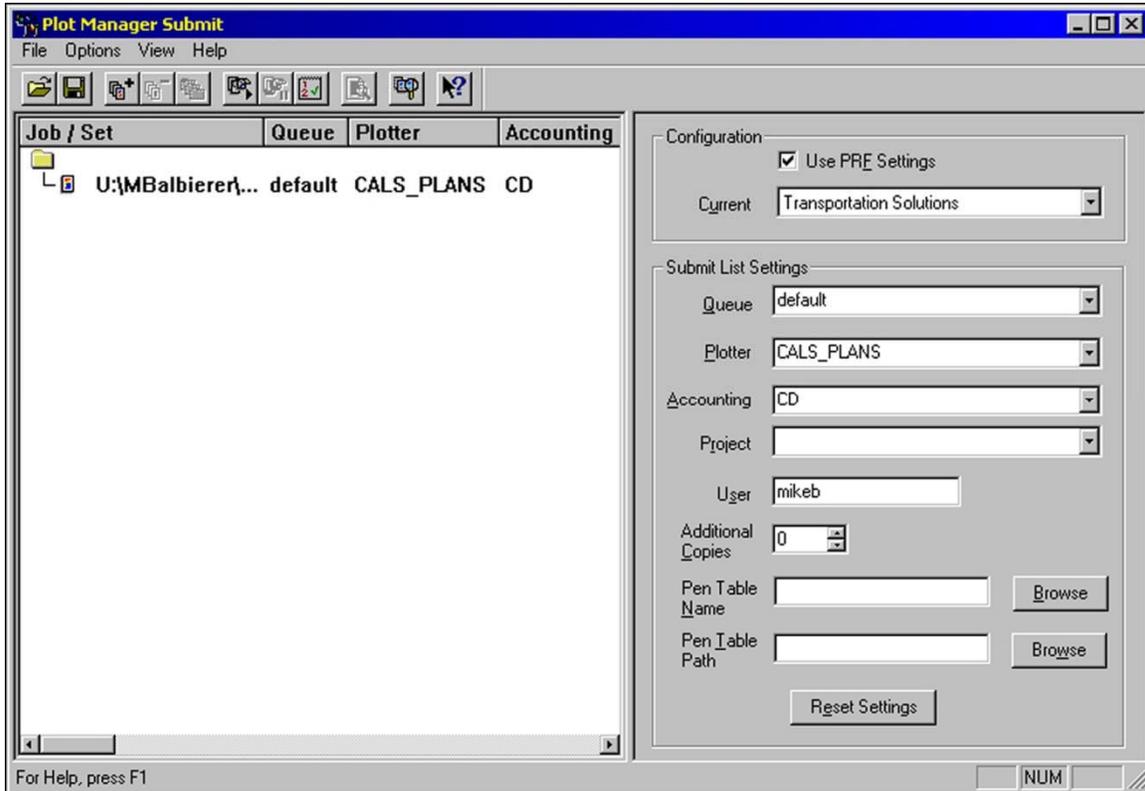
**Rotation:** Enter the angle that the sheet or fence is rotated from the positive x-axis. Angles measured counter-clockwise are to be entered as a negative angle.

- Select the Create PRF button to finalize the PRF creation process.

## Creating CALs, PDFs or Plots from PRF Files Using Plot Manager

Once a Plot Request File (PRF) has been generated there are multiple output files that can be created from this file such as CALs, PDFs or paper plots. To generate an output file, you must process the PRF file through the eQuorum Plot Manager application, using the following workflow and settings listed below.

- Choose **Start > All Programs > Plot Manager > Submit** and enter the following information into their respective fields.



### Plotter

**CALS\_PLANS** = This option creates a cal file from your prf file and places the new cal file in your user folder located on the T Drive (Ex: T:\Equorum\cal\michael.balbierer\CD\_xs.cal). Make sure you transfer these files to your project folder within 7 days or they will be purged from this location automatically.

**PDFMonoRaster200** = This option creates a 200DPI Black & White PDF file from your prf file and places the new Black & White PDF file in the bw folder located on the T Drive. The PDF file will be named as USER\_PRF NAME.pdf (Ex: T:\Equorum\pdf\bw\michael.balbierer\_xs.pdf).

## DelDOT CADD Standards Manual

**PDFColorRaster200** = This option creates a 200DPI Color PDF file from your prf file and places the new Color PDF file in the Color folder located on the T Drive. The PDF file will be named as USER\_PRF NAME.pdf (Ex: T:\Equorum\pdf\color\michael.balbierer\_xs.pdf).

**TS\_OCETDS600** = This option plots the selected prf file to the OCE plotter (Located on the 2<sup>nd</sup> Floor of the DelDOT Administration Building, in the South Project Development Section)

### Accounting

CD = Construction Plans

RW = Right-of-Way Plans

XS = Cross Sections

### Pen Table Name

If the “Use PRF Settings” box is not selected, then you will have to assign a Pen Table to be used when plotting your PRFs or creating a CAL/PDF file. Select the “**Pen Table Name**” browse button and select one of the available Pen Tables from the list that appears. If a list of Pen Tables did not appear when you selected the browse button, navigate to G:\CADD\msv8\PenTables\Equorum\200DPI and select a Pen Table.

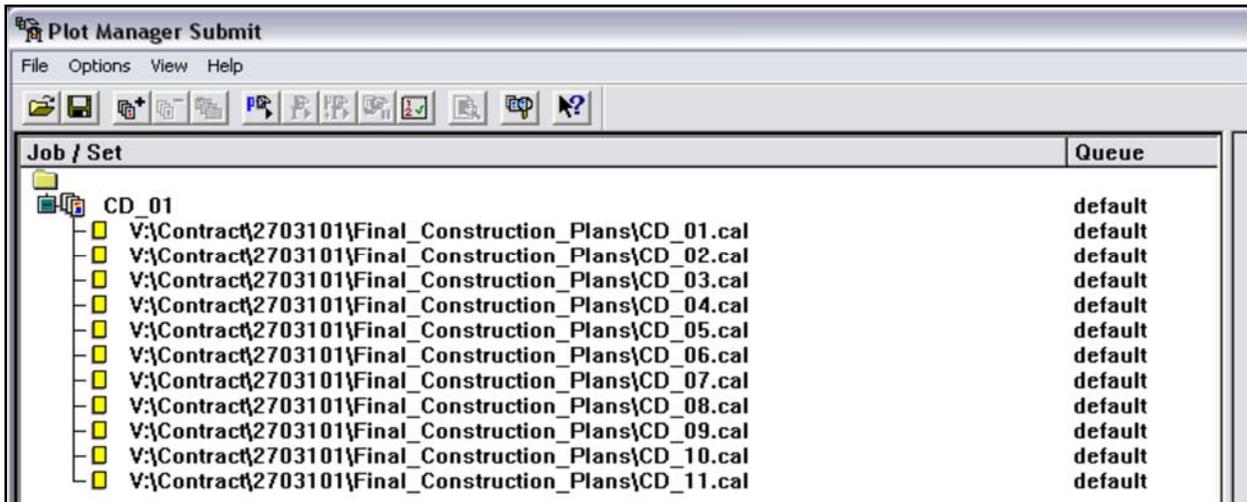
- Choose **File > Add Entry to List** and browse for the PRF file that you would like to convert into a CAL file, PDF file or print. Files can be also be placed directly into the “**Job/Set**” window area via a drag and drop operation using Windows Explorer.
- Highlight the PRF file(s) within the “**Job/Set**” window area and choose **File > Start Submit** to complete the conversion or printing process.

If you modify a “**Job/Set**” item (Ex: Changing a PRF file Pen Table), then you must highlight the file(s) within the “**Job/Set**” window and choose **File > ReSubmit** to refresh the data before choosing **File > Start Submit** to complete the conversion or printing process. (You can also right-click the highlighted item and choose “Resubmit” from the pop-up menu.)

## Multipage PDF File Creation from CAL Files

Multipage PDF files can be created from CAL files via Plot Manager using the following workflow and settings listed below.

- While in Plot Manager select PDFMonoRaster200 from the Plotter drop-down list.
- Drag and drop your CAL files into the Job/Set section of the Plot Manager.
- Highlight all of the files and select **File > Create Set In List**.
- Make sure the CAL files are in the proper order. If not they can be moved (drag/drop) to rearrange ordering of sheets if needed.
- Submit the job to create the multipage PDF file.
- The file will be placed on the T-Drive under the **t:\pdf\bw\** directory. The file will be named **<username>\_<firstfileprocessed>.pdf** regardless of the set name. In the example below the multipage PDF file will be named ***michael.balbierer\_CD\_01.pdf***.



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## **Appendix A – DeIDOT MicroStation Element Symbology Templates**

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Due to the dynamic nature of the deldot\_templates.dgnlib file, a PDF listing of DeIDOT MicroStation Element Symbology Templates can be found on the Delaware Department of Transportation's Design Resource Center web site at the following address:

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

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## **Appendix B - DelDOT Level Assignments**

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Due to the dynamic nature of the deldot\_levels.dgnlib file, a PDF listing of DelDOT Level Assignments can be found on the Delaware Department of Transportation's Design Resource Center web site at the following address:

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

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## **Appendix C – DelDOT Cell Libraries**

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Due to the dynamic nature of the DelDOT Cell Library files, a PDF listing of the DelDOT Cells can be found on the Delaware Department of Transportation’s Design Resource Center web site at the following address:

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