

# A Practical Guide for Using MicroStation XM

*Colorado Department of Transportation*

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CADD and Engineering Innovation  
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Version DRAFT



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This manual may be freely copied or distributed for the purpose of providing the Colorado Department of Transportation and Colorado customers a consistent guide to using the Bentley suite of products to meet CDOT's design and drafting standards.

**Software Versions**

The software products referred to in this publication are furnished under a license and may only be used in accordance with the terms of such license. This document intended for use with the following software versions:

MicroStation® version 08.09.04.88  
InRoads® version 08.09.02.16  
0209 – Version 04.00 CDOT Configuration

## Document Conventions

There are several conventions that are used throughout this document to indicate actions to be taken or to highlight important information. The conventions are as follows:

<b><u>Item</u></b>	<b><u>Meaning</u></b>
<b>View Perimeter</b>	a command name or a file that you are to select
<b>Tools &gt; Options</b>	a command path that you are to select – usually from the pull-down menus
<i>Document Name</i>	the name of a document that is not hyperlinked
<i>Emphasis</i>	style used when referring to important word or phrases
<a href="#">Hyperlink</a>	style used when you have a direct link to another document on the web
<b><i>Key in</i></b>	entering data with the keyboard
<i>Quote</i>	style used to indicate an external source quotation
<b>Note:</b> text	information about a command or process that you should pay particular attention to
1. Numbered Steps	actions that you are to perform as part of the lab activities
<b>&lt;D&gt;</b> or Data	press the data button on the mouse
<b>&lt;R&gt;</b> or Reset	press the reset button on the mouse
<b>&lt;T&gt;</b> or Tentative	press the tentative button on the mouse

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# Chapter 1 - Introduction to CDOT

## An Introduction to CDOT XM Configuration

This document outlines the Colorado Department of Transportation's (CDOT) standardized CADD procedures. Topics are covered in detail and curriculum has been developed providing a foundation for CDOT users to effectively learn. The material covered is structured as a project motivated learning experience modeled after CDOT engineering workflows.

The remaining sections of this document present the reference material for each subject with supporting lab work for the student.

### **Chapter Objectives:**

- Identify the Training Directory Structure
- Where to find MicroStation XM and InRoads XM reference material
- Where to find MicroStation XM and InRoads XM lab material
- Where to look for help

## Reference Material

CDOT has developed a reference material library for the CDOT user working with the Bentley MicroStation XM and InRoads XM software.

- A Practical Guide for Using MicroStation XM
- A Practical Guide for Using InRoads XM

### **A Practical Guide for Using MicroStation XM**

This guide breaks down the use of MicroStation XM into manageable modules placing emphasis on the CDOT workflow.

- ◆ Getting Started in MicroStation
- ◆ Levels
- ◆ Working in a CDOT 3D Design Model
- ◆ Creating a CDOT Project
- ◆ Creating Your Design Graphics
- ◆ Manipulating and Modifying Design Graphics
- ◆ Cells and Patterns
- ◆ Grouping Design Graphics
- ◆ Creating Sheets
- ◆ Annotating and Plotting Sheets

### **A Practical Guide for Using InRoads XM**

This guide breaks down the use of InRoads XM into manageable modules placing emphasis on the CDOT design workflows.

- ◆ Getting Started in InRoads
- ◆ Reports
- ◆ Typical Sections
- ◆ Roadway Modeling
- ◆ Surface Editing]
- ◆ Initial Geometry Procedures
- ◆ Cross Sections
- ◆ Volumes
- ◆ Initial Surface Procedures
- ◆ Defining Vertical Geometry
- ◆ Profiles
- ◆ InRoads Options
- ◆ Hydraulics
- ◆ Creating Plan Sheets
- ◆ Surface Fundamentals
- ◆ Other Helpful Tools
- ◆ Defining Geometry

## Lab Material

CDOT has developed a lab material library for CDOT user's working with the Bentley MicroStation XM and InRoads XM software.

- Labs for Using MicroStation XM
- Labs for Using InRoads XM

### Labs for Using MicroStation XM

Labs have been created for MicroStation XM placing emphasis on the CDOT workflows.

- Getting Started In MicroStation XM
- Levels
- 3D View Controls
- Creating the Project and Design Model
- Drawing Basics using the CDOT Menu
- Draw the Median Island Nose Section
- Place Guardrail Lines
- Create 3D Utility Graphics
- Create Landscape Graphics
- Create Hydraulics Graphics
- Draw a Bridge Typical Section

- Create Plan/Profile Sheet for the Intersection
- Create a Project Specific Border
- Create a 40-Scale Plan Sheet
- Create a Bridge General Layout Sheet at Different Scales
- Create a General Notes Sheets
- Create the Standard Plans List Sheets
- Create a Title Sheet
- Annotate the Intersection Plan/Profile Sheet
- Annotate the Bridge General Layout Sheet
- Printing to a Printer
- Batch Printing to PDF

## **Labs for Using InRoads XM**

Labs have been created for MicroStation XM placing emphasis on the CDOT workflows.

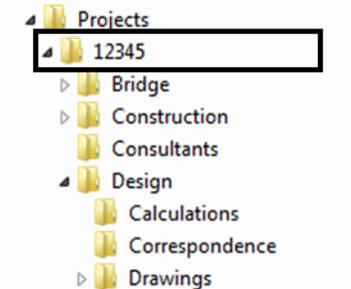
- Building Components
- Building Sections
- Modifying Templates
- Corridors & Template Drops
- Superelevation Wizard
- Point Controls, Secondary Alignments and Parametric Constraints
- Modifying Single Template Drops and Target Aliasing
- Creating Design Surfaces
- Cross Sections, Volumes and Reports
- Creating Plan Sheets

## **Training Directory Structure**

CDOT has developed a training directory structure replicating a CDOT project directory structure for use in all training. The directory has been designed so the top level (project) directory is used to designate the job project code. During training, the project code will be 12345. Sub-directories for each CDOT specialty group are included under the project directory.

## Training Directory Structure

All of the files for class are located in the **C:\Projects\12345** directory. This directory structure, as well as the file names used, conforms to the CDOT standards. More information on the CDOT directory structure and file naming convention is found in the **Creating a CDOT Project** chapter.



## How To Get Help

There are many resources available to assist you when working on your CDOT CADD project. These resources can be found on the **CDOT CADD & Engineering Innovation** website. See the **CADD Resources** chapter for detailed information on each of these options.

### **CDOT CADD & Engineering Innovation Website**

The CDOT CADD & Engineering Innovation Website is available at: <http://internal/cadd/>. It can also be found on the internet **CDOT website: Organizations > Projects Development > CADD and Engineering Innovation**.

The website provides CDOT users with up to date information, tools, and resources related to CADD.

This website is a valuable resource for CADD users and includes:

#### **CADD Library**

The **CADD Library** page provides links to manuals, newsletters, standard details, etc. One extremely useful link is to the **Tips and Tricks** section for MicroStation and InRoads.

#### **CADD Manual**

The **CDOT Computer Aided Design and Drafting (CADD) Manual** outlines CDOT's use of Bentley's MicroStation and InRoads software. It can be accessed several different ways including:

- ◆ From the Windows Start menu  
(**Start > All Programs > \_CDOT\_CADD\_Information > V09.08.XX-XM > Workflows**)
- ◆ From the CDOT Menu (**CDOT Help > Workflows**)

#### **Request & Support**

This page provides CADD help solutions where you can help, submit questions and requests, and obtain InRoads Survey and MicroStation support.

There is also a link to **IT Services** for hardware support, “how to” instructions, installation, training files, and dual monitor and work space setup.

## **CADD & Engineering Processes**

The CDOT CADD & Engineering Processes Website is available at: <http://www.dot.state.co.us/DesignSupport/CADD%20and%20Engineering%20Innovation/CADD%20Index.htm>. The website provides CDOT consultants with the latest MicroStation/InRoads configurations, CADD Workflows, manuals, training materials, resources, CADD detail library, CDOT Standards and Design Guides, and more.



### **Manuals, Training Materials, and Resources**

#### **CDOT CADD Manual**

#### **Training Materials**

##### **MicroStation 2004**

[CDOT MicroStation Essentials](#)

##### **MicroStation XM**

[Migrating CDOT Projects & MicroStation XM Update Guide](#)

##### **Redline**

[CDOT Redline Essentials](#)

##### **InRoads 2004**

[Roadway Design Using InRoads](#)

[InRoads Geometry Fundamentals](#)

[Advanced Roadway Modeling](#)

##### **InRoads XM**

[A Practical Guide for Using InRoads XM \(Draft Copy\)](#)

##### **InRoads ROW/Survey**

[InRoads Geometry for ROW and Row Plan Development Using MicroStation \(Document 1 of 2\)](#)

[InRoads Geometry for ROW and Row Plan Development Using MicroStation \(Document 2 of 2\)](#)

[InRoads Survey Date Reduction](#)

#### **ProjectWise XM**

[CDOT ProjectWise User Guide](#)

#### **CADD Training Curriculum**

[MicroStation Essentials](#)

[Traffic Workflow Using MicroStation](#)

[Roadway Design Using InRoads](#)

[InRoads Geometry Fundamentals](#)

[InRoads Geometry for ROW and ROW Plan Development Using MicroStation](#)

[InRoads Survey Data Reduction](#)

[Advance Roadway Modeling](#)

[Redline Essentials](#)

## **CADD Manager**

Contact the CDOT CADD Manager at [CADDManager@dot.state.co.us](mailto:CADDManager@dot.state.co.us) for additional help or questions.



# Chapter 2 - Getting Started in MicroStation

## Design File Basics

This Section identifies the basics of working in a MicroStation XM design file. This includes mouse mechanics, opening and navigating in a design file, toolbars, views, snaps, and how to get help.

### **Chapter Objectives:**

- Identify mouse settings and mouse mechanics
- Open an existing MicroStation design file
- Create a new MicroStation design file
- Navigate within a MicroStation design file
- Interface introduction
- How to get help

## Mouse Mechanics

There are three types of mouse “points” you can execute in MicroStation. These points correspond to the different buttons on the mouse.



**Data point <D>** - used to select tools, pull down menus, etc., identify coordinate locations, place and manipulate elements, or confirm actions before they take place. The left button is the default data button. Used when prompted to Accept.

**Reset <R>** - releases the current operation or rejects a highlighted element. The right button is the default reset button. Used when prompted to Reject.

**Tentative <D><R>** - used to temporarily locate a point in space or an element. Using the Data point and Reset buttons simultaneously is the default tentative mouse command.

### **Using the Mouse**

**Click** - tap the mouse button once.

**Double click** - tap the mouse button twice quickly.

**Snap** - locate an existing point on an element by using **tentative <D><R>**, then a **data point <D>** to accept.

## Wheel Mouse Settings

MicroStation XM supports wheel mice. You can set your middle wheel to perform several different view control options including zoom in/out, pan radial, pan with zoom, etc. \

There are CDOT default settings for the Wheel Mouse.

**Pan** - this works the same way as most software packages. Once you have clicked the middle button, you get the little hand symbol and while you hold down on the left button the view can be moved or pulled around.

**Note:** This WILL NOT WORK if you override the tentative button settings.

**Double Click** - this will expand the viewing area to include all elements within the design file that are currently turned on.

**Roll** - by rolling the mouse ball, the user can **Zoom In** and **Zoom Out** of the current view.

**Alt + Roll** - used to Pan Left and Pan Right.

Default configuration settings can be changed by selecting **Workspace > Preferences > Mouse Wheel**.

## Starting MicroStation

To start MicroStation on the Windows platform:

- From the Windows Start Button, select **Start > All Programs > Bentley > MicroStation V8 XM > MicroStation V8 XM Edition**.

or

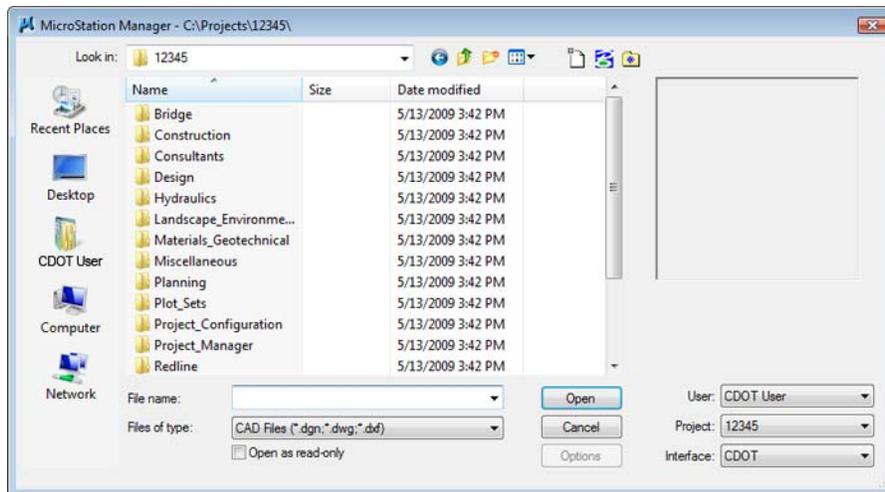
- **Double-click** on the **MicroStation V8 XM** icon located on your desktop.



MicroStation will start and the **MicroStation Manager** dialog box will appear on your screen.

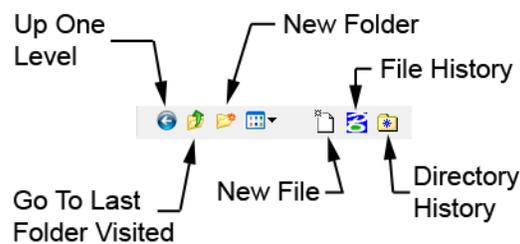
## The MicroStation Manager

The **MicroStation Manager** is your file management interface to MicroStation.



By default, a MicroStation design file has an extension of **.dgn**. “Design file” is a generic term used to describe all MicroStation files, regardless of their use - design, drafting, etc. In addition to MicroStation XM DGN files, you can also open previous version MicroStation files and AutoCAD files (**.dwg** or **.dxf**). This is designated under List Files of Type drop down.

Use the MicroStation Manager icons to move within folders, create a new folder, change the default MicroStation Manager look, create a new file, compress a file, and see past directory history.



In the Workspace category, select

**User:** Your login name

**Project:** Your project name - this is the same as your JPC number

**Interface:** **CDOT** for the customized CDOT interface settings

For **Training purposes** your workspace settings will be:

**User:** **CDOT User**

**Project:** **12345** (the JPC for this class)

**Interface:** **CDOT**

**Note:** A more detailed discussion of the CDOT Workspace, which is set with the Project and Interface options, will take place in the “*Creating a CDOT Project*” chapter.

## Opening a MicroStation Design File

To open a MicroStation design file:

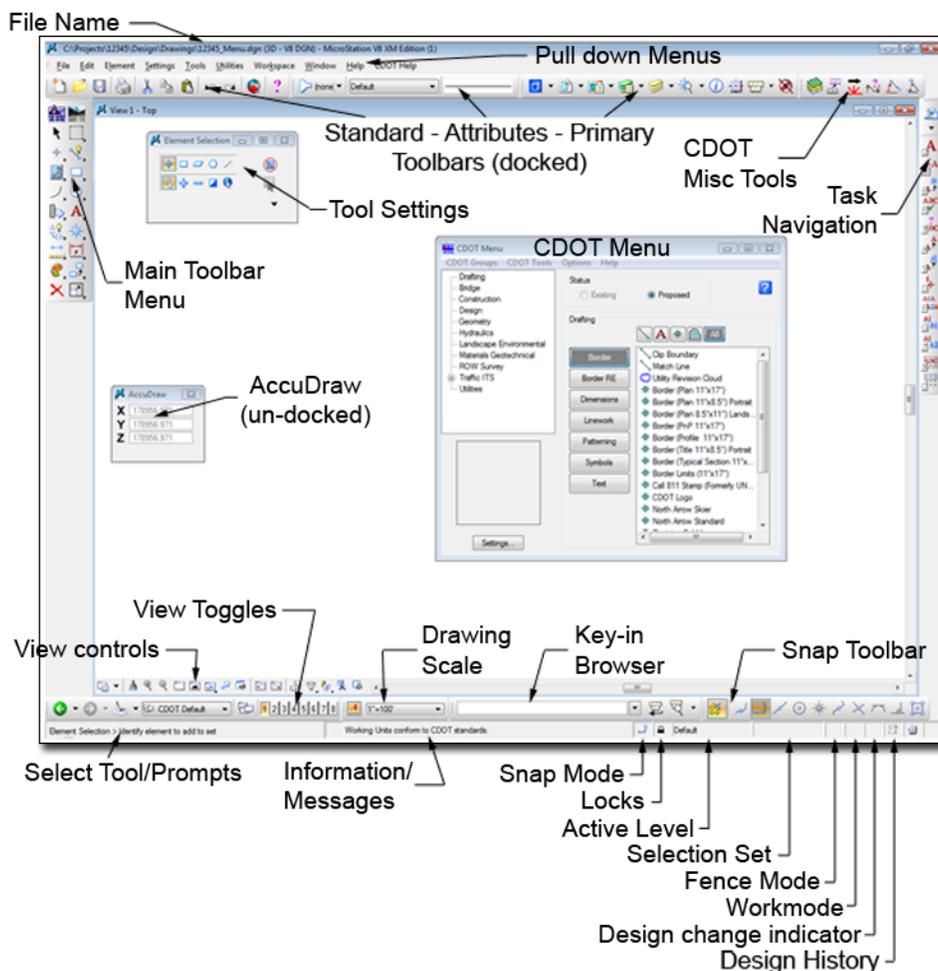
- Set **Look in:** to the drive containing your file
- Navigate to the correct directory

Set **Files of type** to **All files (\*.\*)** (or to the type of file you wish to open)

- **Click** the file name to highlight the file
- Click the **Open** button to open file

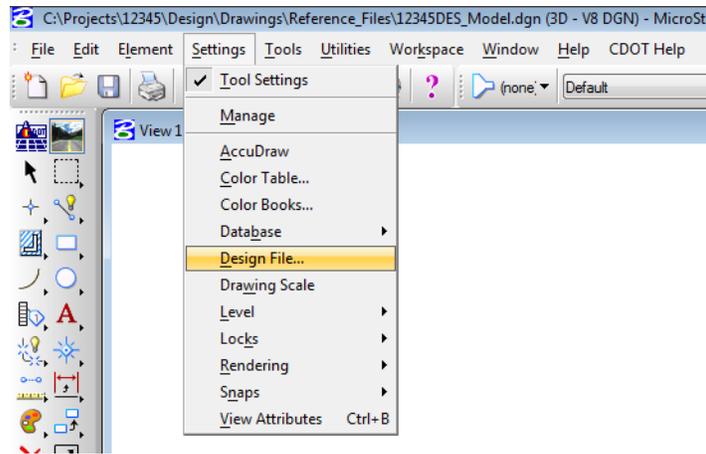
**Note:** MicroStation design files have a default extension of **.dgn**, but can have any extension.

## The CDOT Default MicroStation Interface



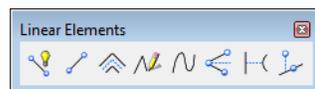
## MicroStation Interface Sections

### Pull down menus

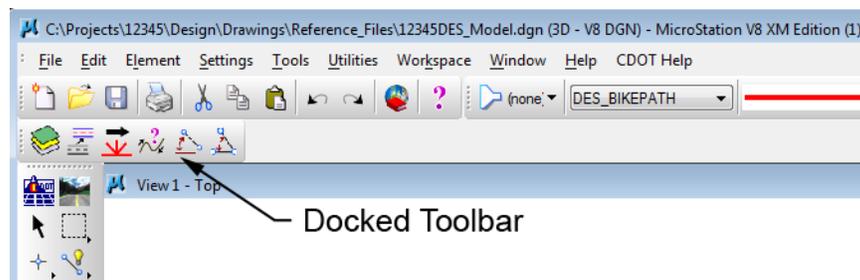


- ◆ Pull down menus are used to access MicroStation toolbars, settings and dialog boxes.
- ◆ An arrow next to a pull-down command indicates sub-menu options.
- ◆ ... Indicates a dialog box to open.

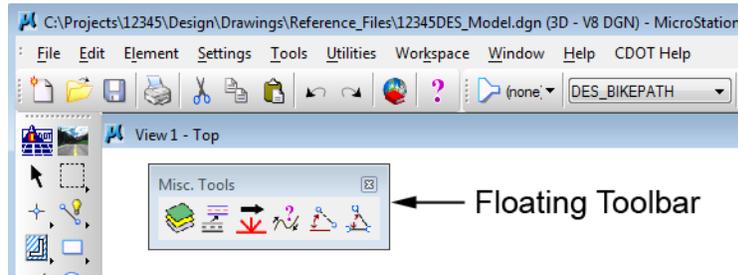
### Toolbars



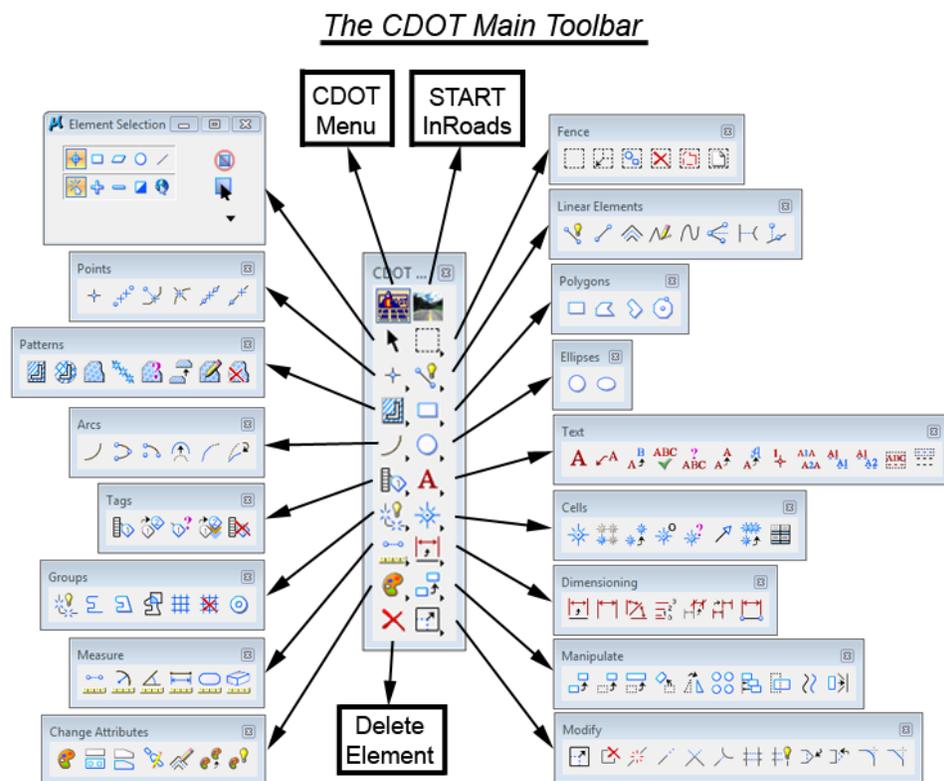
- ◆ MicroStation's tools for creating and manipulating your design elements are organized into logical groupings called toolbars.
- ◆ Each tool is represented by an icon on its toolbar.
- ◆ Toolbars can be opened, closed and moved around the screen like dialog boxes, views and the command window.
- ◆ Toolbars can be **"docked"**,



- ◆ Or **“floated”** within the drawing workspace.

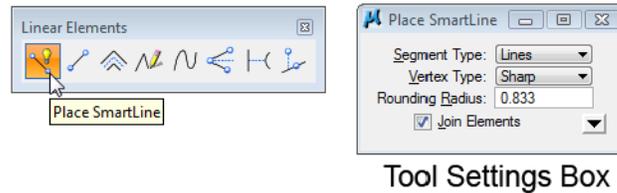


- ◆ Most toolbars can be accessed from the menu or from the **Main** toolbar.



- ◆ The **CDOT Main** toolbar opens automatically when you start MicroStation. If you close the **CDOT Main** toolbar and want to re-open it, select **Tools > Tool Boxes** from the command window, or type **CTRL T**.
- ◆ This opens up **Tool Boxes**. Tool Boxes is where you access all toolbars.
- ◆ Select **CDOT Main - Custom** to reopen the **CDOT Main** toolbar.

## Tool Settings



Tool Settings Box

- ◆ Many tools have parameters or settings associated with them, which are shown in the **Tool Settings** dialog box. Each time you select a new drawing tool, the optional settings will appear in the **Tool Settings** box.

## The Primary Toolbar



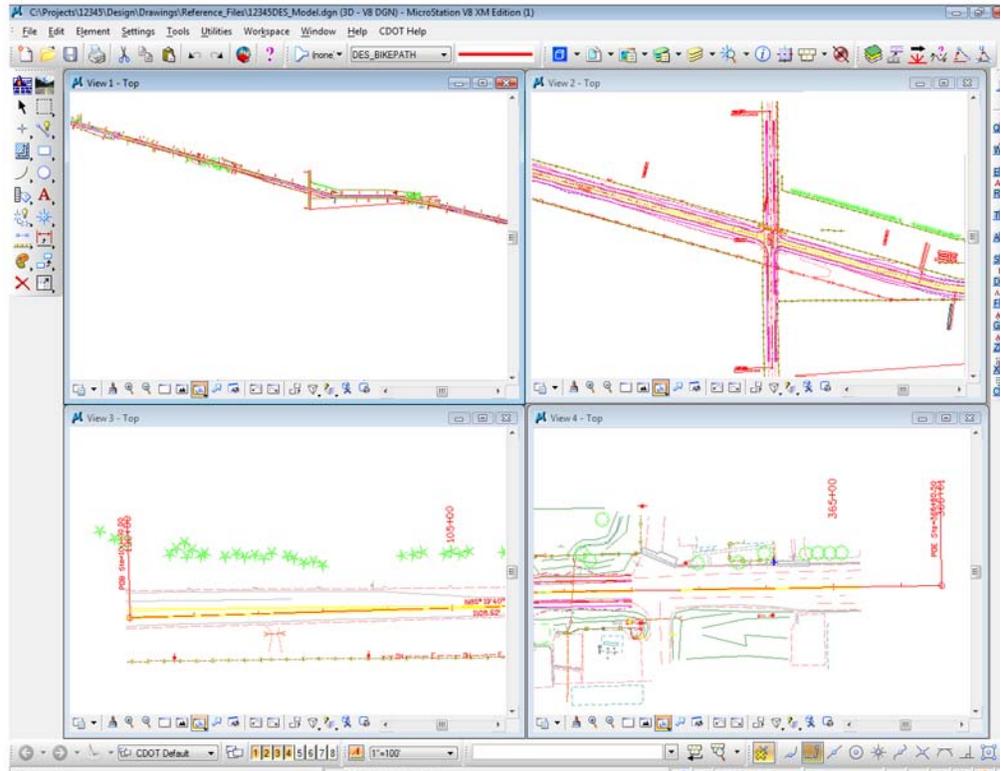
- ◆ The **Primary** toolbar contains commonly used MicroStation tools.
- ◆ This is on toolbar you'll frequently use, so you will probably want to open and dock it.
- ◆ Select **Tools > Primary** to toggle on the Primary toolbar.

## The Key-in Browser Box

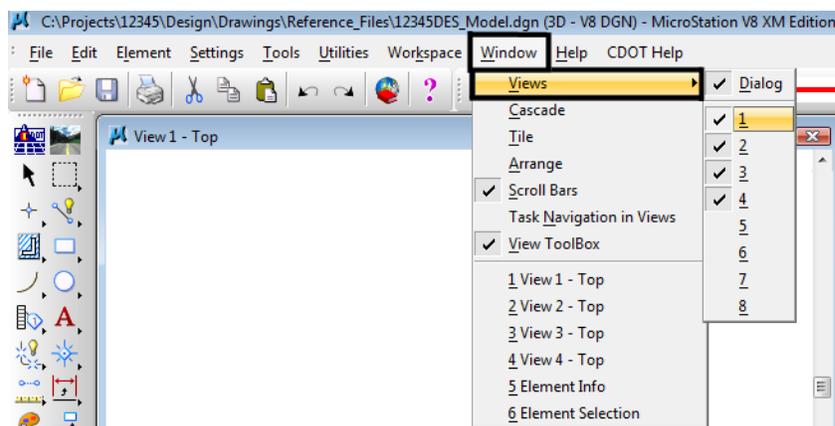


- ◆ Many MicroStation commands can be accomplished by keying in the command text (e.g. **Place Line**).
- ◆ Key-ins can also be used to input data (e.g. **XY=<x,y,z>** to locate a coordinate).  
**Note:** Key-ins are **not** case sensitive.
- ◆ This is another toolbar you'll frequently use. Select **Utilities > Key-in** to open, then dock the box.
- ◆ When you're ready to key in a command, set the focus in the Key-in box by data pointing in it.
- ◆ After you key in the command, use the **<Enter>** or **<Tab>** key to activate the command.

## Views



- ◆ The area where graphics are placed is called a view.
- ◆ Up to eight view windows can be opened.
- ◆ Open and close views from **Window > Views** or the **Views** dialog box.
- ◆ You can set different view perspectives (top, front, rotated, *etc.*).



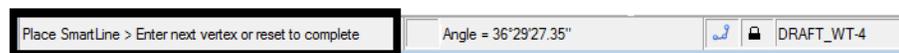
You can also select **Window > Views > Dialog** to open the View Groups toolbar where you can quickly turn views on or off.



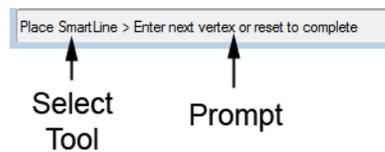
- ◆ You can use the control buttons in the upper right-hand corner to maximize, minimize or close a view.

### Status Bar

The Status Bar is MicroStation’s command center composed of the following areas (left to right):



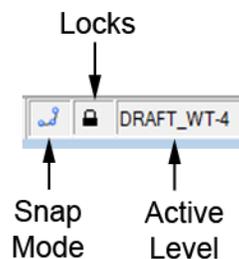
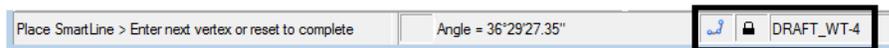
- ◆ **Select Tool** - displays the name of the active drawing tool.
- ◆ **Prompt** - displays the next user operation needed by MicroStation.



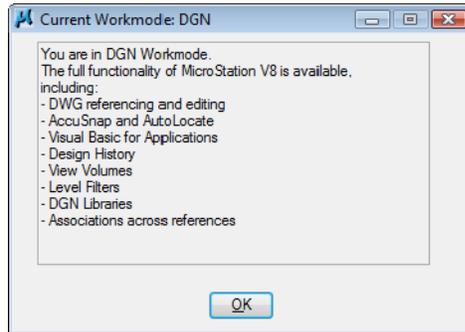
- ◆ **Information and Messages** - displays current element parameter settings, error messages, etc. A data point **<D>** in this area activates the **Message Center**.



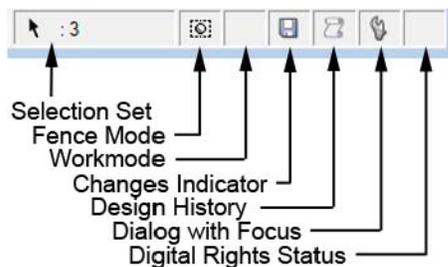
- ◆ **Snap Mode** - displays the active snap mode used in conjunction with a tentative point or AccuSnap.
- ◆ **Locks** - displays a list of locks that you can toggle on/off.
- ◆ **Active Level** - displays the current level on which graphics are placed. A data point **<D>** in this area activates the Level Manager.



- ◆ **Select Set** - displays number of elements in the current selection set. A data point <D> in this area activates selection set commands.
- ◆ **Fence Mode** - displays the active fence mode setting. A data point <D> in this area allows you to change the active fence.
- ◆ **Workmode** - a data point <D> in this area displays the current Workmode - DGN, V7, or DWG.



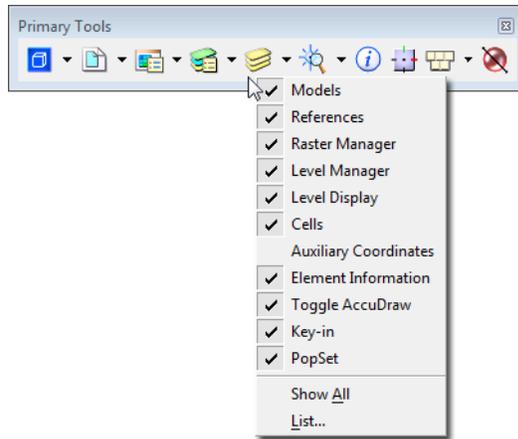
- ◆ **Changes Indicator** - if a diskette icon  is shown, the file has been modified since opened. If the icon shows a "X" , it means the file is read only.
- ◆ **Design History** - if the icon is dimmed , Design History is not initialized. If Design History is initialized without committed changes, the icon will include a pencil .
- ◆ **Dialog with Focus** - indicates what is controlling the input focus. These include Home , Tool Settings , Key-in , AccuDraw , or nothing.
- ◆ **Digital Rights Status** - File is not protected or signed.



Many of these concepts will be covered in complementary modules.

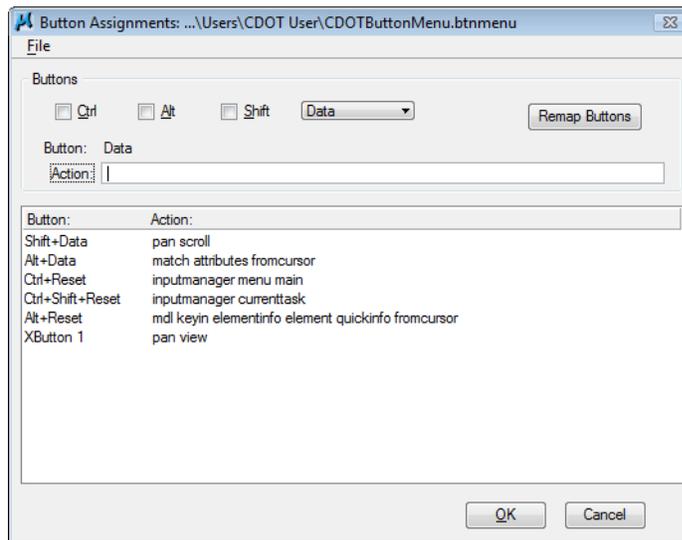
## Show/Hide toolbar options

You can select which tools you want to include on any toolbar. This helps streamline your toolbars for the way you work and lets you customize your MicroStation setup.



To show/hide tools, **right click** on any toolbar and toggle the tools on/off as desired. The changes are stored in your MicroStation Workspace.

## Controlling the mouse



By default, the left mouse button is the **Data** button, the right is the **Reset** and the left and right together is the **Tentative**.

**Note:** The middle button has been set to be the scroll wheel by default.

You can change these button assignments by selecting **Workspace > Button Assignments**.

## View Control toolbar

The **View Control** toolbar is located by default in the lower-left corner of the MicroStation interface. The horizontal and vertical scroll bars also help you move around in the view. To use the **View Control** toolbar and scroll bars, turn on the options under **Workspace > Preferences > View Options**. To show the scroll bars, turn on **Scroll Bars on View Windows**. To show the view toolbox settings, turn on **Show View Toolbox** and set the location from the pull down menu.



Use the following View Control tools as follows:

- ◆ **View Attributes** - to set view attribute settings.



- ◆ **Update View** - to update a view (refresh or redraw).



- ◆ **Zoom In** - to increase the magnification of a view by Zoom factor.



- ◆ **Zoom Out** - to decrease the magnification of a view by Zoom factor.



- ◆ **Window Area** - to increase the magnification of a view by drawing a “box” around the area you want to see close up.



- ◆ **Fit View** - to show all displayable elements in a view.



- ◆ **Rotate View** - to rotate the view (top, front, etc.)



- ◆ **Pan View** - to move around in the view (up, down, left, right, etc.)



- ◆ **Walk** - to interactively walk through a 3D model.



- ◆ **Fly** - to interactively fly through a 3D model.



- ◆ **Navigate View** - to interactively navigate a 3D view.



- ◆ **View Previous** - to step back through view operations.



- ◆ **View Next** - to step ahead through view operations.



- ◆ **Copy View** - to copy the contents from one view to another.



- ◆ **Change View Perspective** - to change the Perspective Angle.



- ◆ **Set Display Depth** - to set the Display Depth of a view.



- ◆ **Set Active Depth** - to set the Active Depth of a view.



- ◆ **Show Display Depth** - to see the Display Depth of the active view.



- ◆ **Show Active Depth** - to view the Active Depth of the view.



- ◆ **Camera Settings** - to adjust the Camera in a 3D view.



- ◆ **Render** - to Render the contents within the active view.



- ◆ **View Display Mode** - to set the Display Mode.



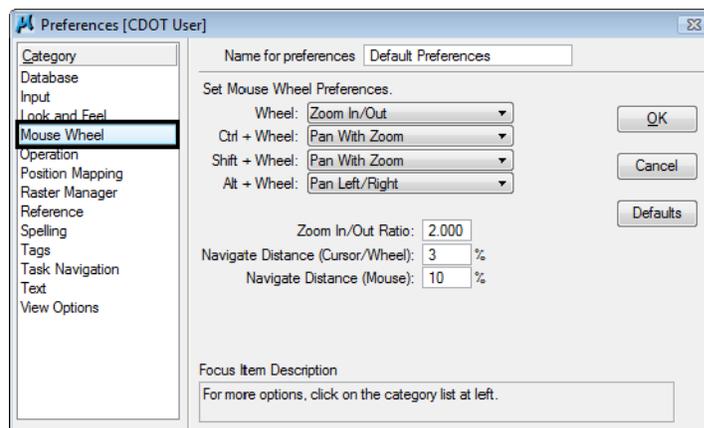
- ◆ **Clip Volume** - to apply Clip Volume to a view.



- ◆ **Clip Mask** - to apply Clip Mask to a view.



You can set your middle wheel to perform several different view control options including zoom in/out, pan radial, pan with zoom, *etc.* These options are set under **Workspace > Preferences > Mouse Wheel**.

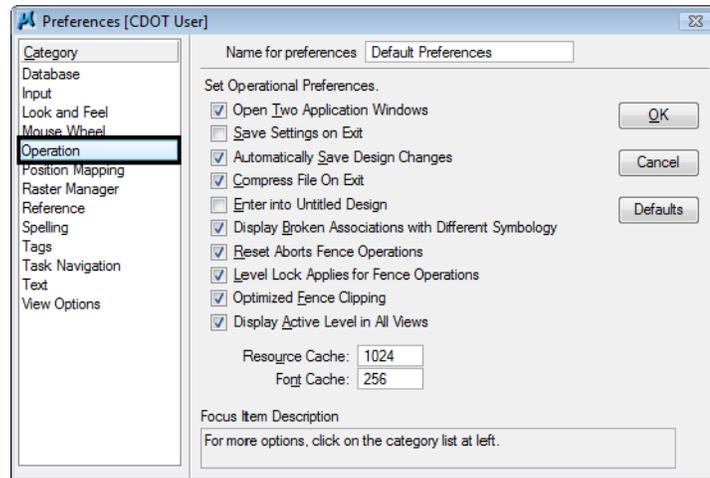


### Setting Views for dual monitors

The default CDOT MicroStation workspace is set up to recognize dual monitor machines. However, in case these settings are changed, follow the steps below to reset this feature.

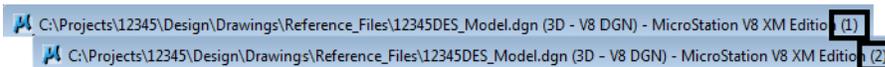
- **Start** MicroStation

- Select **Workspace > Preferences > Operation** and toggle on **Open Two Application Windows**.



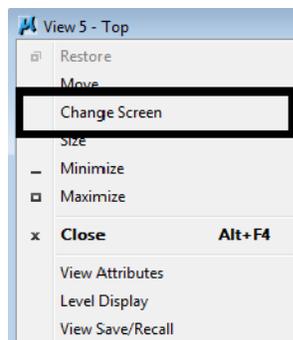
- Select **File > Save Settings**
- **Exit**, then restart MicroStation

When MicroStation starts this time, it will open two different windows.



You can drag one window to the second monitor. (**Click on the title bar and drag the window - don't stretch it**). When you maximize the window, it will fill the screen, but remain on the monitor where you placed it rather than trying to span the monitors. In MicroStation, Views 1-4 open in application window 1, while Views 5-8 open in application window 2.

You can drag most MicroStation windows from one monitor to the other, but there are some that will not allow dragging. If you run into one, pick the Bentley logo in the upper left corner and choose Change Screen to move the dialog box or menu to the other screen.





# Chapter 3 - Levels

Levels help you separate graphics in the design file and for plotting. By placing your graphics on different levels, you can easily control what graphics to display by turning the appropriate levels on or off. Levels are synonymous with layers in AutoCAD.

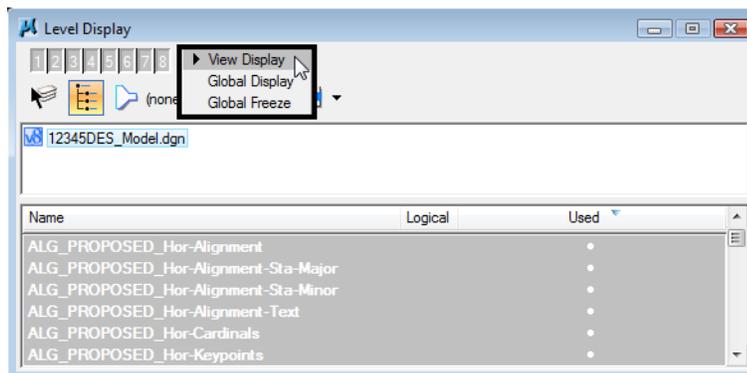
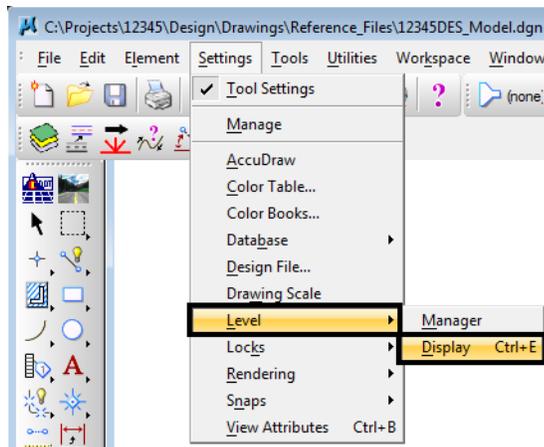
By using a standard level structure defined in your CADD standards, you can create a logical design file. Everyone in the organization knows exactly what graphics are on what level by referring to the CADD standards. This improves the CADD workflow efficiency.

Levels are named and numbered and you can then turn levels on or off by name or number. There is no limit to the number of levels you have in a design file.

The level on which you place graphics is known as the **active level**. When you set a level active, it is automatically turned on.

## Using the Level Display box

Access **Level Display** from **Settings > Level > Display** or from the **Primary** toolbar.



The **Level Display** is used primarily to turn levels on and off in the views selected. You also have the option to turn levels on or off by selecting an element (**right-click <R>** on a level or **click** the **Change Level** button).

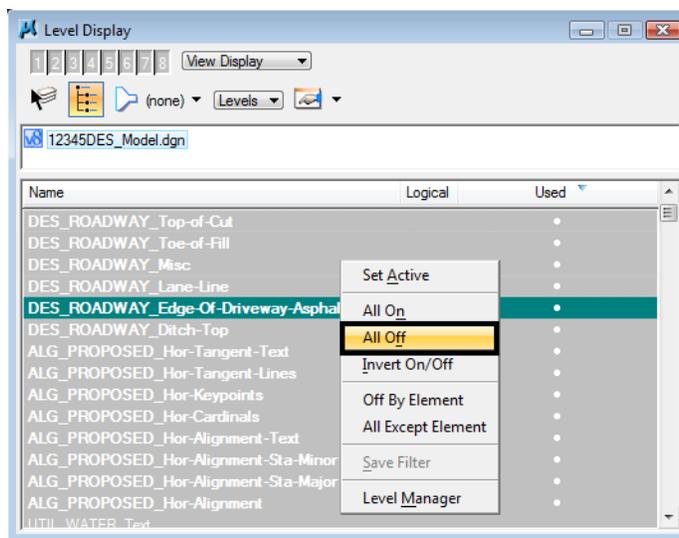
There are three display modes:

- **View Display** – turns levels on/off in the chosen view(s).
- **Global Display** – turns levels on/off in all views.
- **Global Freeze** – elements in selected view(s) are not displayed, cannot be plotted and graphics cannot be placed on a frozen level.

**Note:** you can also turn levels on or off with the following key-ins:

- ◆ **on=<level name or number >**
- ◆ **off=<level name or number >**

**Note:** **<D>** and drag across levels in **Level Display** to select multiple consecutive levels or use **<Ctrl>** to select non-consecutive levels. **Right-click <R>** on any level name to quickly turn all levels off/on.

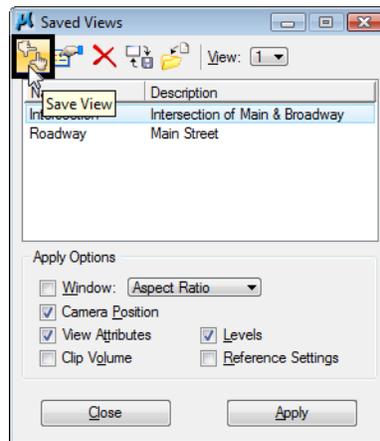


## Saved views

Once you have defined a view's parameters (area of display, levels, etc.), you can save the view for recall later. For example, you can **Zoom In** on an intersection, turn on all necessary levels and then save the view. Then, no matter where you are in the design file, or what levels you've turned on or off, you can always return to the intersection saved view with the appropriate levels turned on.

**To save a view, either:**

- Access the **Saved Views** dialog box from **Utilities > Saved Views** and use the **Save View** icon.



- Or, use the **sv=<view name,description >** key-in (e.g. **sv=intersection**)

You can later recall the save view from the **Saved Views** dialog box or use the key-in **vi=<view name >**.

## Working with Level Libraries

So, where do the levels come from? Levels are obtained from a level library. A level library is a master template of levels, which is attached to your active design file. Libraries can be separated by type: (Bridge, Roadway Design, Survey, etc. Users can then attach multiple level libraries to an active file.

### CDOT Level Libraries

CDOT level libraries are attached as a file type DGNLIB. A DGNLIB file is the same format as a DGN file (they can be opened just like a DGN file in MicroStation) but with a .dgnlib extension. Typically there are no graphics in a DGNLIB file – just level setups. DGNLIB files can also be used to store text styles and dimension styles.

The following CDOT level libraries (DGNLIB files) are currently available:

1. Alignments
2. Bridge
3. Construction
4. Drafting
5. General
6. GIS
7. Hydraulics
8. Landscape and Environmental

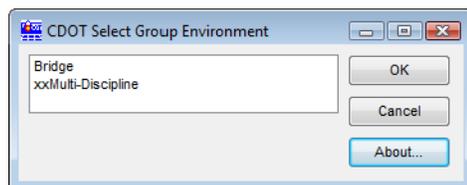
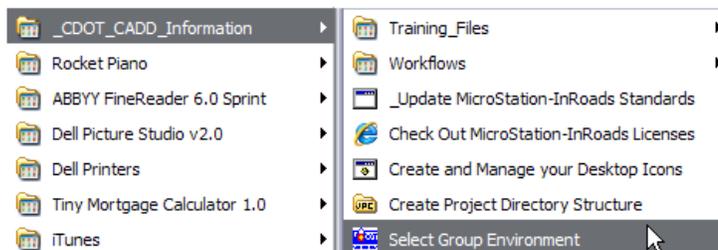
9. Materials and Geotechnical
10. Roadway Design
11. ROW
12. Survey
13. Topo
14. Traffic
15. Utilities

## CDOT Select Group Environment

The CDOT discipline-specific DGNLIBs are automatically attached via the **CDOT Select Group Environment** program. When attached, levels from the library are available for use in the active design file. When graphics are placed on a level from the library, the level is copied from the library into the active design file.

Access the Select Group program from the `_CDOT_CADD_Information` program group on your computer's Windows Start menu (Start > All Programs > `_CDOT_CADD_Information` > Select Group Environment). This program provides you two options: Bridge and xxMulti-Discipline. The Bridge option will attach only those libraries necessary for the Bridge specialty group. All other groups will choose the xxMulti-Discipline option, which attaches all level libraries so you can work across disciplines.

Level libraries selected via the CDOT Select Group Environment will be automatically attached to any design file opened with MicroStation after running the program. You only have to run the utility again if you need to switch groups.



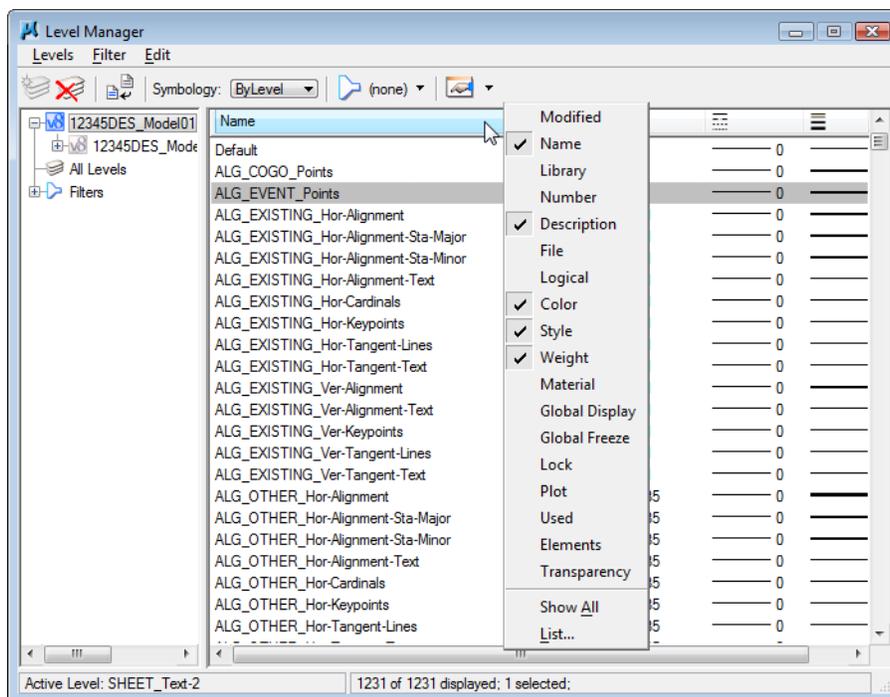
## Using the Level Manager

The Level Manager is used to set level properties (name, description, number, display, plot, symbologies, etc.) and is located next to Level Display on the Primary toolbar.



You can also access Level Manager from **Settings > Level > Manager**.

The Level Manager shows a list of all levels attached and the library the level is in. Additional information can be displayed by right-clicking in the column headings and turning columns on/off – information such as the level number, description, and its ByLevel Symbology.

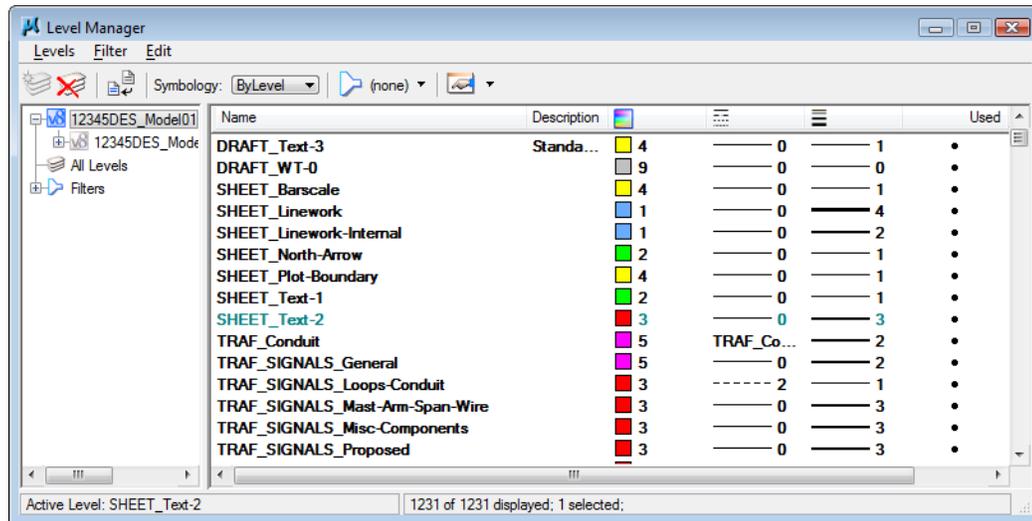


### **ByLevel symbology**

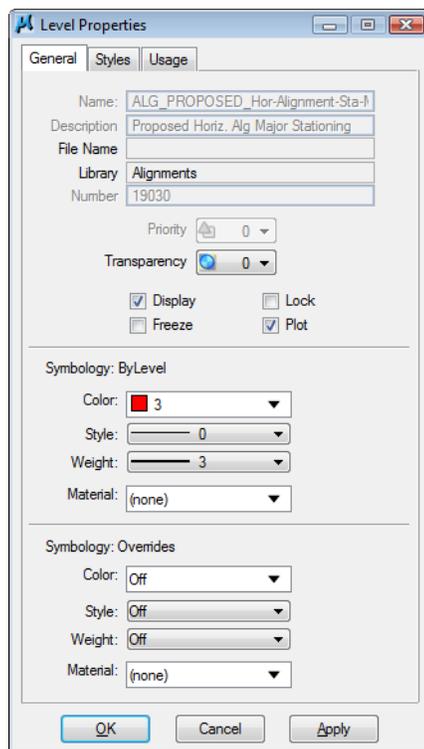
**ByLevel** symbology is the color, line style and line weight assigned to a level. When graphics are placed on that level, the elements take on the level's symbology. The combination of naming levels and using **ByLevel** symbology is a good way to ensure CADD standards are maintained.

**Note:** CDOT has established **ByLevel** symbology for all its standard levels to conform to CDOT CADD standards. The **ByLevel** symbology is stored with the level in the level library. You should not change the **ByLevel** Symbology.

You can review a level's **ByLevel** symbology by turning on the appropriate columns in the **Level Manager**.

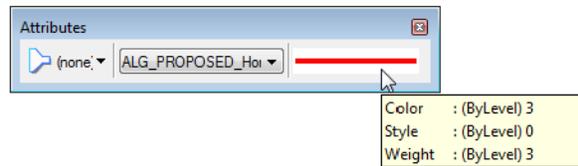


You can also obtain level properties by selecting **Level>Properties** from the **Level Manager**.



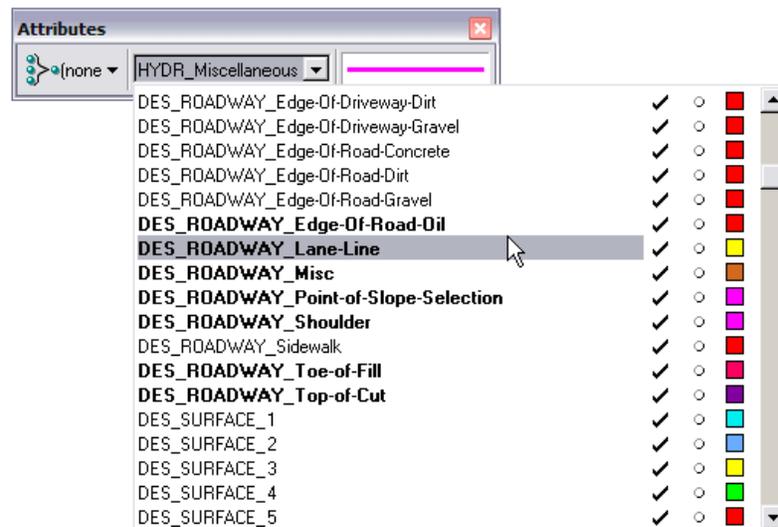
The **Attributes** toolbar is where you can set the **Active Level** (the level on which you will place graphics), which in turn sets the **ByLevel** symbology for the graphics. After making your selection, the **Attributes** toolbar shows you a preview of the **ByLevel** symbology for that level. Hold your cursor over the symbology preview for a description of active color, style and weight.

**Note:** Unless you have specific reasons or permissions not to, you should **always** use **ByLevel** symbologies when creating elements.



**Note:** The CDOT menu automates the process of setting the proper level and ByLevel symbology for drawing elements.

The Attributes toolbar provides other useful information. In addition to showing the active level, it also shows if the level is turned on/off (global setting – all views), if it is locked (graphics on the level can not be deleted or modified), and the ByLevel color.

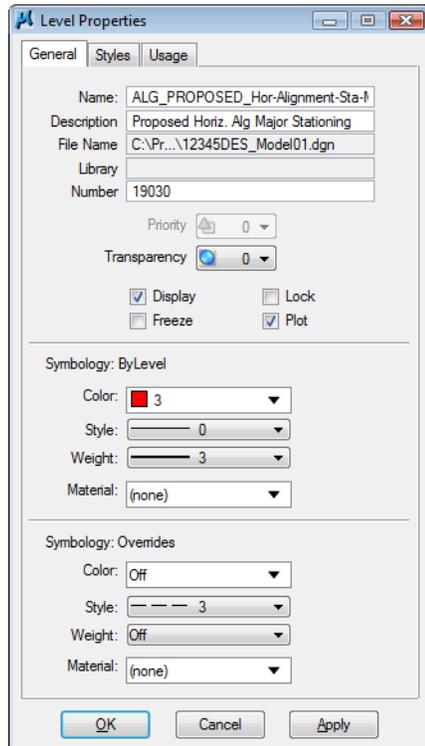


### Setting Symbology Overrides

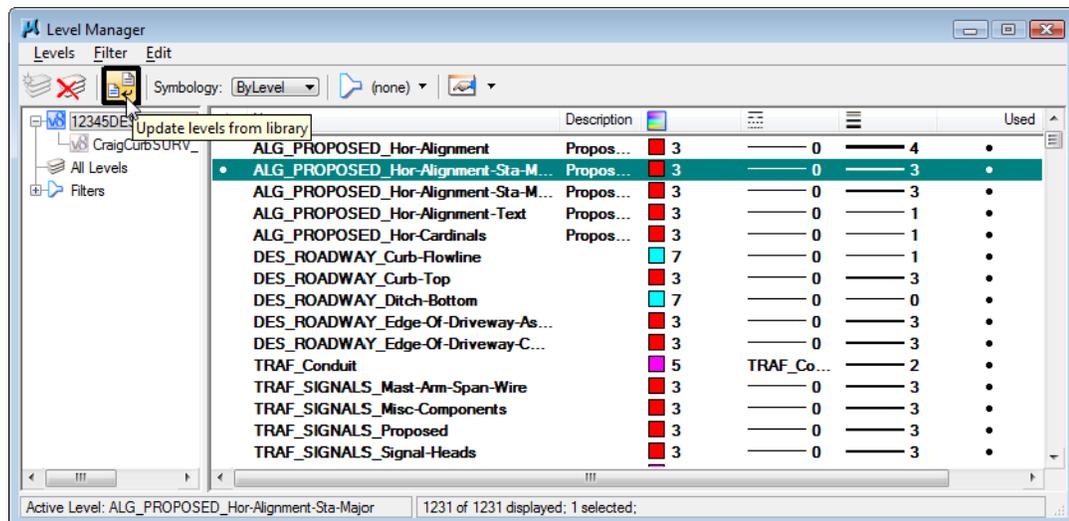
The **Level Manager** is also where you set level **Symbology Overrides**. You can set a different symbology for each level. For example, you may want to “dither out” (to show faintly, typically using a gray color) graphics on a specific level before plotting by setting color, style and weight to 0.

**Note:** If you need to override the **ByLevel** symbology of an element for a special plot, for example, you should do so by setting the **Symbology Overrides**. Do not change the **ByLevel** symbology.

Set **Symbology Overrides** under **Level > Properties**.



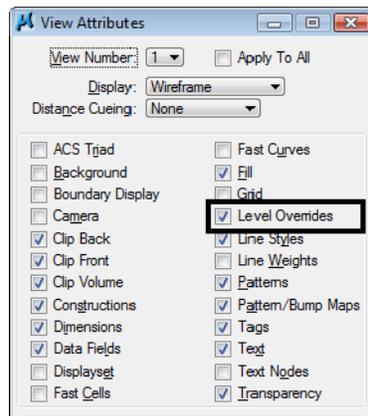
After setting symbology overrides (or if the ByLevel symbology has been changed), a dot appears in the **Modified** column beside the level to let you know that has been changed from the library standards. To synchronize the level back to the library standards, select Update Levels from Library.



## View Attributes and Symbology Overrides

The **View Attributes** box (**Settings > View Attributes**) is where you tell MicroStation what you want to see (or not see) in a view. For example, you can turn all text in the view on or off. You can also turn off line weights (thicknesses) or line styles (solid, dashed, etc.) to show all graphics the same. If you have set **Symbology Overrides** in the **Level Manager**, you have to turn on **Level Overrides** in **View Attributes** before the override takes affect.

Symbology Overrides only affect how graphics are displayed (the element attributes are not changed, just temporarily overridden), whereas ByLevel symbology actually sets or changes the element's attributes.



**Note:** More information on how to set up shaded color and grayscale printing is available in the *Annotating and Plotting Sheets* chapter.

## Working with Level Filters

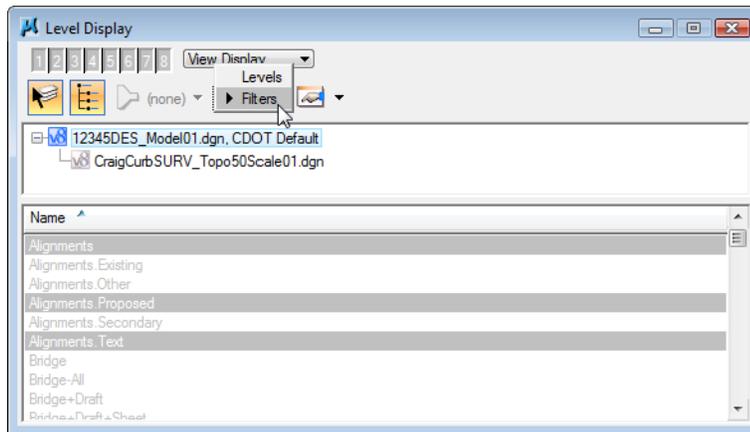
Level filters are named groups of levels that can be turned on or off as a group (e.g. all road design levels, all survey levels, all topo levels). You can filter on many criteria (name, number, etc.) to create the groups.

### CDOT filters

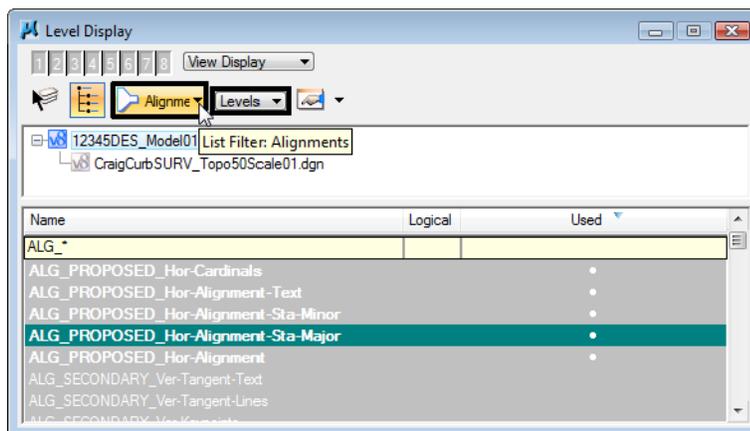
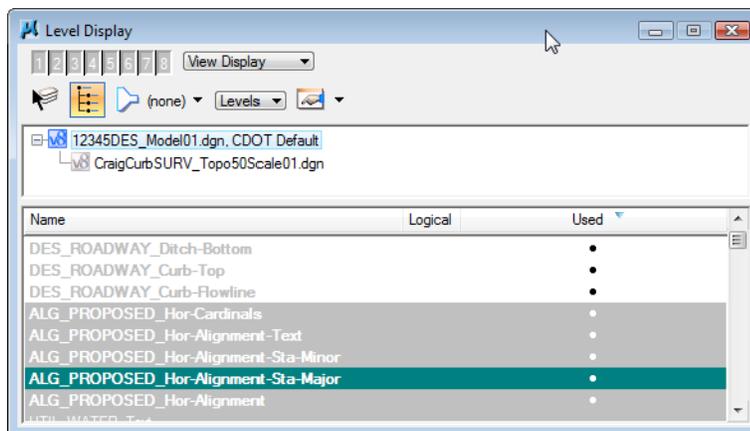
Several pre-defined CDOT filters are available for your use. These filters are obtained from the various discipline-specific CDOT level libraries attached via the **Select Group Environment** program. The filters have been defined based on logical groups of levels that you normally work with (e.g. **Cross Section**, **Profiles**, **Surface** for the Design group, **Existing**, **Easements**, **Ownership** for the ROW group.)

### Setting filters

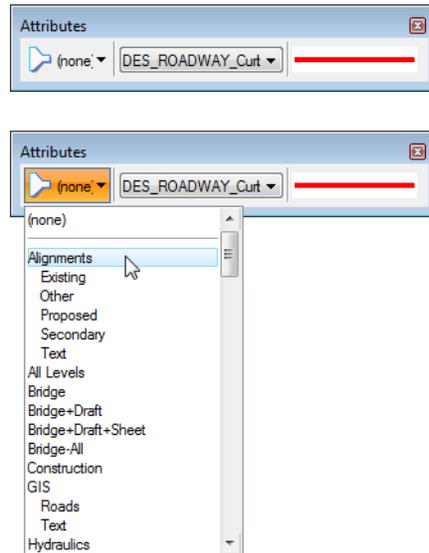
Use **Level Display** to turn the filters on or off. Set the **Show** option to **Filters**, and then select the filter from the list. This turns the entire group of levels on/off.



When working with levels, it is often easier to work with just a subset to quickly find a level to set active or turn on/off. In this case, you can “filter down” your levels by setting the Show Option to Levels and then changing the List Filter option from (none) to the desired filter.



Filters can also be set on the Attributes toolbar when setting the active level.

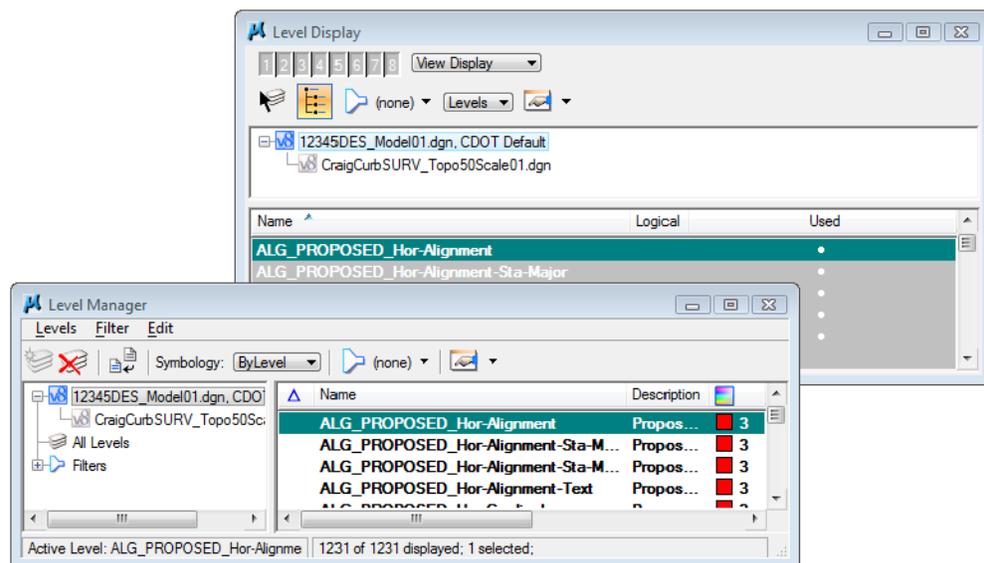


## Setting the active level

The active level is the level on which you will place graphics, using the level's ByLevel symbology. There are many ways to set the active level including:

- ◆ **Double-clicking <D><D>** the level in **Level Display**
- ◆ **Double-clicking <D><D>** the level in **Level Manager**
- ◆ **Right-click <R>** in the Level Manager and choose **Set Active**
- ◆ Using the **lv= <name or number >** key-in
- ◆ **Selecting** the level from the **Attributes toolbar**

The active level appears highlighted in the Level Display and Level Manager boxes.





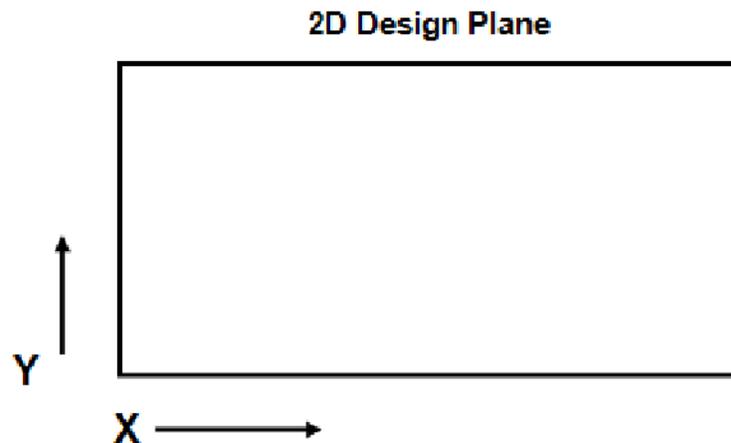
# Chapter 4 - Working in a CDOT 3D Design Model

This chapter covers the difference between working in 2D and 3D model, and the 3D concepts you need before moving on to InRoads or other 3D applications.

## 2D vs. 3D

### ***2D design plane***

In MicroStation, you can create either 2D or 3D models within a design file. In a 2D model, the working area is known as the ***design plane***. A 2D design plane is similar to drawing on a sheet of paper. You have an X (horizontal) and Y (vertical) axis and all graphics placed in the 2D file are “flat”.

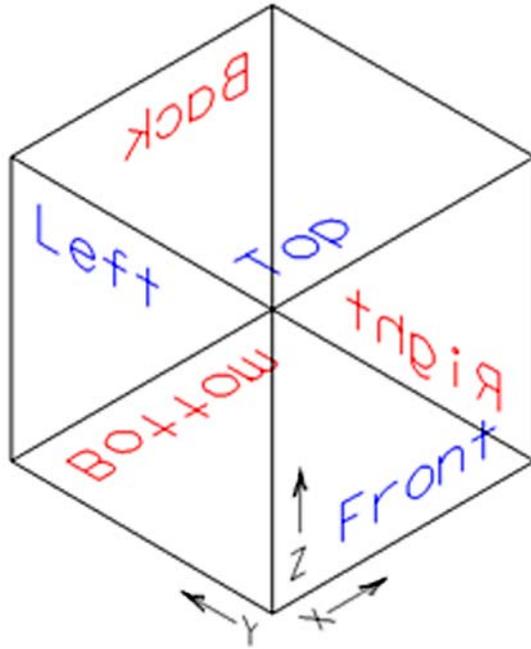


You can rotate the 2D design plane about its perpendicular axis (the Z axis coming out of the screen).

### ***3D design cube***

In a 3D model, your work area is called the ***design cube***. You’re working in a volume of space with 3 axes — X, Y and Z. When you place elements, you can place them not only in the correct horizontal (X, Y) location, but also in the correct vertical (depth or Z) location to create a true 3D model of your design.

In the design cube, different view orientations can be set. These include: Top, Bottom, Front, Back, Right, Left, Isometric, and Rotated.

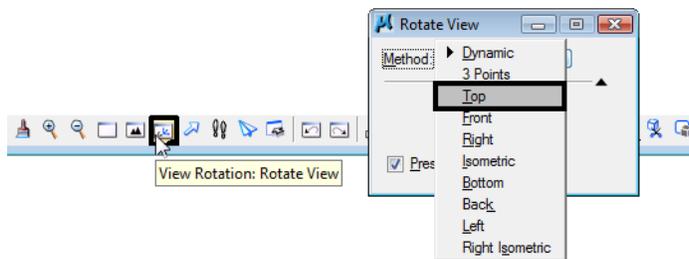


Think of a view as a camera location that's taking a snapshot of your design. When you rotate a view, you're **not** rotating **graphics**. Instead, you're rotating the camera position (or the orientation) of how you're looking at the graphics.

Each "face" of the design cube is a standard view (Top, Front, etc.) In addition you can set an isometric view and you can rotate any view about the X, Y or Z-axis. For most civil drafting and design work, the top view is synonymous with the **plan** view and the **front** view is synonymous with the **elevation** view.

Set view orientations by using either:

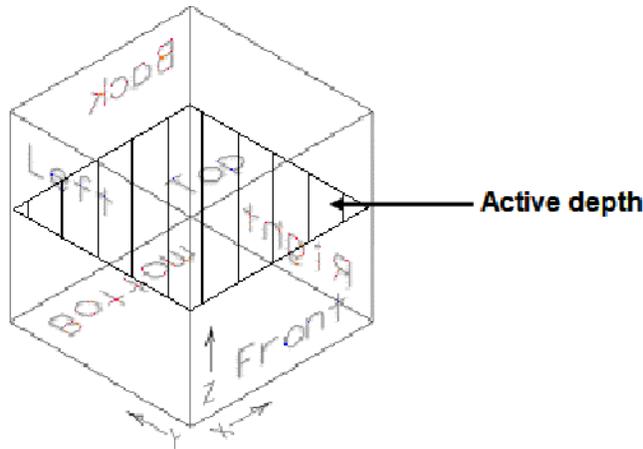
- ◆ The Rotate View command on the View Controls toolbar



- ◆ The **vi= <view name >** key-in (e.g. **vi=top**).
- ◆ The **rv= <x,y,z>** keyin to rotate a view about the x, y and /or z axis (e.g. **rv=,, -30** rotates a view 30 degrees clockwise about the z axis).

## Using Active Depth

When working in a 3D design model and placing graphics in a view, at what depth are the graphics being placed? They are placed at the active depth. The active depth is a plane, parallel to your view screen, on which you're placing elements. For example, if you are creating a topo map and manually drawing the 5000-foot contour in the top view, you first set the active depth for the top view to 5000, and then draw the contour.



### To set a view's active depth:

- Key in **az=<depth>**.
- **<D>** to select the view of interest.

The active depth is view dependent. Therefore, you must tell MicroStation which view you're setting the active depth in by data pointing in the view.

**Note:** For most civil work, you'll set an active depth in the top (plan) view. The active depth is then the elevation at which you're placing graphics. If you switch to a Front view, you'll see the elements at the different elevations.

**Active depth** is synonymous with the term **active z**.

### To check a view's current active depth:

- Key in **az=\$**
- **<D>** in the view of interest

The current active depth is displayed in the message field.

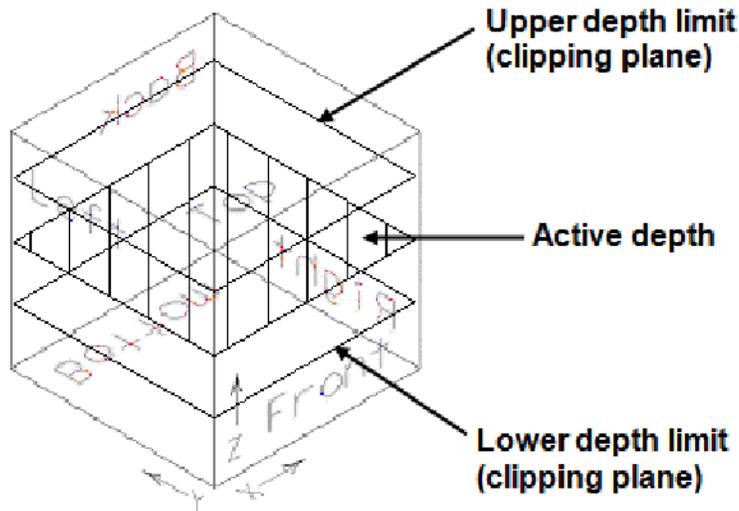
Show Active Depth > Select view

View 1: Active Depth=0.000

**Note:** Use the delta key-in **dz=<depth>** to move the active depth by the delta <depth> amount, then **<D>** in the view. Multiple data points change the depth each time.

## Using Display Depth

**Display depth** is the depth range or the “slice” of the design cube in which elements are visible. You set the display depth by specifying an upper and lower depth (elevation) range for the view.



To set a view's display depth:

- Key in **dp= <lower depth, upper depth>**
- **<D>** in the view of interest

**Note:** Like active depth, display depth is also **view dependent**. So you have to tell MicroStation which view you're setting the display depth range for by data pointing in the view (the top view in most cases). This allows you to have different display depths in different views.

### Display Depth tips:

- Display depth limits are also known as the view's **clipping planes**.
- A view's active depth is always within its display depth range (i.e. you can not set an active depth outside the display depth).
- Use the key-in **dd= <delta lower depth, delta upper depth>** to expand the display depth by the delta amount. This moves the display depth as specified from its current location.
- The **Fit** command automatically changes a view's display depth (expands or shrinks to fit elements currently turned on in the view).

**Note:** If you can't see graphics in a 3D model, they may just be outside your display depth. Fit your view as a quick check.

- The current active and display depth settings are saved when you save settings (**File > Save Settings**). This determines the default depth when you open a design file.

**To check a view's display depth:**

- Key in **dp=\$**.
- **<D>** in the view of interest

The view's current display depth is displayed in the message field.

Show Display Depth > Select view

View 1: Display Depth=-1000.000,15000.000

## CDOT 3D Seed File Defaults

The CDOT default settings for active and display depth are set in the CDOT 3D seed files for each specialty group.

### **Active Depth**

The CDOT default setting for active depth is **0**.

### **Display Depth**

The CDOT default setting for display depth is **-1000, 15000**.



# Chapter 5 - CDOT MicroStation Workflow

Now that you are comfortable working in a MicroStation design file, you are ready to learn how CDOT specifically uses MicroStation in the project process. This section concentrates on how CDOT creates model file graphics by utilizing the CDOT Menu. It also covers the sheet file creation process. Once your sheets are created, you will learn how to annotate, dimension and plot the sheets.

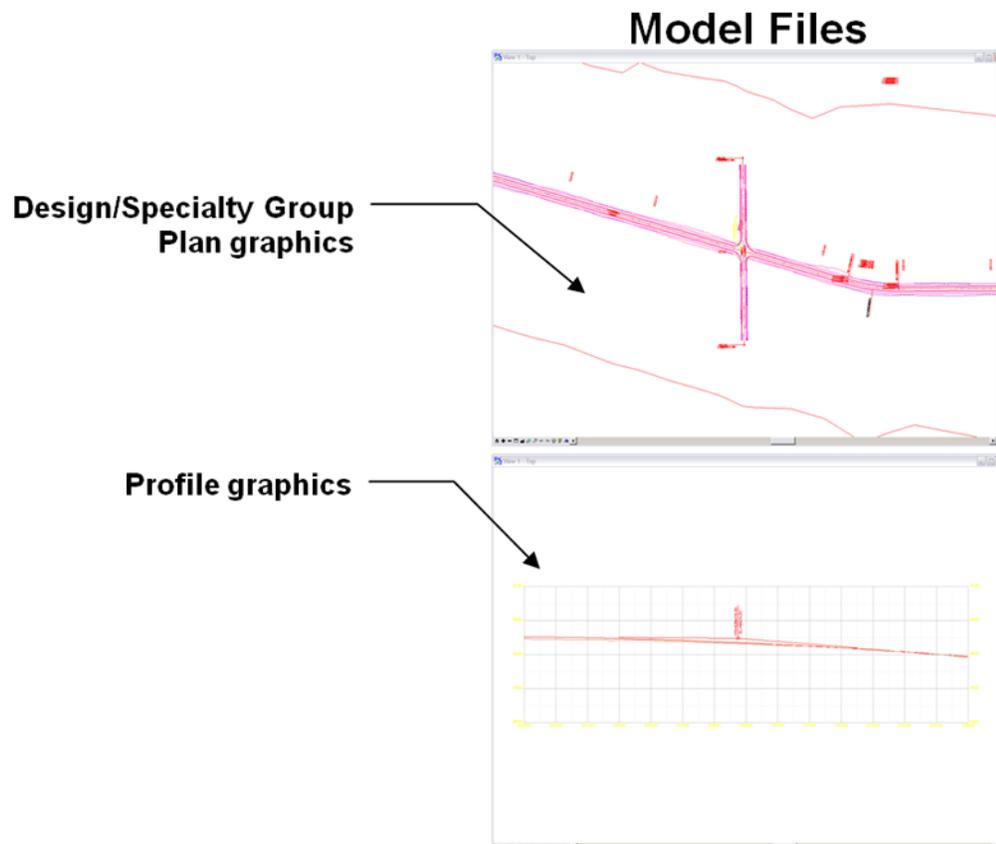
## Creating a CDOT Project

This chapter is a general overview of the entire CDOT workflow to complete a CADD project using MicroStation. You will learn how to set up a CDOT project and create your design model file and reference other discipline's files.

### CADD Workflows

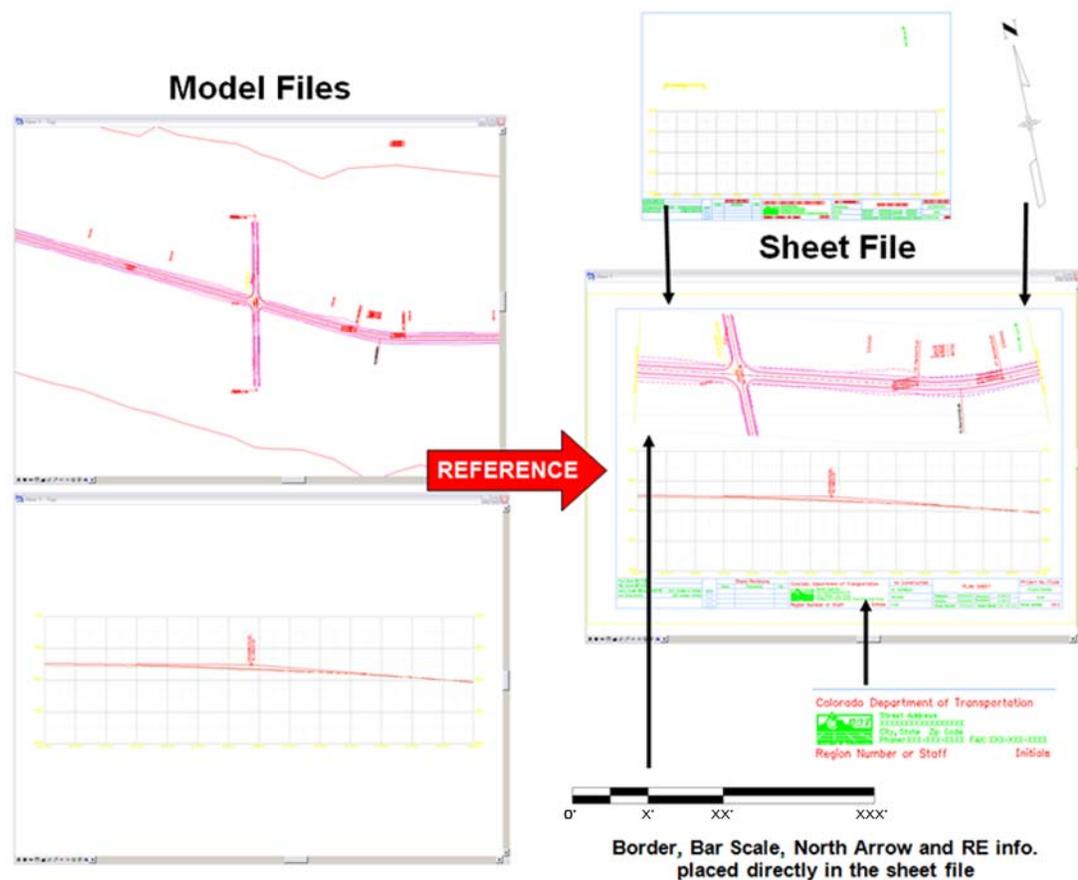
#### *Model files vs. Sheet files*

To understand how CDOT uses MicroStation for design and drafting, you first need to understand the difference between Model files and Sheet files. **Model files** contain the design graphics. These are the working files for your design. Each group has at least one Model file, but can have multiple model files for different types of graphics. For example, the Roadway Design group can have a model file for plan graphics and another model file for profile graphics. The Traffic group may have separate model files for signs, signals and lighting.



**Sheet files** are the files that will be plotted for the creation of a plan set. **Sheet files reference model file graphics.** A reference is just a MicroStation file attached to your active file (the file you have opened). You can reference multiple model files to create a sheet file. For example, a Bridge general layout sheet may reference the existing survey/topo model, the proposed roadway design model and the proposed bridge model to show all of the needed information on the sheet. A Plan Profile sheet (shown below) references the proposed roadway design model and the profile model.

Sheet files typically do not contain design graphics since they are referenced in from the model files. You can't modify the model file reference graphics in a sheet file; they are there for information only. The sheet files, however, do contain the border and associated information (bar scale, north arrow, *etc.*) along with text and dimensions, which can be modified since these elements are placed directly in the sheet.

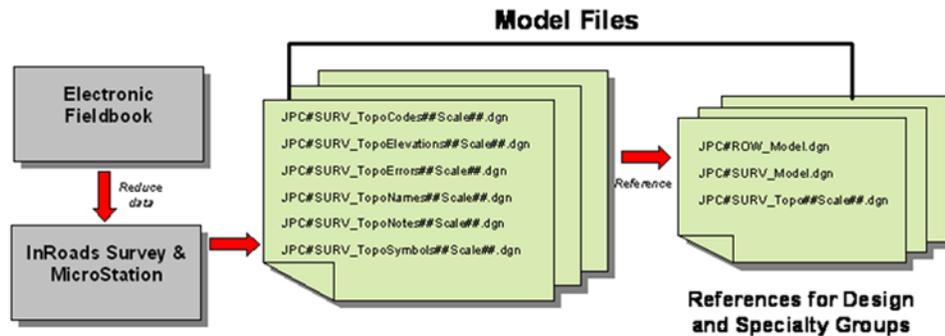


For more information on References, see the section Referencing Other's Work in this chapter.

### **Model File Workflow for Survey/ROW**

To create existing model files, the Survey/ROW group uses MicroStation and InRoads Survey to reduce the electronic fieldbook data and create model files for ROW, survey planimetrics and existing topographics. These existing model files can then be referenced by Design and specialty groups as a base for creating the proposed model files.

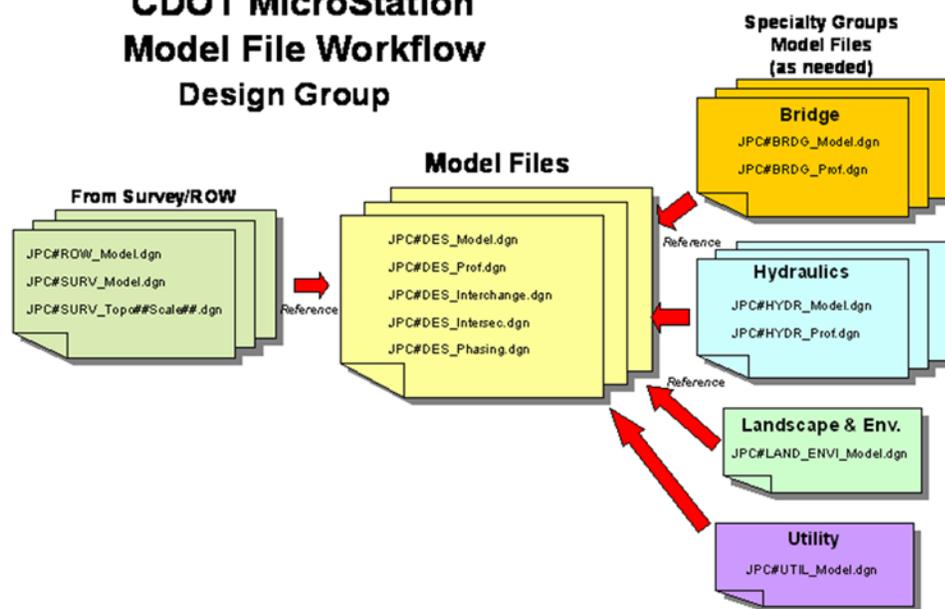
### CDOT MicroStation Model File Workflow Survey/Row Group



### Model File Workflow for Roadway Design

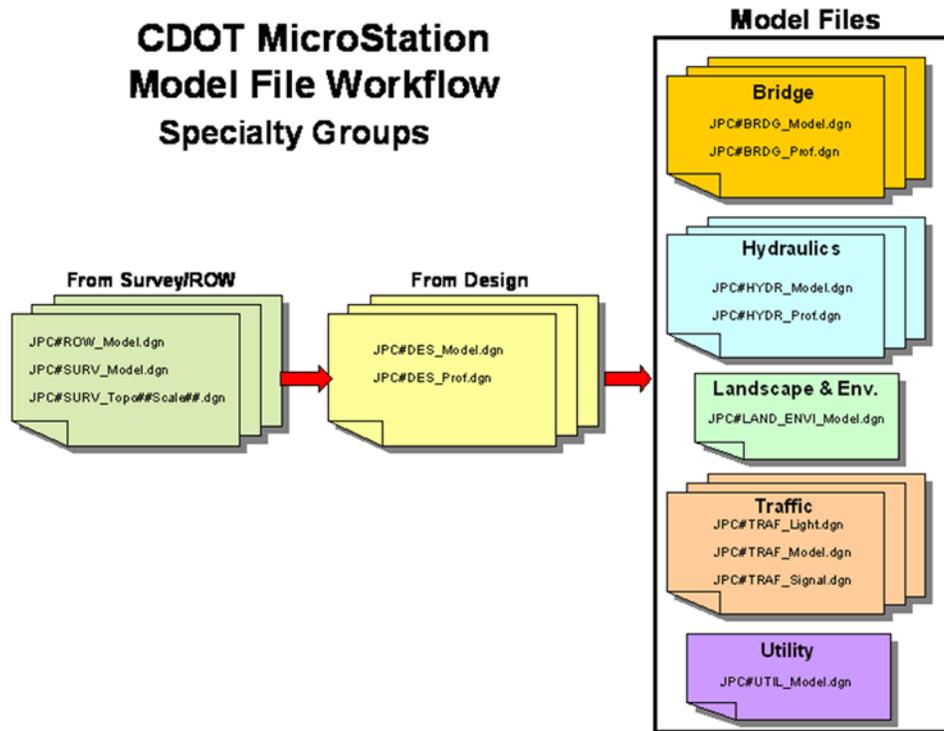
To create proposed design model files, the Roadway Design group references the existing survey/topo and ROW models to begin the design. MicroStation and InRoads are then used to create the proposed graphics in various model files – plan, profile, intersection, etc. Occasionally, other specialty group model files are needed by Design, so these model files may be attached as reference files.

### CDOT MicroStation Model File Workflow Design Group



### Model File Workflow for Specialty Groups

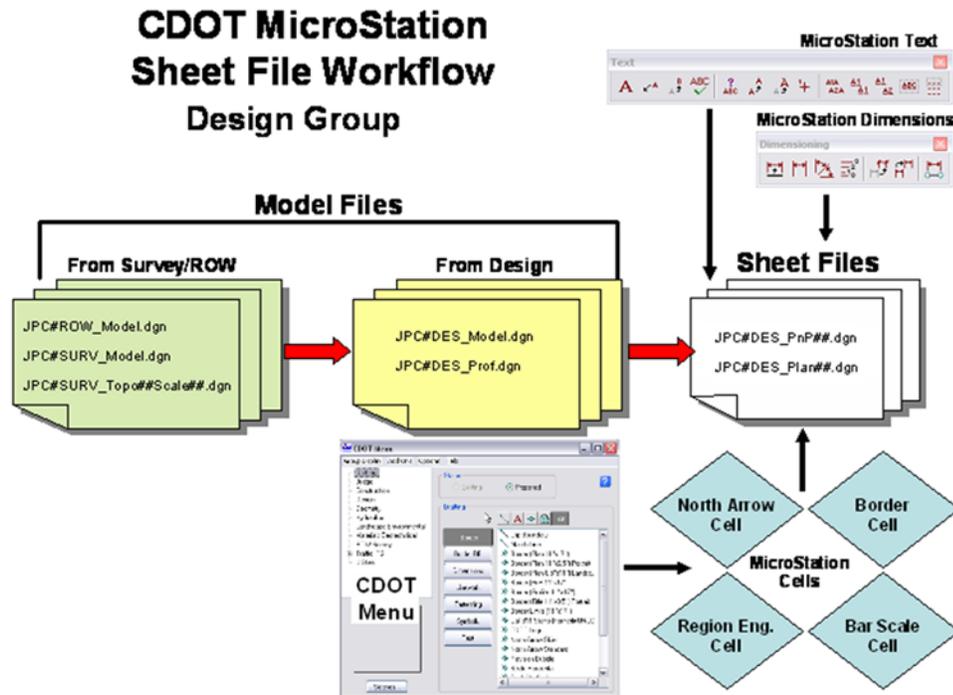
Each specialty group references the Roadway Design group's proposed model file to begin their design. MicroStation and other specialty programs are used to create the graphics in separate model file(s) for each group. When a specialty group references Design's model file, they can choose to reference the existing model file(s) from the Survey/ROW group as well. This way, both existing and proposed graphics can be displayed in the specialty group's model file, if needed.



### Sheet File Workflow for Roadway Design

To create sheets (specifically plan or plan/profile sheets in this example), the Design group creates a new MicroStation design file for each sheet. Then, the proposed model file is referenced into the sheet file. Since the proposed model also has the existing model file referenced, the survey graphics can be displayed in the sheet. The sheet file view is rotated, if needed, so graphics appear horizontal. Then, only the portion of graphics needed for the sheet is “clipped” out from the reference. The border, north arrow, bar scale and Resident Engineer information is then placed directly in the sheet file via the CDOT Menu. Many generic sheet files also contain a border, which can be edited. The sheet can be annotated with MicroStation text and the reference graphics dimensioned, if required. Unlike reference graphics, text and dimensions are placed directly in the sheet file and, therefore, can be edited in the sheet.

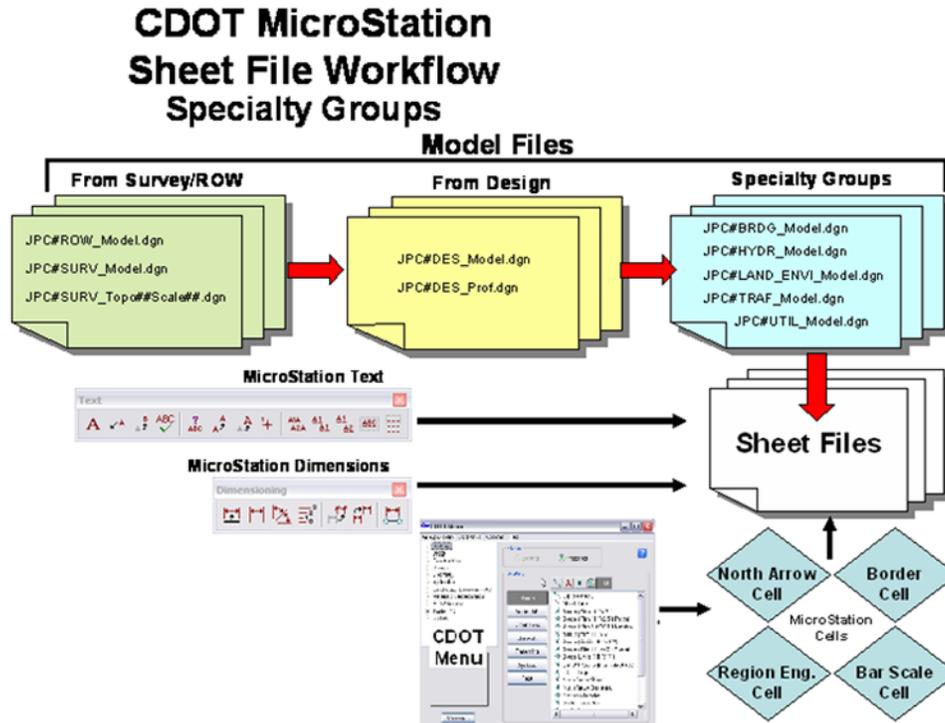
Other sheets such as detail, title, general notes, *etc.* have specific requirements, but use the same general premise of referencing the model file(s) to the sheet file. Typical Section sheets are an exception to the rule, since graphics are created directly in the sheet file using the CDOT Typical Section Program.



### Sheet File Workflow for Specialty Groups

Specialty groups create a separate MicroStation design file for each sheet, and then reference their own model file(s) into the sheet file. Since this model file can also have Roadway Design and ROW/Survey's model files referenced, these graphics can be displayed in the sheet. The sheet file view is rotated, if needed, so graphics appear horizontal. Then, only the portion of graphics needed for the sheet is "clipped" out from the reference. The border, north arrow, bar scale and Resident Engineer information is then placed directly in the sheet file via the CDOT Menu. Many generic sheet files also contain a border, which can be edited. The sheet can be annotated with MicroStation text and the reference graphics dimensioned, if required. Unlike reference graphics, text and dimensions are placed directly in the sheet file and, therefore, can be edited in the sheet.

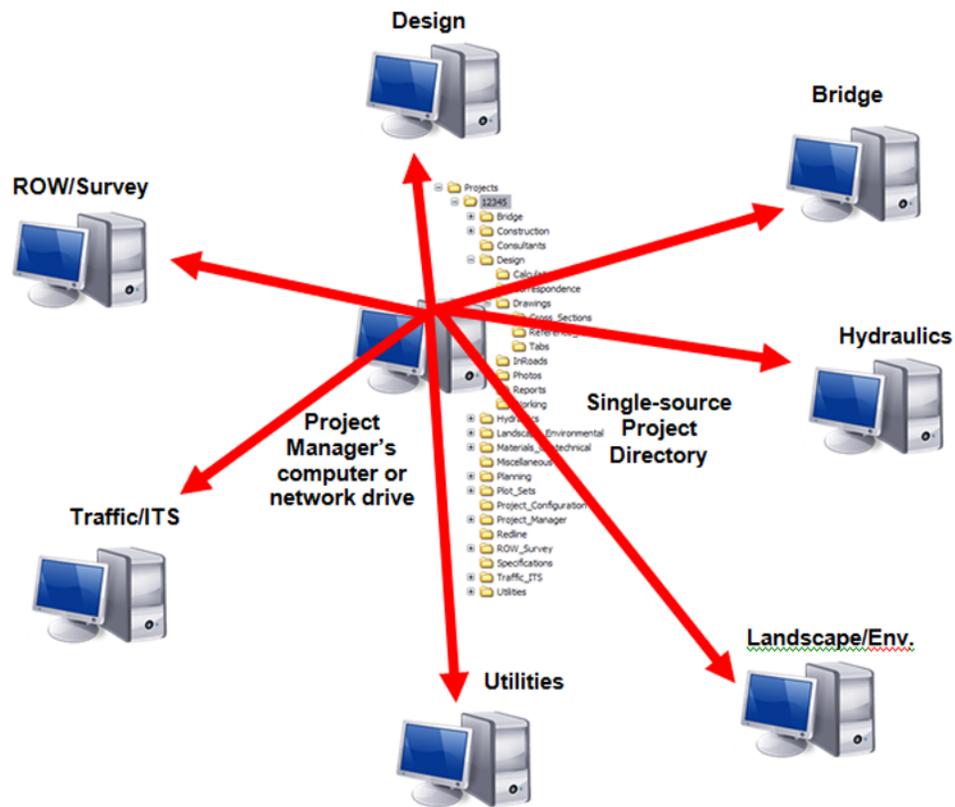
Other sheets such as detail, tab, and note sheets have specific requirements.



## Single Source Project Data

The use of MicroStation references is a powerful tool that allows all users on a project to share graphical data files from a single source. You should always access graphics files from a central location, either on a project server or from a Project Manager's machine. This eliminates the need to copy graphics files to multiple machines when several users are working on a project. ***Copying graphics files out of their project location is bad practice and should be avoided.***

You can use MicroStation to reference files you need from other groups, and multiple users can reference the same file. The “owner” of the file can continue working on it while those referencing the file can see the updates. This way, the file remains in a central location and you’re assured that you’re working with the latest version of that file.

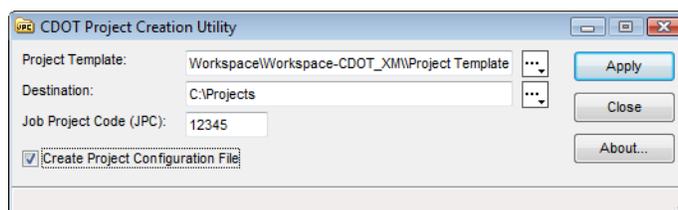


## Project set-up

The Project Manager (PM) is responsible for setting up a new project. To take full advantage of single source data, the project directory is created on either a network server or on the PM’s personal computer. All users working on a project would then need to map the PM’s machine in order to access the project directory.

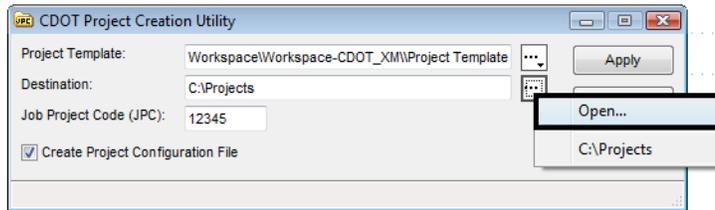
### **The Create Project Directory Utility**

To create the project directory, the Project Manager runs the **Create Project Directory** utility. The utility is found on the Windows Start Menu (**Start > All Programs > \_CDOT\_CADD\_Information > Create Project Directory Structure**).

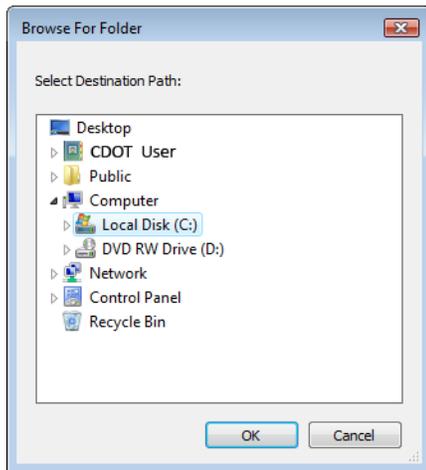


The PM enters the Job Project Code (JPC) and runs the utility. This creates the project directory and associated blank and auto-populated files, along with the Project Configuration File (PCF).

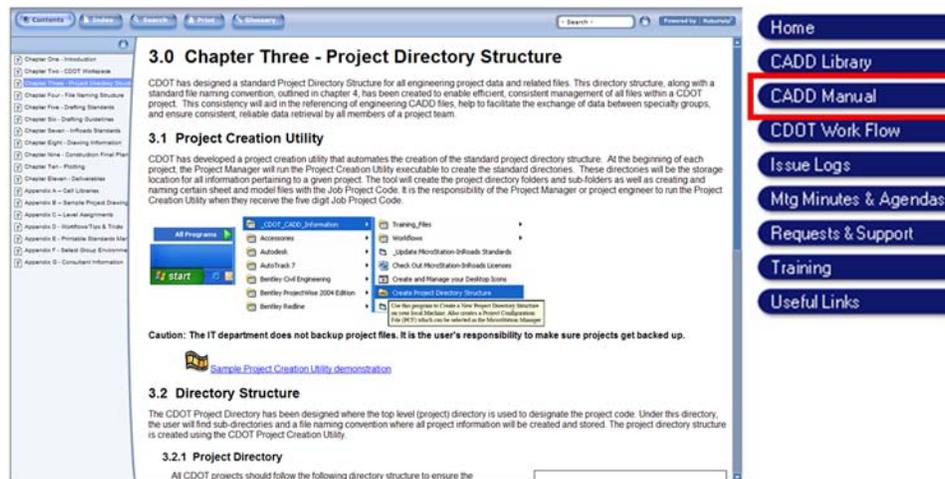
The project can either reside on the Project Manager’s computer or on a network drive. If it’s on the PM’s machine, make sure this drive is shared to others working on the project. To create the project on a network drive, select the Browse button (...) next to **Destination** and then select **Open**.



You can now set the path to any mapped network drive.



For more information see the *CDOT CADD Manual, Chapter Three—Project Directory Structure, section 3.1 – Project Creation Utility*.



## The PCF file

The Project Configuration File, created by the utility, defines a specific directory that MicroStation defaults to when opening up a DGN file or referencing model files. PCF files are extremely useful when multiple users are accessing the same project directory across the network, or when DGN files are moved from one directory to another.

## Working in a server environment

If multiple users are accessing the same project directory, the PCF file will need to be distributed to everyone on the team accessing the project directory. Each member of the team should have their own copy of the PCF file and it should be saved to the same location, **C:\Program Files\Workspace-CDOT\Standards-Local\Projects**. The PCF is also useful for managing references. If a reference file is moved, you should never have to reattach it. You can use the PCF to manage the reference locations.

**CDOT Work Flow**

Work Flow :

- [CDOT Alignment Display in Cross Section.Ink](#)
- [CDOT Annotating Horizontal and Vertical Alignments.Ink](#)
- [CDOT Batch Printing.Ink](#)
- [CDOT Batch Processing.Ink](#)
- [CDOT Configuration ReadMe file.Ink](#)
- [CDOT Converting AutoCAD Files to MicroStation.Ink](#)
- [CDOT Creating Multiple Plan Sheets.Ink](#)
- [CDOT Directory Structure.Ink](#)
- [CDOT Displaying Features in Cross Section and Profile.Ink](#)
- [CDOT Exporting Fieldbook Files.Ink](#)
- [CDOT Greek Characters.Ink](#)
- [CDOT Level Update for V03.01.Ink](#)
- [CDOT Linking MicroStation to Excel Documents.Ink](#)
- [CDOT MicroStation Printing.Ink](#)
- [CDOT Note Sheets.Ink](#)
- [CDOT PCF Management.Ink](#)

Home  
CADD Library  
CADD Manual  
**CDOT Work Flow**  
Issue Logs  
Mtg Minutes & Agendas  
Requests & Support  
Training  
Useful Links

When team members are sharing the Project Manager's machine, the PCF file will need to be edited. See the Workflow **CDOT PCF Management** for more information.

## The CDOT Project Directory Structure

The **Project Creation** utility creates the project directory structure on the server or PM's computer. All CDOT projects should follow this structure to ensure the accurate sharing of information between groups within the Department as well as outside consultants. The CDOT Project Directory's top level designates the project code. Below this folder is a set of standardized sub-directories for each CDOT specialty group. Under each specialty group folder is a sub-directory structure unique to that specialty group.

For more information about the CDOT project directory structure, see the *CDOT CADD Manual, Chapter Three – Project Directory Structure, section 3.2 – Directory Structure.*

The screenshot shows a web browser window displaying the CDOT CADD Manual. The main content area is titled "3.2 Directory Structure" and contains the following text:

The CDOT Project Directory has been designed where the top level (project) directory is used to designate the project code. Under this directory, the user will find sub-directories and a file naming convention where all project information will be created and stored. The project directory structure is created using the CDOT Project Creation Utility.

**3.2.1 Project Directory**

All CDOT projects should follow the following directory structure to ensure the accurate sharing of information between groups within the Department as well as outside consultants. Each project includes a unique top level directory and a set of standardized sub-directories located under the **Projects** root directory on the appropriate server or Project Manager's computer.

**3.2.1.1 Group Sub-Directories**

Below the top-level directory you will find subdirectories for each CDOT specialty group. Under each specialty group directory is a sub-directory structure unique to that specialty group. The example shown to the right shows these specialty group sub-directories below the JPC 14942. In this example, the sub-directory Design has been opened to see the sub-folders where the Roadway Design group will store all their project information.

**3.2.2 Group Sub-Directory Structure**

The following links can be used to review detailed tables showing the project directories for each group and the file types that go into these directories.

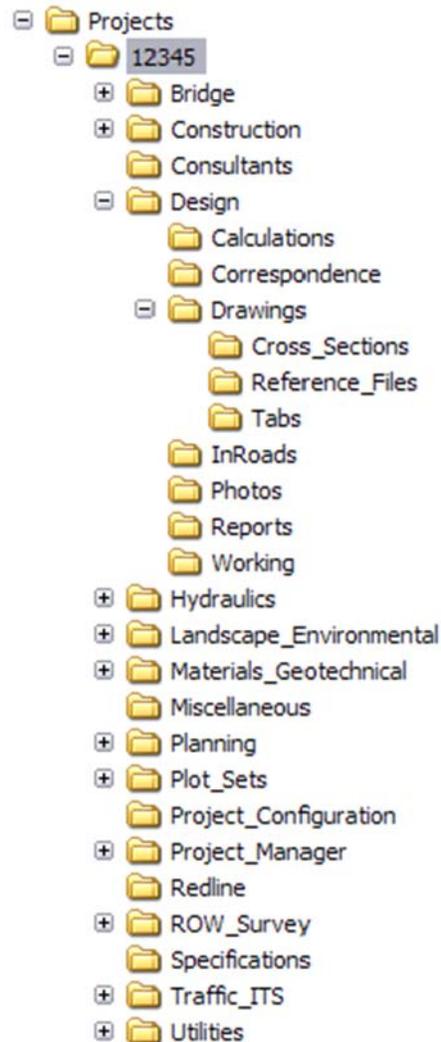
- [Bridge Project Folder \(Bridge\)](#)
- [Construction Project Folder \(Construction\)](#)
- [Consultants Project Folder \(Consultants\)](#)
- [This project folder is an exact duplicate of all the CDOT group sub-directories.](#)
- [Roadway Design Project Folder \(Design\)](#)
- [Landscape\\_Environmental Project Folder \(Landscape\\_Environmental\)](#)
- [Hydraulics Project Folder \(Hydraulics\)](#)
- [Materials\\_Geotechnical Project Folder \(Materials\\_Geotechnical\)](#)
- [Miscellaneous Project Folder \(Miscellaneous\)](#)
- [Planning Project Folder \(Planning\)](#)
- [Pit Sets Project Folder \(Pit\\_Sets\)](#)
- [Project Configuration Project Folder \(Project\\_Configuration\)](#)
- [Project Manager Project Folder \(Project\\_Manager\)](#)
- [ROW Survey Project Folder \(ROW\\_Survey\)](#)

On the right side of the page, a "Directory" tree is shown, listing various folders such as Desktop, My Computer, Local Disk (C:), Projects, 14942, Bridge, Construction, Consultants, Design, Calculations, Correspondence, Drawings, IRoads, Photos, Reports, Working, Environmental\_Landscape, Hydraulics, Materials\_Geotechnical, Miscellaneous, Planning, Pit\_Sets, ProjectConfiguration, Project\_Manager, ROW\_Survey, Specifications, and Traffic ITS.

The right sidebar of the browser contains a vertical menu of navigation links: Home, CADD Library, **CADD Manual** (highlighted with a red box), CDOT Work Flow, Issue Logs, Mtg Minutes & Agendas, Requests & Support, Training, and Useful Links.

## Training Project Directory

For this training class, you will create a project directory structure with an example Job Project Code (JPC) of 12345 shown below. The Roadway Design group's sub-folder is shown expanded to show an example of a group's sub-folder structure.



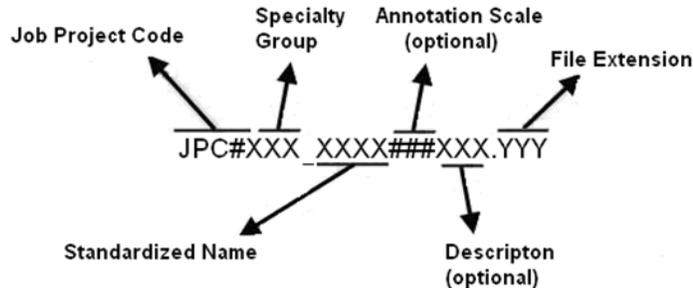
## Training files

The training lab files for CDOT CADD courses can be accessed from the Windows Start Menu. **Select Start > All Programs > \_CDOT\_CADD\_Information > V08.09.XX-XM > Training Files > Insert training files on my computer.** A link is also available on the Training page of the CDOT CADD web site.

## CDOT file naming convention

Model files and Sheet files need standard, informative, and unique names to allow easy identification of the specialty group responsible for the file and the type of information contained within the file. All CDOT CADD drawings created should follow this naming convention so the data can be easily identified and shared by all users.

The CDOT file naming convention contains the Job Project Code, a specialty group identifier, short standardized file name, an optional annotation scale identifier, an optional description, and file extension.



An example of a MicroStation design file would look like the following:

**12345DES\_Model100US285.dgn**

**12345** indicating the CDOT Project Number, **DES** indicates it is Roadway Design’s model file and **100** indicating it uses a 1”=100’ annotation scale, US285 is a description identifying the highway this model depicts. **.DGN** is the default extension for MicroStation design files.

**Note:** A seventh segment is used on Working Files. This segment should be the initials of the designer or engineer who is working on the file.

Example: **JS12345DES\_Model100.dgn** where JS, are the initials of the designer or engineer (in this example, JS stands for “John Smith”).

For more information about the CDOT project directory structure, see the **CDOT CADD Manual, Chapter Four – File Naming Convention**.

The screenshot shows a web page titled "4.0 Chapter Four - File Naming Convention". The page content includes:

- 4.1 File Naming Convention**: A paragraph explaining the CDOT file naming convention and a diagram showing the structure of a file name: `12345 DES Model 100 US 285.dgn`. The diagram labels the segments as Job Project Code (JPC), File Name (DES), Counter (Model), and MicroStation File Extension (.dgn).
- 4.2 File Types**: A paragraph stating that CDOT uses three different types of files: Model files, Sheet files, and Working files.

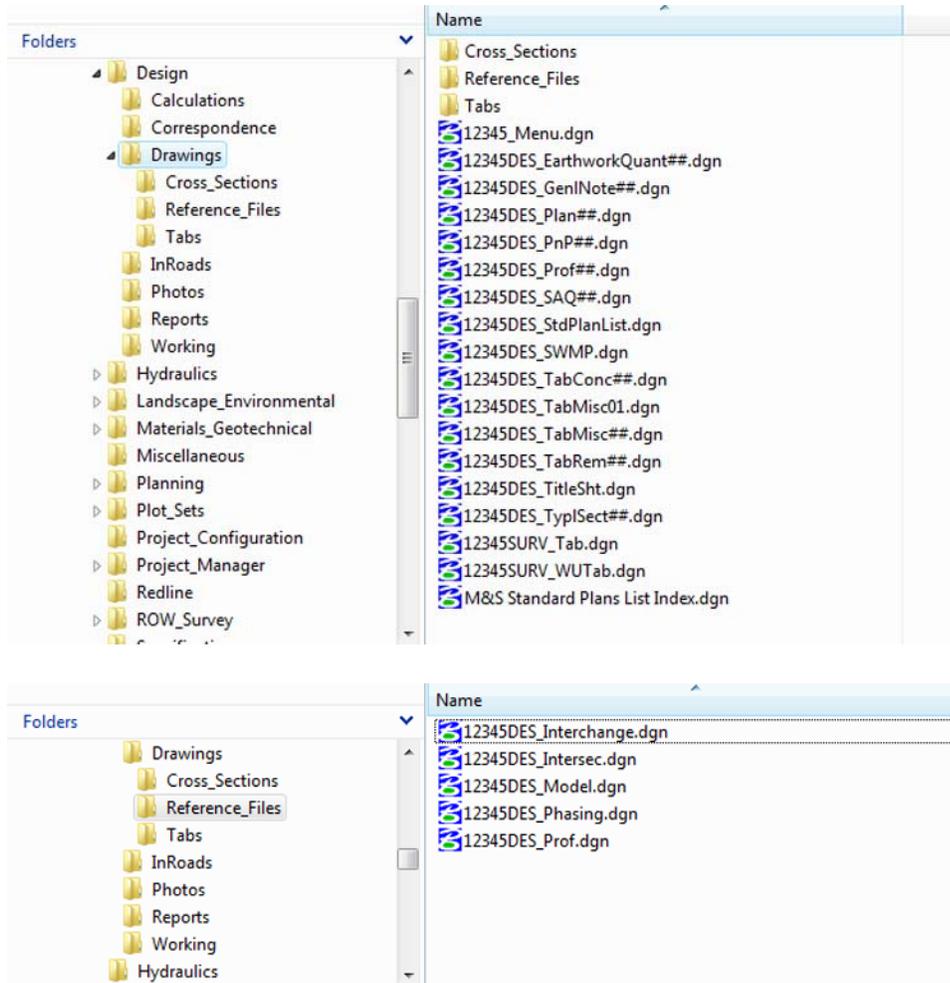
On the right side of the screenshot is a navigation menu with the following items:

- Home
- CADD Library
- CADD Manual** (highlighted with a red box)
- CDOT Work Flow
- Issue Logs
- Mtg Minutes & Agendas
- Requests & Support
- Training
- Useful Links

### Auto-populated files

In addition to creating the project directory structure, the Project Creation Utility also creates several auto-populated drawing files that have the CDOT standard file names already assigned. The # symbol is used for the counter. When creating a new file, one option is to open the appropriate auto-populated file in MicroStation, select **File > Save As** and then rename the file.

The diagrams below shows an example of auto-populated files automatically created for the Roadway Design group.

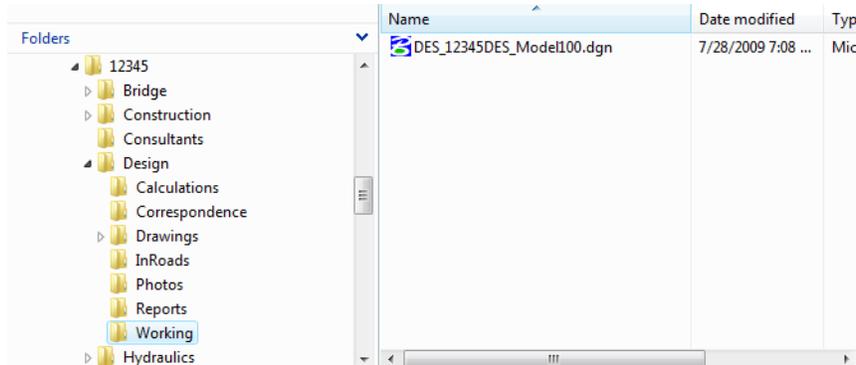


### **What files go where?**

As you've learned there are two main types of CADD files for a CDOT project: **Model files**, which contain graphics for referencing into sheets, and **Sheet files** which generally contain either references to model files or non-design related items such as general notes, special symbols, quantities, sheet borders, etc.

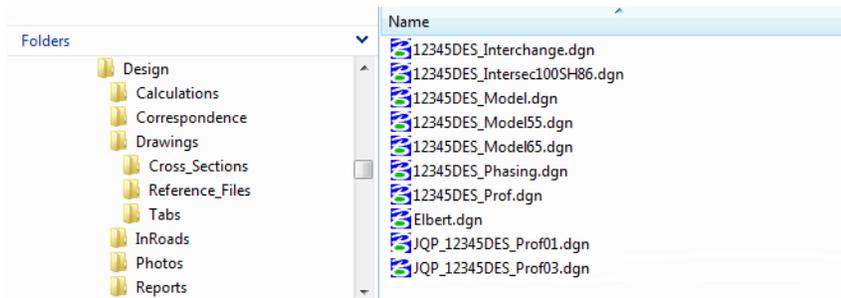
## Working Model files

Working files (or sketch files) are model files containing graphical data created during the design workflow. These files should be placed in the "Working" folder in each group's sub-folder. The file name should include the designer's initials. **These files are not to be considered final design files, and should not be referenced to sheet files or other reference model files.** An example of a working file would be: *//12345/Design/Working/JS\_12345Des\_Model100.dgn*



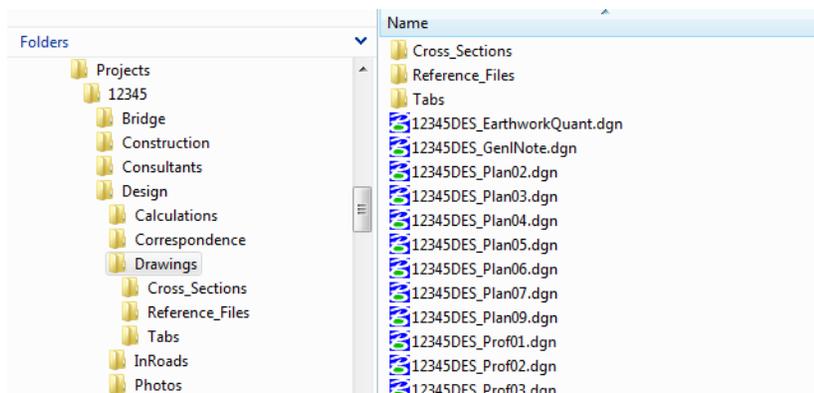
## Reference Model files

The most up-to-date model files which are available to other groups for referencing, that only have the most current non-sketch or working information in them, should be placed in the group's **Drawing > Reference\_Files** folder. The designer's or engineer's initials should be removed after moving this file.



## Sheet files

Sheet files are typically stored in a group's **Drawings** folder, as shown.



## Plot files

When sheet files are plotted to PDF, the plot files are placed in the project's **Plot\_Sets** folder. Sub folders for AD, FIR, FOR and ROW are available.

Name	Size
12345DES_Plan01-001.pdf	36 KB
12345DES_Plan02-001.pdf	13 KB
12345DES_Plan03-001.pdf	59 KB
12345DES_Plan04-001.pdf	36 KB
12345DES_Plan05-001.pdf	36 KB
12345DES_Plan06-001.pdf	13 KB
12345DES_Plan07-001.pdf	13 KB
12345DES_Plan08-001.pdf	13 KB
12345DES_Plan09-001.pdf	13 KB
12345DES_Plan10-001.pdf	59 KB
12345DES_Plan11-001.pdf	59 KB
12345DES_Plan12-001.pdf	59 KB
12345DES_Plan13-001.pdf	59 KB

For more information, see the *CDOT CADD Manual, Chapter Three – Project Directory Structure, section 3.2.2 – Group Sub-Directory Structure.*

The screenshot shows a web portal interface. On the right side, there is a vertical navigation menu with buttons for: Home, CADD Library, **CADD Manual** (highlighted with a red box), CDOT Work Flow, Issue Logs, Mtg Minutes & Agendas, Requests & Support, Training, and Useful Links. The main content area on the left contains text under the heading "3.2.1 Group Sub-Directories" and "3.2.2 Group Sub-Directory Structure". It lists various project folders such as Bridge, Construction, Consultants, Design, etc. A file tree on the right shows a hierarchy starting with Local Disk (C:) and Projects, leading to a specific project directory with sub-folders like Bridge, Construction, Consultants, Design, etc.

Sub-directory	File Name	Description
'Calculations 'Correspondence 'Drawings	JPC\ApproximateQuantities.dgn	Sheet Files - Plan set sheets and detail sheets
	JPC\EarthworkQuantities.dgn	
	JPC\GeneralNotes.dgn	
	JPC\IndexOSheets.dgn	
	JPC\PlanProfile.dgn	
	JPC\PlanSheet.dgn	
	JPC\ProfileSheet.dgn	
	JPC\StandardPlanList.dgn	
	JPC\SURV\TasSheets.dgn	
	JPC\TDS.dgn	
	JPC\TypicalSection.dgn	
	GeneralNotes.xls	
	IndexOSheets.xls	
	M&S Standard Plans List Index.dgn	
'Cross_Sections		All cross section models and cross section * job files
'Reference_Files		All final model files to be referenced to the sheets
	11x17 P&P Generator Border.dgn	Border Sheet specific for use with InRoads P&P Generator
	JPC\DesignModel.dgn	
	JPC\DesignProfile.dgn	
	JPC\InterchangeLayout.dgn	Interchange Layout File
	JPC\Intersection.dgn	Intersection Design File
	JPC\PhasingModel.dgn	Phasing Design File
'Tabs		All tabulation support data: xls, doc, and pdf files
'InRoads	Earthwork Summary.xls	All InRoads data: dtm, alq, trf, nri, nsk and

See also:

- *CDOT CADD Manual, Chapter Four – File Naming Convention, section 4.2 File Types*
- *CDOT Directory Structure Workflow.*

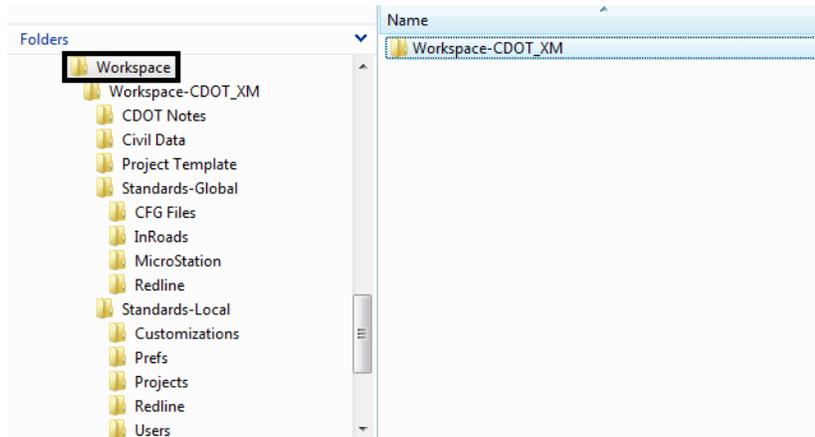
## The CDOT Workspace

The CDOT Workspace is a custom environment designed to facilitate CADD productivity and direct the user to CDOT-specific standards, workflows and processes. The CDOT Workspace is a complex set of configuration files, MicroStation and InRoads resource files, workflow documents, and many other customized tools, all designed to work together to increase productivity and efficiency, and allow for a standardized project plan set output. Some of the items in the workspace include:

- Seed files (starter files that contain MicroStation settings for creating new files)
- Cell libraries (standard details, symbols, notes, etc.)
- DGN libraries (standard level structures, text styles and dimension styles)
- Line style resource files (custom line styles)
- Font resource files (special fonts)
- Plot drivers (for plotter configuration and PDFs)
- Pen tables (for special plotting preferences for certain graphics)
- InRoads preference files (for controlling InRoads graphical displays)
- InRoads templates (for standard typical sections)
- CDOT configuration files (to set the correct MicroStation resource files and other standard files located on the user's computer)
- Workflow documents (CDOT standardized procedures for specific MicroStation and InRoads tasks)
- CDOT Group Menus (access to tools and applications which provides a simple, efficient method of applying CDOT's CADD standards to every project)

The installation of the Workspace will be controlled and maintained by the Information Technologies (IT) Department. You can manually update the workspace at any time by selecting the **Start > All Programs > CDOT\_CADD\_Information > Update MicroStation-InRoads Standards.**

The CDOT workspace and configuration files are located on each user's computer in the **C:\Workspace** folder.

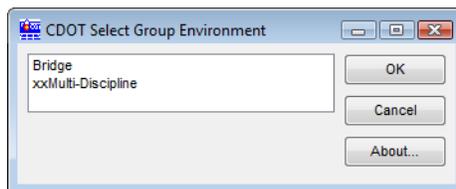


### **The Select Group Environment Utility**

The **Select Group Environment** utility automatically attaches the correct level libraries needed for working on a CDOT project. This utility also provides CDOT users **additional** MicroStation resources unique to their group (group-specific cells, seed files, linestyles, levels and symbology, *etc.*) The utility must be run prior to starting MicroStation in order to set up tools specific to that user's group.

There are two group options: **Bridge** and **xxMulti-Discipline**. The multi-discipline environment enables MicroStation to have all the cell libraries, level libraries and filters, available at anytime with out having to load these items individually. The Bridge option loads just the specific files needed for the Bridge group.

The Select Group Environment Utility can be run from the user's computer through the Start button **Start > All Programs > \_CDOT\_CADD\_Information > Select Group Environment**. You **MUST** exit MicroStation prior to running this utility.



For more information on the Select Group Environment, see the **CDOT CADD Manual, Appendix F - Select Group Environment Utility**.

For more information on the CDOT Workspace in general, see the **CDOT CADD Manual, Chapter Two - CDOT Workspace**.

The screenshot shows the CDOT Work Flow page. At the top, there is a navigation bar with "Intranet Home", "CDOT External", and "Search". Below this is the Colorado Department of Transportation logo and the text "CADD & Engineering Innovation". A secondary navigation bar includes "Projects", "Employee Info", "Teams", "Organizations", "Resources", "Contacts", "News", and "Help".

The main heading is "CDOT Work Flow". Below it, a "Work Flow :" section contains a list of links:
 

- [CDOT Alignment Display in Cross Section.Ink](#)
- [CDOT Annotating Horizontal and Vertical Alignments.Ink](#)
- [CDOT Batch Printing.Ink](#)
- [CDOT Batch Processing.Ink](#)
- [CDOT Configuration ReadMe file.Ink](#)
- [CDOT Converting AutoCAD Files to microStation.Ink](#)
- [CDOT Creating Multiple Plan Sheets.Ink](#)
- [CDOT Directory Structure.Ink](#)

To the right of the main content is a sidebar menu with the following items:
 

- Home
- CADD Library
- CADD Manual
- CDOT Work Flow
- Issue Logs
- Mtg Minutes & Agendas
- Requests & Support
- Training
- Useful Links

### Configuration releases

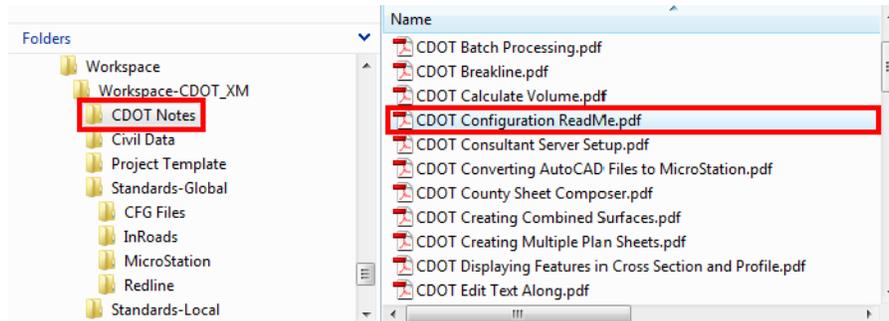
The IT Department is responsible for updating your computer when the CDOT workspace and configuration is updated. For a detailed description on what's in the new configuration release, see the CDOT Configuration ReadMe workflow.

This screenshot is identical to the one above, showing the CDOT Work Flow page. The "Work Flow :" section lists the following links:
 

- [CDOT Alignment Display in Cross Section.Ink](#)
- [CDOT Annotating Horizontal and Vertical Alignments.Ink](#)
- [CDOT Batch Printing.Ink](#)
- [CDOT Batch Processing.Ink](#)
- [CDOT Configuration ReadMe file.Ink](#)
- [CDOT Converting AutoCAD Files to microStation.Ink](#)
- [CDOT Creating Multiple Plan Sheets.Ink](#)
- [CDOT Directory Structure.Ink](#)
- [CDOT Displaying Features in Cross Section and Profile.Ink](#)
- [CDOT Exporting Fieldbook Files.Ink](#)
- [CDOT Greek Characters.Ink](#)
- [CDOT Level Update for V03.01.Ink](#)
- [CDOT Linking MicroStation to Excel Documents.Ink](#)
- [CDOT MicroStation Printing.Ink](#)
- [CDOT Note Sheets.Ink](#)
- [CDOT PCF Management.Ink](#)

The sidebar menu remains the same as in the previous screenshot.

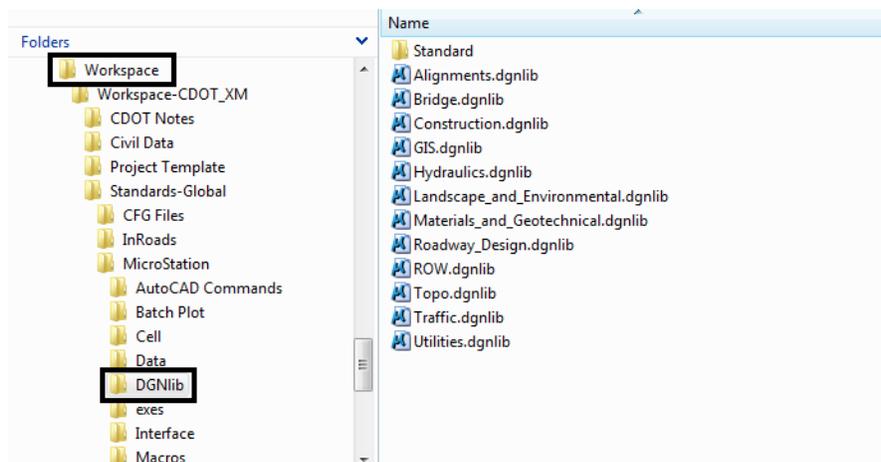
You can also access this workflow and others (in PDF format) from the CDOT workspace in the **CDOT Notes** sub-folder.



## The CDOT Level Structure

Thirteen Specialty Group Design File Level Libraries (**DGNLIBs**) are available for use within CDOT. The level libraries are attached to the MicroStation design file via the **Select Group Environment** utility and provide the CDOT approved standard discipline levels for use when placing graphics. You can not create, edit or delete levels within the CDOT Workspace – you must use the levels provided in the DGNLIBs. Likewise, you can not modify the level's symbology, thereby maintaining “ByLevel” status for standardization purposes. ByLevel symbology is used by default for all level libraries and is the required standard for plan set creation. CDOT has adopted an “existing vs. proposed” leveling scheme, whereas with the use of pen tables, all existing design data will plot gray scale. Level duplication across disciplines has been avoided wherever possible.

Level libraries (DBNLIBs) are stored in the CDOT workspace (**C:\Workspace\Workspace-CDOT\_XM\Standards-Global\MicroStation\DGNlib**).



For more information about the CDOT level structure and a list of all discipline level libraries, see the *CADD Manual, Chapter 5 – Drafting Standards, section 5.3 – Design File Level Libraries*. You can link to a specific group to review its standard level structure.

**5.3 Design File Level Libraries (Level definition files)**

Thirteen Specialty Group Design File Level Libraries (DGNLIB) have been developed for use within CDOT. The DGNLIB files are assigned when the Select Group Environment Utility is run prior to entering MicroStation. Design File levels are controlled by the use of these level libraries. The libraries provide the CDOT approved standard discipline levels. The CDOT Workplace locks the creation of levels and modifications of each level's symbology, thereby maintaining "ByLevel" status for standardization. The ByLevel symbology definitions allow graphical data to inherit attributes for color, linestyle and weight from the level that is selected. ByLevel symbology is used by default for all level libraries and is the required standard for plan set creation. CDOT has adopted an "inherited vs. proposed" leveling scheme, whereas with the use of pen tables, all existing design data will plot gray scale. See Chapter 10 for further discussion on pen tables. Level duplication across disciplines has been avoided wherever possible.

In the future, the use of the MicroStation "Standards Checker" utility will be employed to ensure level compliance.

The following links will expand on each group's levels:

Alignments	Bridge	Construction	Drafting
GIS	Hydraulics	Landscape and Environmental	
Materials & Technical	Roadway Design	ROW	Survey
Traffic	Utilities		

**5.3.1 Attached Level Libraries**

The CDOT Workplace requires the use of level libraries across disciplines. If the appropriate level library is not attached, the menu will display an error each time a command is chosen from the Specialty Group level library. Users can attach level libraries individually or exit MicroStation to run the Select Group Environment and choose another discipline.

The xMulti-User Discipline Level Library setting is set by default when initially opening MicroStation. This setting attaches all the available CDOT level libraries and filters, allowing users to seamlessly work across disciplines. This is the recommended level library that should be attached for anyone opening to use levels from other disciplines.

The Drafting level general level libraries are attached to all disciplines by default. These levels have been created for basic drafting purposes. Specialty Group levels should be applied to any design model that requires specific level stratification for future Quantity Manager use. Use with I/Roads or that will be referenced to many drawings as a model. Drafting Levels should be applied to all drawings that are created in standalone documents, graphical details and graphical elements being placed in sheet files.

Name	Description	LevelColor	LevelStyle	LevelWt
ALG_ALTERNATE_Cogo	Alternative Cogo Points [cell, symb font, text]	5	0	2
ALG_ALTERNATE_Hor-Alignment	Alternative Horiz. Centerline (lines, arcs, spirals) [network]	7	0	4
ALG_ALTERNATE_Hor-Alignment-Sta-Major	Alternative Horiz. Alg Major Stationing	7	0	4
ALG_ALTERNATE_Hor-Alignment-Sta-Minor	Alternative Horiz. Alg Minor Stationing	7	0	3
ALG_ALTERNATE_Hor-Alignment-Text	Alternative Horiz. CL, Tangent & Curve Annotation [text]	7	0	3
ALG_ALTERNATE_Hor-Cardinals	Alternative Horiz. Keypoint(s) Leads & Annotation	7	0	3
ALG_ALTERNATE_Hor-Keypoints	Alternative Horiz. Keypoint as cells [pc, pt, p, cc, etc] [cells or symb font]	7	0	3
ALG_ALTERNATE_Hor-Keypoints-Text	Alternative Horiz. Keypoint as text symbology [pc, pt, p, cc, etc] [text]	7	0	3
ALG_ALTERNATE_Hor-Tangent-Lines	Alternative Horiz. Curve (external) Tangents [lines]	7	0	2
ALG_ALTERNATE_Hor-Tangent-Text	Alternative Horiz. Curve (external) Tangent Annotation [text]	7	0	2
ALG_ALTERNATE_Ver-Alignment	Alternative Vert. Lines, Area [network]	7	0	3
ALG_ALTERNATE_Ver-Alignment-Dim	Alternative Vert. Curve Dimension [unless lineshead]	7	0	3
ALG_ALTERNATE_Ver-Alignment-Text	Alternative Vert. Curve & Tangent Annotation [text]	7	0	3
ALG_ALTERNATE_Ver-Keypoints	Alternative Vert. Keypoint [pc, pt, p, cc, etc] [text]	7	0	3
ALG_ALTERNATE_Ver-Keypoints-Text	Alternative Vert. Keypoint [pc, pt, p, cc, etc] [text]	7	0	3
ALG_ALTERNATE_Ver-Tangent-Lines	Alternative Vert. Curve (external) Tangents [lines]	7	0	1
ALG_ALTERNATE_Ver-Tangent-Text	Alternative Vert. Curve (external) Tangents Annotation [text]	7	0	1
ALG_APPROACH_ROAD_Cogo	Approach Road Horiz. Cogo Points [cell, symb font, text]	5	0	1
ALG_APPROACH_ROAD_Hor-Alignment	Approach Road Horiz. Centerline (lines, arcs, spirals) [network]	232	0	1
ALG_APPROACH_ROAD_Hor-Alignment-Sta-Major	Approach Road Horiz. Alg Major Stationing	232	0	1
ALG_APPROACH_ROAD_Hor-Alignment-Sta-Minor	Approach Road Horiz. Alg Minor Stationing	232	0	1
ALG_APPROACH_ROAD_Hor-Alignment-Text	Approach Road Horiz. CL, Tangent & Curve Annotation [text]	232	0	1
ALG_APPROACH_ROAD_Hor-Cardinals	Approach Road Horiz. Keypoint(s) Leads & Annotation	232	0	1
ALG_APPROACH_ROAD_Hor-Keypoints	Approach Road Horiz. Keypoint as cells [pc, pt, p, cc, etc] [cells or symb font]	232	0	1
ALG_APPROACH_ROAD_Hor-Keypoints-Text	Approach Road Horiz. Keypoint as text symbology [pc, pt, p, cc, etc] [text]	232	0	1
ALG_APPROACH_ROAD_Hor-Tangent-Lines	Approach Road Horiz. Curve (external) Tangents [lines]	232	0	1
ALG_APPROACH_ROAD_Hor-Tangent-Text	Approach Road Horiz. Curve (external) Tangent Annotation [text]	232	0	1
ALG_APPROACH_ROAD_Ver-Alignment	Approach Road Vert. Lines, Area [network]	232	0	1
ALG_APPROACH_ROAD_Ver-Alignment-Dim	Approach Road Vert. Curve Dimension [unless lineshead]	232	0	1
ALG_APPROACH_ROAD_Ver-Alignment-Text	Approach Road Vert. Curve & Tangent Annotation [text]	232	0	1
ALG_APPROACH_ROAD_Ver-Keypoints	Approach Road Vert. Keypoint [pc, pt, p, cc, etc] [text]	232	0	1
ALG_APPROACH_ROAD_Ver-Keypoints-Text	Approach Road Vert. Keypoint [pc, pt, p, cc, etc] [text]	232	0	1
ALG_APPROACH_ROAD_Ver-Tangent-Lines	Approach Road Vert. Curve (external) Tangents [lines]	232	0	1
ALG_APPROACH_ROAD_Ver-Tangent-Text	Approach Road Vert. Curve (external) Tangents Annotation [text]	232	0	1
ALG_EXISTING_Cogo	Existing Cogo Points [cell, symb font, text]	5	0	2
ALG_EXISTING_Hor-Alignment	Existing Horiz. Centerline (lines, arcs, spirals) [network]	81	0	2
ALG_EXISTING_Hor-Alignment-Sta-Major	Existing Horiz. Alg Major Stationing	81	0	2
ALG_EXISTING_Hor-Alignment-Sta-Minor	Existing Horiz. Alg Minor Stationing	81	0	2
ALG_EXISTING_Hor-Alignment-Text	Existing Horiz. CL, Tangent & Curve Annotation [text]	81	0	2
ALG_EXISTING_Hor-Cardinals	Existing Horiz. Keypoint(s) Leads & Annotation	81	0	2

**Level naming convention**

The standard CDOT level naming convention shown below is used to allow for easy filtering of levels in MicroStation's *Level Display* or *Level Manager*.

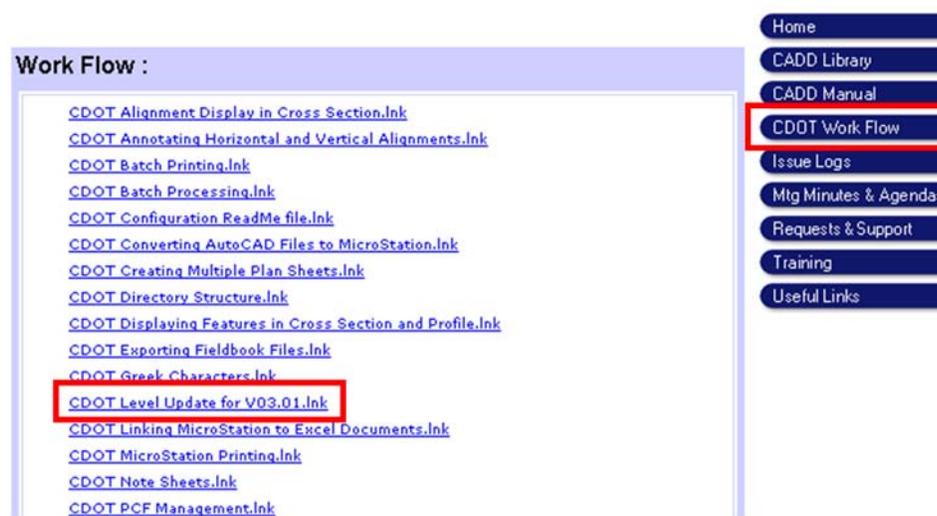


## Levels and configuration releases

When a new configuration is released, it is not unusual for the CDOT Standards and Configuration committee to add, change or delete levels from the level libraries. If you're working on a project, you will need to update the used levels in a design file to the new configuration standards. Each new configuration release includes a comma separated variable (CSV) file that maps old levels to new levels. You will need to apply this level mapping to all existing files that you wish to update to the new configuration. Refer to the *CDOT Level Update* workflow for more information.



### CDOT Work Flow



## Creating a new CDOT Model file

When you're ready to create a new model file to begin your work, you have two options:

- Create the new file from an auto-populated file
- Create the new file from a seed file

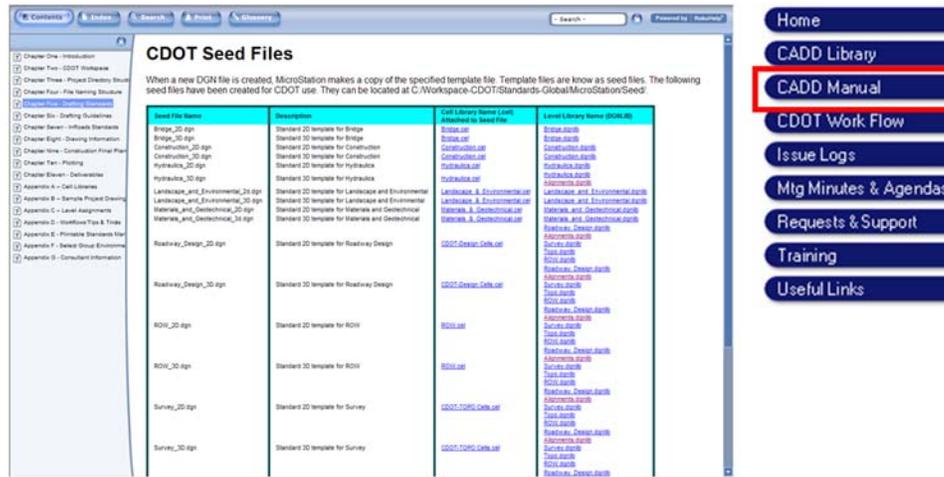
### Creating a model file from an auto-populated file

Auto-populated files are created by the Project Creation utility. The model files are created in the group's **\Drawing\Reference\_Files** folder. You can rename these files and save them to the project's **\Design\Working** folder to create your new model file.

### Creating Model files from seed files

A seed file is a "starter" file. It has all CDOT standard settings for each specialty group. Seed files are either 2D or 3D, so make sure you choose 3D when creating model files.

See the *CDOT CADD Manual, Chapter Five – Drafting Standards, section 5.2 – Seed files* for more information.



### CDOT default settings

When a new file is created from a seed file or auto-populated file, there are several settings already established that conform to the CDOT standards. Two important settings include **Working Units** and **Coordinate Readout**.

### Working Units

The working units in either a 2D or 3D file determine the measurement system for the design file. Working units are defined as:

- Master Units:Sub Units
- MU:SU

You set a design file's working units for any desired measurement system. For typical imperial units (English), you could set Master Unit to **feet** and Sub Units to **inches**. The working units would then be expressed as **1:12**. If you set Master Units to **Feet** and Sub Units to **tenths of a foot**, your units would be expressed as **1:10**.

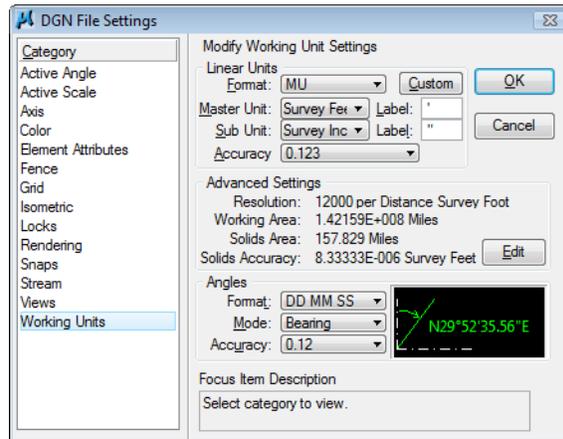
### CDOT standard Working Units

CDOT standard working units are 1:12 and expressed as:

- ◆ **Master Units = Survey Feet (')**
- ◆ **Sub Units = Survey Inches (")**

There are two types of unit definitions for imperial feet – survey and international. These have a slightly different conversion factor from metric. CDOT uses the survey foot definition.

The working units settings are found under **Settings > Design File > Working Units**.



### Entering data

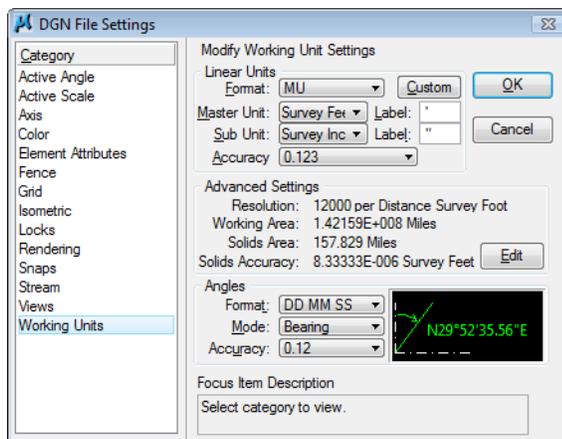
When you enter data for lengths, distances, etc. you use the format for working units: **MU:SU**. You can enter data in just master units, just sub units, or both. For example, if your working units are 1:12 (feet and inches), and you want to place a line with a length of 1 foot 1 ½ inches, you could enter the length as:

- ◆ 1.125
- ◆ 1: 1 1/2
- ◆ :13 1/2

**Note:** You can use either fractions or decimals when entering data.

### Coordinate Readout

Use **Settings > Design File > Working Units** to determine how MicroStation values are displayed. This is helpful, for example, when you measure graphics. The CDOT standard coordinate and angle readouts are shown below. These settings are copied over from the seed file.



You can set your linear values to readout in master units, sub units or both. Angles can readout in either degrees-minutes-seconds (**DD MM SS**) or decimal degrees (**DD.DDDD**) with up to 8 decimal place accuracy.

## Referencing other's work

A Reference is a file that is attached to your active file, so that you can see the file's graphics. Reference graphics are not actually in your active file, but serve as background data. You cannot modify reference graphics from the active file. You can, however, copy graphics from the reference model to the active model and then modify them, if desired. Using references is a good way to copy a large number of graphics from model to model.

The proper use of MicroStation References is critical to achieving two key components of the CDOT MicroStation workflow:

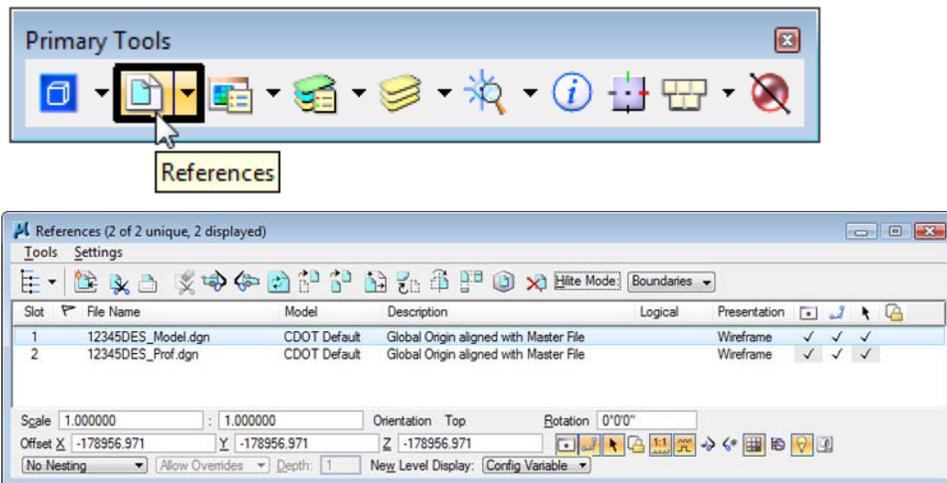
1. Maintaining a single source for project data.
2. Sharing graphical data between specialty groups.

References allow multiple users to work on different parts of a project at the same time. Multiple users can access the same reference from a central location (e.g. project directory on the PM's computer). Specialty groups can interact throughout the design process by referencing other discipline-specific model files. The data exchange between disciplines is "real time" when using MicroStation References.

References are useful in the plan set creation phase. You can "build" the sheets by referencing in the individual model files (survey/topo, design, utilities, etc.) Each discipline's Master Model file can reference other discipline's model files, as needed. The Master Model file can then be referenced into a newly created sheet file. You can also reference in details and show these at a different scale on the same sheet.

## Attaching References

To attach references, select **References** from the **Primary toolbar**. In the References dialog box, select **Tools > Attach**.

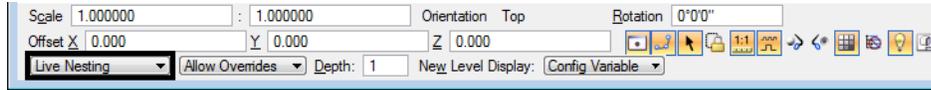


Different reference file attachment methods are available to help control reference manipulations and displays. These include:

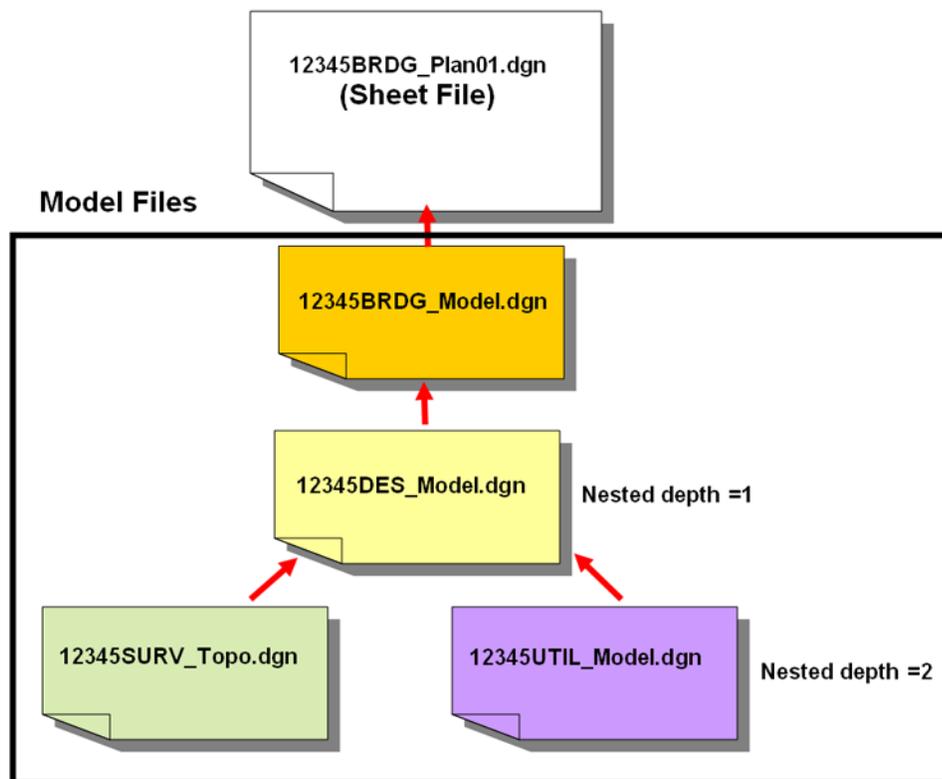
- No nesting
- Live nesting
- Copy attachments

## Nested References

References can be attached nested — meaning you can attach a reference's reference.



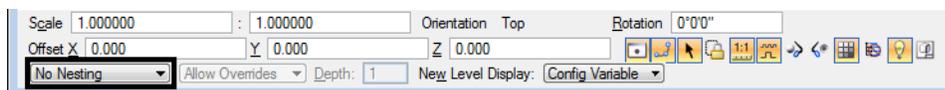
The **Nested Depth** option determines how many reference levels deep you can attach. In the example below, if the reference **BridgeModel** is attached to **BridgePlanSheet01** with **No Nesting**, only the **Bridge Model** graphics are attached. If the nested depth is set to **1**, you would attach **BridgeModel01** and **DesignModel01**. If the nested depth is set to **2**, you would attach **BridgeModel01**, **DesignModel01**, **Survey/Topo** and **UtilityModel01**.



The **Live Nesting** option allows you to dynamically update a reference's sub-references **after** the reference is attached. You can change your **Live Nested Depth** and your references will automatically update without having to detach and reattach the reference.

## The Copy Attachment Option

The **Copy Attachment** option allows you to dynamically make all nested references upper-level references. This way, you can manipulate and control each reference display individually, if needed. You can switch between nested references and the copy attachment at any time.



## Working with Raster Attachments

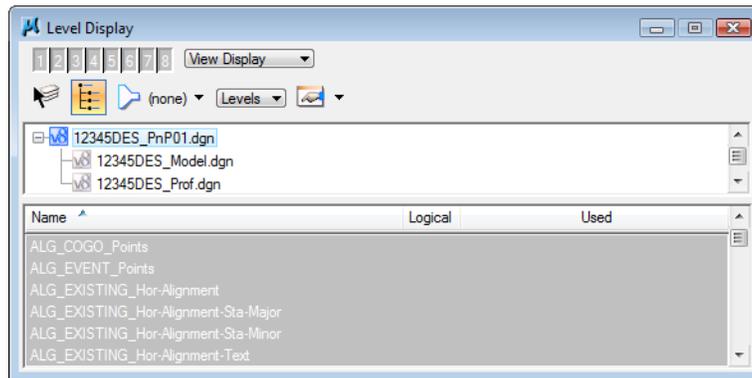
When you attach a reference, you have the option to Display Raster References. If the reference has a raster image attached (e.g. aerial photo), you can choose to attach the raster with the reference. You can toggle the raster reference on/off from the Reference dialog box.



For more information on working with raster references, see the *CDOT Raster Manager* workflow.

## Reference Levels

You can control each reference's levels just like the master file levels. The **Level Display** box shows a list of all attached references to the Master file. Select the reference and then turn the reference level on/off.



# Chapter 6 - Creating Your Design Graphics

In this Chapter you will learn how to use the CDOT Menu to set standards and place simple graphics. You will also learn how to use precision drawing techniques to locate your graphics.

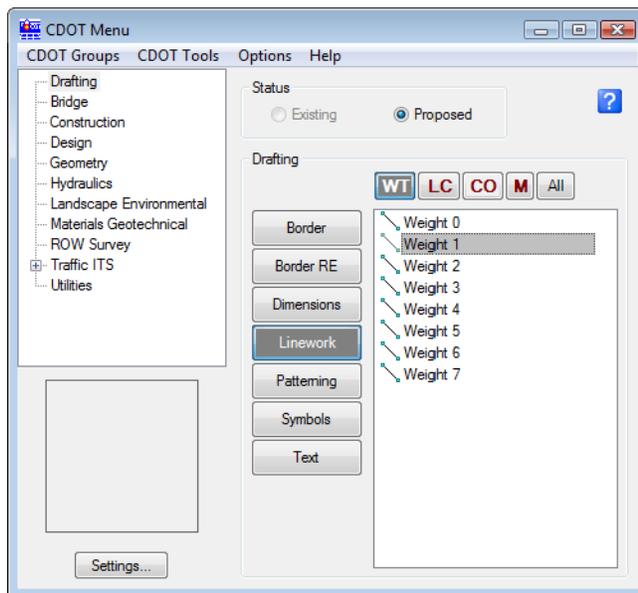
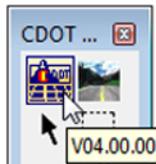
## The CDOT Menu

The customized CDOT menu provides access to tools and applications intended to provide the user a simple, efficient method to apply CDOT's CADD standards to every project. These menus direct MicroStation to place elements on discipline-defined levels for drawing consistency.

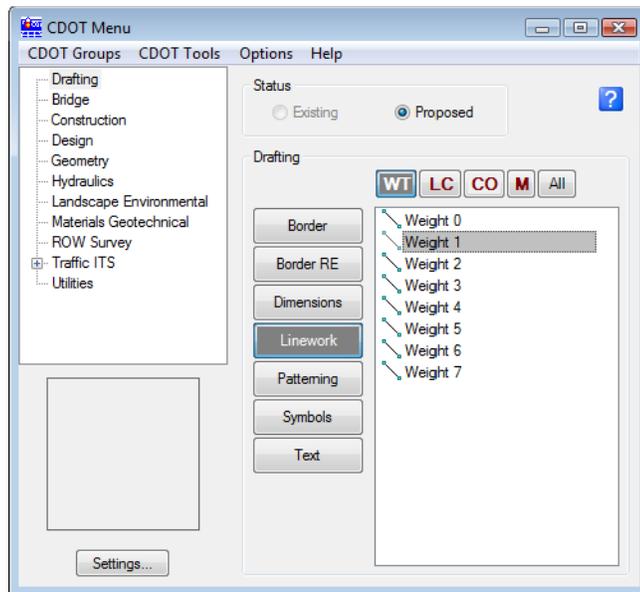
**Note:** Since the CDOT Menu automatically selects the correct level for element placement across disciplines, you must have selected the xxxMulti-Discipline group from the Select Group Environment program.

## Opening the Menu

After starting MicroStation, select the CDOT icon from MicroStation's Main toolbar to open the CDOT Menu. You can hover over the icon to verify the CDOT configuration release.



## Parts of the Menu

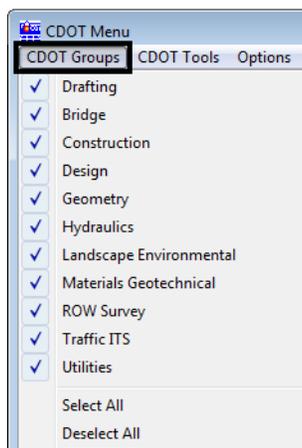


### Drop-down menus

Use the drop-down menus to make the following selections:

#### Group Display

Toggle on your Group to display Explorer menu selections for placing graphics. In the Explorer menu tree some groups like Traffic ITS have “children” options that can be expanded with the “+” symbol. Drafting is a generic group (i.e. it’s used by all groups) for placing general text, dimensions, borders, etc. There is also an option on this menu to select/deselect all groups.



#### CDOT Tools

The CDOT Tool’s menu allows you to launch custom add-on programs like AutoTrack, SignCAD, Typical Section Program as well as other MDL and automation tools for working with graphics like the Breakline tool and the ModElev tool.

## Options

This menu allows you to have the CDOT Menu appear on top of any Windows Application, or have it reside behind other programs.

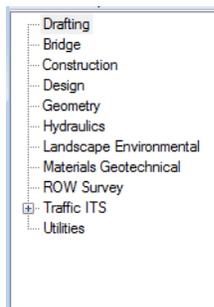
## Help

This pull-down provides convenient links to the CDOT CADD web site Home page, the CDOT CADD Manual, Support Requests and Workflows.

## CDOT Menu Sections

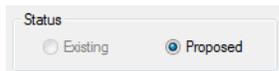
### Explorer

The Explorer Window is used to navigate through the tree structure of group options.



### Status Window

The Status Window is used to select either Existing or Proposed categories/items for a particular group. Category options change based on the Existing or Proposed status.



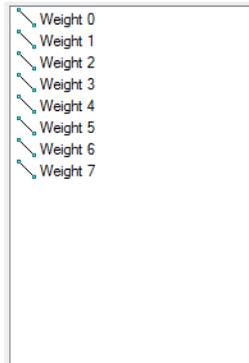
### Category

Group categories for graphic placement.



## Item

Items are the specific graphical elements that can be placed in the design file. When an item is selected, the CDOT Menu automatically selects the proper drawing tool and selects the appropriate level for placement (along with that level's ByLevel symbology).



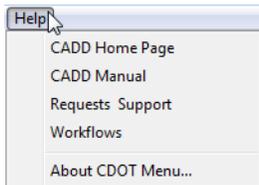
## Filters

Filters are used to filter types of items. There are five filters: Lines, Text, Cells, Patterns and All. Selecting a filter shows you only those types of elements in the selection window.



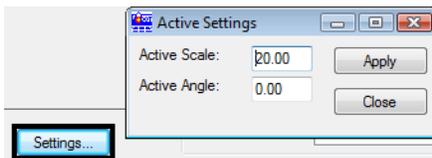
## Main Menu Help

Discipline specific help topics using the CDOT menu.



## Settings

Allows you to set the Active Angle and Active Scale before placing text, cell and pattern items.



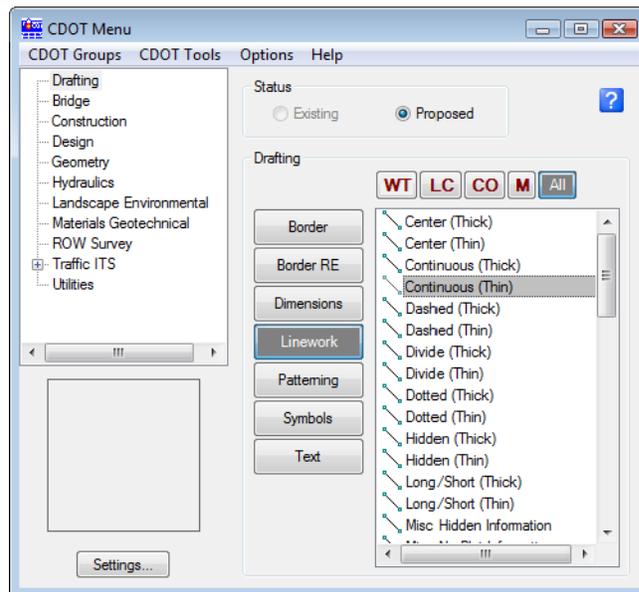
## Placing Graphics

### The CDOT Drafting Menu

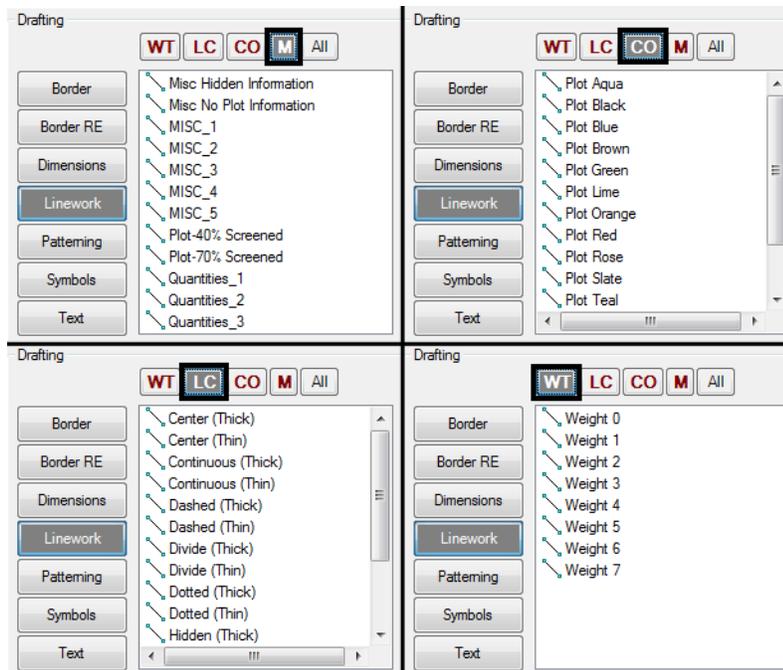
#### Linework tools

The CDOT Drafting > Linework group provides a convenient way to place basic elements from one location. From here you can place SmartLines, Shapes, Circles, Arcs and Hatch areas.

SmartLines are used to place a chain of connected line segments and arc segments as individual elements or as a single line string or shape.



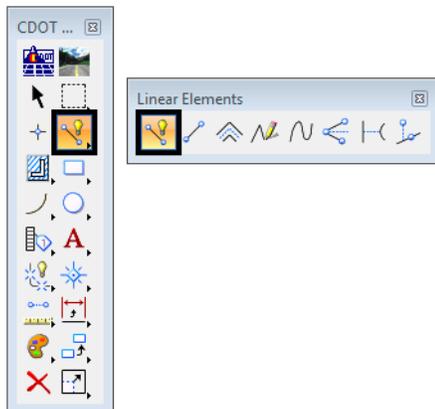
Selecting the **WT** Weight (line weight), **LC** Line Code (line style), and **CO** Plot Color filters sets the appropriate level. Each item in the **Linework** category goes on a unique Drafting level.



## MicroStation Drawing Tools

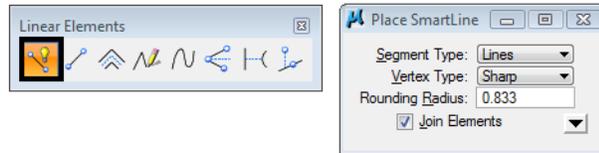
You can also access basic drawing tools from the MicroStation Main toolbar.

**Important!** Read your prompts for proper use of these drawing tools!



## Tool Settings

Each time you select a new drawing tool, the optional settings will appear in the Tool Settings box.

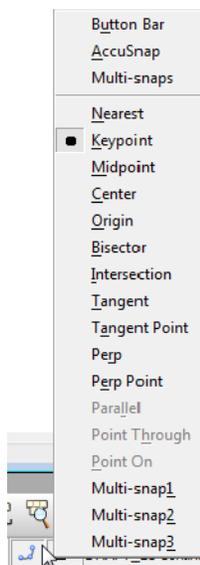


## Snap Lock

Snap lock determines if your tentative point snaps are forced onto nearby elements. If Snap lock is on and you place a tentative point on or near an element, your cursor locks onto that element at the location specified by the snap mode.

## Snap Modes

The active snap mode determines how you will snap onto an element. Several different snap modes are available and can be accessed from the Status bar.



You can also access snap modes from the Snap Mode button bar.



## Executing snaps

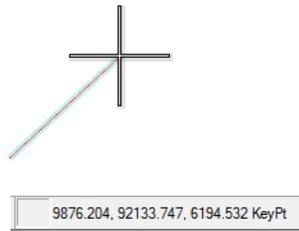
You can execute a snap two ways:

- Using a tentative point
- Using AccuSnap

**To snap to an element using a tentative point:**

- Select the drawing tool (Place Line, Place Block, etc.)
- Set the Snap mode (if not currently active)
- <T> on the element

A large cross hair appears at the snap mode location and the element highlights. MicroStation displays the X,Y,Z coordinates of the <T> location in the Message field.



- <D> to accept the tentative

Snaps can be a one-time setting. Once you've executed the snap, the snap mode returns to the default setting. One-time overrides of the default snap mode are accomplished by:

- Choosing a snap mode from the Status Bar
- Selecting **Settings > Snaps**
- By single clicking on snap on the Button Bar

You can change the default snap mode by:

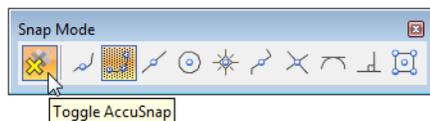
- Selecting a new mode in the Full Locks dialog box
- Double clicking the snap mode on the Button Bar

## Using AccuSnap

AccuSnap is a feature that streamlines your snaps. Instead of tentative snapping to an element, you can AccuSnap to it. In addition, AccuSnap can give you basic element information (element type and level).

### Turning AccuSnap on/off

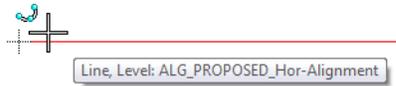
You can also toggle AccuSnap on/off from the Snaps Button Bar.



### To snap to an element using AccuSnap:

- Select a drawing tool
- Select a Snap mode
- Move your cursor across the element

AccuSnap identifies the element type and its level with pop-up information. An icon representing the current snap mode is displayed along with a tentative hint – a light dashed cross hair at the closest snap point according to the selected snap mode.



- Move your cursor closer to the tentative hint.

The cursor changes to a bold X and the element highlights to indicate you're locked on to the snap point.



- <D> to select this location.

A Tentative point is not necessary to define the temporary snap location.

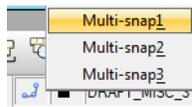
**Note:** AccuSnap sometimes does not work correctly with Depth lock on. Therefore, if you're snapping to elements with Depth lock on, be sure to turn AccuSnap off and use a Tentative snap <T> instead. This ensures that you'll pick up the active depth instead of the element's depth.

### Multi-Snaps

MicroStation includes three Multi-Snap modes. Multi-snaps are an ordered list of snaps. When you choose a multi-snap with AccuSnap on, MicroStation processes the multiple snaps according to your cursor location.

### Using Multi-Snaps

- From the Snaps button bar or from the Status bar, select a Multi-Snap (Multi-snap1, Multi-snap2 or Multi-snap3)

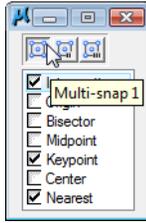


- Move your cursor over the element until AccuSnap locates the first multi-snap option
- Continue moving your cursor until the next snap option highlights
- When you have locked on the correct snap point, <D> to accept

### Editing Multi-Snaps

- Select *Settings > Snaps > Multi-snaps* (or select Multi-snaps from the Snaps button on the Status bar)

- Select a multi-snap (1, 2 or 3)



**Note:** You can also right-click on the Multi-snap icon and select Properties.

- Toggle on the snaps you want to include in the multi-snap
- Toggle off snaps you don't want
- Close the Multi-snaps box

### **Precision keyins**

Precision key-ins allow you to precisely locate elements in your design file based on its coordinate system. You can locate data points at exact coordinates, at a delta distance from your current location, or at a distance and direction from the current location.

#### ***xy=key-in***

Use the xy= key-in to specify a point's exact x, y and z coordinates. The syntax for this key-in is: xy=<x,y,z>.

To place an element at the active depth, leave off the z value.

#### ***dx=key-in***

Use the dx= key-in to specify an x distance, y distance and z distance from the current point or from a tentative point. This key-in is sometimes referred to as the "delta" key-in, since it locates a point at a delta distance from the current location. The syntax for this key-in is: dx=<dx,dy,dz>.

You can leave out variables in the key-in. For example, if you only want to locate 100 feet (assuming your master units are feet) in the y direction from the current location, key in dx=,100. To draw planar elements at the active depth in a 3D file, leave off the z value.

The dx= key-in behaves the same regardless of the view in which you're working. It uses the view axis, meaning it always assigns the x axis to horizontal and the y axis to vertical in any view (top, front, right, etc.)

#### ***dl=key-in***

The dl= key-in is also a "delta" key-in and works in a similar fashion to the dx= key-in. It also locates a point at an x distance, y distance and z distance from the current point or from a tentative point. The syntax for this key-in is dl=<dx,dy,dz>.

The difference between the dl= and the dx= key-ins is dl= uses the model axis in a 3D file. Instead of assigning every view's x-axis to horizontal and y-axis to vertical, it uses the design cube's true coordinate system. For example, a front view's horizontal axis is the x-axis and the vertical axis is the z-axis.

The dl= key-in behaves differently based on the view in which you're working. In a top view of a 3D file, there is no difference between the dx= and the dl= key-ins.

**di=key-in**

Use the di= key-in to specify a distance and direction along the view axis from the current point. The syntax for this key-in is: di=<distance,direction> Like the dx= key-in, this key-in also uses the view axis.

You can specify the direction in either DMS (degrees, minutes, seconds) or DD (decimal degrees). This key-in also works in any angle mode (conventional, azimuth or bearing). For DMS, use ^ for degrees, ' for minutes and " for seconds. For example, di=10,n37^19'30.27"e would place a point 10 feet at the specified bearing angle.

**Note:** When using the dx=, dl= or di= key-ins, you can place multiple points by using the pipe symbol (above the \ on a standard keyboard). For example if you're in the Place Line command and key in dx=10|3, this would place three lines, 10 feet long each, in the x direction.

**AccuDraw**

AccuDraw is a precision drawing tool that streamlines the placement of data points. It basically combines the techniques of precision keyins with axis lock-type features into one command to help you place, modify or manipulate elements.

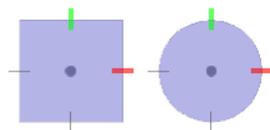
AccuDraw is context sensitive. Its behavior changes depending on which drawing tool you've selected. AccuDraw will evaluate your current position, the previous data point, the drawing tools needs, etc. to help you place your next data point.

**Starting AccuDraw**

In the CDOT workspace, AccuDraw automatically loads when you open a design file. If you don't want to use AccuDraw, you can toggle it off by selecting the Toggle AccuDraw button from the Primary toolbar.

**The AccuDraw Compass**

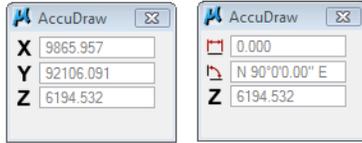
When you start AccuDraw, one of the first things you notice is the AccuDraw compass. The compass shows your origin location (current drawing location) and defines your drawing plane. There are two different drawing plane modes and, therefore, two different compasses: rectangular and polar.



The rectangular mode allows you to enter coordinates or delta distances, relative to the origin point, in an X,Y,Z coordinate system (like an XY=, DX= or DL= keyin). The polar mode allows you to enter distances and angles relative to an origin point (like a DI= keyin).

## The AccuDraw Window

The AccuDraw window is where you enter your X,Y,Z or Distance and Angle values. You can also lock the drawing axes. The window changes according to your compass mode.



**Note:** To toggle the compass (rectangular and polar mode), set the focus into the AccuDraw window and press <Spacebar>.

You can dock the AccuDraw window at the top or bottom of the MicroStation window, or you can float the window into the view.

## AccuDraw locks

You've seen how to lock your X,Y or Distance, Angle entries you enter in the AccuDraw window using the <Enter> key. You can also lock "dynamically" in AccuDraw. Dynamic entries are X,Y or Distance, Angle values that are entered automatically as you drag your cursor. Use the following keyboard shortcuts to lock dynamic entries:

- <X> – to lock x-axis entries in rectangular mode
- <Y> – to lock y-axis entries in rectangular mode
- <D> – to lock distance entries in polar mode
- <A> – to lock angle entries in polar mode

## Smart Lock

Use AccuDraw's Smart Lock feature to lock your cursor in one direction only (your pointer location). For example, if you're working in Rectangular compass mode and you only want to move in the Y direction, lock your cursor on the Y axis, move your cursor up or down and then press < Enter>. You can now only move in the Y direction only. Smart Lock in Polar mode will lock your cursor to the closest 90 degree axis.



Smart Lock summary:

- In Rectangular coordinates, locks X to 0 if the pointer is on the drawing plane; y-axis or Y to 0 if the pointer is on the x-axis.
- In Polar coordinates, locks Angle to 0°, 90°, -90°, or 180° if the pointer is on a drawing plane axis or otherwise locks Distance to its last entered value.

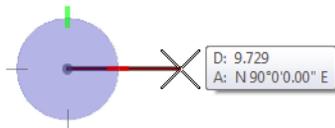
### Rotating the AccuDraw compass

There may be times when you do not want the AccuDraw compass to rotate with the element being placed. Instead, you want the compass to maintain its conventional drawing plan mode of X-axis horizontal and Y-axis vertical. In this case, press **V** on the keyboard to rotate the compass back to the “view” plane.

**Note:** When using AccuDraw with the SmartLine tool, there is a SmartLine placement Setting (select the drop-down arrow) called Rotate AccuDraw to Segments. Toggle this option off if you always want the AccuDraw compass to maintain its conventional drawing plane mode of X-axis horizontal and Y-axis vertical.

The AccuDraw keyboard shortcut **V** will always rotate the compass to the view in which you’re placing elements. Therefore, in a 3D file, pressing **V** in a front view, rotates the AccuDraw compass so that the X-axis is horizontal in the front view; whereas pressing **V** in a top view rotates the compass so that the X-axis is horizontal in the top view, etc. Or, you can quickly rotate the compass to a particular view by pressing the appropriate keyboard shortcut below:

- T – top view
- F – front view
- S – side view



Using these keyboard shortcuts simplifies drawing in 3D. For civil design applications, however, most of the time you will be drawing in a top (plan) view.

Another handy rotation option is Quick Rotate (keyboard shortcut <R> <Q>). This temporarily rotates the compass dynamically as you move your cursor. This is handy to rotate the AccuDraw compass to match the angle of an existing element to place off of that element or when placing cells or text.

### Moving the AccuDraw Origin to your cursor location

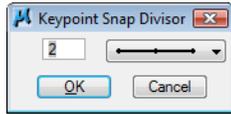
When you tentatively snap to an existing element, press **O** on the keyboard to move the AccuDraw origin temporarily to the tentative location. You can then locate the AccuDraw compass off of this tentative point by entering values in the AccuDraw window. If you accept the tentative with a data point, your compass “sticks” in this location.

### Shortcut snap modes

AccuDraw provides a shortcut alternative for selecting a few snap modes. Instead of selecting the snap mode from the status bar or the Snaps button bar, you can use one of the following keyboard shortcuts:

- <N> — Nearest
- <C> — Center
- <I> — Intersect

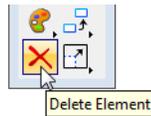
In addition, you can press **<K>** to set the keypoint snap division when using AccuDraw.



## Deleting Elements

### **To delete an element:**

- Choose the Delete Element command from the Main toolbar



- Move your cursor over the element (it will highlight)

**Note:** The element highlights if Identify Elements Automatically is on in AccuSnap Settings. If this option is not on, **<D>** or snap to identify the element.

- **<D>** to accept the deletion

**Note:** Choose Element Select or another tool to get out of the Delete command.

## Using the Undo and Redo Commands

When you delete an element, it is moved to the Undo buffer, so MicroStation actually remembers everything that is placed in the design file, even after it's gone. You can retrieve a deleted element using the Undo command (Edit > Undo). The Redo command (Edit > Redo) negates the last Undo command.

The Undo and Redo commands not only work on deleted elements, but on most graphics commands. For example, you can place a line, use Undo to remove the line, then use Redo to re-place the line.

The Undo buffer is virtually unlimited in size (it's only limited by the operating system file size limit).

The Undo and Redo commands can also be accessed from the Standard toolbar (Tools > Standard).



**Note:** Compressing the design file (File > Compress Design), or exiting the design file clears the Undo buffer.

### **Compressing the design file**

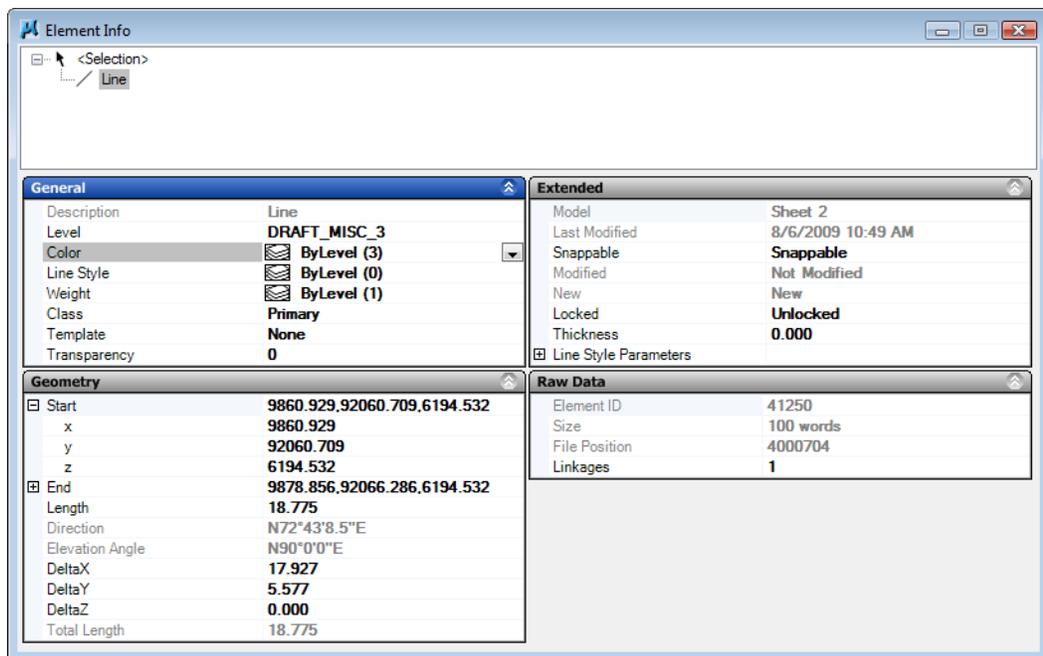
**Select File > Compress > Design** to permanently remove deleted elements from the Undo Buffer. This will make your design file smaller and more efficient. However, you will lose your Undo history for the design file session.

## Element Information

Use the Element Information command from the Primary toolbar to analyze an element for general and detailed information.



Select the element and then **<D>** on the command to get general information on the element's attributes and its properties (solid, snappable, etc.) You can change any information in the General section to update the element. The Geometry section contains information on the element's geometry, including coordinates, size, etc.





# Chapter 7 - Manipulating and Modifying Design Graphics

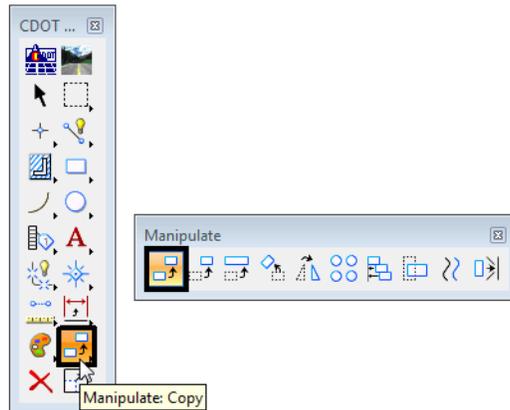
## Using Manipulate Tools

Now that you know how to place basic elements and control their placement using various locks and snap modes, you're ready to learn how to manipulate and modify the elements you've placed.

The **Manipulate** toolbar commands allow you to manipulate the entire element (copy, move, rotate, scale, etc.). Follow your prompts closely to properly execute the commands.

### Chapter Objectives:

## Manipulate Commands



Some of the more commonly used commands include:

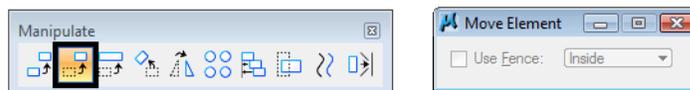
### Copy

Copies an element from one location to another.



### Move

Moves an element from one location to another.

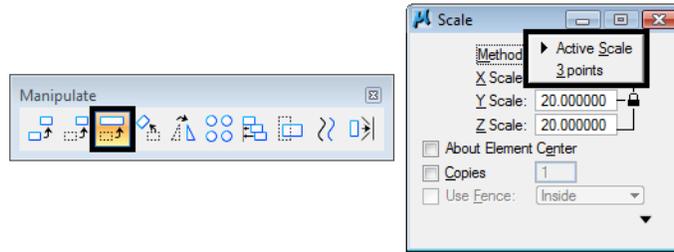


### Scale

Resizes an element based on one of two methods:

- ◆ **Active scale**

### ◆ 3 points



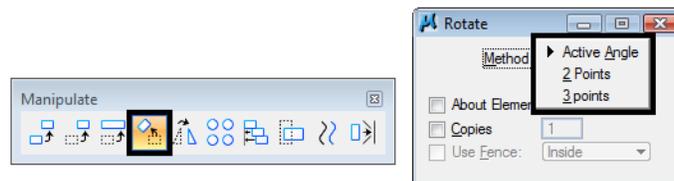
**About Element Center**, which, when used with the **Active Scale** method, allows you to scale about the element's center with just one data point.

If you like, you can create a copy or copies of the scaled element.

### Rotate

Rotates an element using one of three methods:

- ◆ **Active Angle**
- ◆ **2 Points**
- ◆ **3 Points**

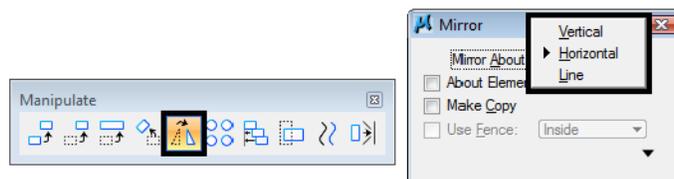


Like the **Scale** command, you can toggle on **About Element Center** which allows you to always rotate about the element's center.

### Mirror

Mirrors an element using one of three methods:

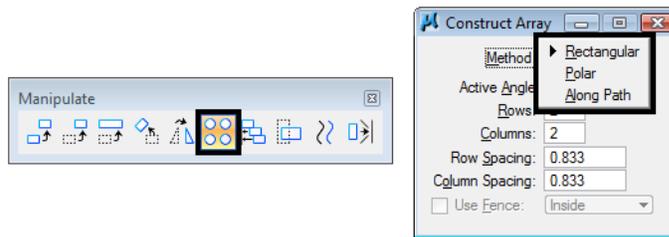
- ◆ **Vertical** — about vertical axis
- ◆ **Horizontal** — about horizontal axis
- ◆ **Line** — about line defined by two data points



### Construct Array

Copies elements multiple times in an array of two types:

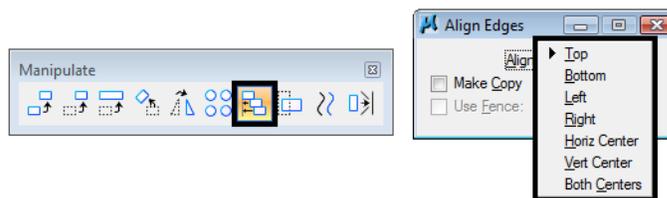
- ◆ **Rectangular**
- ◆ **Polar**
- ◆ **Along Path**



### Align Elements By Edge

Aligns the edge of one element with the edge of another element using one of the following alignment options:

- ◆ **Top**
- ◆ **Bottom**
- ◆ **Left**
- ◆ **Right**
- ◆ **Horiz Center**
- ◆ **Vert Center**
- ◆ **Both Centers**



### Stretch

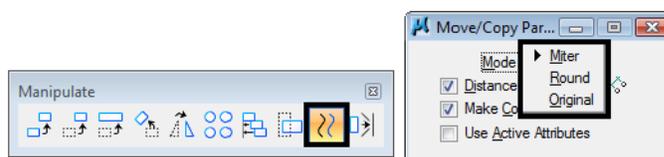
Used to stretch elements by a defined fence or cells.



### Move Parallel

Moves or copies an element parallel to the original element using one of three modes.

- ◆ **Miter** — extends or shortens the segments while maintaining the angle of their connections
- ◆ **Round** — fills the gap with a rounded arc between the two moved elements
- ◆ **Original** — the resulting element is the same type as the original element.



The **Miter** and **Round** modes also help eliminate “loops” that sometimes form in interior corners of the offset element using the **Original** mode.

If you specify a distance, you only need to data point the direction.

With **Use Active Attributes** on, the parallel element takes on the active level, color, style and weight.

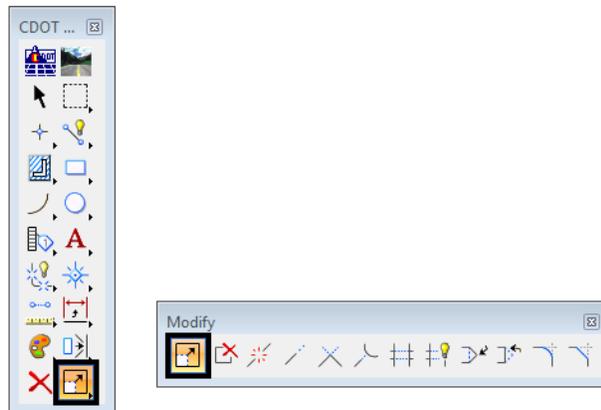
### Move To Contact

Used to move elements until they contact another element.



## Using the Modify tools

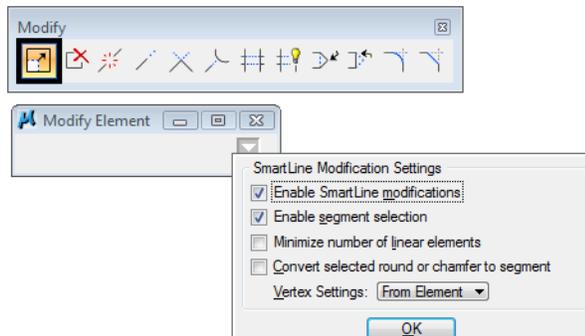
The **Modify** toolbar commands allow you to modify a piece or part of an element (trim, extend, partial delete), instead of manipulating it as a whole.



### Modify

Modifies the geometry of an element. This tool works differently on different types of elements. For example, you can:

- ◆ Move a vertex or segment of a line, linestring or shape
- ◆ Scale a block or circular arc
- ◆ Change a circle's radius



### Partial Delete

Deletes part of an element. The element can be closed, or you can delete an interior portion of line, linestring, curve or arc.



### Break Element

Breaks an element at a defined point.



### Extend

Extend or shorten a line or linestring.



If **Distance** is off, enter a data point to define the new endpoint (i.e. dynamically extend or shorten the line or linestring).

**Note:** Toggle on *From End* to extend/shorten from the nearest endpoint that you identify. If off, the line is extended/shortened relative to the origin point, no matter where you identify the line.

### Extend Two Elements to Intersection

Extends two lines, linestrings, or arcs to their intersection. If the lines or elements currently intersect, it will shorten the elements to their intersection point.



### Extend Element to Intersection

Extends one line, linestring or arc to intersect with another element (which does not have to be another line, linestring or arc). If the original element already intersects or overlaps the second element, it is shortened to the intersection point.



## Trim

Trims an element at its intersection with a specified cutting element. You can trim multiple elements and you can have more than one cutting element.



When identifying elements to trim, always data point on the portion of the element that you want trimmed.

You can place two cutting elements in a selection set before executing the command and trim elements between them. However, a more effective way of accomplishing this is to use the **IntelliTrim** command.

## IntelliTrim

Trims, extends or cuts multiple elements in one operation using two different modes:

- ◆ **Quick Mode** — allows you to draw a line through multiple elements to trim (or extend) to one cutting (or extension) element
- ◆ **Advanced Mode** — allows you to select multiple cutting elements. You can trim or extend elements between or outside of the cutting elements



To extend elements, set the **Operation** to **Extend** and follow the same steps to define an extension element and then draw a line through the elements to extend.

The Operation **Cut** will break elements in two pieces at the cutting element.

## Insert Vertex

Inserts a vertex on a line, linestring or shape. It is also used to attach a line segment onto the end of a line or linestring.



## Delete Vertex

Deletes a vertex on a line, linestring or shape.



## Fillet

Constructs a circular fillet (an arc) of a specified radius between two elements or two sides of a linestring or shape. You can truncate one side, both sides or neither side of the original element.



**Note:** To fillet between 3D elements, they must be co-planar.

## Chamfer

Constructs a chamfer between two lines or two sides of a linestring or shape.



**Note:** To chamfer between 3D elements, they must be co-planar.

## Drawing graphics in 3D

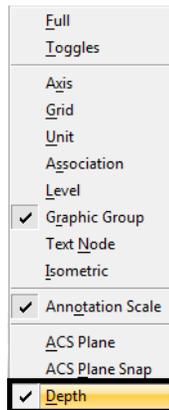
When drawing graphics in a 3D file, you can either draw planar graphics at a particular elevation, or you can draw 3D graphics (endpoints at different elevations).

### Active Depth

To draw planar graphics at a particular depth in a 3D file, set the active depth to the desired depth **<az=depth>**, and then place the graphics. The active depth would be the elevation you want to place the graphics if you're drawing in the top view. For example, if you want to draw the 5000 ft. contour, set **az=5000**, then draw the contour. All data points will be placed at a Z value of 5000 unless you snap or AccuSnap to existing elements.

## Depth lock

When placing new graphics by snapping on to existing elements, you'll pick up the elements' elevation if **Depth** lock is turned off. **Depth** lock locks all of your data points onto the view's active depth plane. Therefore, if you want to place planar elements, but you're snapping on to elements at different elevations, set the active depth to the desired elevation *<az=depth>*, and then turn **Depth** lock on.



## Depth lock and AccuSnaps

Depth lock behaves inconsistently with AccuSnap. Therefore, if you want to place element with **Depth** lock *on*, turn AccuSnap *off* and **Tentative** snap to the elements.

## Using the CDOT Menu ModElev Add On

Another way to set the elevation of an element in the top view of a 3D file is to move it (after it is placed) in the Z direction only. This is useful if you want to planarize elements to a specified elevation. The ModElev program is located on the *CDOT Menus*. Select **Add On's > ModElev**.



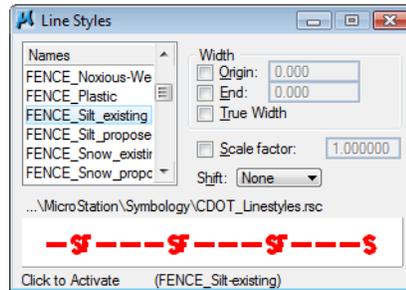
You can specify the elevation to planarize a single element, elements within a fence or all elements in the design file.

## CDOT Custom Line styles

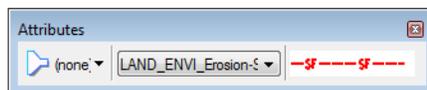
CDOT custom line styles are used to represent various types of graphics in the CDOT MicroStation configuration. CDOT custom line styles, unlike standard line styles, can be scaled. The line style scale should match the plot scale of the sheet file in which they will be referenced.

## Setting the Scale

You should set the line style scale before placing the custom line style. The line style scale is set under **Element > Line Style > Custom**. In the default CDOT workspace, the custom line style scale is set to **100**. You only need to change the custom line style scale if you will eventually reference this file into a sheet with a different scale.



**Note:** Custom line styles are assigned to levels via **ByLevel** symbology. The line style is automatically selected when the level is set active.



## Changing the scale

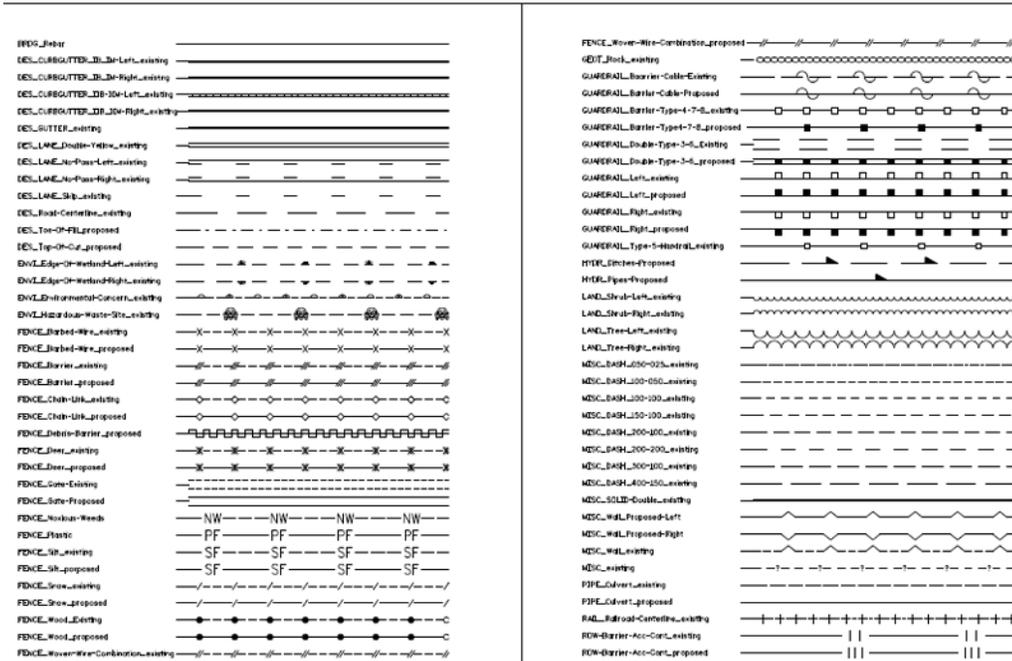
If you have placed a line style at the wrong scale, you can change the scale with the keyin **Change Linestyle Scale ##** (where ## = the scale), and then select the element to change.

## Changing Direction

Some custom line styles are directional and depend on the direction they are drawn (e.g. Type 3 guardrail). If you place a custom line style in the wrong direction, key in **Change Direction**, and then select the element.

For more information on custom line styles, see the *CDOT CADD Manual, Chapter Five – Drafting Standards, Section 5.7 – Line Styles* and follow the *CDOT Line Styles* links.

### CDOT LINE STYLES

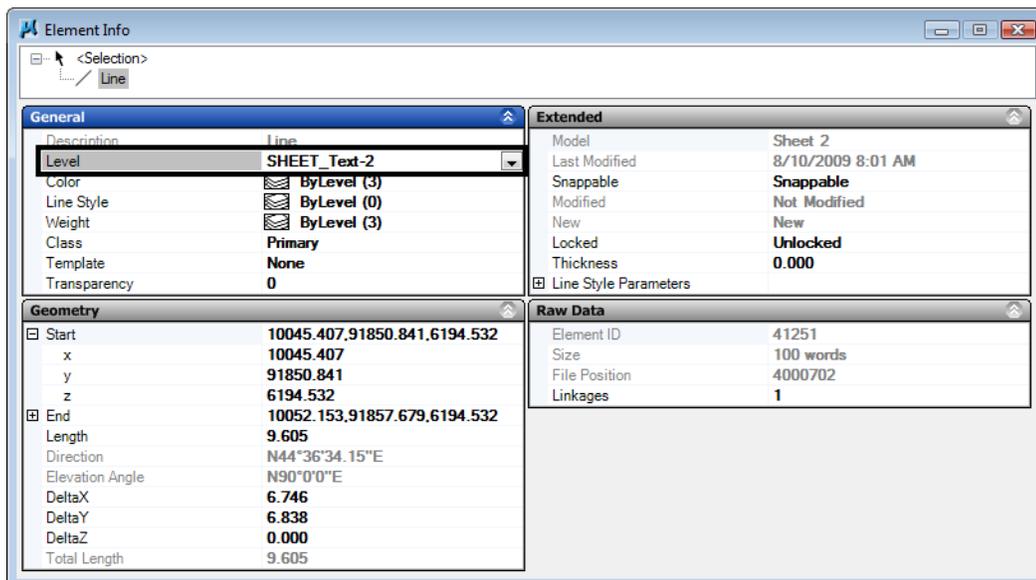


## Changing Levels and ByLevel Symbology

If you place an element on the wrong level, and thereby place it with the wrong *ByLevel* symbology, you can change that element to the correct level. Once changed, the graphics will take on the new level's *ByLevel* symbology (as long as the element was originally placed *ByLevel*).

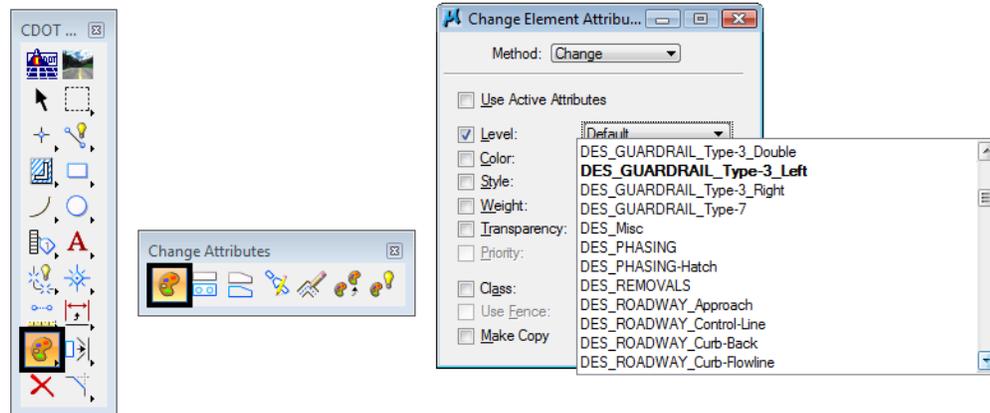
### Using Element Information

You can change the level of an element using the **Element Information** command.



## Using the Change Element Attributes tool

The **Change Element Attributes** command on the **Change Attributes** toolbar also allows you to change an element's level.



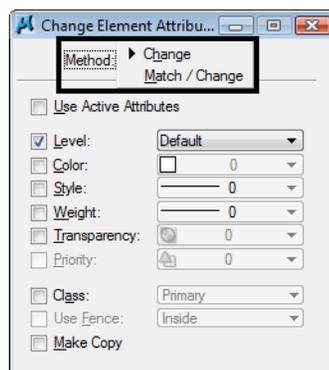
There are two options:

- **Change**

With this option, set the level you want to change to, then select the element.

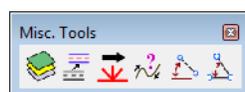
- **Match/Change**

With this option, you can change an element to a level by matching another element's level. First select the element to match, then select the element to change.



**Note:** *Be careful!* If **Use Active Attributes** is turned **on**, the level you set in the **Change** option, or the level you match in the **Match/Change** option, will become the **active level**. If you do not want to change your active level, turn this option **off**.

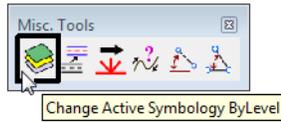
## The CDOT Misc. Toolbar



The CDOT Miscellaneous Tools toolbar (**Add On's > Launch Miscellaneous Tools** from the **CDOT Menu**) contains six useful tools:

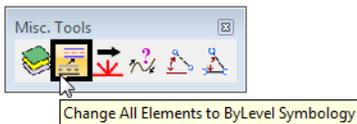
### Change Active Symbology ByLevel

If you accidentally change the active color, line style or line weight in the **Change Element Attributes** command, you can re-set the actives back to **ByLevel** symbology with the **Change Active Symbology ByLevel** command.



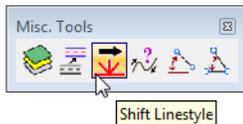
### Change All Elements to ByLevel Symbology

If graphics have been placed with symbology other than **ByLevel** symbology, use the **Change All Elements to ByLevel Symbology** command. This is especially useful before plotting to ensure all graphics conform to CDOT standards.



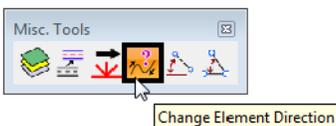
### Shift Linestyles

Sometimes custom line styles need to be shifted to meet in corners to avoid interference with other graphics. Use the **Shift Linestyle** tool to accomplish this.



### Change Element Direction

The display of some custom line styles is dependent on the direction the line was drawn. Use the **Change Element Direction** tool to reverse the line so that the style is displayed as desired.



### Active Angle From 2 PTs

Use the **Active Angle From 2 Pts** tool to set the active angle by the selection of two points.



### Active Angle From 3 Pts

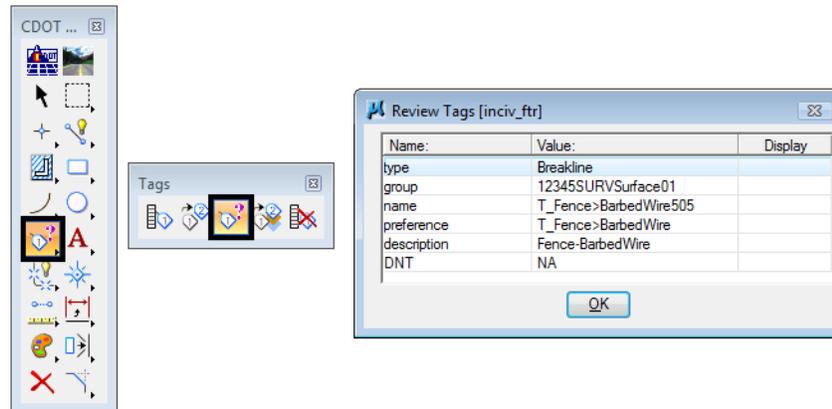
Use the **Active Angle From 3 Pts** tool to set the active angle by the selection of three points.



## Tags

MicroStation tags are a special way of attaching information to elements drawn in the design file. For example, survey graphics contain tag information like feature name, the InRoads preference and description.

Use the **Review Tags** command on the **Tags** toolbar to obtain tag information on an element.





# Chapter 8 - Cells and Patterns

## Understanding Cells

Cells are a permanent group of graphics. They are typically used for standard graphics (symbols, details, notes, borders, etc.), which may be used over and over on multiple projects. Cells are stored in a separate cell library file.

When you're ready to place the cell in your design file, attach the cell library to the file. You can then place the cell out of the library multiple times, like a rubber stamp. Once the cell is placed in the design file, it is a single element that exists in the design file. You do not have to have the cell library attached to see the cell.

### **Cell libraries**

Cell libraries are just ordinary MicroStation design files that have a **.cel** extension. Cells can be organized into different libraries or you can place all cells in one library. CDOT uses discipline-specific cell libraries, where each group has its own library (Design, Bridge, Traffic, etc).

### **Cell Library = DGN file**

The cell library file contains multiple models and each cell is stored in a separate model.

### **Cell = Model**

## What Are MicroStation Models?

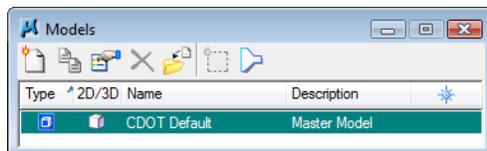
Models are “containers” for graphics within a DGN. Design files must have at least one model (named **CDOT Default** in the CDOT workspace), but can have many. Models in a DGN file are analogous to a workbook in an XLS file. Just like each workbook is a separate spreadsheet, each model is a separate set of graphics. And, you can have multiple models in a DGN just like multiple spreadsheets in a XLS file.

**Note:** Do not confuse **Model files** with **MicroStation Models**. They are two totally separate concepts. A **Model file** is a generic term used to describe any working file that contains graphics. A **MicroStation Model** is a separate container for graphics inside any MicroStation file – Model or Sheet file.

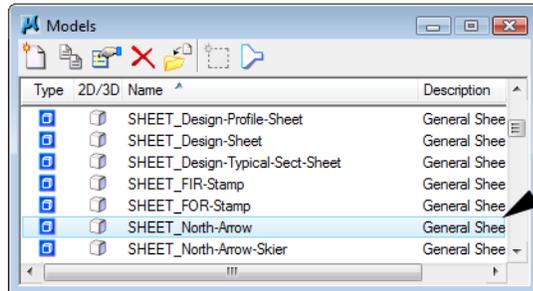
**Models** are accessed from the **Primary Toolbar**. They can be entirely different sets of graphics or different components of the same project (e.g. three separate models for plan, profile and cross sections in one project DGN file).



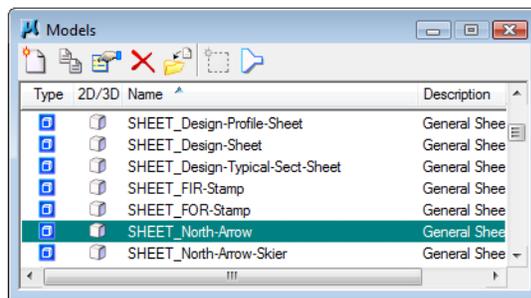
**In almost all cases, you will work in one model -- the CDOT Default model in all model files and sheet files.**



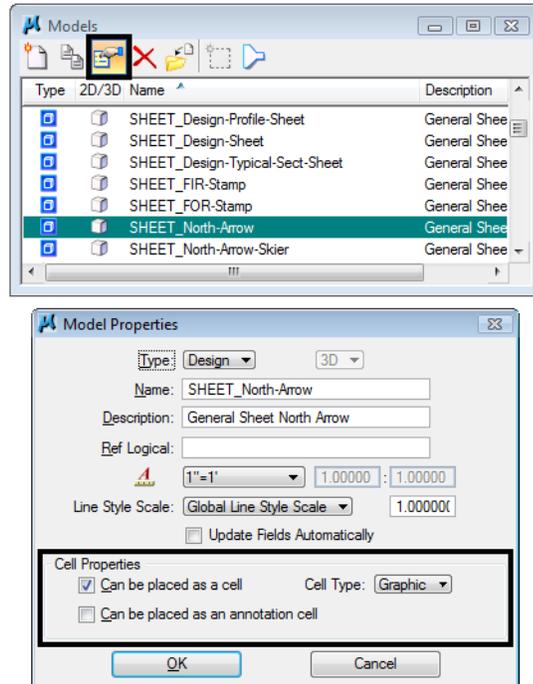
**The one exception is when you're working directly in a cell library.** Each cell in a cell library is actually just a separate model inside the cell library design file (cell=model). The design file containing the model (cell) can be attached to any other design file as a cell library, and then the model (cell) can be placed out of this file.



Models in a cell library. Each model is a cell.



In order for models to be placed as cells, the option **Can be placed as cell** must be toggled on in the model's properties. In the **Models** dialog box, select the **Edit Models Properties** command to turn this option on/off.



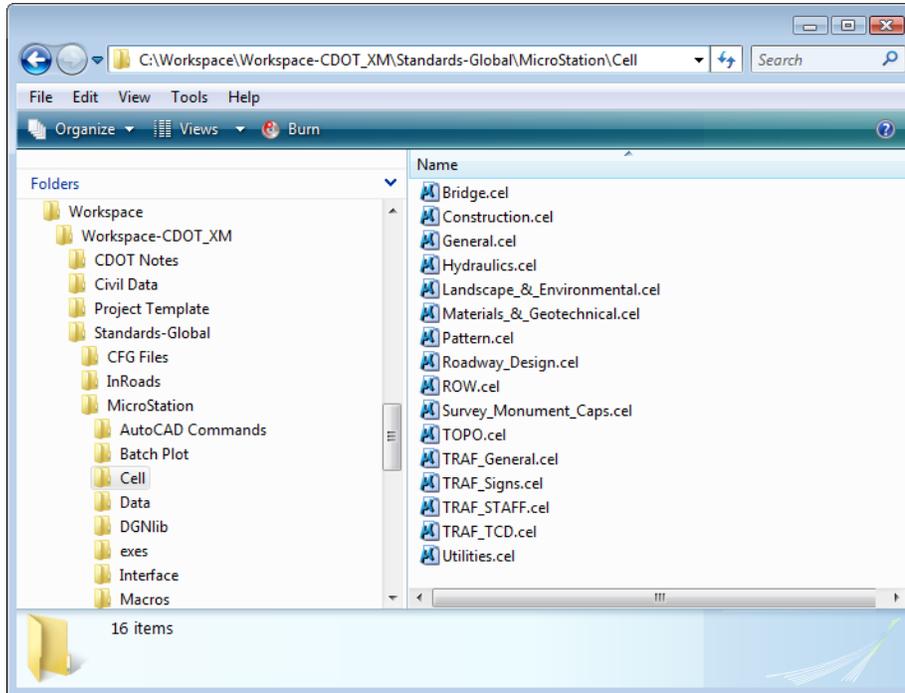
The design file's levels are shared among all models; however each model can have different levels turned on/off for different views. A **Global Display** or **Global Freeze** mode on the **Level Display** box carries through to all models.

Models can also be imported from other DGN files. This is a good way to copy a lot of graphics from one DGN to another, or a good way to build a cell library.

### CDOT Cell Libraries

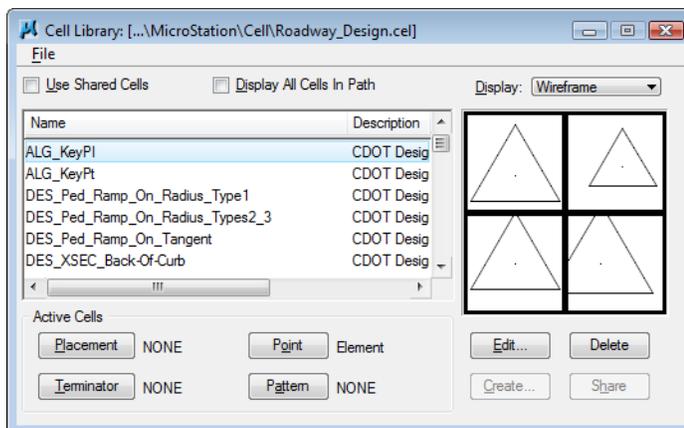
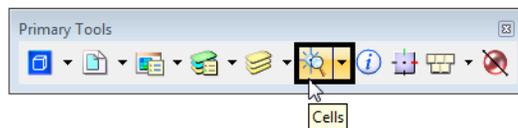
Many of the CDOT standard cells have been created and are stored in discipline-specific cell libraries (e.g. Design, Bridge, ROW). The appropriate cell library or libraries are attached to the discipline seed file. When you create a new file from a discipline seed file, the associated cell library is automatically attached to the new file.

The standard CDOT cell libraries are stored in the CDOT workspace in the folder **C:\Program Files\Workspace-CDOT\Standards-Global\MicroStation\Cells**. The discipline-specific as well as general cell libraries (used by all groups) are shown below.



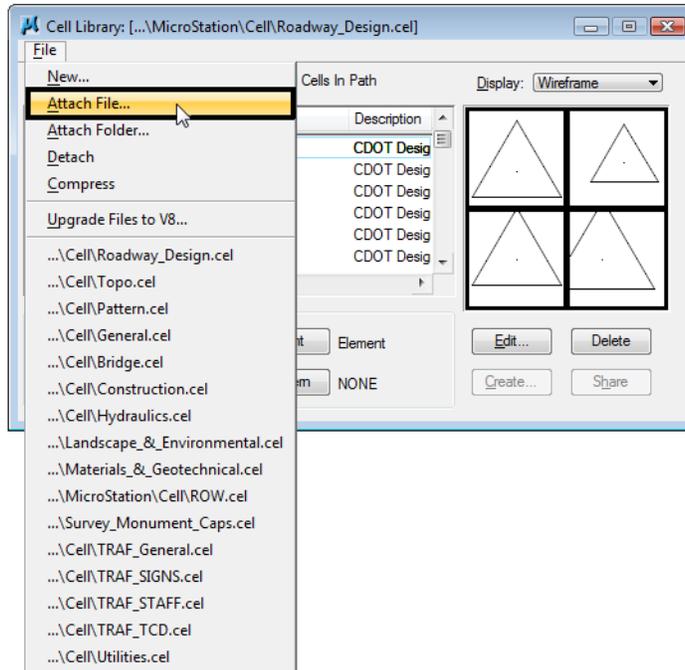
### The Cell Library Dialog

To view all cells contained in a library, you can open the **Cell Library** dialog box. Select **Element > Cells**, or select **Cells** from the **Primary** toolbar.

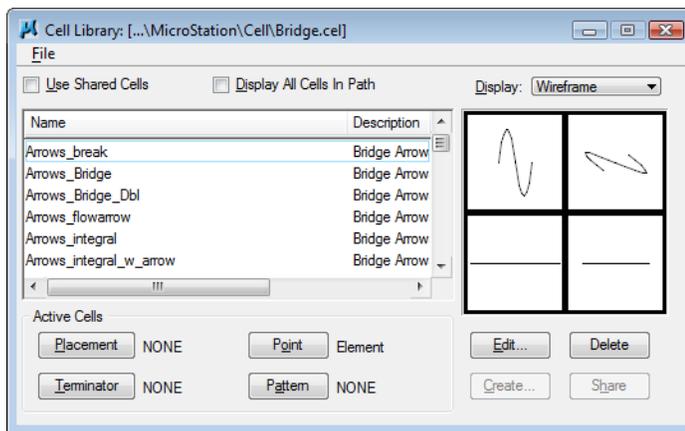
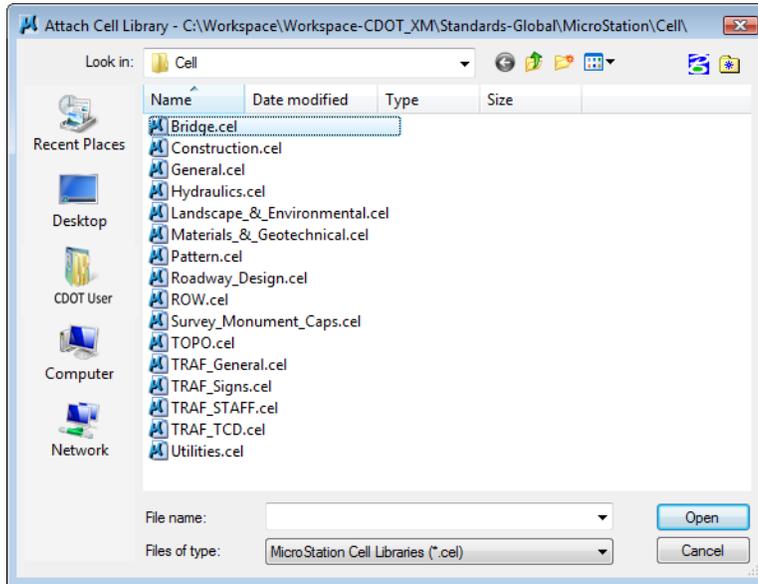


This opens your discipline cell library (attached via your seed file) and a list of cells is shown in the **Cell Library** dialog box.

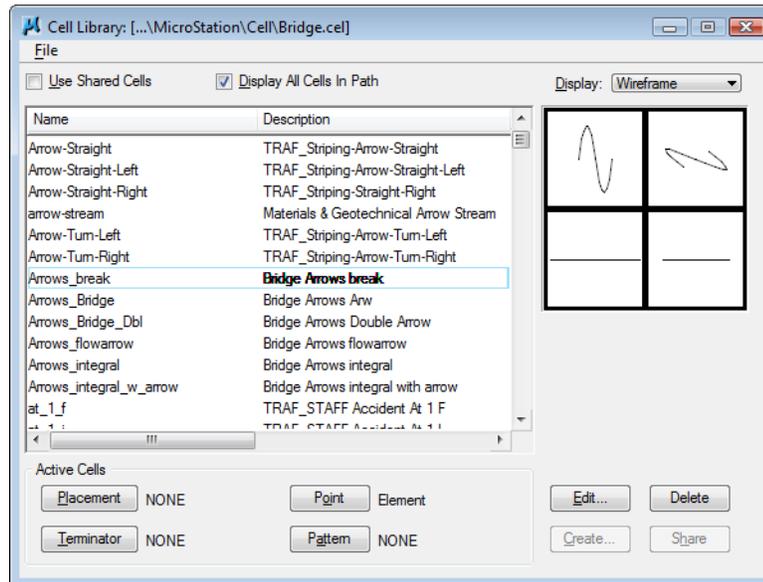
If you want to access cells from a different library, you can manually attach a library to your active design file. From the **Cell Library** dialog box, select **File > Attach File**.



When working in the CDOT workspace, the configuration automatically sets the correct path for *.cel* files. Select the library to open and then select **OK** to attach the library.



**Note:** You can only attach one cell library at a time; when you attach a library, it automatically detaches the current library and attaches the new one. Only the cells from the active library are shown in the list of cells. **However**, if you toggle on **Display All Cells in Path**, MicroStation displays cells from all of the CDOT libraries that are pathed in the CDOT configuration.



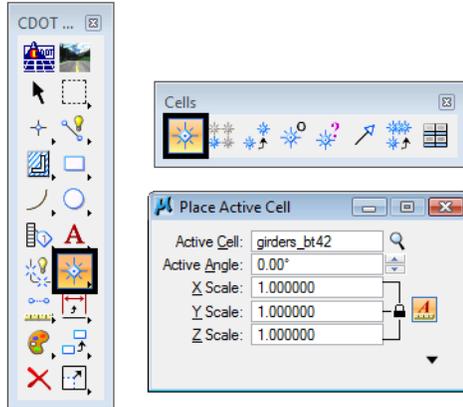
### Types of cells

Cells are either **Graphic** cells or **Point** cells. **Graphic** and **Point** cells have different properties after they are placed in the design file. The properties of each type of cell are as follows:

	<b>Graphic Cell</b>	<b>Point Cell</b>
Symbology	Maintains active settings used when created	Takes on active settings when placed
Level	Level(s) as created (relative or absolute mode) when placed	Active level when placed
Snappable points	Keypoints	Cell Origin
View	View dependent — appears different according to the view (top, front, etc.)	View independent — appears as originally drawn in all views

### Placing Cells with the Place Active Cell Command

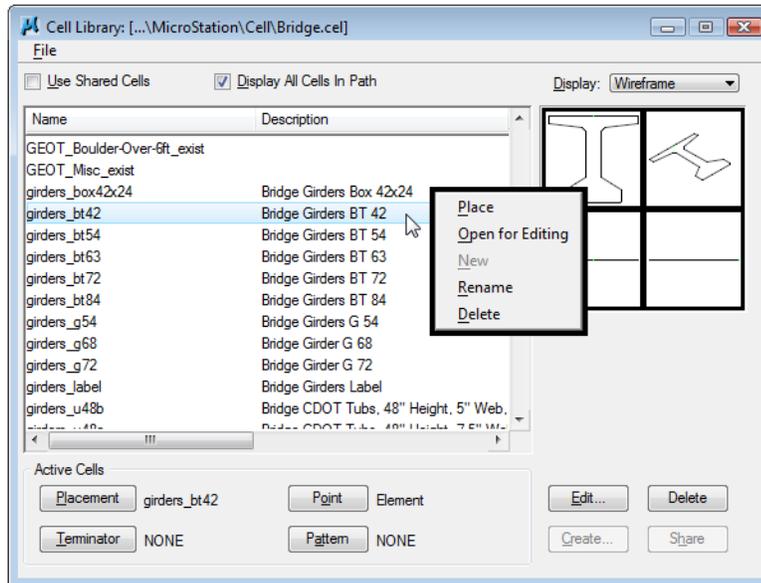
You can place cells out of the cell library into your design file using the **Place Active Cell** command located on the **Cells** toolbar.



The command places either a point or graphic cell in the design file using the active placement parameters including:

- Active cell name (you can browse out to the cell library and select the cell from a list – double-click the cell to make it active)
- Active scale (**as**= <*scale factor*>)
- Active angle (**aa**= <*angle*>)
- Active element symbology — for point cells only
- Active level — for point cells only

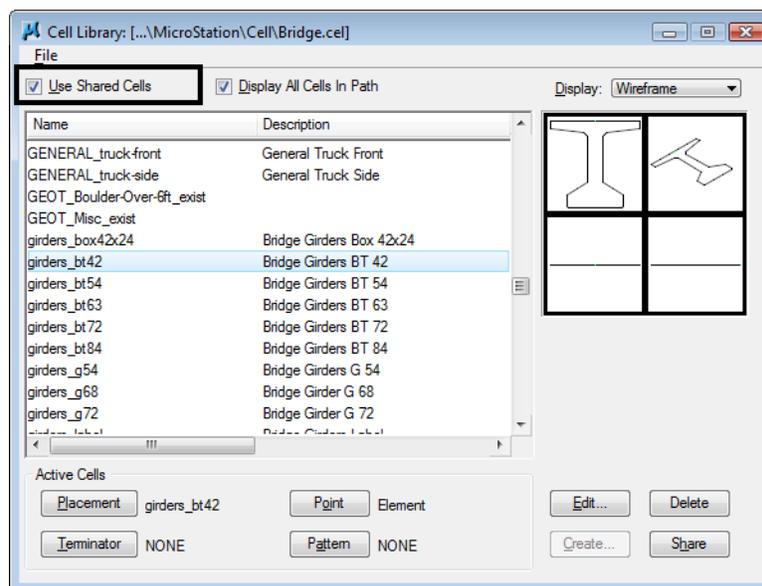
**Note:** You can also place a cell by **<D> <D>** clicking on it in the cell library dialog box. This sets the cell as the active Placement cell and automatically selects the **Place Active Cell** command. You can also **<R>** on the cell in the cell library dialog box and select **Place**.



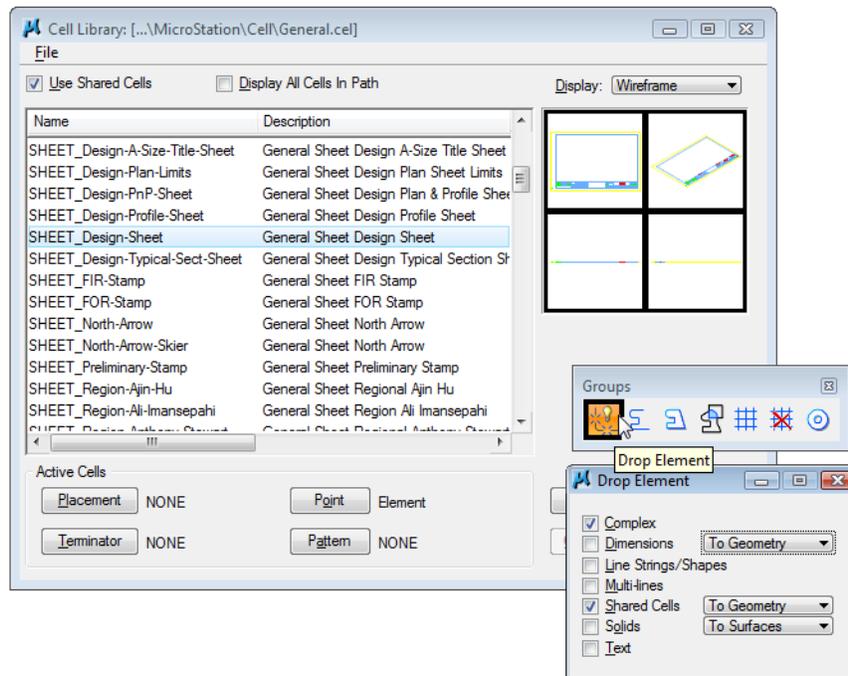
## Shared Cells

Cells can be placed as **Shared**. Then, when you place multiple cells in a design file, MicroStation stores the shared cell definition data once, and all other instances of the cell placement reference this definition. Shared cells keep your design file efficient by writing the cell graphics to the file only once.

**Note:** To place a shared cell, toggle on **Use Shared Cells** in the cells dialog box.

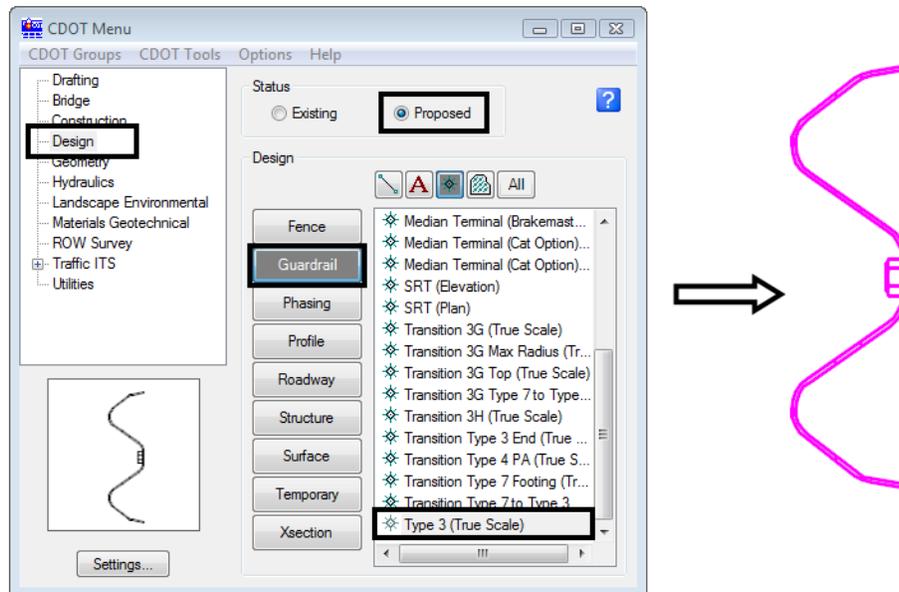


If you're placing a sheet border cell, do not place it as shared. If you do, you will not be able to edit the cell text. If you want to remove the share status of a cell, you can do so with the **Drop Element** command. You can drop a *Shared Cell* to a Normal Cell (for text editing) or to **Geometry** (individual graphics).

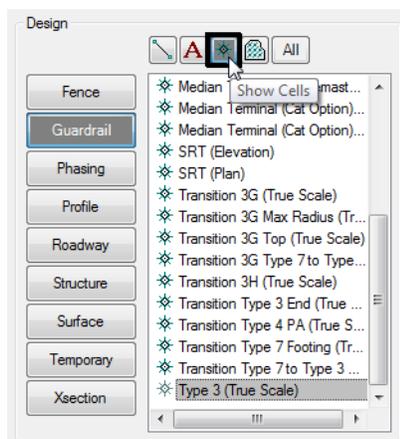


## Placing Cells with the CDOT Menu

The CDOT Menu streamlines the process of placing cells. After selecting the **Group**, **Status** and **Category**, a list of available cells for that category is shown in the item selection window. Just select the cell item and then place it in your file. The proper level is set active and the **Place Active Cell** command is automatically selected. The specified cell is automatically set active and placed out of the appropriate cell library.



**Note:** You can set the **Filter** to **Show Cells** to filter only the cell items for a category.



## Cell Divide Program

The *Cell Divide* program located on the *CDOT Menu* (**CDOT Menu > Cell Divide**), will divide any linear or curvilinear elements with the active cell. The program allows you to specify a length and angle to place the cell along the element.

## More information

For more information on cells and cell libraries, see the **CDOT CADD Manual, Chapter Five – Drafting Standards, Section 5.1 Cell Libraries.**

### 5.1 Cell Libraries

The libraries are automatically loaded through the use of configuration variable cell library lists (MS\_CELLLIST) and available from the Cell Library dialog box within MicroStation. When the user opens a design (.dgn) file in MicroStation, all of the 16 cell libraries will be available for attachment from the Cell library dialog boxes' File dropdown menu. The Cell Library dialog box contains a location for selecting the Display All Cells in Path. If this toggle is chosen, all cells within the workspace are available for use within the cell list. By default this toggle is not selected.

#### 5.1.1 Types of Cells

There are two types of cells available within the CDOT workspace: Graphic cells and Point cells. The major differences include Graphic cells maintaining the symbology they were created with when placed and Point cells taking on the active symbology when placed. The one exception is when Graphic cells are created on the default level. In this case the cell will adopt the active symbology similar to a point cell. Another difference is cell rotation. Graphic cells will remain rotated as placed while Point cells are "view independent". View independent applies to both cells and text and means that if a view is rotated, a plan sheet for example, the cell or text will remain oriented to the view, not as rotated when placed. Graphic cells have become the main choice at CDOT and are utilized wherever possible and point cells have been removed in all but a few cases.

[Learn more about Cell Types](#)

#### 5.1.2 Cell Placement

Cells have been created to be placed relative to the plot scale, or the active scale which should be equivalent to the Model Properties>Annotation Scale setting. Cells can be placed in either the Model file or the Sheet file, depending on what type of drawing is being produced. Most cells have been drawn at a 1:1 scale, based on the CDOT Seed file resolution, but there are some exceptions. The scaling exceptions are those cells discussed below. The insertion point of each cell is the coordinate 0,0,0 in each model. When cells are placed into a Model File, the individual Specialty Group lead is responsible for providing the base mapping. If a different scaled model is desired, the group lead should be contacted for the desired scale. The varying scaled base mapping should reside in the Specialty Group folder structure and referenced to the project plan set sheet files.

The Hydraulic (Hydraulics.cel) library contains many true size cells that have been drawn true size and must be placed at an active scale factor of 1 to be true scale. These cells include Plan and Elevation Inlet cells and Plan and Elevation End Sections cells. The Traffic (TRAF.General.cel) library also contains many striping pavement markings that have been drawn true size and must be placed at an active scale factor of 1 to be true scale.

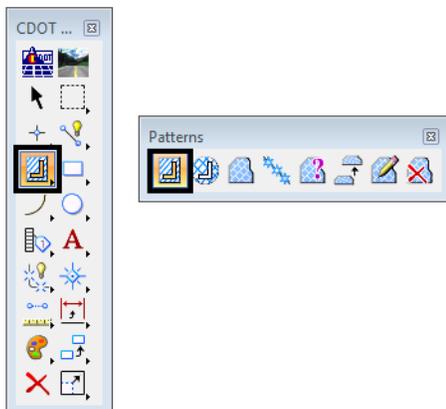
## Creating Cells

For information on how to create a cell library and cells, see the lab *Create a Project Specific Border*.

## Understanding patterns

You may have a need to pattern areas with a hatch, crosshatch or special pattern (concrete, rip-rap, etc.). Or, you may need to pattern linear elements like pavement lines with an asphalt pattern. For these situations, you'll use MicroStation's patterning tools.

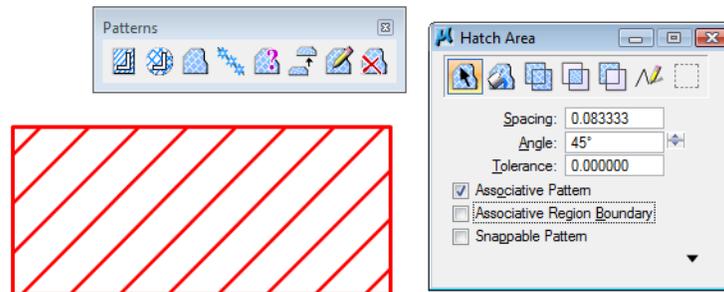
### Patterns toolbar



The **Patterns** toolbar contains tools for hatching and cross-hatching shapes or areas. You can also pattern any line, shape or area with a cell. The **Pattern** tools include:

## Hatch Area

The Hatch Area command hatches a closed shape or area in the active model or a reference. Set the **Spacing** (in master units) and **Angle** of the hatch line and turn on **Snappable Pattern** if you later want to snap to the pattern graphics (the hatch lines in this case). If you're patterning a curved element, key in a **Tolerance** or minimum distance for chording off the pattern around the curve.



Toggle on **Associative Patterning** if you want the pattern to update if the element is modified. In addition, broken patterns can be re-associated by re-connecting the pattern shapes.

Toggle on **Associative Region Boundary** to place the pattern on different level from the patterned element (useful for removing the “box” around text)

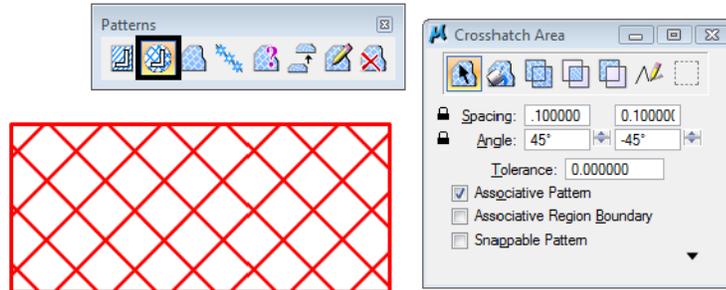
The icon bar at the top of the dialog box allows you to select the pattern method (how the area will be patterned), which includes (items listed in order from left to right on the icon bar):



- ◆ **Element** — a closed shape
- ◆ **Flood** — the area enclosed by a set of elements
- ◆ **Union** — area defined by the union of two or more closed shapes
- ◆ **Intersection** — area defined by the intersection between two or more closed shapes
- ◆ **Difference** — area defined by the difference between two or more closed shapes
- ◆ **Points** — an area defined by a series of data points where you dynamically define an area
- ◆ **Fence** — the area inside the fence

## Cross Hatch Area

The **Cross Hatch Area** command uses similar settings to the **Hatch Area** command to cross-hatch an area.

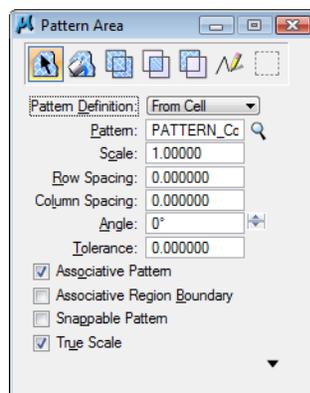
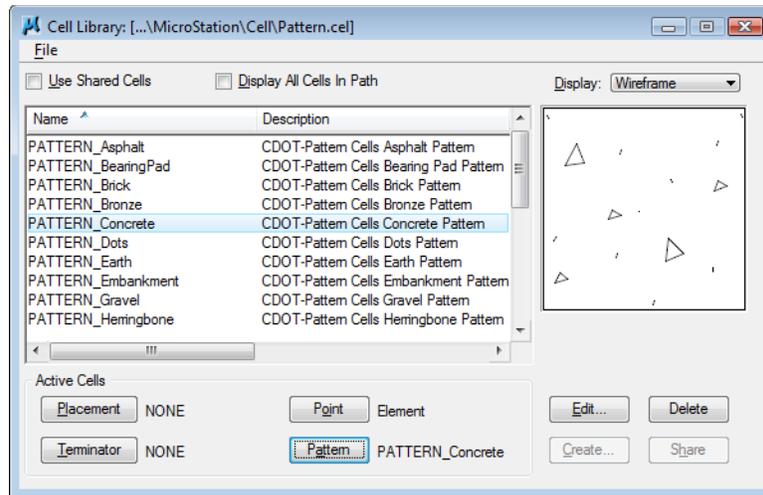


## Pattern Area

This command patterns an area or closed shape with a cell. The pattern element(s) can be in the active design file or in references.



Key in the active **Pattern** cell or set it in the **Cells** dialog box (**Element > Cells**). If you toggle on Display All Cells in Path, all pattern cells begin with the cell name PATTERN.



Set the active **Scale** to size the cell, the active **Angle** to determine the placement angle for the pattern graphics, and the pattern **Row** and **Column Spacing** in master units (distance between the tiled cells). The **True Scale** option will reconcile the difference between the cell model's working units and the working units of the design file model in which it is placed (e.g. patterning with a metric cell in an imperial design file model). For this option to work, the pattern cell must be a shared cell.

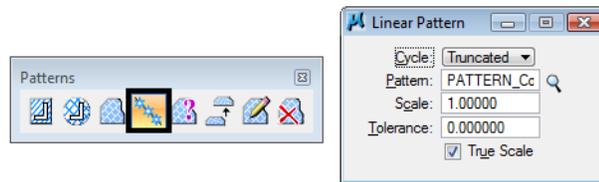
Other options are the same as noted for the **Hatch** and **Crosshatch** commands.

### Linear Pattern

**Linear Pattern** patterns with a cell along an existing linear element. You can pattern both linear and curvilinear elements. Specify the **Cell**, **Scale** and **Tolerance** just like the **Pattern Area** command. In addition, the **Linear Pattern** command has the following **Cycle** options:

- ◆ **Truncated** – places the cell for the linear pattern using the specified active scale. Based on this scale, the last instance of the pattern may be truncated.
- ◆ **Complete** – adjusts the scale for pattern cell so that only complete instances of the cell are placed along the linear element.
- ◆ **Single** – patterns with one instance of a cell on each linear segment.

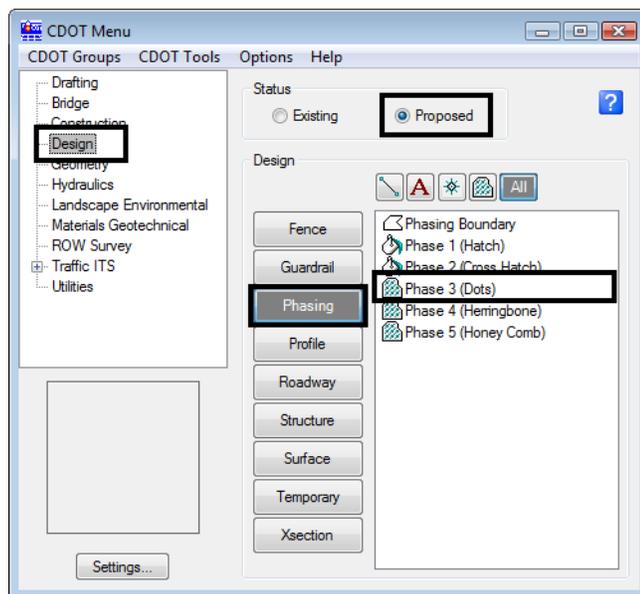
- ◆ **Multiple**– adjusts the scale for pattern cell so that only complete instances of the cell are placed along each segment of the linear element.



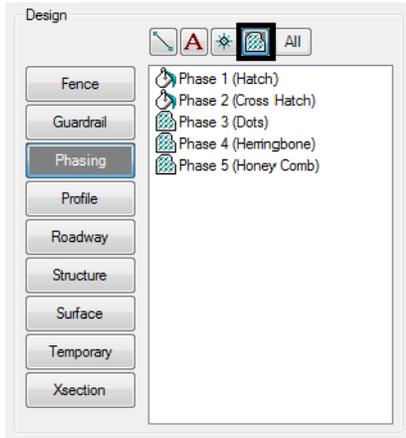
After patterning, you can turn off **Patterns** in the **Settings>View Attributes**. Doing so will display the original linear element.

### Placing Patterns with the CDOT Menu

The **CDOT Menu** streamlines the process of placing patterns. After selecting the **Group**, **Status** and **Category**, a list of available patterns for that category is shown in the item selection window. Just select the pattern item and then data point inside the region to pattern. (The CDOT Menu uses the Flood method of patterning, so you must data point inside the region to pattern). The proper pattern level is set active and the appropriate pattern command is automatically selected (**Hatch Area**, **Cross Hatch Area**, **Pattern Area** or **Linear Pattern**). If patterning with a cell, the appropriate pattern cell is automatically set active.



**Note:** You can set the *Filter* to *Show Patterns* to filter only the pattern items for a category.





# Chapter 9 - Grouping Design Graphics

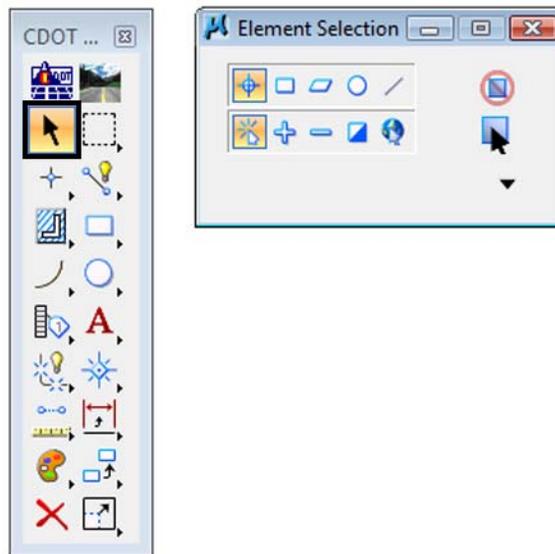
There are times when it is necessary to group elements because it is more efficient to place, modify or manipulate groups of elements rather than perform repetitive commands on individual elements. Element groups can be:

- ◆ Temporary — fences and selection sets or
- ◆ Semi-permanent — graphic groups and complex elements.

## Temporary groups

If you want to perform a one-time manipulation on a group of elements (i.e. copy them or delete them), create a selection set or use a fence to group the elements.

### *Using Selection Sets*



The **Element Selection** toolbar provides various methods for temporarily grouping elements. Once grouped, elements can be modified, manipulated or deleted as a group. When elements are grouped with these tools, they are placed in a selection set and remain in the selection set until you clear the set.

When elements are added to a selection set, they become highlighted. You can set the selection set color under **Settings > Design File > Color > Selection Set Color**. You can also quickly see the number of elements in the selection set from the indicator on the **Status Bar**.

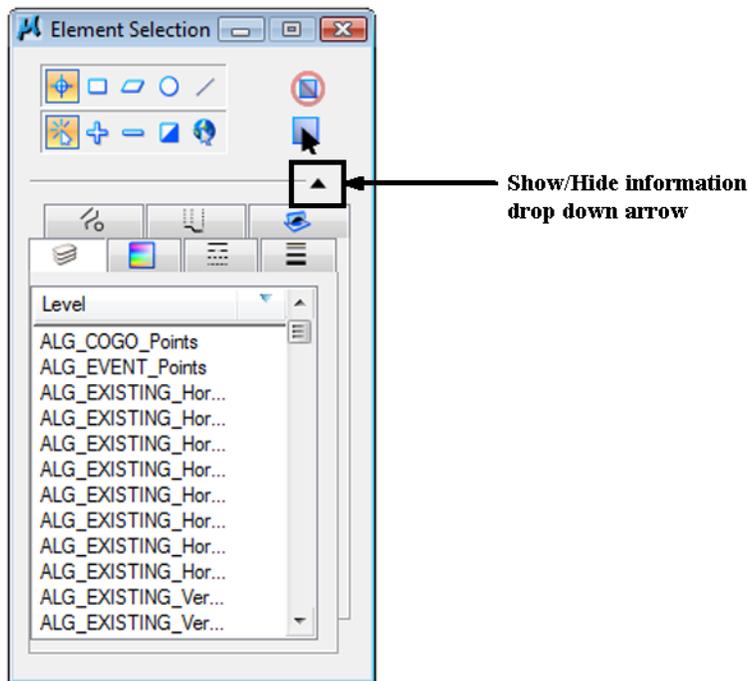
These tools include:

#### *Element Selection*

Selects individual elements and adds them to the selection set. You can select multiple elements by either holding down the Ctrl key or by holding down the data button and dragging across the elements.

### Power Selector

Power Selector provides more options for how elements are added to or deleted from the selection set. This includes filtering elements based on their attributes (color, style, weight, etc.) In many cases, you can find and add elements to a set much more quickly by filtering on attributes (e.g. all elements on level Design\_Guradrail\_Type-3), than individually picking them with the Element Selection tool.



**Power Selector** also provides several methods for selecting elements including:

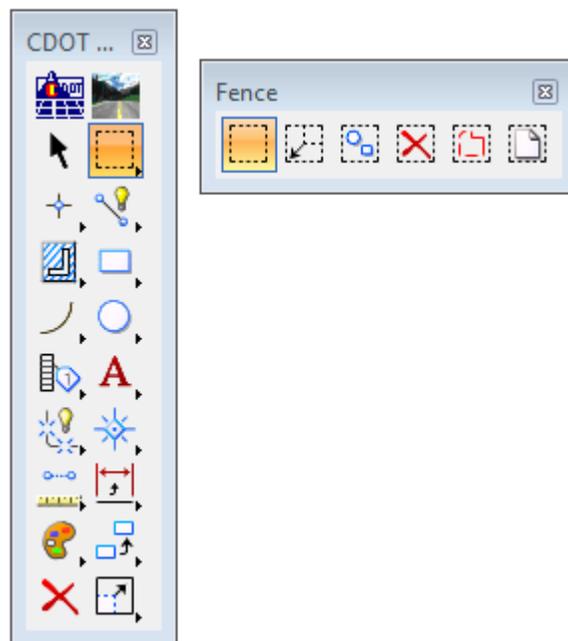
- ◆ **Individual** — <D> on individual elements.
- ◆ **Block** — selects all elements inside a block you draw. You can toggle the Block option to either inside or overlap.
- ◆ **Shape** — selects all elements inside an irregular shape your draw. You can toggle the Shape option to either inside or overlap.
- ◆ **Line** — selects elements by drawing a line through the elements.

The **Mode** option gives you options for adding and removing elements from the set including:

- ◆ **Add** — places elements in the set.
- ◆ **Subtract** — removes elements from the set.
- ◆ **Invert** — toggles an element (adds a removed element or removes an added element).
- ◆ **New** — clears the current selection set and creates a new set.
- ◆ **Clear/Select All** — removes all selected elements from the current set, or adds all elements if the set is empty.

To access the attribute filtering option, select the **Show Selection Information** drop down arrow on the PowerSelector **Tool Settings** box.

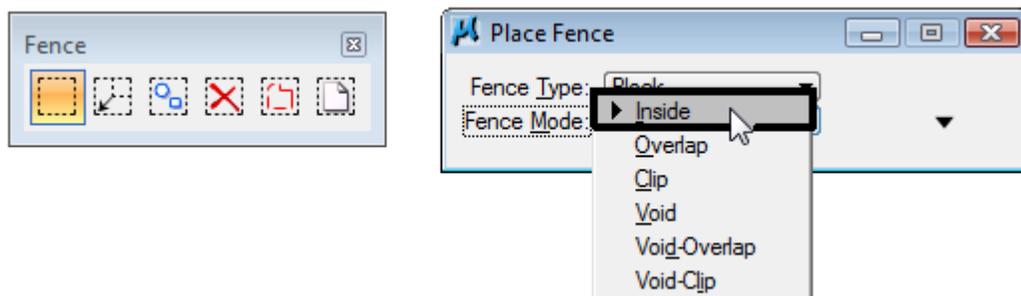
## Using Fences



The **Fence** toolbar provides another set of tools to temporarily group elements. Once placed in the fence, the elements can be deleted, manipulated or the attributes changed. When the fence is removed, the elements are no longer grouped.

### *Place Fence*

Temporarily groups elements by drawing a fence boundary around the elements. There are several types of fences you can place including blocks (drawn corner to opposite corner), shapes, and circles, also by element, view or design file.



The fence mode determines which elements will be affected by the fence. These include:

- ◆ **Inside** — to select elements entirely inside the fence.
- ◆ **Overlap** — to select elements inside or overlapping the fence.
- ◆ **Clip** — to select elements inside the fence and cut or break all elements that intersect the fence.
- ◆ **Void** — to select all elements outside the fence.
- ◆ **Void-Overlap** — to select all elements outside or overlapping the fence.

- ◆ **Void-Clip** — to select elements outside the fence and cut or break all elements that intersect the fence.

Once the elements are grouped in the fence, they can be deleted, manipulated, etc. You can use MicroStation view controls (**Zoom In, Zoom Out, Pan** etc.) and the fence remains persistent.

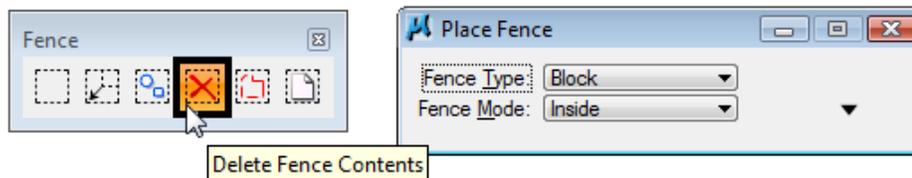
To remove the fence, select the **Place Fence** command again.

**Note:** Check the fence indicator on the **Status Bar** to quickly determine if there is a fence placed in the design file.

The **Void** and **Clip** modes are two features not available with selection sets. However, there may be times when attribute filtering (not available with fences) is easier to use — especially when grouping graphics in high-density areas.

### Delete Fence Contents

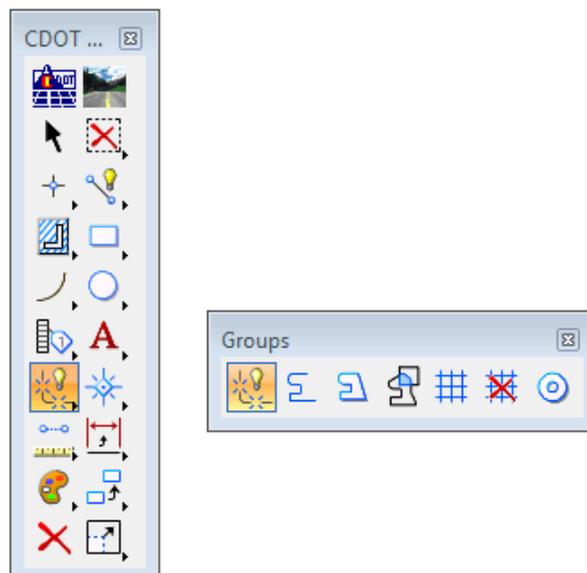
Deletes the contents of the fence based on the fence mode. Note that the **Delete Element** tool on the **Main** toolbar *does not* work for fenced elements.



## Semi-permanent groups

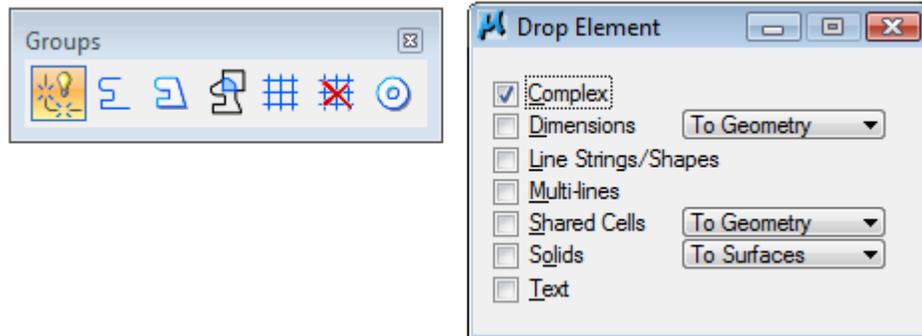
For groups that require more frequent manipulation, it is often more efficient for the elements to remain grouped until you “ungroup” them. These groups — complex chains, complex shapes or graphic groups are created using the **Groups** toolbar.

### Groups toolbar



## Drop Element

**Drop Element** returns a complex element to its original graphics. In addition to breaking up complex elements, this command is also used to drop other types of groups including linestrings and cells (discuss later).



## Creating Complex elements

### Create Complex Chain

The Create Complex Chain command joins a series of lines, linestrings and/or arcs into one element with two end points. This command uses two methods:

- ◆ **Manual** — you graphically select each element to add to the complex chain.
- ◆ **Automatic** — adds all elements to the complex chain that are within the specified **Max Gap** distance (handy for numerous elements which would be tedious to pick individually).

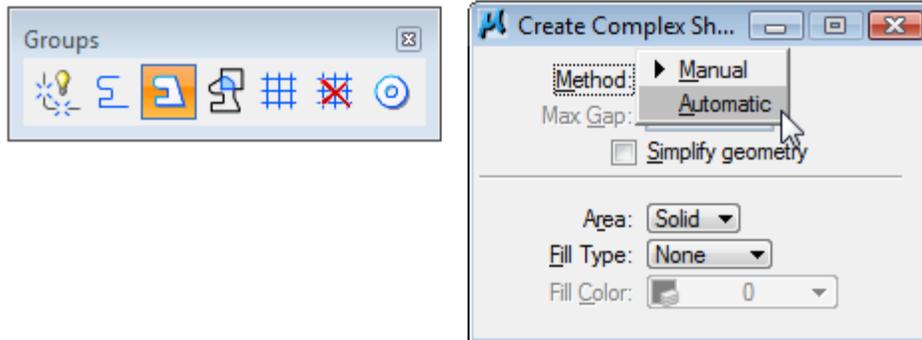


If you toggle on **Simplify geometry**, the new element is created as a linestring instead of a complex element. The advantage is that you can more easily modify a linestring than a complex element.

The new complex chain takes on the active element attributes, regardless of the attributes of the original elements that make up the chain. Be sure to set your active element attributes before creating the complex chain.

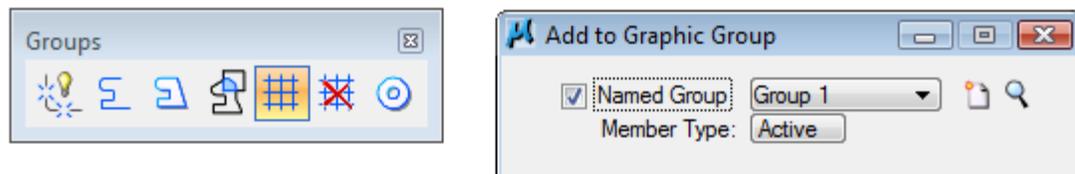
### Create Complex Shape

**Create Complex Shape** joins a series of lines, linestrings and/or arcs into one closed element. A “filler” segment is added, if needed, to close the shape. The same **Manual** and **Automatic** methods found in the **Complex Chain** command are also available on the **Complex Shape** command.

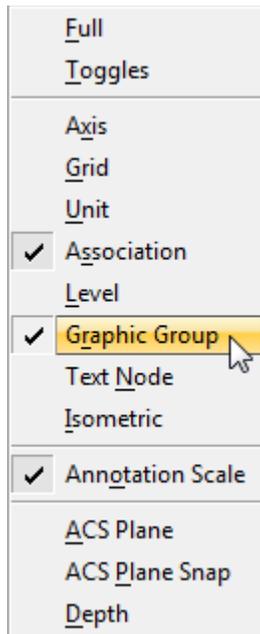


### Add to Graphic Group

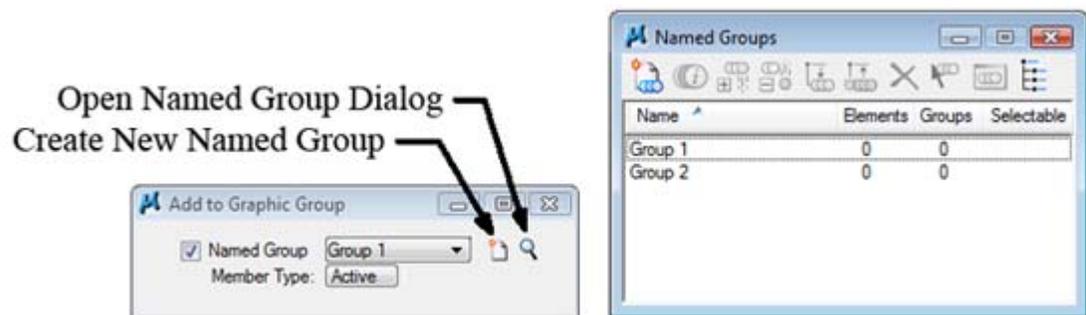
**Add to Graphic Group** creates a group of individual elements that can be named. Graphic groups are more efficient than a fence or a selection set for items that must be frequently grouped and manipulated. This command can also add elements to an existing named group or can combine groups.



After creating the graphic group, the elements behave as a group as long as the **Graphic Group** lock is on (**Settings > Locks** or **Locks** button on the **Status Bar**). If the **Graphic Group** lock is off, you can manipulate, modify or delete individual elements in the group. However, the elements retain their group status and can be manipulated again as a group if the **Graphic Group** lock is turned back on.

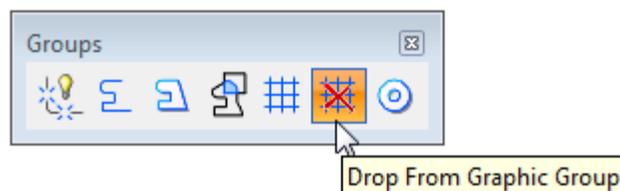


The Open Named Group option (magnifying glass icon) is used to manage your named groups (create new groups, add or removed elements from the group, create group hierarchies, etc.)



### Drop from Graphic Group

Removes individual elements from a graphic group or named group. The command is also used to drop an entire group (break up the entire group into its component elements).





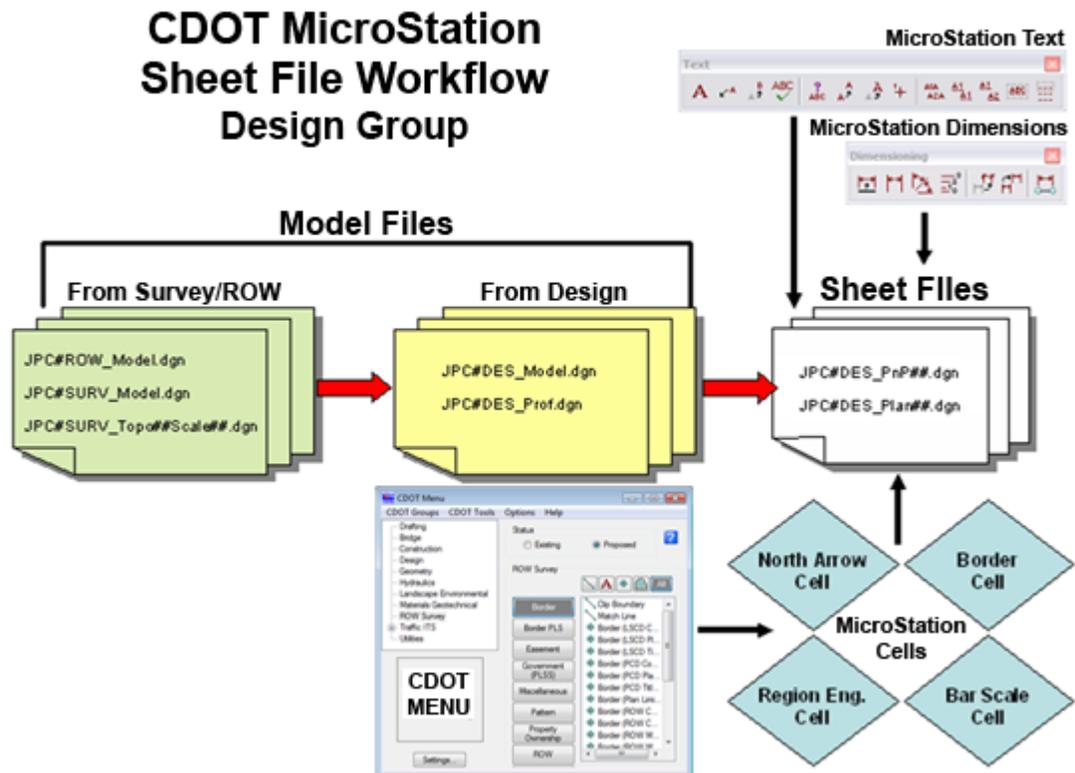
# Chapter 10 - Creating Sheets

## Roadway Design group

### *Plan or Plan/Profile sheets*

The Design group's sheet file workflow is covered in detail in **Chapter 4, The CDOT workflow**. The following is a summary of the Design group's Plan or Plan/Profile sheet workflow:

- ◆ Create a new MicroStation design file for each sheet.
- ◆ Reference into the sheet file the proposed model file with the Survey/Topo model file nested.
- ◆ Rotate the view, if needed, so graphics appear horizontal.
- ◆ Clip the references to show only what graphics are needed for the sheet.
- ◆ Place the border, north arrow, bar scale and resident engineer information cell directly in the sheet file.
- ◆ Check the sheet file's Model Properties and verify set the Annotation Scale to the sheet's plot scale. The default for all sheet files except Typical Section sheets is 1:100.
- ◆ Edit the border text as needed.
- ◆ Annotate with MicroStation text.
- ◆ Dimension reference graphics, if desired.



**Note:** InRoads Plan/Profile Generator automates this process and can quickly generate a set of sheets along an InRoads alignment. Use the above workflow for special situations (approach roads, intersections, etc.) or where just a few sheets are needed.

### ***Typical Section sheets***

Typical Section sheets are an exception to the rule, since graphics are created directly in the sheet file using the CDOT Typical Section Program. Use the following workflow to create Typical Section sheets (an example is also provided in the lab exercises):

- ◆ Create a new sheet file each sheet (you can use the auto-populated file **JPC#DES\_TypISect##.dgn**).
- ◆ If you're using the auto-populated file, it contains a generic border. You can either edit the border information, delete the generic border and place a project border, or replace the generic border cell with the project border cell using the **Replace Cell** command.
- ◆ Check the sheet file's **Model Properties** and verify set the **Annotation Scale** to **1:10**. This is already set-up if you created your file from the auto-populated file.
- ◆ Start the **Typical Section Program** (from the **CDOT Menu** select **Add On's > Launch Typical Section Program**).
- ◆ Use the program to create your Typical Section(s). Place the sections directly inside the sheet border.
- ◆ Save the typical section input file from the Typical Section Program.

### ***Other sheets***

Other sheets like detail, title, general notes, etc. have specific requirements, but use the same general premise of referencing the model file(s) to the sheet file and are illustrated in lab exercises.

## ***Specialty Groups***

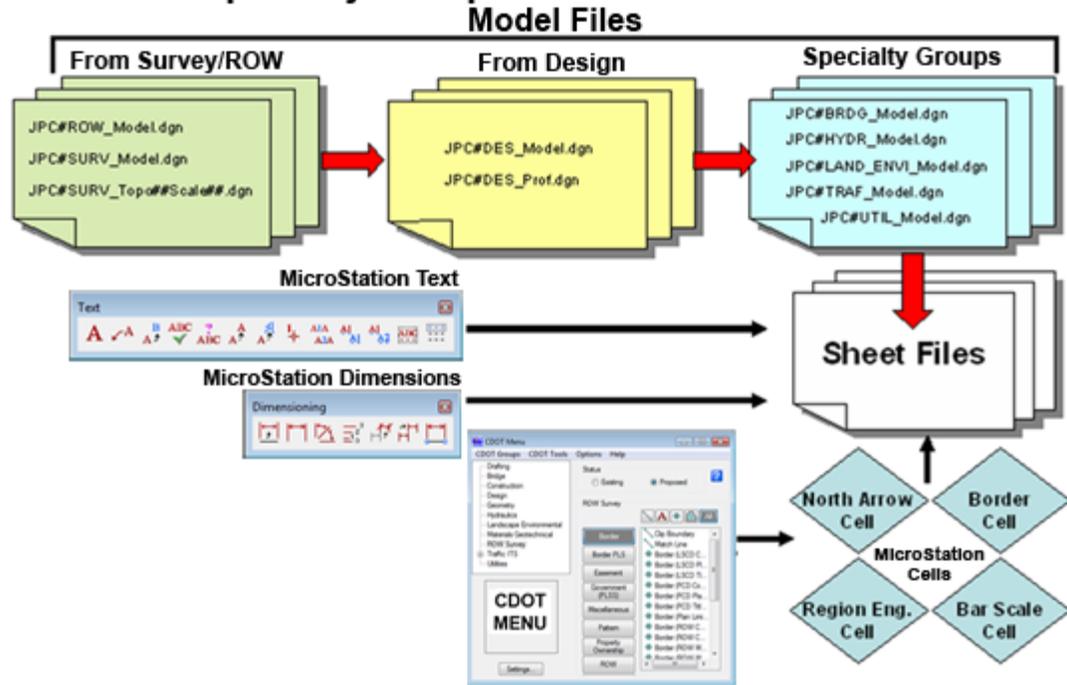
### ***Plan sheets***

The following is a summary of the Specialty group's sheet file workflow:

- ◆ The Specialty group creates a new MicroStation design file for each sheet.
- ◆ Reference into the sheet file the Specialty group model file with the Design model and Survey/Topo model files nested.
- ◆ Rotate the view, if needed, so graphics appear horizontal.
- ◆ Clip the references to show only what graphics are needed for the sheet.
- ◆ Place the border, north arrow, bar scale and resident engineer information cell directly in the sheet file.
- ◆ Check the sheet file's Model Properties and verify set the Annotation Scale to the sheet's plot scale. The default for all sheet files except Typical Section sheets is 1:100.
- ◆ Edit the border text as needed.
- ◆ Annotate with MicroStation text.

- ◆ Dimension reference graphics, if desired.

## CDOT MicroStation Sheet File Workflow Specialty Groups



### Other sheets

Other sheets like detail, tab, and notes sheets have specific requirements which are illustrated in lab exercises.

## More Information

For more information on creating sheet file, see CDOT Workflows **Sheet File Creation**, **Sheet File Creation Multiple Scales**, **Creating Multiple Plan Sheets**, **Note Sheets**, and **Title Vicinity Map**.

**CDOT Work Flow**

Work Flow :

- [CDOT Alignment Display in Cross Section.Ink](#)
- [CDOT Annotating Horizontal and Vertical Alignments.Ink](#)
- [CDOT Batch Printing.Ink](#)
- [CDOT Batch Processing.Ink](#)
- [CDOT Configuration ReadMe file.Ink](#)
- [CDOT Converting AutoCAD Files to MicroStation.Ink](#)
- [CDOT Creating Multiple Plan Sheets.Ink](#)
- [CDOT Directory Structure.Ink](#)
- [CDOT Displaying Features in Cross Section and Profile.Ink](#)
- [CDOT Exporting Fieldbook Files.Ink](#)
- [CDOT Greek Characters.Ink](#)
- [CDOT Level Update for V03.01.Ink](#)
- [CDOT Linking MicroStation to Excel Documents.Ink](#)
- [CDOT MicroStation Printing.Ink](#)
- [CDOT Note Sheets.Ink](#)
- [CDOT PCF Management.Ink](#)

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See also the **CDOT CADD Manual, Chapter Eight – Drawing Information, Section 8.4 Project Sheets**. This contains several useful links for sheet workflows.

Simple Resident Engineer Job Placement Demonstration

### 8.4 Project Sheets

Many sheets for each project are created after the Project Manager runs the [Project Creation Utility](#) program, as described in Chapter 3. The sheets are created, named and placed in the appropriate directories for the project team's use. The following sections will address the standard sheets, outlining what should be included on them in order to achieve consistency between projects.

#### 8.4.1 Title Sheet

Title Sheet development begins with the completion of the project. Title Sheet is located in the project folder under \DesignDrawings. The file will be named Job Project Code TitleSheet.dgn.

Standard Title Sheet information includes:

- Title information
  - DEPARTMENT OF TRANSPORTATION
  - STATE OF COLORADO
  - HIGHWAY CONSTRUCTION BIG PLANS OF PROPOSED
- Project Specific Title Sheet information that must be edited per project includes:
  - Federal Aid or Colorado Project Number
  - State Highway Number
  - Project Code Number
  - ENRWA oversight and National Highway System check blocks
  - Other project numbers and codes (e.g. R.O.W., U/I or P.E.)
  - Index of Revisions
  - Tabulation of Length and Design Data
  - Project Location Map
  - Index of Sheets
  - Time and issued Standard Plans
  - Designer block (e.g. Resident Engineer initials and Region information)
  - Contract Information block
  - Description of Project

[Title Sheet Samples](#)

#### 8.4.2 Typical Section Sheet

Typical Section sheets show a detailed, cross-sectional view of the roadway surface design. Development of the typical section sheets includes the use of custom program called CDOT Typical Section Program. This program writes graphical data to the typical section file at a scale of 1/10. All of the graphical properties such as the levels, patterns, text, and coils are set by default to CDOT standards. This drawing is located in the \DesignDrawings folder and is called Job Project Code\TypicalSection.dgn. See the [Typical Section Workflow](#) to

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## Rotating Views

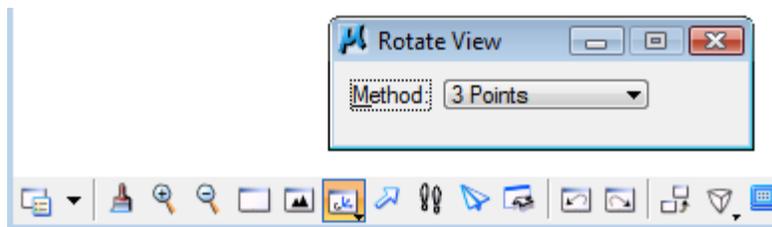
It is often necessary, especially with highway design projects, to rotate a plan view so that the alignment is horizontal to the view. This is especially useful when creating plan sheets. You can accomplish this using the following methods.

### ***Rotate the Plan View with a Keyin***

If you know the degree of rotation, you can rotate the view using the rv= keyin (**rv=X axis rotation, Y axis rotation, Z axis rotation**).

### ***Rotate the Plan View by 3 Points***

Use this method to define a view's new positive horizontal (X) axis and new positive vertical (Y) axis. The first two data points define the view's new X axis and the third data point defines the direction for rotation.



### ***Rotate the Plan View by Element***

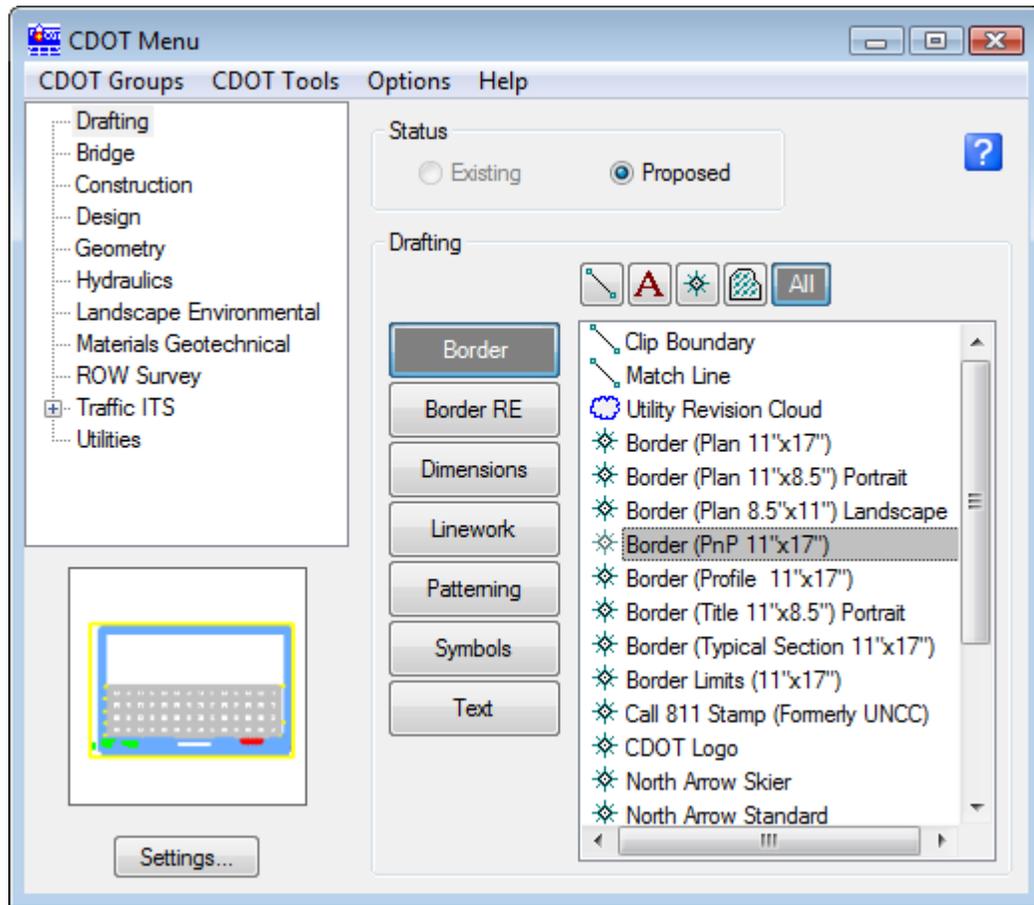
You can use the direction of an element to rotate a view so that the view is horizontal to the element (e.g. a horizontal alignment). Key in **Rotate View Element** and then <D> on the element to rotate the view.

**Note:** The view is rotated based on the direction the element was drawn. The positive X axis is based on the positive direction of the element.

## Placing Borders

### ***Using the CDOT Menu for Border Placement***

The **Border** and **Border RE** Categories under **Drafting** on the CDOT Menu provide a convenient method of placing the border and related information in a sheet file.

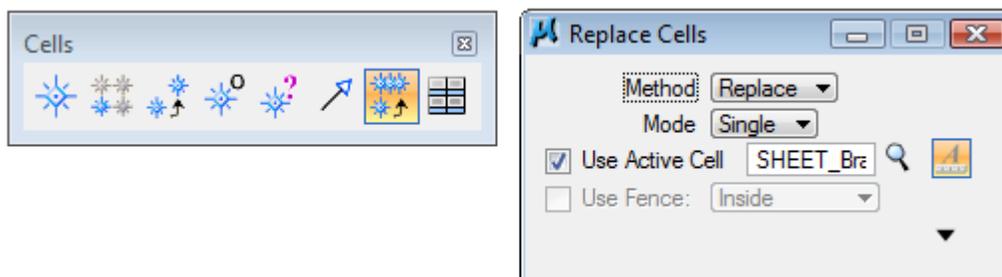


You have the option of placing different types of border cells, as well as other cells for the bar scale, north arrow and resident engineer.

### ***Creating a Project-Specific Border Cell***

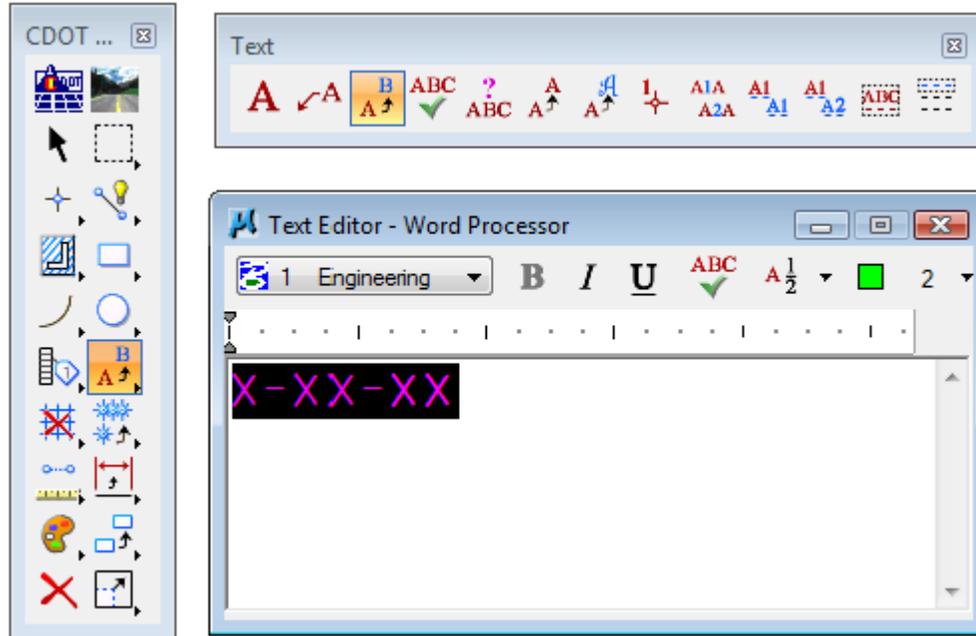
If you use the generic border in the auto-populated sheet files, or if you place a border cell in a sheet file using the CDOT Menu or the **Place Active Cell** command, then you will need to edit the border to specify all of the project-specific information for every sheet. This can be a time-consuming process.

Instead, you can create a project-specific border cell. Place the cell in a blank file, and then edit the cell text to fill in all of the project information (number, code, initials, etc.). You can either place this border in a blank sheet file, or replace the generic border cell with the project border cell in the auto-populated file. MicroStation's **Replace Cell** command is handy for this.

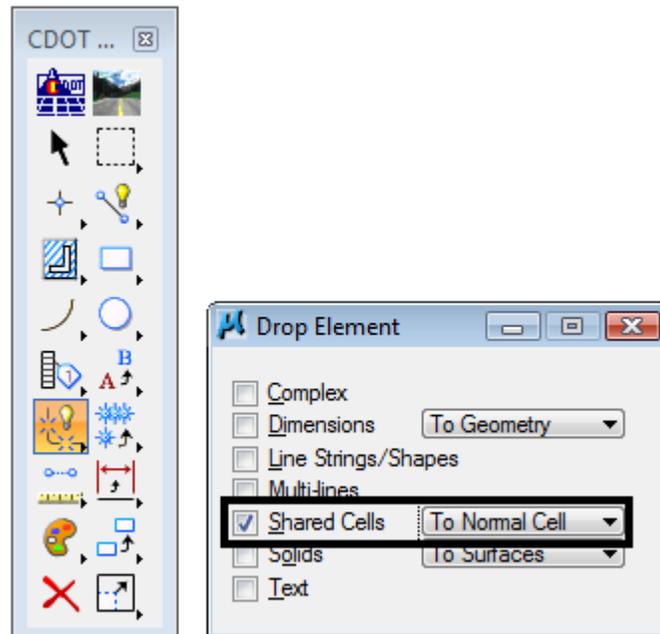


### Editing text on the Border

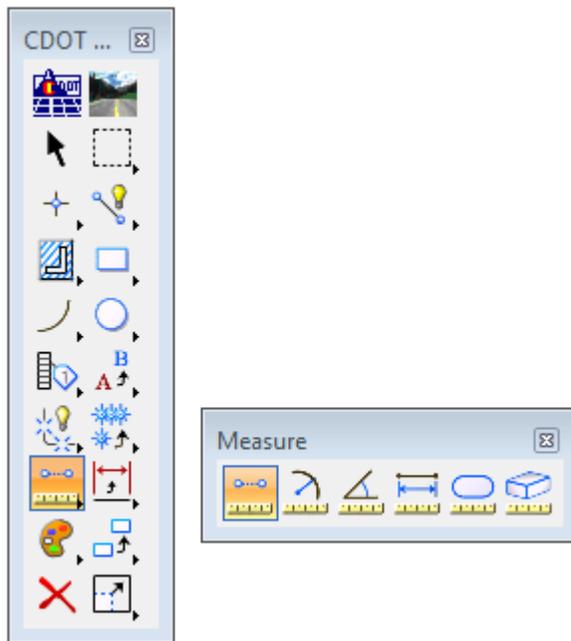
Text in the border cell can be edited using the **Edit Text** command on the **Text** toolbar. Select the text to edit, key in the new text in the **Text Editor** window, and then **<D>** to accept the edit.



**Note:** If you place the border cell as a Shared Cell, you must first drop the cell status to a regular cell if order to edit the cell text.



## Measurement Tools

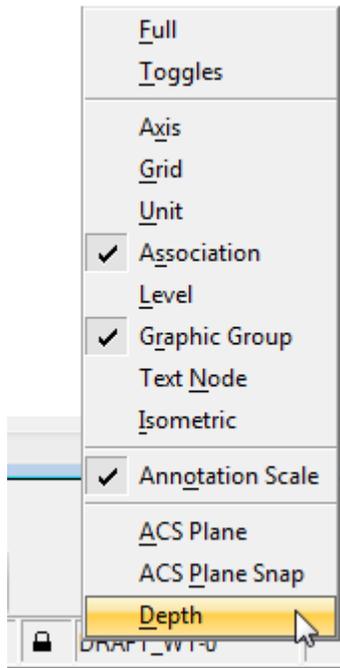


The **Measure** toolbar is used to measure distances, angles, radii and areas. Use **Settings > Design File > Working Units** to define how measurement values will display (units, precision, etc.). If you reference your model file graphics into your sheet file at 1:1, you can measure graphics in the sheet file with accurate results. Otherwise, you'll need to measure graphics in the model file.

### **Measuring in 3D**

**Important!** In a 3D file, if you want planar measurements, turn on Depth lock before using the appropriate measure command. Make sure AccuSnap is off if you're snapping to points when measuring in 3D. Use Tentative snaps instead.

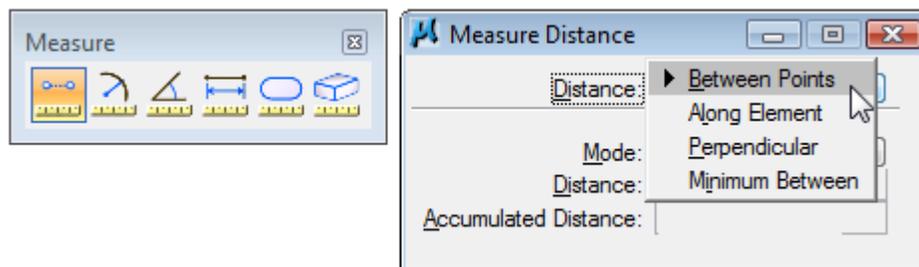
If you want true slope (3D) measurements, turn **Depth** lock off.



Some of the more commonly used measuring tools include:

### ***Measure Distance***

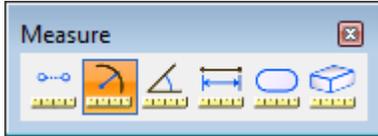
Measures distance using one of the following methods:



- ◆ Between Points
- ◆ Along Element
- ◆ Perpendicular
- ◆ Minimum Between

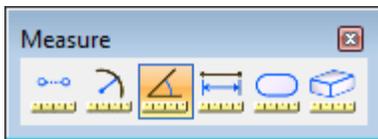
### Measure Radius

Measures the radius of a circle or an arc, or a circular segment of a complex chain or shape, or the primary and secondary axes of an ellipse.



### Measure Angle

Measures the angle between two lines or linestrings, or the angle between two segments of a shape.



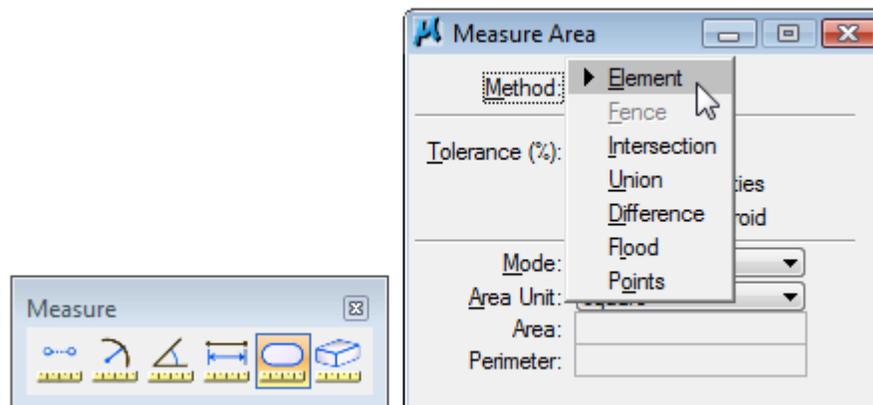
### Measure Length

Measures the length of an element or the perimeter of a shape.

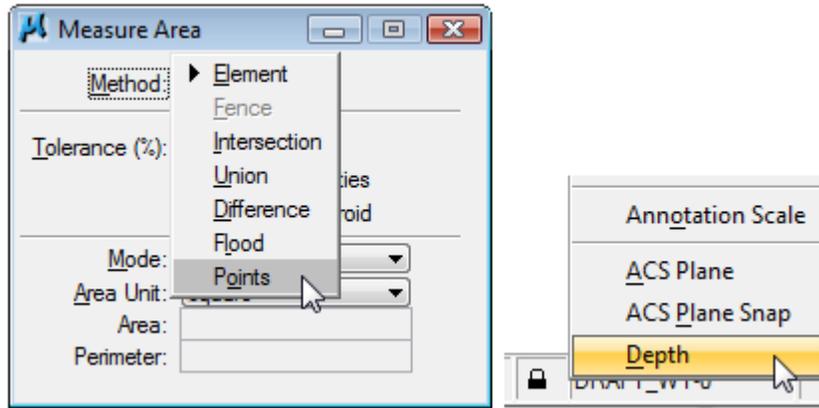


### Measure Area

Measures area using the same method options as the **Pattern** tools. This includes the area of a shape (**Element** method) or an area you dynamically define using the **Points** method. In addition, you can **Flood** an area or measure the area of the **Intersection**, **Union** or **Difference** between elements (see **Pattern** commands for an explanation of these methods).



**Note:** If you're measuring the area of 3D graphics, the Points method is the only method that will provide a planar measurement with Depth lock turned on.



### The CDOT Custom Measure XY Distance tool

From the **CDOT Menu**, select **Add On's > Measure XY Distance** to open this custom tool, which allows you to easily obtain *both* planar XY distances along with true 3D slope measurements *without having to check or set active depth or the depth lock*. You can use this tool the standard MicroStation Measurement tools for options shown below, including the **Perpendicular from element** option.

XY Distance

Measurement Options

- Between points
- From point on element
- Perpendicular from element
- Perpendicular from point on element
- Tangent from element
- Tangent from point on element

Calculated Values

Delta X: -288.756'

Delta Y: 577.511'

Delta Z: -518.628'

Slope: 80.323%

Angle: N 26° 33' 54.18" W

Horiz. Distance: 645.677'

**Slope Distance: 828.175'**

Use Reference Attachment Scale

Restart Exit

# Chapter 11 - Annotating and Plotting Sheets

## Understanding Text and Text Styles

After creating the sheet file, you can now annotate the sheet using MicroStation's text tools and dimension the drawing with the dimensioning tools.

### Text Styles

Text Styles provide a method of saving and applying text attributes in MicroStation. They function similar to styles used in word processing software, saving text setups that include font, height and width, line spacing, color, etc. When you apply a style, it's like applying a whole set of characteristics in one step. Once the style is applied, the text is linked to the style and any future changes to the style will update all text currently using the style. The text style contains attributes like font, height, width, line spacing, line length, text justification, etc.

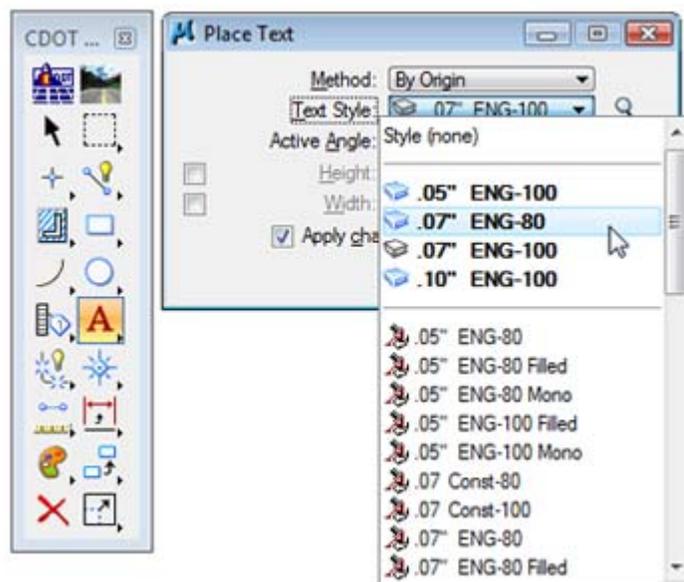
### CDOT Text Styles

CDOT text styles are saved in a DGNLIB file called **CDOT-Text & Dim Styles.dgnlib**, located in the **C:\Workspace\Workspace-CDOT\_XM\Standards-Global\MicroStation\DGNlib\Standard** folder. This file is automatically attached to any design file opened in the CDOT workspace. This way, you will always have your text styles loaded. Using Text Styles is a very effective in standardizing text throughout a project or agency.

CDOT text styles are categorized by text size (e.g. .07", .10", .14", etc.) Each style is one of two types – 100 or 80 (e.g. **.07" ENG 80**). 100 styles have the same text height and width. 80 styles are proportional sized – the text width is 80% of the text height.

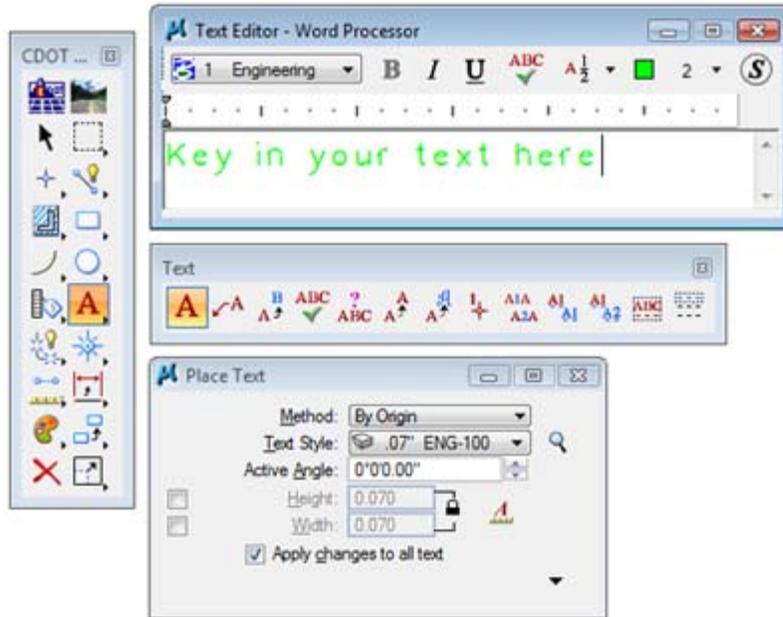
### Text Toolbar

The Text toolbar is used to place and edit text. When you place text, you specify a Text Style to apply to the text.



## Place Text

Places text that you enter into the **Text Editor — Word Processor** window. The MicroStation Text Editor uses some basic word processing format options (font, bold, underline, italics, etc.), which allows for quick text manipulations. You can change these attribute per letter, word or string within a text block.



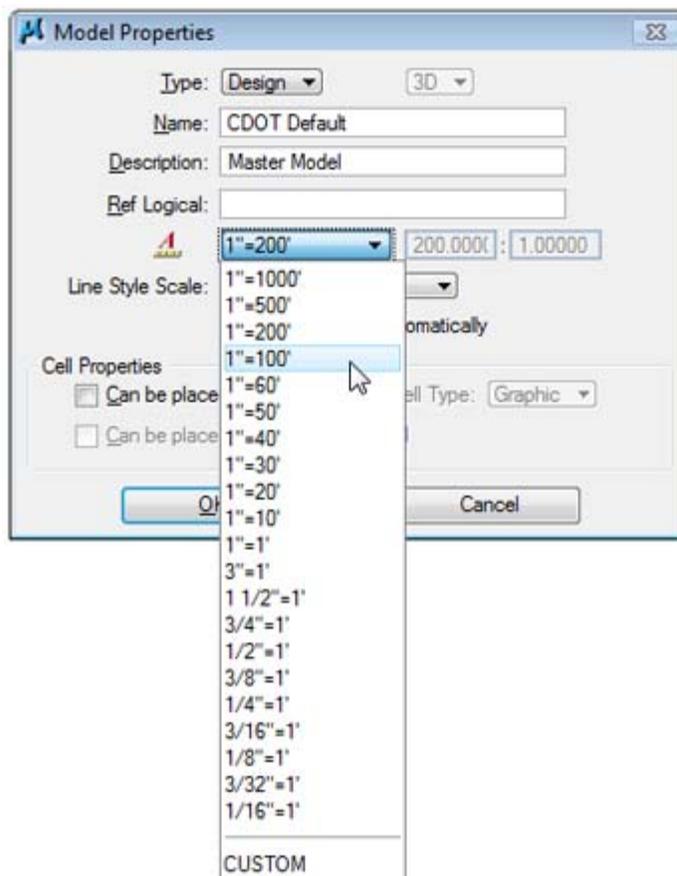
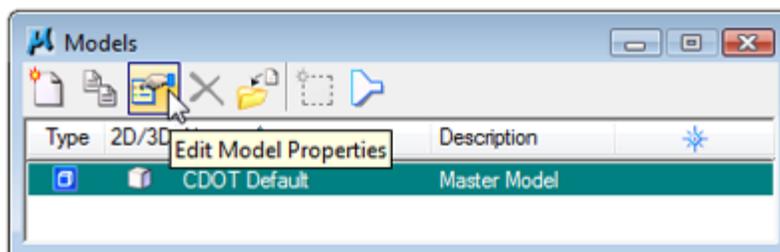
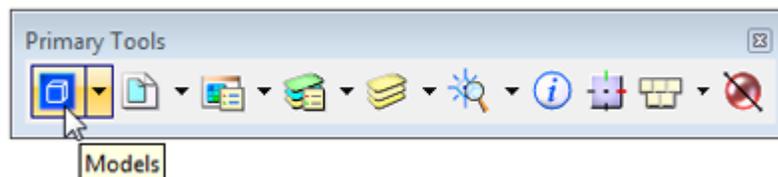
Other word processing functionality includes checking spelling prior to placing text and using **Cut**, **Copy** and **Paste** between MicroStation and other Windows applications.

Text is placed using active text and design file parameters including:

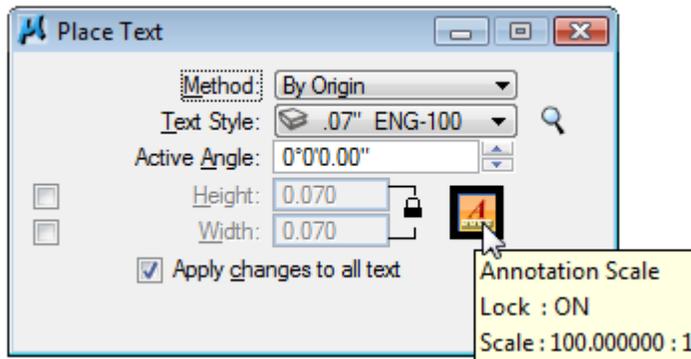
- ◆ Active element symbology (color, weight)
- ◆ Active level
- ◆ Active angle and
- ◆ Text style.

### Drawing Scale

Before placing text, check the **Annotation Scale** for text under **Model Properties**. The **Annotation Scale** is set to **100**, by default, in the CDOT seed file. This should be the same as your plot scale. If you're plotting at any other scale, change the **Annotation Scale** here. Any text that you've previously placed will be updated (i.e. you don't have to delete and replace the text – it will be re-scaled automatically).



**Note:** To enable scaling of text, make sure that the Annotation Scale lock is turned on in the Place Text command before placing your text.



For more information on text, see the **CDOT CADD Manual, Chapter Five – Drawing Standards, Section 5.4 Standard Annotation.**

Level symbology overrides have only been created for Topo levels and some existing traffic signing levels. These overrides have been created in order to view existing features on the screen in a grayed out color. The overrides are typically assigned to levels attached as reference files through the level manager.

### 5.4 Standard Annotation

CDOT standard Annotation utilizes a Text & Dimension Style (DGN) file called CDOT.Text & Dim Styles.dgn. This library contains many predefined text and dimension settings for several different sizes and widths of text called Text Styles. The text styles include the use of a single MicroStation Font Resource file called CDOT\_FONT.rsc. The Library is attached to all Design files through the use of configuration variables and the select group environment utility. Normally, when a user selects a text style, the height, width, line spacing and font is set for them automatically so no adjustments need to be made. If Italics or Underline is desired, it can be selected through the MicroStation Text Editor.

The standard text style to be used for general purpose annotation is called 07" ENG-100. This style is set by default and attached to all CDOT Seed files. The standard text style for Title Text annotation is called 10" ENG-100. The compressed width or Mono spaced text styles can be used at the designer's discretion. Normally the Mono spaced text is to be used in tables that contain numbers, and the compressed or 80% width can be used where space is limited. There are several larger size text styles available, however these sizes are normally only used on the Title Sheet or on presentation or exhibit work.

[Place Text with Text Style](#)

[Review all available CDOT Text Styles](#)

#### 5.4.1 Attached Text Style Library

The naming convention for CDOT text styles includes the "Posted" height (07"), the Font name (ENG) which equates to the Engineering font found in the CDOT Font Resource file and the "Posted" text width (80) or 80% (.056) of the 100% (.07") width.

#### 5.4.2 Available Fonts within CDOT Font Resource (RSC)

The CDOT font resource file contains six customized Fonts. The default font is 1 Engineering. Both MicroStation and InRoads utilize the font number and font name to display text correctly. The text style as discussed above, calls the correct font by default. If it is not necessary for the font to be changed unless a Greek Character (ς Greek) or a Geometry Symbol (100 Geometry Symbols) is placed. A workflow has also been developed for using Greek Characters within the CDOT environment.

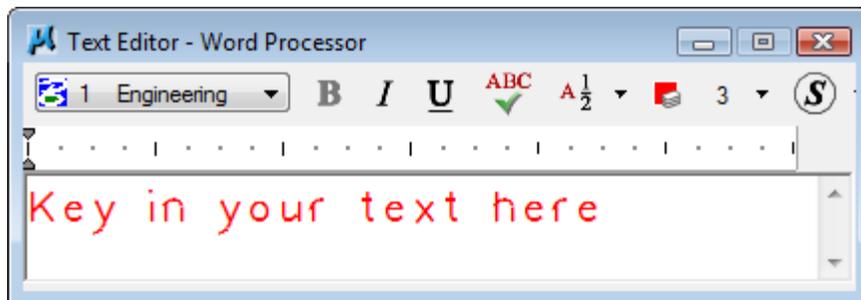
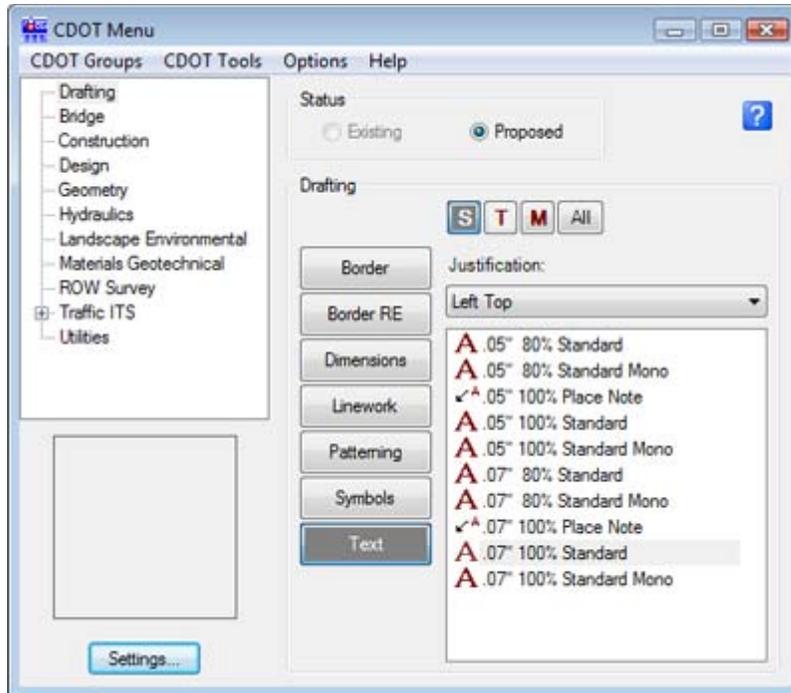
[CDOT Greek Characters Workflow](#)

The 1 Engineering and 2 Engineering - Mono spaced fonts contain stacked fractions and special characters. These fractions and characters can be placed directly from the font when available. The special character must be placed with a keyboard backslash and the number displayed above the character (210 equates to a Centerline symbol). If the character is edited in the MicroStation Text Editor, the 210 will appear as a screen font character (©) in the editor. The character will still display correctly in MicroStation once accepted. This requirement is due to a limitation in the MicroStation software.

## CDOT Menu text

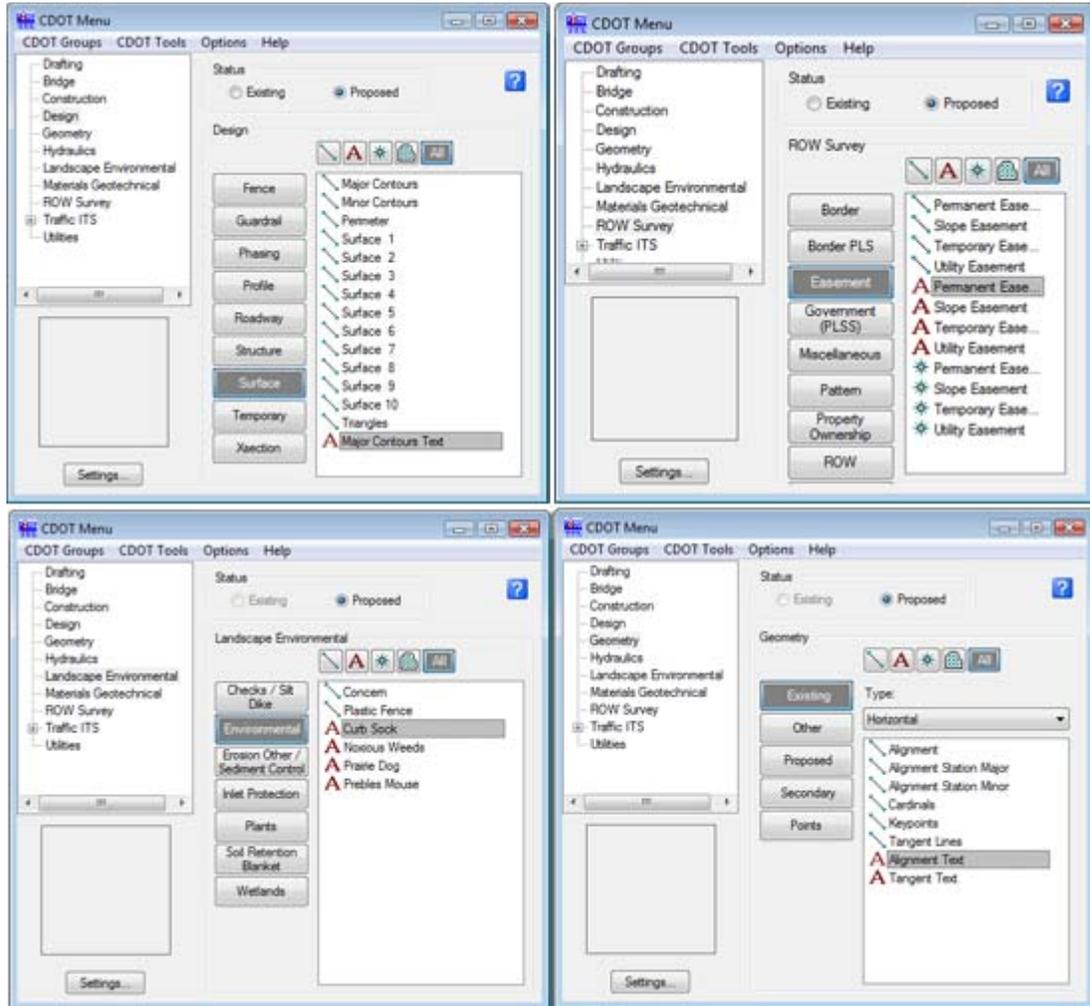
### Placing general text using the CDOT Menu

The **CDOT Menu** streamlines the text placement process by minimizing text placement options to those frequently used on CDOT drawings. Select the **Drafting > Text** group to place **Standard** or **Title** text. **Text Justification**, **Spacing** and size can be specified in one location. After setting these main text parameters, key-in your text in the **Text Editor** and then **<D>** to place the text in the file.



### Placing Specialty Group text with CDOT Menu

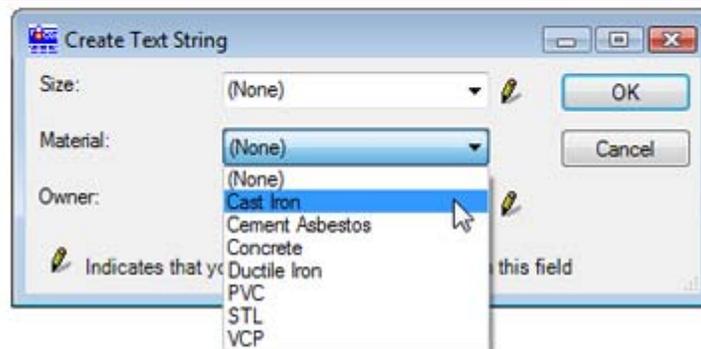
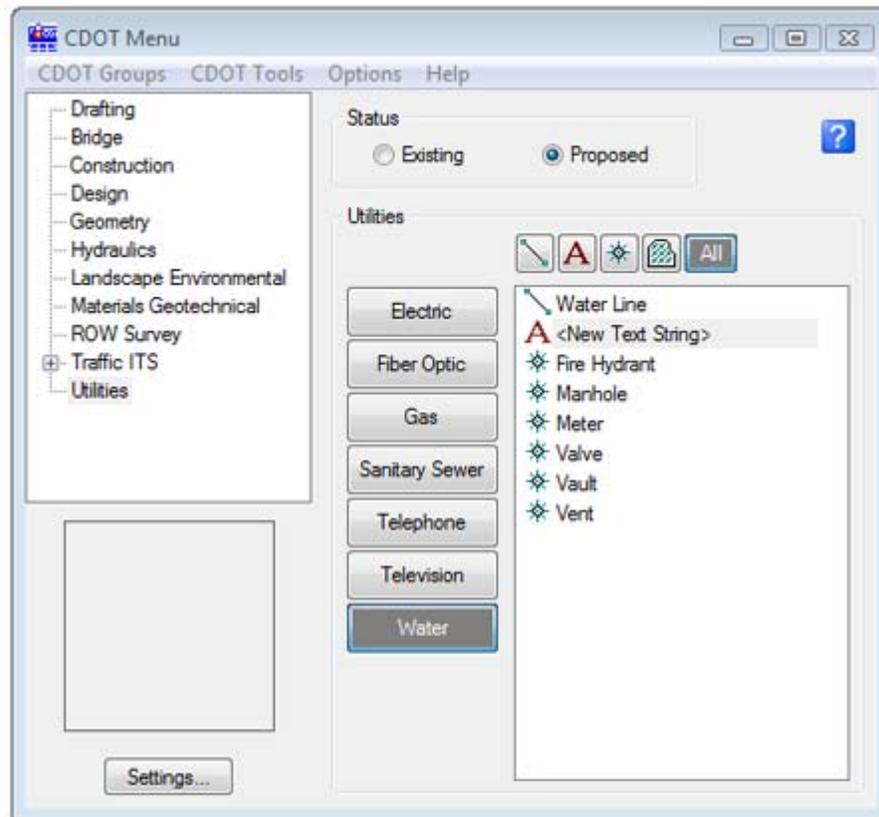
The CDOT Menu also takes the guess work out of placing specialty group text. Select the **Group** and **Category**, and the menu shows the annotation options for the different items in that group. Select the text item and all the text options are automatically set in the **Place Text** command. Just key-in your text in the **Text Editor** and then place in the file.



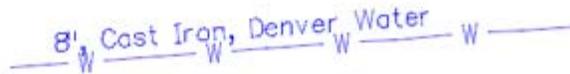
### Placing User-defined Utility text

The Utility Group on the CDOT Menu has special options for placing text that allows you to build a database of utility information and then annotate that information directly on the utility line. Each different type of utility has its own set of annotation options specific to that utility line.

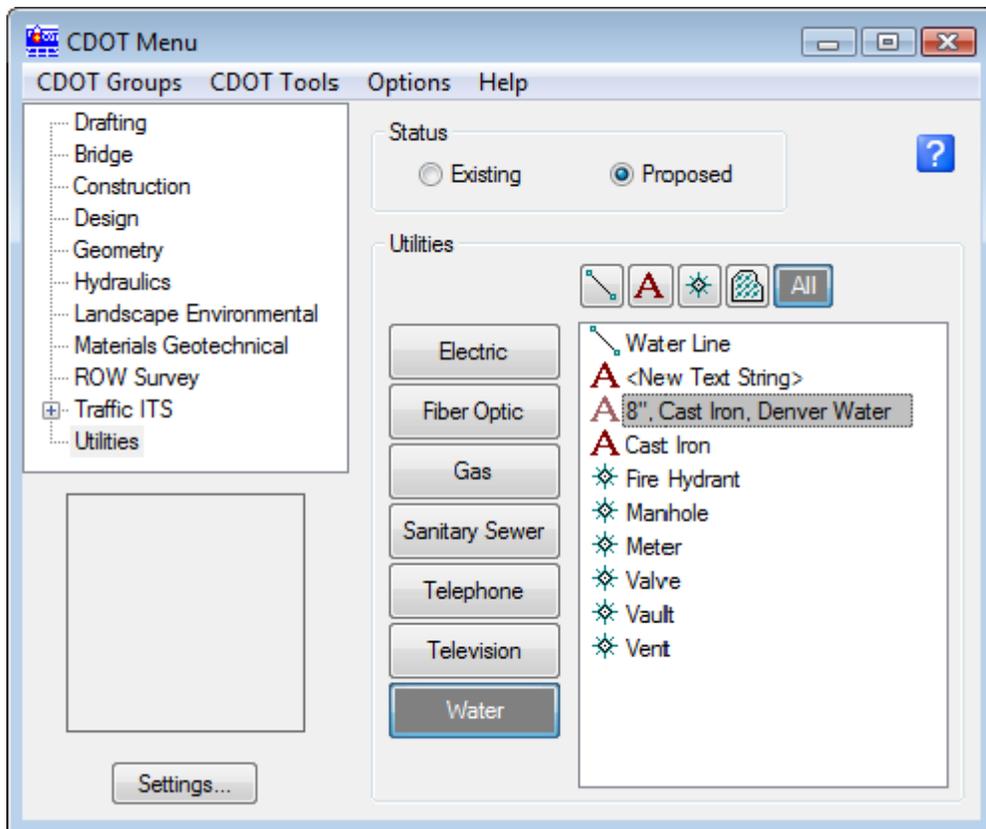
To create a new Utility text annotation, select the **Category** and then select the **<New Text String >** item. You can then select from a list of pre-defined utility features, or create new ones.



After specifying the utility line features, select **OK** and then **<D>** on the line to place the text.



You can save this text information in the CDOT item list for placement again later.



## Using the Greek characters font

If you need to place Greek characters on a drawing, then see the **CDOT Workflow, Greek Characters**.



## Understanding Dimensions and Dimension Styles

### Dimension Styles

**Dimension Styles** provide a way of saving and applying dimension attributes in MicroStation. They function similar to the text styles, saving setups that include terminators, tolerances, units, etc. When you apply a dimension style, it's like applying a whole set of characteristics in one step. Once the style is applied, the dimension is linked to the style and any future changes to the style update all dimensions currently using the style.

CDOT Dimension styles are saved in the **DGNLIB file CDOT-Text & Dim Styles.dgnlib** located in the **C:\Workspace\Workspace-CDOT\Standards-Global\MicroStation\DGNlib\Standard** folder. This file is automatically attached to any MicroStation design file opened in the CDOT workspace. This is a very effective in standardizing your dimensions throughout CDOT.

### CDOT Dimension Styles

There are currently three CDOT dimension styles available:

- ◆ CDOT 1 – Accuracy of 0.1234
- ◆ CDOT 2 – Accuracy of 0.12

- ◆ CDOT 3 – Feet and inches.
- ◆ CDOT 4 – Accuracy of 0.12 B spline Notes
- ◆ CDOT 5 – Accuracy of 0

**Note:** All CDOT Dimension styles have the option **Reference scale** turned **on**. This allows you to dimension reference graphics actual size if the reference attachment was scaled.

### Placing Dimensions using the CDOT Menu

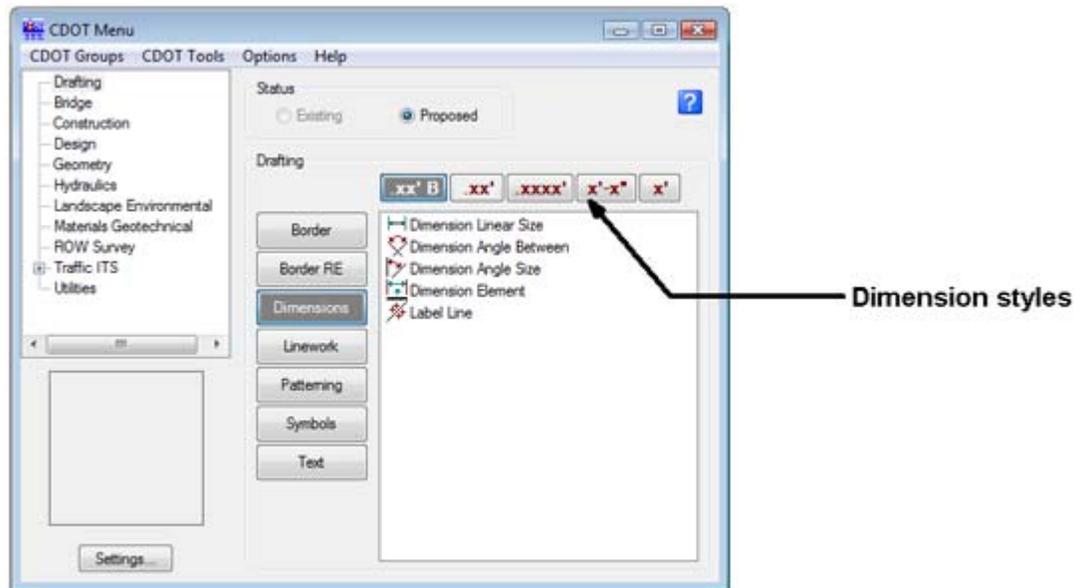
The CDOT Menu streamlines the process of dimensioning elements. From the CDOT Menu Explore select **Drafting**, set the category to **Dimensions**. Five Filters represent the different dimension styles in the configuration.



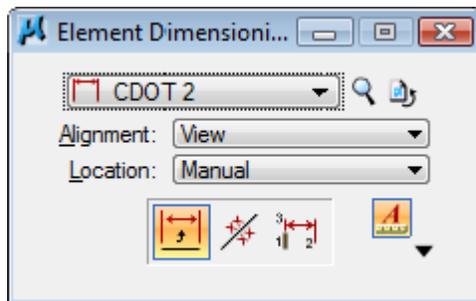
There are five options for each **Filter** or dimension style:

- ◆ Dimension Linear Size – Dimensions size by specifying a start and end point.
- ◆ Dimension Angle Between – Dimensions the angle between two points.
- ◆ Dimension Angle Size – Dimensions the angle between lines.
- ◆ Dimension Element - Dimensions an element (line, linestring, shape, arc, or circle).
- ◆ Label Line – Labels a line with a bearing and/or distance and labels the line.

The three accuracy options, .1234, .12 and x'-xx" allow you to specify the CDOT dimension styles CDOT 1, 2 or 3.

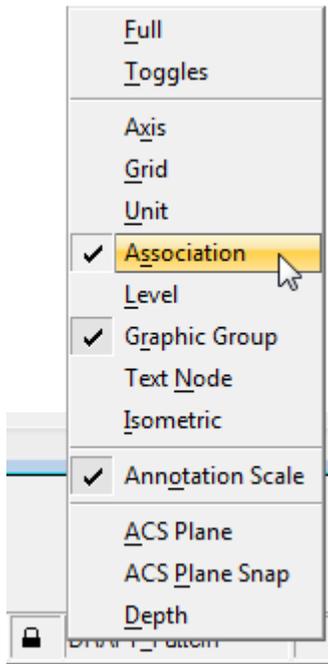


The menu automatically selects the proper dimension command and active level for placing the dimension.



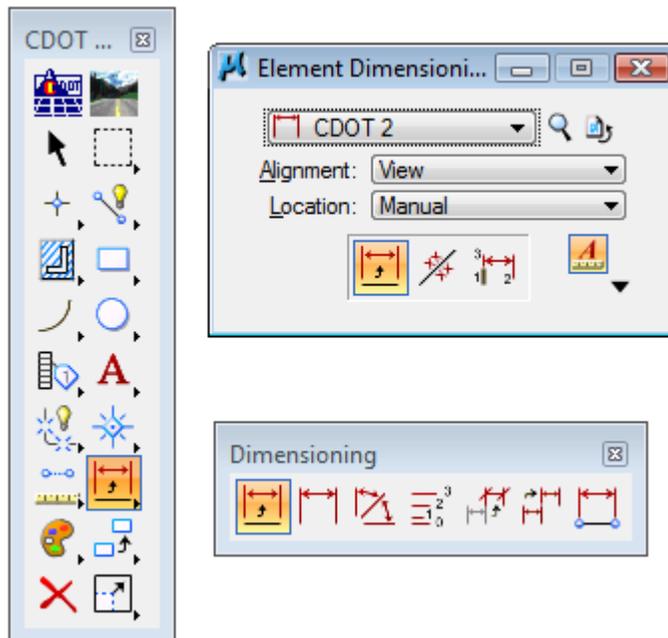
Toggle on **Association** if you want the dimension to update if the element is modified. Associative dimensioning also works for reference elements.

**Note:** You must turn on the **Association** lock in order to activate the **Association** toggle in the dimension command.



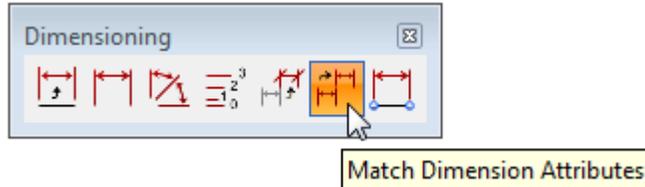
### Dimension toolbar

In addition to the CDOT Menu, you can also use the **Dimensioning** toolbar to place dimensions. However, the most common dimensions are on the toolbar.



### Using the Match Dimension tool

If there are existing dimensions in the design file, you can match the dimension and then place it again using the dimension command on the toolbar.



### Plotting

#### Workflows

CDOT has established workflows for plotting to either 11" x 17" printers or plotting to Adobe Portable Document Files (PDFs). These workflows include MicroStation Printing for single sheets or Batch Printing for printing multiple sheets or PDF files. See the CDOT Workflows for more information.



### CDOT Work Flow

**Work Flow :**

- [CDOT Alignment Display in Cross Section.Ink](#)
- [CDOT Annotating Horizontal and Vertical Alignments.Ink](#)
- [CDOT Batch Printing.Ink](#)
- [CDOT Batch Processing.Ink](#)
- [CDOT Configuration ReadMe file.Ink](#)
- [CDOT Converting AutoCAD Files to MicroStation.Ink](#)
- [CDOT Creating Multiple Plan Sheets.Ink](#)
- [CDOT Directory Structure.Ink](#)
- [CDOT Displaying Features in Cross Section and Profile.Ink](#)
- [CDOT Exporting Fieldbook Files.Ink](#)
- [CDOT Greek Characters.Ink](#)
- [CDOT Level Update for V03.01.Ink](#)
- [CDOT Linking MicroStation to Excel Documents.Ink](#)
- [CDOT MicroStation Printing.Ink](#)
- [CDOT Note Sheets.Ink](#)
- [CDOT PCF Management.Ink](#)

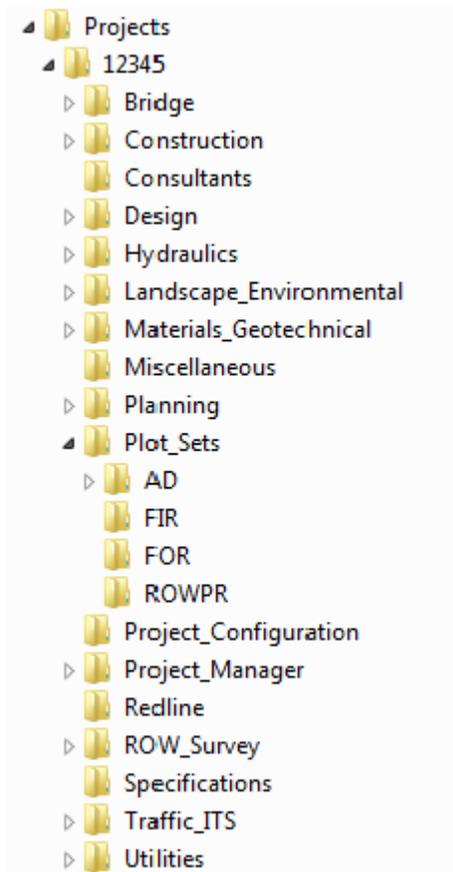
- [Home](#)
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- [CDOT Work Flow](#)
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- [Mtg Minutes & Agendas](#)
- [Requests & Support](#)
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## Printer Drivers

Five CDOT printer drivers are available to select before plotting – **CDOT-DefaultPlotter\_XM.pltcfg**, **CDOT-DefaultPrinter\_XM.pltcfg**, **CDOT-PDFDraftQuality\_XM.pltcfg**, **CDOT-PDFHighQuality\_XM.pltcfg**, and **CDOT-Shaded\_PlotterDriver.pltcfg**. Choose the first or second if you're plotting to a plotter or printer and the third or fourth if you're plotting to PDF. Printer drivers control plotting devices, plot sizes, CDOT pen tables, etc.

## Location of PDF files

When plotting to PDF files, they should be placed in the project's **Plot\_Sets** folder under the appropriate subfolder, for use by the reproduction department and other disciplines for reference and review. Only final submittals should be stored in this location.



## Additional Plotting Workflows

Additional workflows regarding MicroStation printing include *Printing AutoCAD file in MicroStation, Printing Raster Images, Shaded Color and Grayscale Printing* and *Printer Driver Adjustments*.

The screenshot displays the Colorado Department of Transportation (CDOT) website's CADD & Engineering Innovation section. The header includes navigation links for Intranet Home, CDOT External, and Search. Below the header, there are links for Projects, Employee Info, Teams, Organizations, Resources, Contacts, News, and Help. The main content area is titled "CDOT Work Flow" and features a "Work Flow :" section with a list of links to various workflow documents. A sidebar on the right contains a vertical menu with buttons for Home, CADD Library, CADD Manual, CDOT Work Flow (highlighted with a red box), Issue Logs, Mtg Minutes & Agendas, Requests & Support, Training, and Useful Links.

**CDOT Work Flow**

**Work Flow :**

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## Assembling Plan Sets

After you've plotted your files for a plan set, refer to the **CDOT CADD Manual, Chapter Eight – Drawing Information**, for a comprehensive listing of sheets, information to include on each type of sheet, sample project sheets and a final checklist.



The screenshot displays a web application interface. On the left is a table of contents for '8.4 Project Sheets', listing chapters from 8.1 to 8.10. The main content area shows the text for '8.4.1 Title Sheet', detailing the development process and listing standard information to include, such as title information, project-specific information, and other project numbers. Below this is the start of '8.4.2 Typical Section Sheet'. On the right is a vertical sidebar with navigation buttons: Home, CADD Library, CADD Manual (highlighted with a red box), CDOT Work Flow, Issue Logs, Mtg Minutes & Agendas, Requests & Support, Training, and Useful Links.

**8.4 Project Sheets**

Many sheets for each project are created after the Project Manager runs the [Project Creation Utility](#) program, as described in Chapter 3. The sheets are created, named and placed in the appropriate directories for the project team's use. The following sections will address the standard sheets, outlining what should be included on them in order to achieve consistency between projects.

**8.4.1 Title Sheet**

Title Sheet development begins with the completion of the project. Title Sheet is located in the project folder under 'DesignDrawings'. The file will be named Job Project Code [TitleSheet.dgn].

Standard Title Sheet information includes:

- Title information
  - DEPARTMENT OF TRANSPORTATION
  - STATE OF COLORADO
  - HIGHWAY CONSTRUCTION BID PLANS OF PROPOSED

Project Specific Title Sheet information that must be edited per project includes:

- Federal Aid or Colorado Project Number
- State Highway Number
- Project Code Number
- FHWA Oversight and National Highway System check blocks
- Other project numbers and codes (e.g., R.D.W., Uti, or P.E.)
- Index of Revisions
- Tabulation of Length and Design Data
- Project Location Map
- Index of Sheets
- New and revised Standard Plans
- Designer blockID, e.g., Resident Engineer initials and Region information.
- Contact information block
- Description of Project.

[Title Sheet Sample](#)

**8.4.2 Typical Section Sheet**

Typical Section sheets show a detailed, cross-sectional view of the roadway surface design. Development of the typical section sheets includes the use of custom program called CDOT Typical Section Program. This program writes graphical data to the typical section file at a scale of 1:50. All of the graphical properties such as the levels, patterns, text, and calls are set by default to CDOT standards. This drawing is located in the 'DesignDrawings\Ndkr and is called [Job Project Code]TypicalSection.dgn. See the [Typical Section WorkFlow](#) to learn more.

[Typical Section Sheet Sample](#)

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