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.

Model Files

Design/Specialty Group Plan graphics
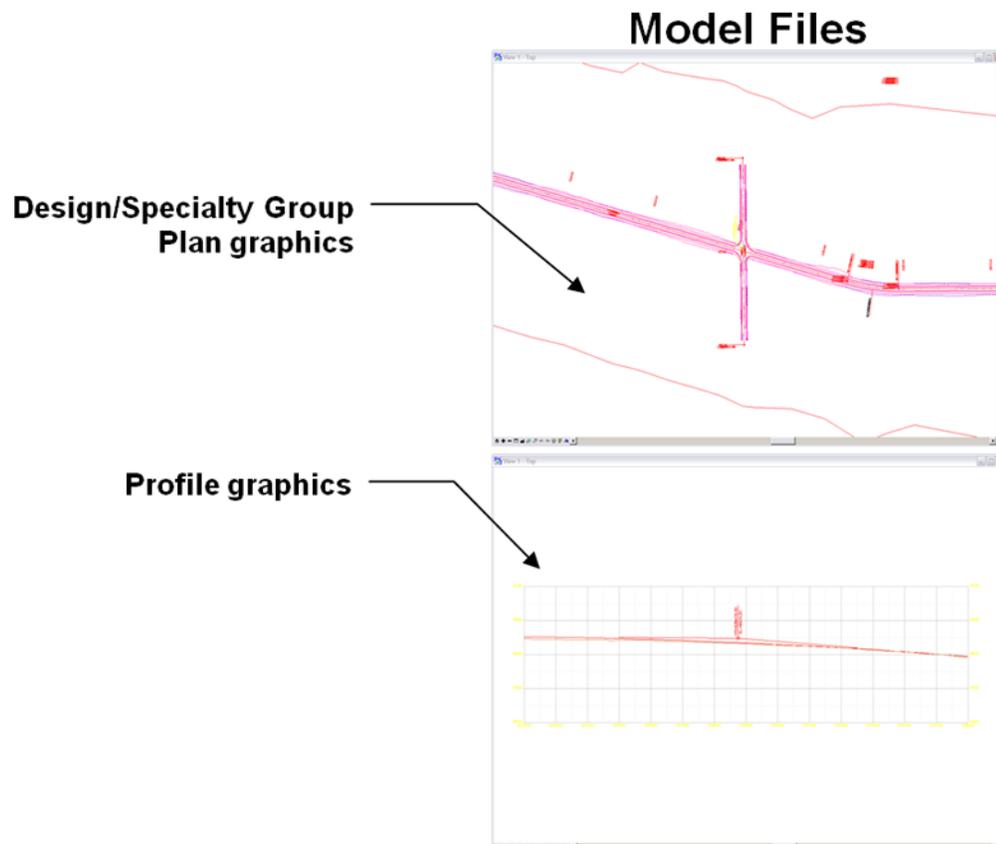
Profile graphics

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.
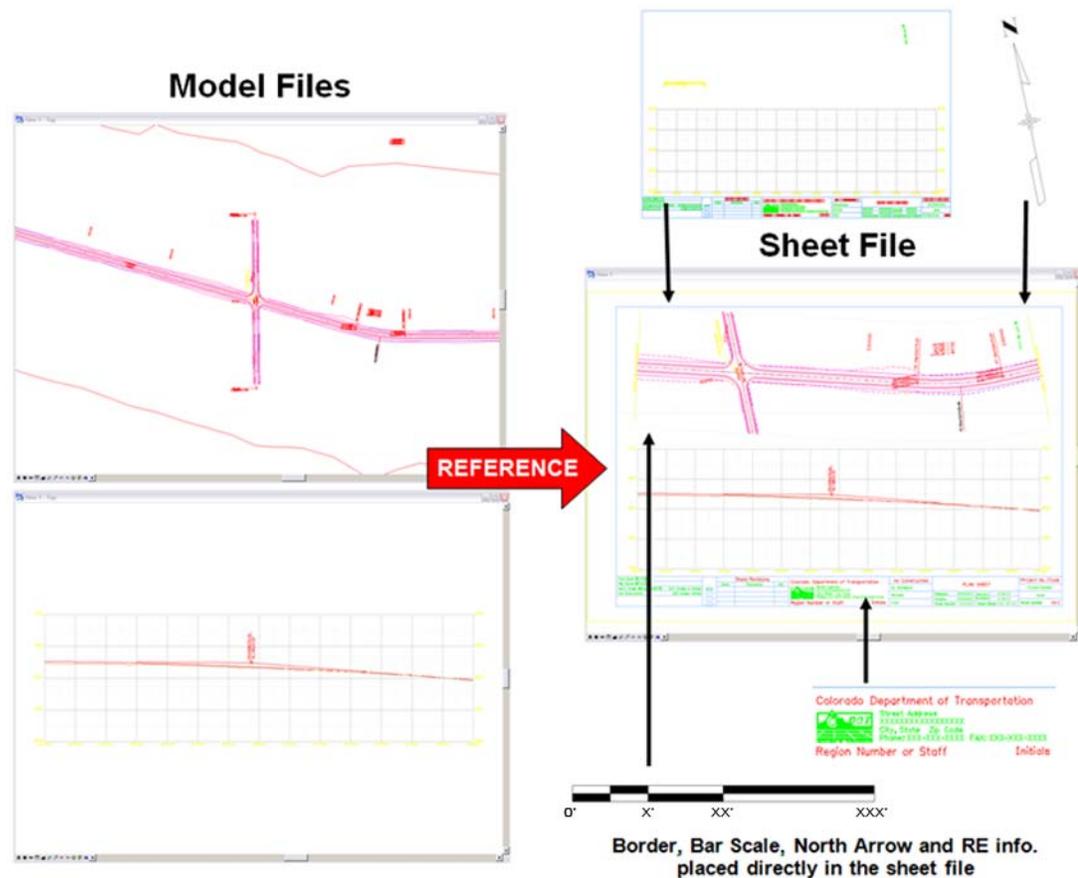

For more information on References, see the section Referencing Other's Work in this chapter.

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.
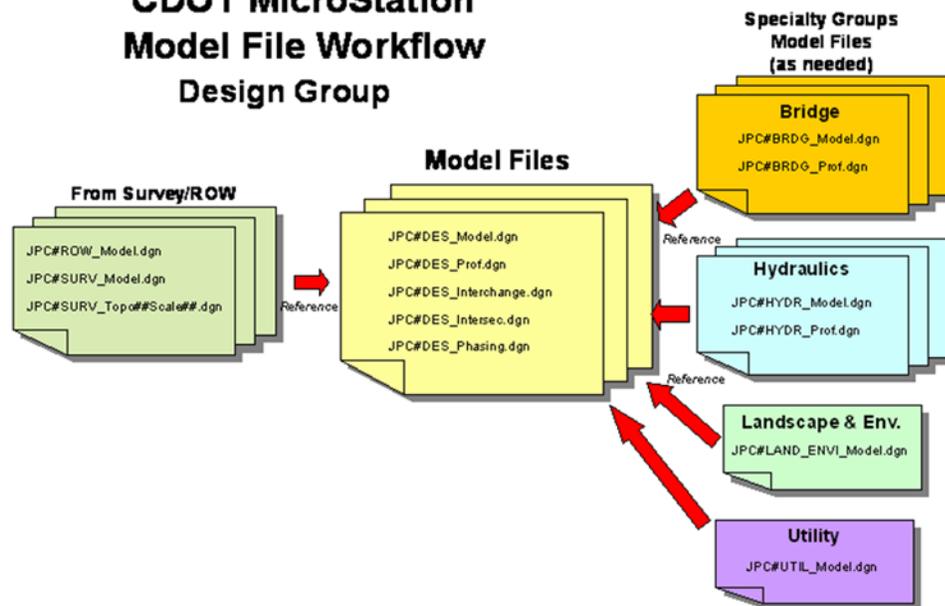
CDOT MicroStation Model File Workflow
Survey/Row Group
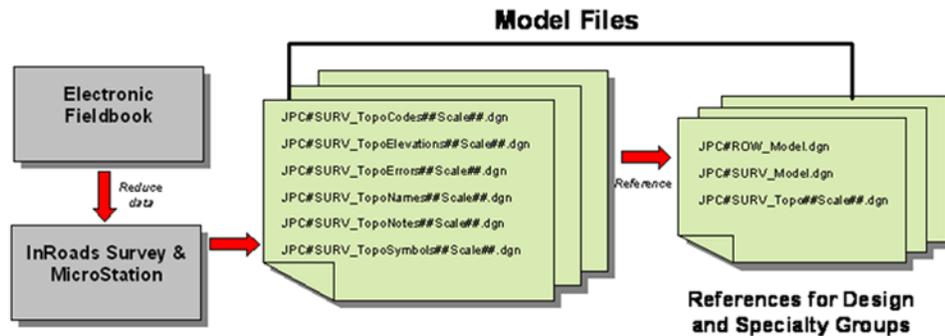
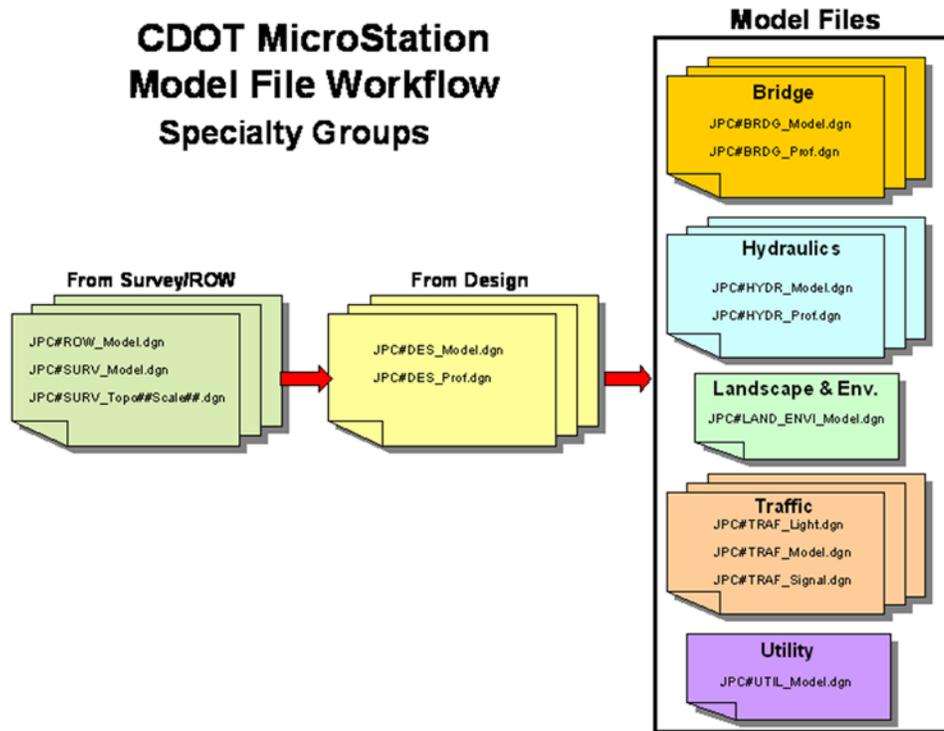### *Model File Workflow for Roadway Design*

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.
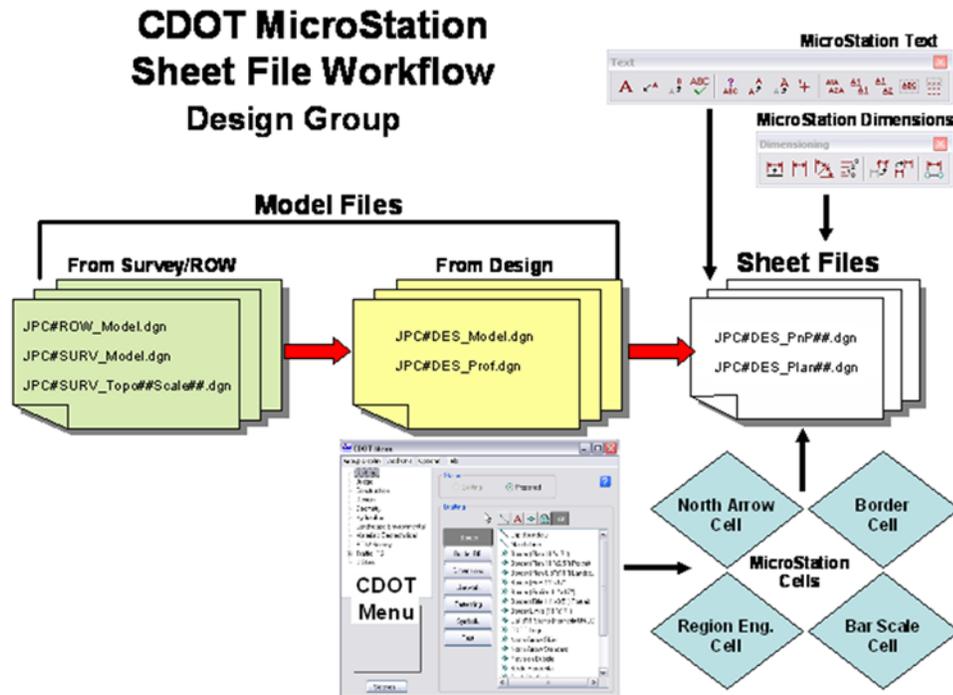

Sheet File Workflow for Specialty Groups

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.
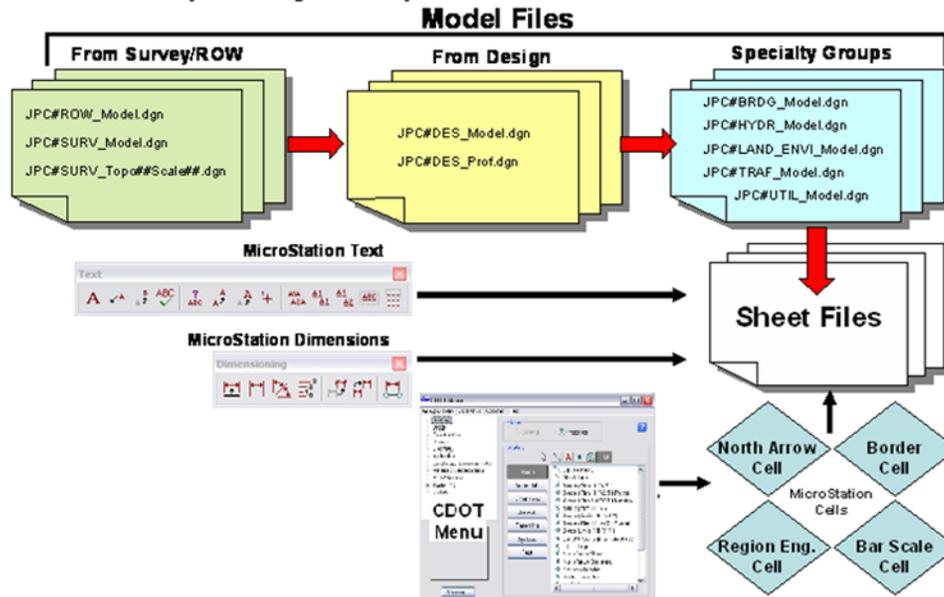
Single Source Project Data

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.
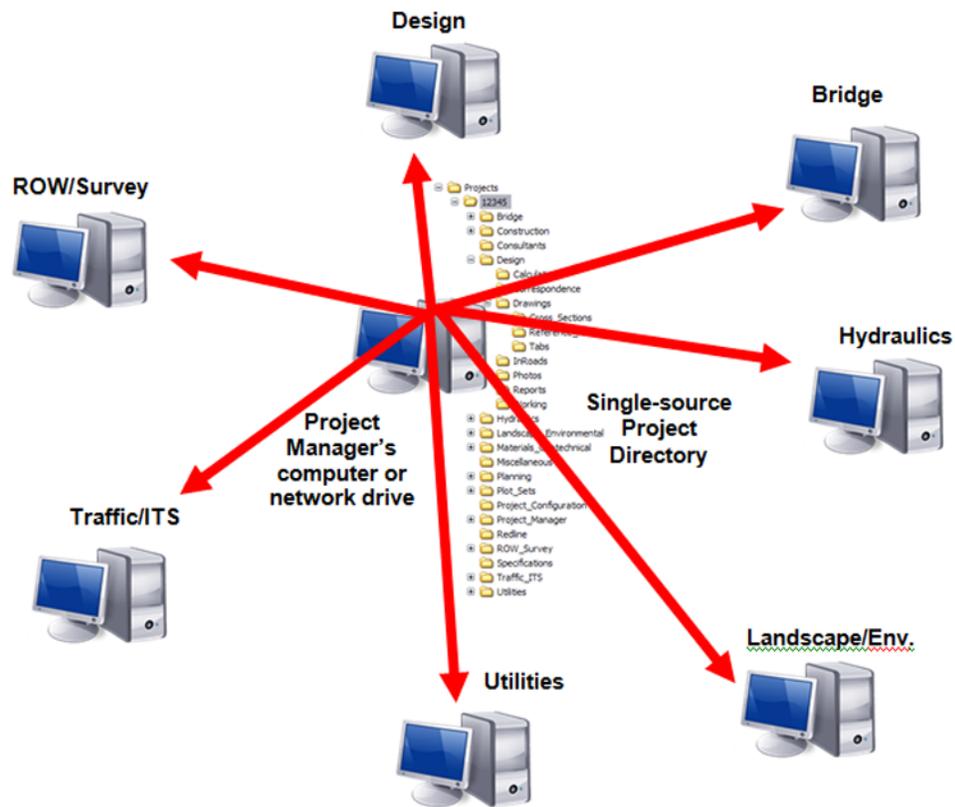
Project set-up

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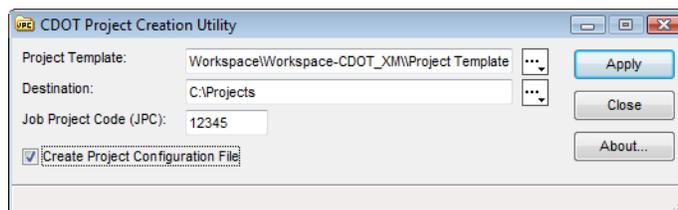
The PM enters the Job Project Code (JPC) and runs the utility. This creates the project directory and associated blank and auto-populated files, along with the Project Configuration File (PCF).

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**.
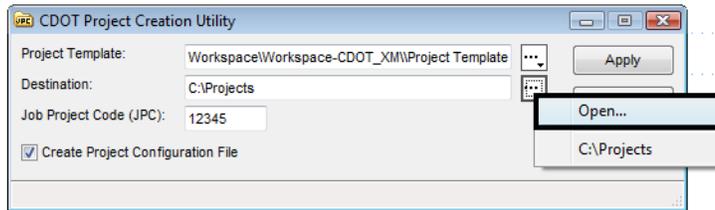
You can now set the path to any mapped network drive.
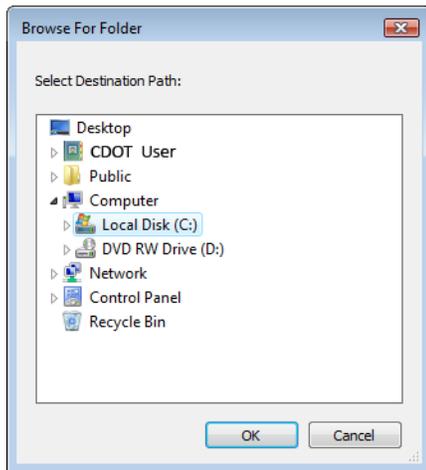
For more information see the ***CDOT CADD Manual, Chapter Three —Project Directory Structure, section 3.1 – Project Creation Utility***.
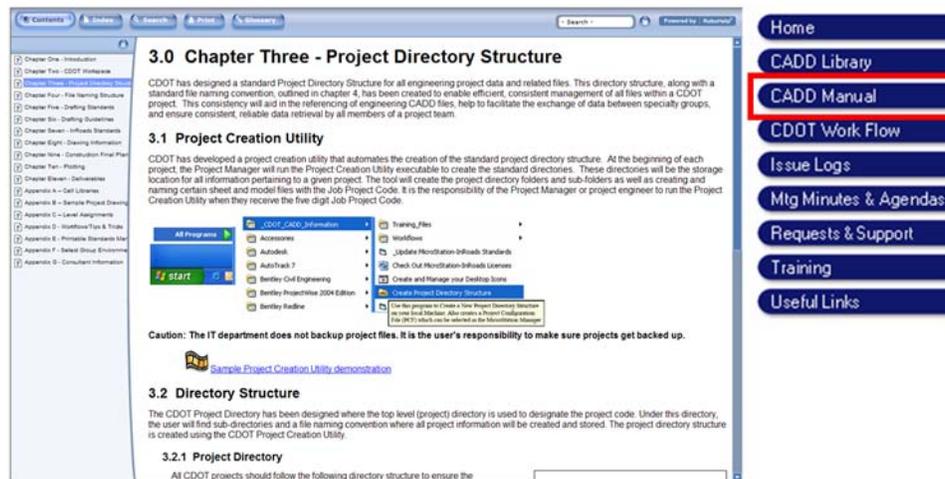
The PCF file

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.

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***.

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.
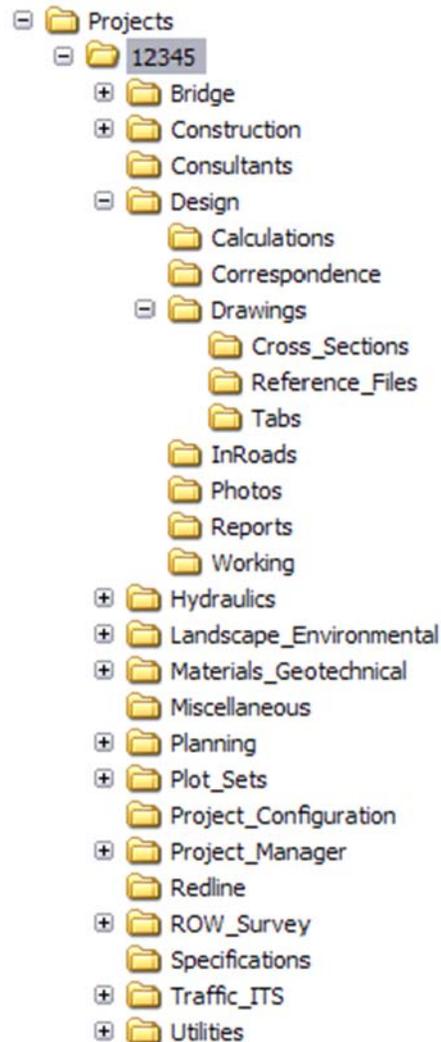

Training files

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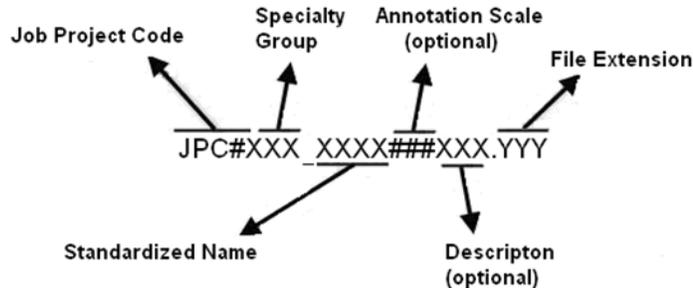
An example of a MicroStation design file would look like the following:

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***.

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.
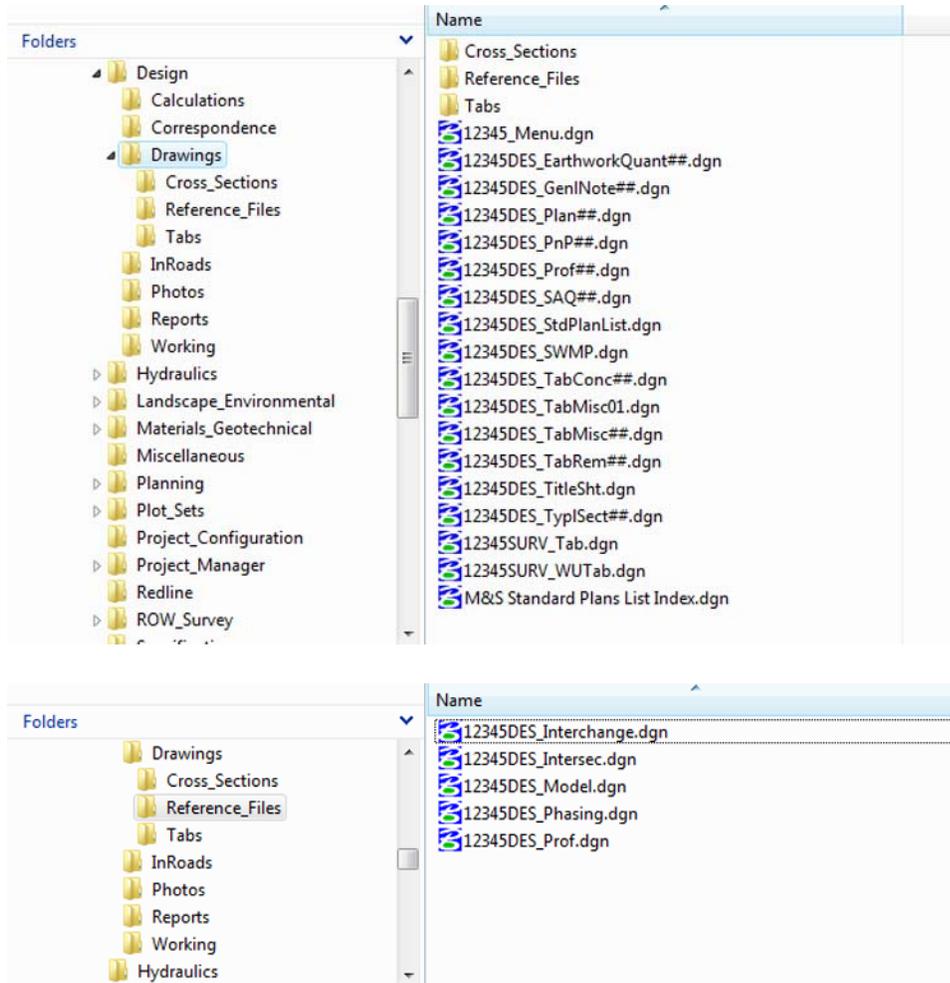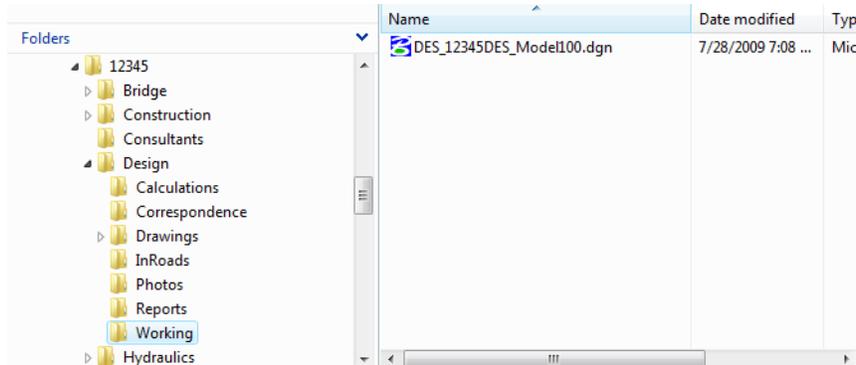

What files go where?

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.
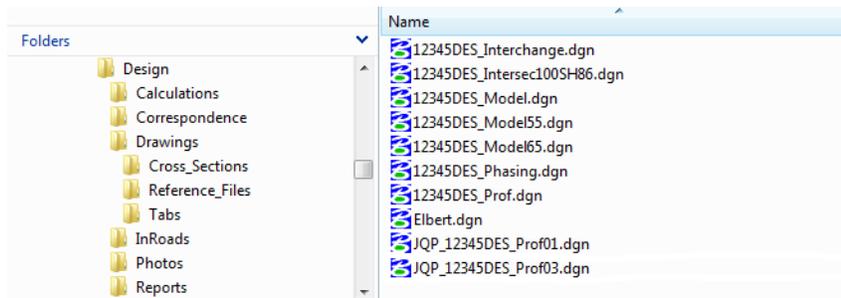
Working Model files

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***

Name	Date modified	Typ
DES_12345DES_Model100.dgn	7/28/2009 7:08 ...	Mic

Folders:
- 12345
  - Bridge
  - Construction
  - Consultants
  - Design
    - Calculations
    - Correspondence
    - Drawings
    - InRoads
    - Photos
    - Reports
    - Working
  - Hydraulics

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.

Name
12345DES_Interchange.dgn
12345DES_Intersec100SH86.dgn
12345DES_Model.dgn
12345DES_Model55.dgn
12345DES_Model65.dgn
12345DES_Phasing.dgn
12345DES_Prof.dgn
Elbert.dgn
JQP_12345DES_Prof01.dgn
JQP_12345DES_Prof03.dgn

Folders:
- Design
  - Calculations
  - Correspondence
  - Drawings
    - Cross_Sections
    - Reference_Files
    - Tabs
  - InRoads
  - Photos
  - Reports

Sheet files

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

Name
Cross_Sections
Reference_Files
Tabs
12345DES_EarthworkQuant.dgn
12345DES_GenlNote.dgn
12345DES_Plan02.dgn
12345DES_Plan03.dgn
12345DES_Plan04.dgn
12345DES_Plan05.dgn
12345DES_Plan06.dgn
12345DES_Plan07.dgn
12345DES_Plan09.dgn
12345DES_Prof01.dgn
12345DES_Prof02.dgn
12345DES_Prof03.dgn

Folders:
- Projects
  - 12345
    - Bridge
    - Construction
    - Consultants
    - Design
      - Calculations
      - Correspondence
      - Drawings
        - Cross_Sections
        - Reference_Files
        - Tabs
      - InRoads
      - Photos

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.

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

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.
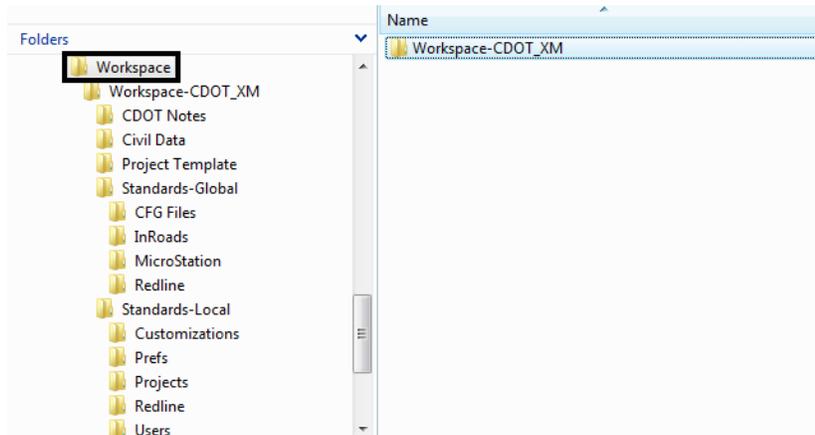
The Select Group Environment Utility

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 informattion on the CDOT Workspace in general, see the ***CDOT CADD Manual, Chapter Two - CDOT Workspace***.

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.

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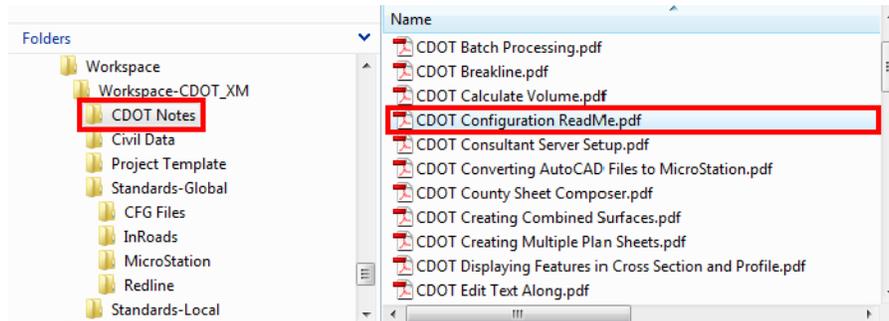
The CDOT Level Structure

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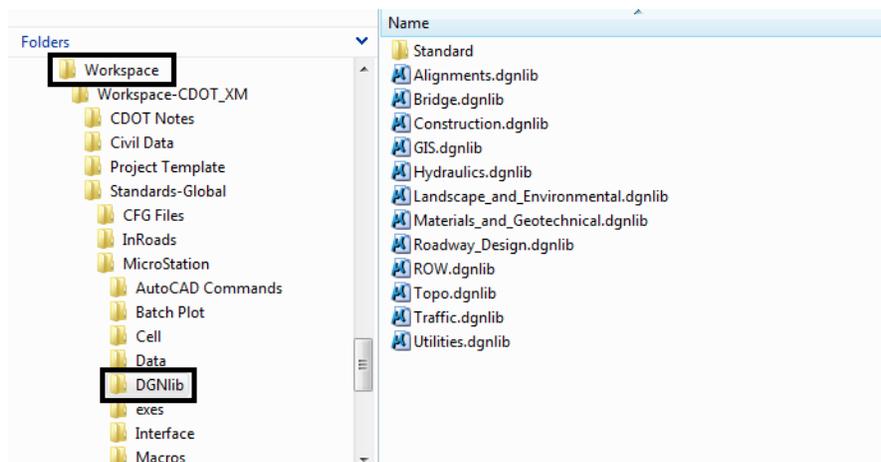
For more information about the CDOT level structure and a list of all discipline level libraries, see the ***CADD Manual, Chapter 5 – Drafting Standards, section 5.3 – Design File Level Libraries***. You can link to a specific group to review its standard level structure.

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.

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**.
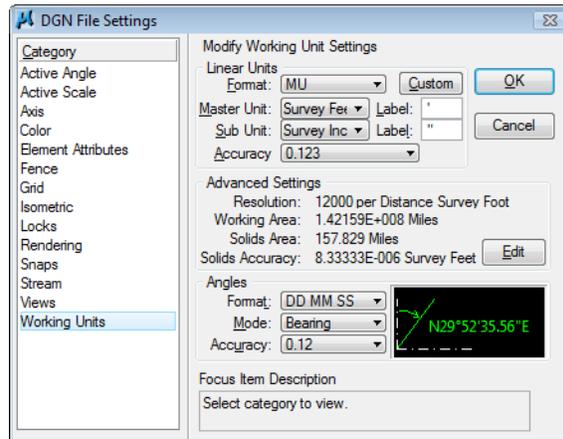
Entering data

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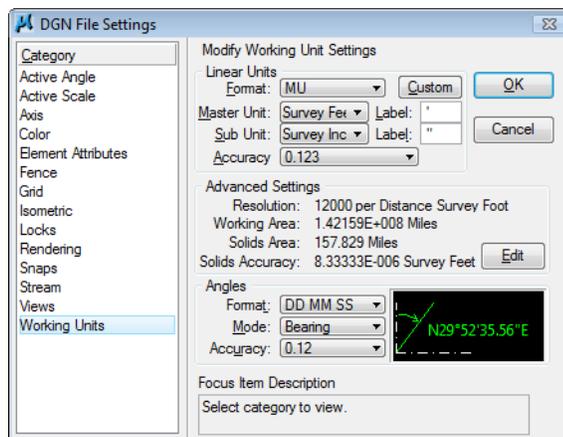
You can set your linear values to readout in master units, sub units or both. Angles can readout in either degrees-minutes-seconds ***(DD MM SS)*** or decimal degrees ***(DD.DDDD)*** with up to 8 decimal place accuracy.

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.
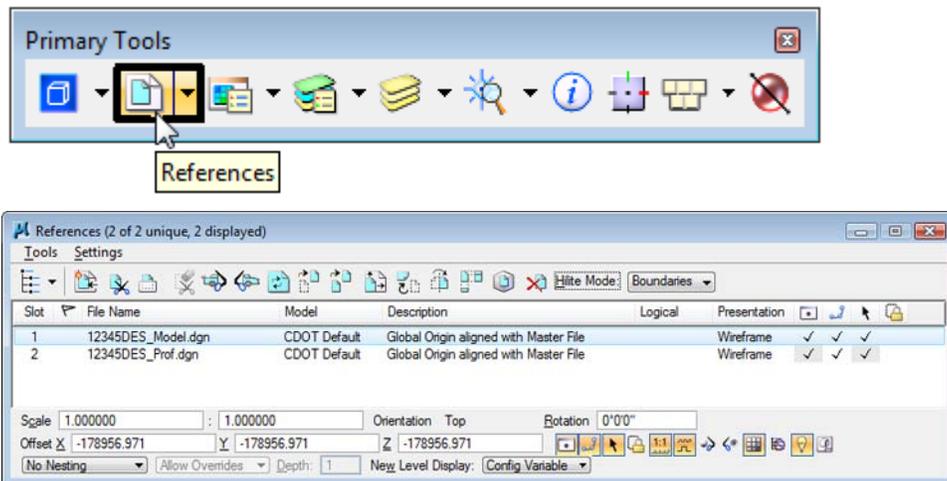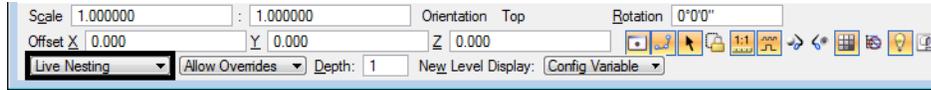

Different reference file attachment methods are available to help control reference manipulations and displays. These include:
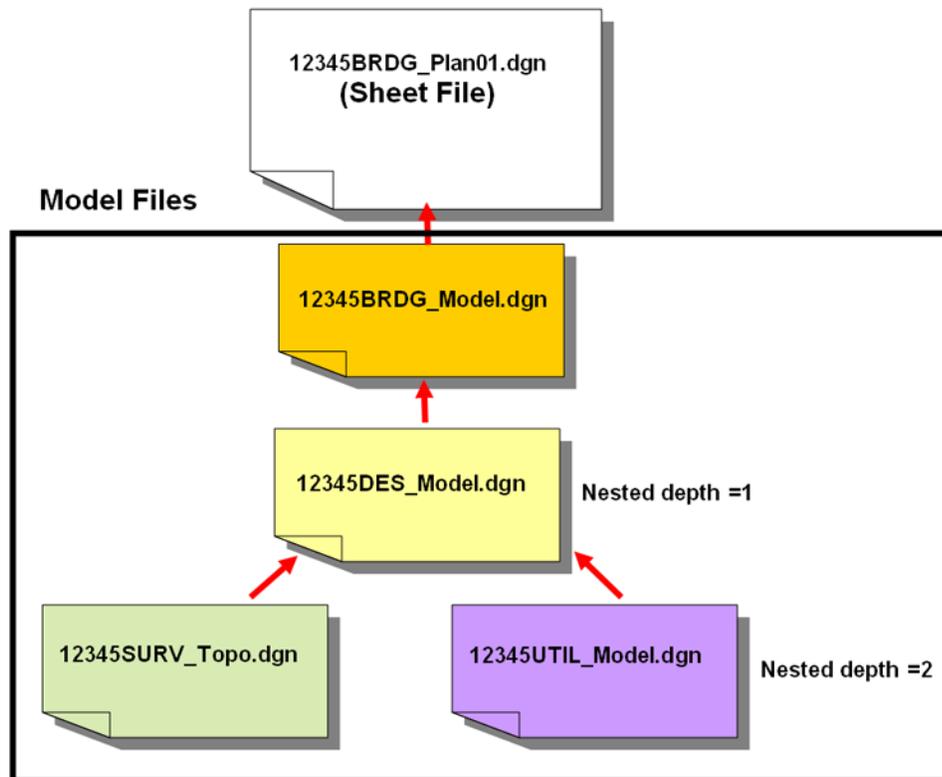
-   No nesting

-   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.
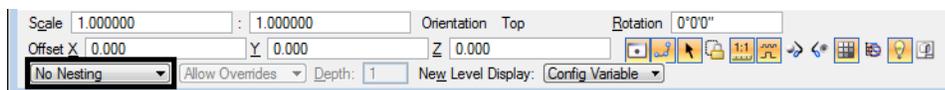
Working with Raster Attachments

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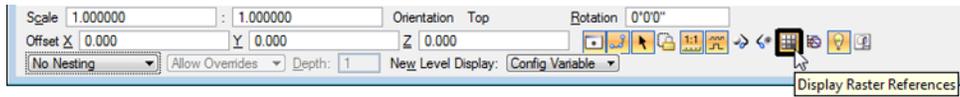
For more information on working with raster references, see the ***CDOT Raster Manager*** workflow.

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.