

CADD Standards

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July 2024

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CADD Standards

Support

1.1 Manuals and Tutorials

April 2022

Internet Resources

This manual, **CADD Standards** manual, is available on the Internet: www.dot.nd.gov/manuals/design/caddmanual/caddmanual-ord.pdf. Users should review this web site for all future revisions.

The “How to Check Supplemental Design Data” guide provides recommendations for reviewing model information that is provided to contractors.

www.dot.nd.gov/manuals/design/caddmanual/How%20to%20check%20Supplemental%20Design%20Data.pdf

NDDOT Server Network Resources

Axiom manuals are located under their respective folders under M:\APPS\Production\Design\AxiomV10.

A variety of “How To” reference videos and guides are available under S:\SUPPORT\How_To.

Chapter 21 –Surveys and Photogrammetry, CADD Editing, is available at S:\SUPPORT\Teams\Survey\NonMicroStationData\DraftingStandards\Level_1\CH21 CADD Editing Standards.pdf

CADD Standards

1.2 The CADD Specialist and Support Contacts

April 2023

The CADD Specialist (Jon Collado, 328-4439) provides technical engineering related support for CADD programs. His other duties include:

- Researching and maintaining CADD technologies
- Providing application specific training
- Coordinating engineering related standards development and implementation

The CADD Specialist is the primary contact for technical engineering related CADD support questions. Support from co-workers is also important. Here is a list of other users who may be able to help you:

| | |
|-------------------------|--------------------------------|
| Survey: | Troy Zornjak |
| Alignments: | Sara Cahlin |
| Earthwork: | Brady Haussler, Sara Cahlin |
| Corridor Modeling: | Sam Welch, Jennifer Kern |
| Corridor Templates: | Sam Welch, Jennifer Kern |
| MicroStation: | Kris Altepeter, Chad Frisinger |
| Information Technology: | Carey Schriener |
| Adobe Acrobat: | Travis Cork, Garrett Hartl |
| GuideSign: | Travis Cork |

CADD Standards

1.3 Standards Committee

April 2023

Members: Adam Cahlin, Sara Cahlin, Jon Collado (chairperson), Travis Cork, Monte Deis, Brady Haussler, Jennifer Kern, Brian Raschke, Randall Sandvig, Alex Spady, Sam Welch, and Troy Zornjak

The Standards committee is responsible for developing, maintaining, documenting, and providing training for the NDDOT CADD standards. The standards committee is not responsible for enforcing the standards. If a user has a problem or cannot use one of the standards, they should contact the CADD support specialist.

CADD Standards

Project Administration

2.1 Current Software

July 2024

The NDDOT is using the following versions of software.

AutoTurn 2024.12

Axiom Toolkit 10

Axiom Title Block Administrator 10.1a

Bentley View 23.00.01.15

GuideSign Plus 2024.8.2.0.150

MicroStation 23.00.02.71

OpenBridge Designer 23.00.01.24

OpenBridge Modeler 23.00.01.24

OpenRoads Designer 23.00.01.11

NDDOT is implementing ORD 23.00, OBD 23.00 and MicroStation 23.00 on **August 19, 2024**.

- Early adoption of software updates listed above, based on project specific schedules, is allowed.
- NDDOT consultants that have concerns with updating software on active projects, such as ORD 10.11 to 23.00, can request an exemption to continue using software listed in contract agreements from a Design Program Manager.

Some NDDOT workflows have not been addressed in the current ORD standards. The main development area in the current standards is roadway design and survey. Standards for bridge, hydraulic, geotechnical and traffic design have not been pursued as much as roadway design.

CADD Standards

2.2 Resource Files

July 2024

The current CADD Standard Index File is dated “7/22/2024 10:53:01 AM”. This index is used with a macro to review your current version of NDDOT CADD Standards. See the “Design” workflow, “Main” tab, “Help” Group, “Index NDDOT Standard Files”. The index file (nndotUpdateIndex.csv) is a comma separated value file that can also be manually reviewed with a text editor or Excel.

The following tables show the update dates for CADD Standard Resource Files. The file name shown in blue is a hyperlink.

| Description | File Name (Link to Resource) | Updated | Posted |
|---------------------------------------|-------------------------------|---------|---------|
| Installation and Administrative Files | Install.exe | 7/02/24 | 7/23/24 |
| Cell Libraries | Cells.exe | 7/22/24 | 7/23/24 |
| DGN Libraries | Dgnlib.exe | 7/22/24 | 7/23/24 |
| All other Resource Files | Data.exe | 7/22/24 | 7/23/24 |
| Workspace and Workset Files | Workspace.exe | 7/02/24 | 7/23/24 |
| GuideSign | GuideSIGN.exe | 7/02/24 | 7/23/24 |

CADD Standards

2.3 Standards Directory

April 2023

Most of the NDDOT CADD standards are stored under the S:\STANDARD\CE10\Organization folder. This is a summary of subdirectories used to store resource files. Files in these directories are used to configure many of the operations performed by software used for NDDOT CADD operations.

| Subdirectory | Description |
|---------------------|--|
| | |
| Cell | Cell Libraries |
| Cfg | Configuration Files |
| Data | Tags and WMS links |
| Dgnlib | Dgn Libraries |
| Geographic | Geographic Coordinate Systems |
| Interface | Default Function Keys |
| Macros | Visual Basic Macros |
| Materials | Materials Symbolology |
| Materials_Civil | Materials Symbolology |
| Mdlapps | MDL Applications |
| Pltcfg | Plot Drivers and Pen Tables |
| Preference Seed | Default Interface Preferences |
| Reports | Style Sheets for the Report Browser |
| Scales | Annotation Scale and Sheet Definition Settings |
| Seed | Seed Files |
| Sheet Borders | Sheet Borders as dgn |
| Sight Visibility | Sight Visibility Settings |
| Superelevation | Superelevation Settings |
| Survey | Text Import Wizard |
| Symb | Line styles, Fonts, Color Table |
| Template Library | Default Corridor Template Library |
| Widening | Curve Widening Settings |

CADD Standards

2.4 Project Directories

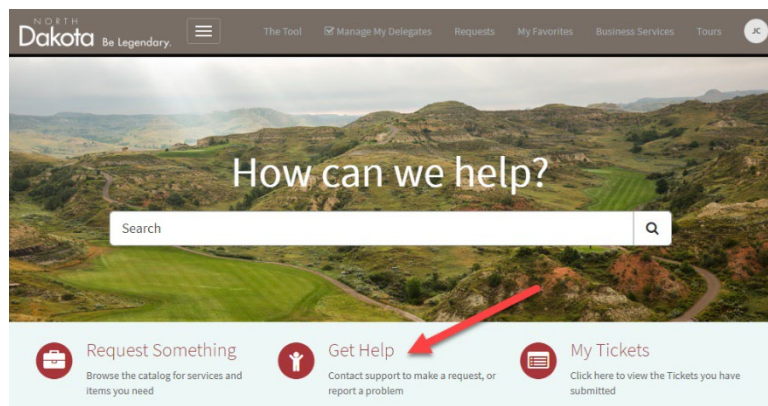
April 2023

The sharing of information is a vital part of the success of a NDDOT project. Thus, when a new project begins, a centralized directory structure is needed. Since it is important that data is shared but not corrupted by unauthorized users, the Department has established a standard procedure for directory creation and file naming.

A NDIT help request is used to have NDIT create project directories.

<https://northdakota.service-now.com/serviceportal>

Use the “Get Help” tool.



NDDOT project numbers consist of a funding code, district, highway, agreement number, and mile point. A typical number may be “SS-1-804(049)027”.

The directory created for this project would be as follows: “R:\project\11804027.049”. Highways named with 4 digits should always use all 4 digits in the folder name even if the project number only uses 3 digits for the highway number.

CADD Standards

Each directory has the appropriate security access set by division. Thus, Bridge staff is only allowed write access to the Bridge subdirectory. Other directories will be “read only” for Bridge staff. The directory under the R:\project\11804027.049 directory would consist of the following subdirectories:

| | |
|------------|---|
| Bridge | (Bridge Division) |
| Consultant | (Hired Consultant Firm) |
| Design | (Roadway Design Sections) |
| District | (Any of the 8 District offices) |
| DOTSC | (DOT Support Center) |
| ePlans | (Electronic Plans) |
| ETS | (Environmental and Transportation Services) |
| Material | (Materials & Research Division) |
| Resources | (common resources such as old plans) |
| ROW | (Right of Way Section) |
| Survey | (Preliminary Surveys Section) |
| Traffic | (Traffic Section) |
| Utilities | (Technical Support Section, Utility Coordination Plans) |

On rare occasions other Divisions will require a project subfolder. If needed, this can be included in NDIT help request.

| | |
|--------------|--------------------------------------|
| Construction | (Construction Division) |
| Maintenance | (Maintenance Division) |
| Planning | (Planning/Asset Management Division) |

NDIT has optimized levels of security so that project related folders, up to and including the above root directories, cannot be deleted or edited. However, any folder can be created by an individual user, past that level. Obviously, users need to follow certain conventions of folder and file naming in order to effectively communicate with others.

CADD Standards

Under each of these root directories, there are unique folders that describe the specialized operations of these users. For example, the users in Preliminary Surveys would use the following directory when they are working on electronic field book data:

R:\project\11804027.049\survey\EFB.

The following are recommended subdirectories:

(^T = Excluded in NDIR setup template, manually add as needed)

(^C = See “F:\Design\78 Technical Support Section\zTemplate”)

Bridge

- Dgn
 - (Subdirectories for each structure, name based on structure number)
- Standards
- Out
- Environmental
 - Field Review
 - Public Input
 - Management Presentation
 - SOV
 - CATEX
 - 404_Permit
 - Flood_Plain_Permit
- Hydraulics
 - Structure
 - Roadway

Consultant

- CADD Files
 - As-built
 - Bridge
 - Design
 - Material
 - ROW
 - Survey
 - Supplemental Design Data
 - Traffic
- Correspondence (^T^C)
- Project Management (^T^C)
- Submittals (^T^C)

Design

- Dgn
- Standards
- Out
- Sheets
- Supplemental_Design_Data
- Environmental
 - Field Review
 - Public Input
 - Management Presentation
 - SOV
 - CATEX
 - 404_Permit
 - Flood_Plain_Permit
- Support_Documents (Non Environmental)
- Excel

District (Same Structure as Design + Asbuilt)

- As-built

DOTSC (Same Structure as Design)

ePlans (PDF Files Only)

- 01_Preliminary
- 02_PSE
- 03_Final
- 04_Addendum
- 05_Change_Order

ETS

Material

CADD Standards

Resources

- Photos
- Old_Plans

ROW

Survey

- Aerial (^T)
- Consultant (^T)
- EFB (^T)
- Final (^T)
 - Photos_Scans (^T)

Traffic

- Sheets

Utilities

CADD Standards

Occasionally, some projects are not associated with a project number. The project may not be adjacent to a highway such as a wetland mitigation project. Miscellaneous projects that don't have standard project numbers should be stored in a subdirectory under R:\project\misc\. A brief project description could be used as the project subdirectory name. The sub directory structure will be set up the same as a normal project. Users should call the help desk to get a base subdirectory created.

Right of Way plots that are not associated with a highway project are stored in the "R:\project\PLATS_misc\" directory.

Consultants

Consultants shall set up and use a directory structure similar to the Central Office.

1. Create a project folder using the NDDOT Standard directory structure. Consultants can revise the server or drive designation as they need (example: x:\NDDOT\project\80013389.031). Everything after the project number (example: 80013389.031) must be setup the same as the NDDOT standard project directory.
2. Work in this directory.
3. When a project is complete copy the files to the applicable MFT folder for the Consultant and Project.
 - a. Consultants shall notify their respective Technical Support Contact within the Design Division when final project files have been posted.
4. The Technical Support Representative will import the project information to the R:\ drive.

All users, especially District and Consultant users, need to use the "Save Relative Path" options when referencing files. The "Save Relative Path" option will help keep the reference path integrity when the files are moved from one drive to another.

CADD Standards

2.5 File Naming Conventions

April 2023

MicroStation drawing names have been standardized for easy, quick and consistent identification and they have been standardized to ease the preparation of plan plot sets. Standard names also apply to non-drawing files that are used in a plan plot set. This section applies to names of original files. For names of the pdf plan sets, see **Section 2.14**

Standard drawing names can be made up from 4 parts; prefix, plot number, suffix and suffix modifier. The following drawing name is in accordance with the standards:

004SW_002_SCOPE.dgn

In this example the “prefix” is **004SW**, the “plot number” is **002**, and the “suffix” is **SCOPE**. Note the underscore characters are standard name dividers. They are used after the prefix, plot number and between the suffix and suffix modifier. The example standard name doesn’t use a “suffix modifier”.

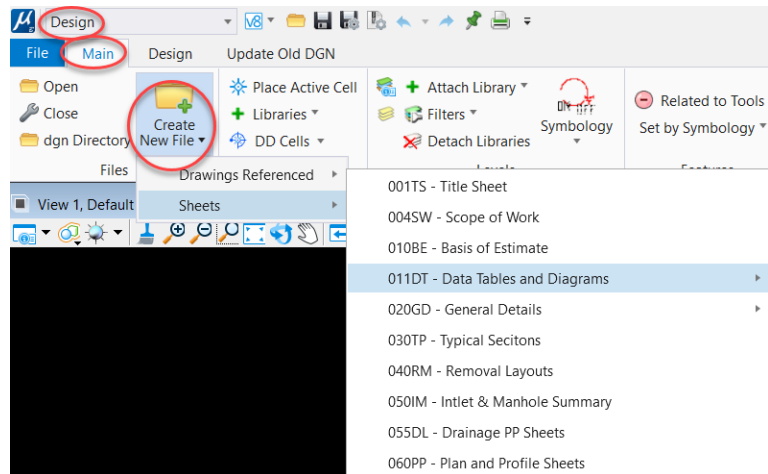
The “prefix” is used to divide and organize plot sets into sections. The prefix is required for all drawings that are going to be directly incorporated into a plot set for plan production. These plots are used to directly print a sheet in the plans. The prefix should not be used for a referenced drawing that is indirectly included in the plans. For example, topog information include in the plans is indirectly included in the plans because it is a referenced drawing. The topog drawing should not have a prefix. The topog drawing would just be named TOPOG.dgn.

[Appendix A](#) lists the current standard drawing names. Check the appendix to find the correct naming convention when creating a new file.

The NDDOT also has a custom macro that can be used to create a new drawing with a standard name. This macro creates a new drawing as you look up the standard name. The Macro is activated through most of the NDDOT workflows under the “Main” tab. It is named “Create New File”.

The macro accommodates suffix modifiers and the page number within section. User will be prompted for this information through a dialog box.

The new file will be created in the present drawing directory. This macro doesn’t provide options to create drawings in other directories.



CADD Standards

Some other features of this macro include a safeguard to prevent creating a drawing that already exists (overwriting a file). Different seed files are used based on the type of drawing selected.

One limitation to this macro is metadata. This macro uses a file copy and open command in the background. The file metadata is not reset with a copy command. Some properties such as author, logged edit time and number of revisions will not be reset. These properties don't affect file performance and metadata is presently not a CADD Standard.

Please contact the CADD Specialist (see *Section 1.2*) if you need a file name that doesn't fit the existing naming standards.

The table on the following page lists standard sheet name prefixes.

CADD Standards

| Section Number | Section Description | Sheet Name Prefix |
|----------------|--|-------------------|
| 001 | Title Sheet | 001TS |
| 002 | Table of Contents | 002TB |
| 004 | Scope of Work | 004SW |
| 006 | Notes | 006NT |
| 008 | Quantities | 008QS |
| 010 | Basis of Estimate | 010BE |
| 011 | Data Tables (Concrete Pavement Repair Locations, Coring Data, Salvaged Base Summary, Earthwork Summary, Mass Diagram, etc) | 011DT |
| 020 | General Details, Lift Station Details, Super Elevation Tables and Layouts | 020GD |
| 030 | Typical Sections | 030TP |
| 040 | Removals | 040RM |
| 050 | Inlet & Manhole Summary, Culvert Hydraulic Data | 050IM |
| 051 | Allowable Pipe List (Pipe Policy) | 051AP |
| 055 | Drainage Layouts (Separate Plan and Profile Sheets for Drainage Items, Use When PP Sheets too Crowded) | 055DL |
| 060 | Plan & Profile | 060PP |
| 070 | Contours | 070CT |
| 075 | Wetlands, Mitigation and Environmental | 075WL |
| 076 | Temporary Sediment and Erosion Control | 076TE |
| 077 | Permanent Sediment and Erosion Control | 077PE |
| 080 | Layouts (Fencing, Curb Ramps and Miscellaneous Layouts) | 080LO |
| 081 | Survey Coordinate and Curve Data | 081CD |
| 082 | Survey Data Layouts | 082SD |
| 085 | Landscaping | 085LS |
| 090 | Paving Layouts | 090PL |
| 100 | Work Zone Traffic Control | 100WZ |
| 110 | Signing | 110SN |
| 120 | Marking | 120MK |
| 130 | Guardrail | 130GR |
| 140 | Lighting | 140LT |
| 150 | Signals | 150SL |
| 160 | ITS | 160IT |
| 170 | Bridges & Box Culverts | 170BR |
| 175 | Soil Boring Logs | 175SB |
| 180 | Pit Plats and Borrow Areas | 180PT |
| 190 | Haul Road Restrictions | 190HR |
| 199 | Tied Plans Not Contractually Requiring NDDOT CADD Standards | 199TI |
| 200 | Cross Sections | 200XS |

Note, If Signing and Marking are on the same layout sheet use section 110-Signing

CADD Standards

Information that is included in sections 040 Removals, 055 Drainage Layouts, 080 Layouts, 085 Landscaping, and or 090 Paving Layouts can be included in section 060 Plan and Profile instead of segregating information in their respective drawings. If the plan and profiles don't have enough space to clearly communicate details, additional sections, such as 040, 055, 080, 085 and 90 should be used.

The "plot number" is used to organize drawings within a section (prefix) of the plans. When plot numbers are used, they should start out at 001 for each section and increment up through the end of the section. Plot numbers are used to organize sheets within a section. They are not intended to be the sole tool to organize all the sheets within a plan plot set.

For example, plan and profile sheets could be organized so that mainline plan and profile sheets are before side street plan and profile sheets. A project may have 7 mainline plan and profile sheets and 4 side street plan and profile sheets. The mainline sheets could be numbered 001 through 007 and each specific side street sheet could be organized by the next plot number. The sheet that directly precedes the mainline plan and profile sheet would be numbered 008, the next sheet would be numbered 009 and so on. Note: the plot number should be named with three characters for sorting purposes. Zeros should be used as place holders for plot numbers less than 100. The text "2" is after the text "002". The text "2" is also after the text "003".

Leading zeros should not be used in the sheet title block for section and page number.

Plot numbers are not needed for drawings that are not directly used for plan plot sets. They are optional for drawings that are directly used for a plan plot set if the full drawing name is sufficient to sort the names in the correct order. Example: a drawing that is the only drawing within the section would not need a plot number. A plan plot sets may not need a "plot number" for the "Scope of Work" sheet if it is the only sheet in the section. There are no other sheets within the "Scope of Work" section to organize.

The "suffix" part of the name is used to identify a sheet within a section by content. For example there are many different types of Data and Table sheets. Several are in section 011. However users need a suffix to distinguish by name the Coring Data Sheets from the Earthwork Summary Layout sheets. For drawings that are not directly included in a plan plot set (a referenced drawing), the suffix part of the name is the same as the name of the drawing. Example the drawing named TOPOG.dgn has a suffix that is the entire name.

Suffix modifiers may be added after the suffix to give additional distinction to a standard drawing name. Suffix modifiers are usually optional. They are only mandatory for as-builts, addenda and change orders (see *sections 7.1 and 7.4*). If used, they should be based on the information in the drawing. Users are to use their discretion when creating a suffix modifier. Example, construction sign layout sheets may have suffix modifiers to indicate the phase and location. The following drawing name is an acceptable standard name: 100WZ_012_CS_Phase1EighthSt.dgn. The suffix is CS and the suffix modifier is Phase1EighthSt. Suffix modifiers can be used with any drawing name.

CADD Standards

2.6 Configuration Setup

July 2024

The majority of NDDOT CADD standards are implemented at the “Organizational” level of configuration files and they are directed to the network at **S:\STANDARD\CE23**. The following recommendations are for configuration setup.

1. Make sure Bentley software is installed correctly and launches correctly without NDDOT standards loaded. The **CE23** folder is intended to support
 - OpenRoads Designer (ORD) **23.00**
 - OpenBridge Designer (OBD) **23.00**
 - MicroStation **23.00**
 - Bentley View (**BV 2023**) **23.00**
2. Close Bentley CADD applications.
3. Run the following batch file.

S:\STANDARD\CE23\Install\Setup_local_workspace.bat

In summary the batch file does the following:

- Creates a local user folder for user files that pertain to the NDDOT CADD Standards.
 - C:\NDDOT_CADD\s_drive\Support\users\%username%\ul> - **BV 2023**
 - **MicroStation 2023**
 - **ORD 2023**
 - **OBD 2023**

If these files already exist, the batch file will not edit these folders and manual adjustments may be needed in this directory.

- **Installs the applicable configuration file** [C:\ProgramData\Bentley\{application}\Configuration\ ConfigurationSetup.cfg (NDDOT version)] and ConfigurationSetup.default files.
- Replaces Batch Tools (C:\NDDOT_CADD\Batch Tools).

CADD Standards

4. Windows 10 users

- Add the administrative “CADD” toolbar to the Windows taskbar. This is done by right mouse button click pressing on the Windows taskbar. Then select “Toolbars > New Toolbar”. Then select C:\NDDOT_CADD\Batch Tools\CADD. Use the “Select Folder” button to complete the selection. Note the sub folders for multiple Bentley Applications.
- The CADD toolbar should now appear in the Windows taskbar. There should be subfolders for installed CADD Applications. From applicable folder select “CADD Standards Toggle” to enable CADD Standards connection. Each CADD application has an independent toggle. Consultants can use the CADD Standard Toggle to quickly connect and disconnect the NDDOT CADD Standards.

Windows 11 users will need to manually navigate to the tools located in the following folder: C:\NDDOT_CADD\Batch Tools\CADD as needed.

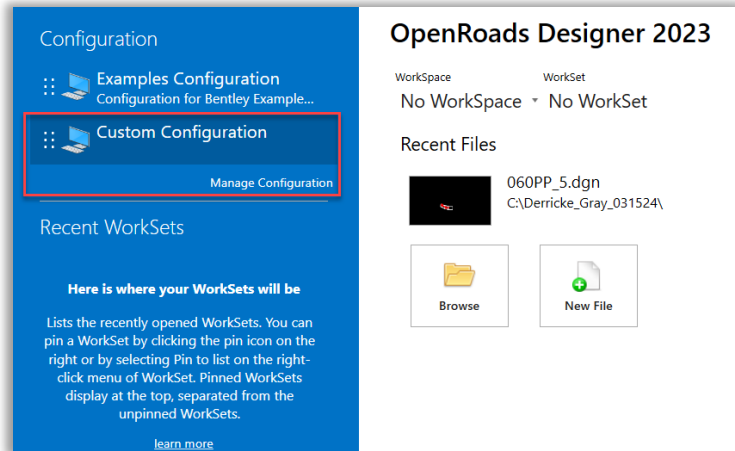
5. The following is an overview of what the CADD Standards Toggle does.

- The toggle exchanges-renames the following files; ConfigurationSetup.cfg, ConfigurationSetup.Default and ConfigurationSetup.NDDOT. ORD configuration setup files are located at: C:\ProgramData\Bentley\{Application}\Configuration\ There should only be 2 of these files on any computer for each CADD application. The file extensions are changed based on the toggle. The file with the cfg extension is the active file.
- The NDDOT version of this file points to NDDOT standards. The Default version points to Bentley standards within the “C:\ProgramData\Bentley\{Application}\Configuration” folder.

CADD Standards

6. “Managed Configuration” is a new tool that Bentley software implemented starting with MicroStation 10.17.

“Custom Configuration” should be selected to use the NDDOT standards.



This tool was intended to perform similar functions as the NDDOT CADD Standards toggle. However, using this tool by itself has limitations.

- It requires a workspace\workset to be used.
- Accessing a file through Windows file explorer (double clicking on a file) does not enable all NDDOT standards even if the file is branded with a workspace\workset. This problem is logged with Bentley as CS0173943.

The NDDOT uses the managed modification tool, but the NDDOT CADD Standards toggle (revised ConfigurationSetup.cfg) is also used to enable non workspace\workset workflows with NDDOT standards. Keeping the CADD standards toggle also enables opening files through Windows file explorer.

There is an instance when using a NDDOT workspace\workset is required! If the last (previous) time the CADD application accessed a Non NDDOT workspace\workset or the file be access is associated with a Non NDDOT workspace\workset, then a NDDOT workspace\workset must be used next to fully switch to NDDOT CADD Standards. After the NDDOT CADD standards are activated, no workspace\ no workset workflows can be used with the NDDOT CADD standards.

Additional Notes for Consultants

Consultants are encouraged to connect to NDDOT standards like NDDOT staff connects. Other deployment methods are allowed, but they won't typically be supported by NDDOT staff. If consultants use the same method, they might not need to review and/or adjust as many installation details as compared to a modified method. The more a consultant administrator changes the installation method, the more they will need to review and/or adjust it on their own. Example, Consultants will need to manually review the batch file commands in step 3 above if they modify NDDOT standard paths.

The NDDOT installation practices allow NDDOT CADD standards to be supported independently of other workspaces – other CADD standards. The NDDOT CADD standards can easily be disabled and enabled. Consultants can turn off NDDOT CADD standards when they need to work with other clients CADD standards.

CADD Standards

Consultants need to download NDDOT CADD resource files. See the hyperlinks in *section 2.2*. Consultants need to Decide how end users should access the resource files. They could be saved on local machine for each user or saved to a network location. Saving resource files to a network location can be advantageous. If multiple users are accessing the standards. Managing standards in one place is usually easier than managing them on multiple computers. Move the standards to where you intend to manage and access them. Be sure to keep the structure below the “CE23” folder the same as the NDDOT. You can change parent folders but not the sub folder structure. Example the NDDOT uses “S:\STANDARD\CE23” but standards can be directed to other paths such as “X:\XXX\XXX\CE23”.

Consultants may need to edit the NDDOT version of the ConfigurationSetup file if they are not storing the NDDOT standards at S:\STANDARD\CE23. This path should be edited to point to the NDDOT CADD standards folder. If multiple CADD applications are used, multiple Configuration Setup files will need to be edited.

CADD Standards

2.7 Preference Settings

June 2024

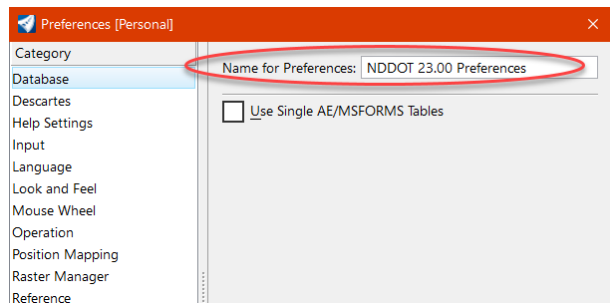
The NDDOT default preference are different from Bentley’s default preferences. Each CADD application has a separate preference file,

- C:\Users\%username%\AppData\Local\Bentley\View\23.0.0\prefs\Personal.upf
- C:\Users\%username%\AppData\Local\Bentley\MicroStation\23.0.0\prefs\Personal.upf
- C:\Users\%username%\AppData\Local\Bentley\OpenRoadsDesigner\23.0.0\prefs\Personal.upf
- C:\Users\%username%\AppData\Local\Bentley\OpenBridgeModeler\23.0.0\prefs\Personal.upf

The NDDOT CADD Standards use a seed preference file. This seed file can be used to set the NDDOT default preference. Follow the next steps to reset NDDOT preferences.

1. Make sure the NDDOT CADD standards are turned on for the applicable application.
2. Exit the applicable CADD application.
3. Delete the applicable “Personal.upf as noted in the paths above.
4. Restart the applicable CADD application. A new “Personal.upf” file should have been created from the NDDOT Seed.

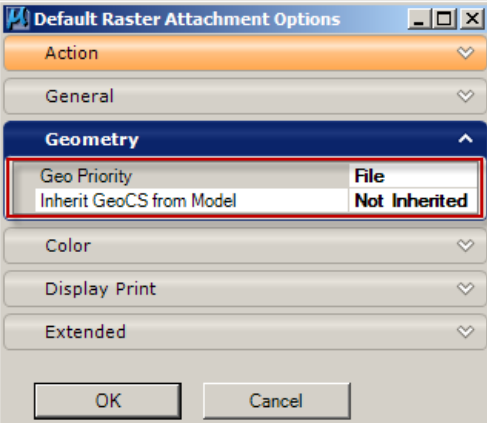
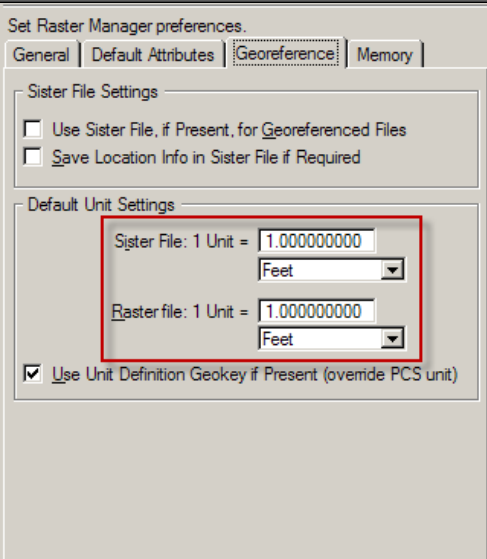
If you check your preferences from within the CADD application, you can see if you are using preference from the NDDOT seed file. The name for Preferences will show “NDDOT 23.00 Preference”.



The following table lists some NDDOT preference settings that are different from Bentley’s. These settings are recommended for the general user.

| Preference Name | Description | Setting |
|---|--|------------------------------------|
| Input>Allow ESC key to stop current command | When the ESC key is selected, the current command is stopped and the default command is started. | enabled |
| Raster Manager > Default Raster Attributes | Use Active Level Default level that rasters are attached to | disabled Level = Raster Group 1 |

CADD Standards

| | | |
|---|---|---|
| <p>Raster Manager > Default Raster Attributes</p> | <p>Set Geographic Coordinate System from Raster</p> |  |
| <p>Raster Manager > Georeference (tab) > (as shown)</p> | <p>These are some settings needed for working with raster images created by the Preliminary Surveys Section</p> |  |
| <p>Reference > Default Attachment Preferences > Display Raster References</p> | <p>When references are attached, they can also automatically attach the rasters that are attached to the reference.</p> | <p>Disable</p> |
| <p>View Options ></p> | <p>Element Highlight color</p> <p>Selection Set Color</p> | <p>Yellow</p> <p>Yellow</p> |

CADD Standards

Some preferences are stored in the preference file (upf) but are not changed through preference settings. The following table lists some NDDOT preference settings that are different than the MicroStation default settings, but not edited in the preference dialog box.

| Preference Name | Description | Setting |
|--|---|--|
| File > Tools > Compress Options | Allow deletion of unused – empty parts of the dgn file | All settings enabled |
| AccuSnap Settings > Enable For Fence Create | Allows AccuSnap while placing a fence. | enable |
| Within MicroStation Print Dialog Box – “Settings>Preferences> Allow Paper Size Editing | This setting is needed to create custom plot sizes from roll plotters | enable |
| Within “Change Attributes” tool | Defaults | Use Active Attributes: On Level: On Color: On Style: On Weight: On |

CADD Standards

2.8 Local User Files

April 2022

Default Directories

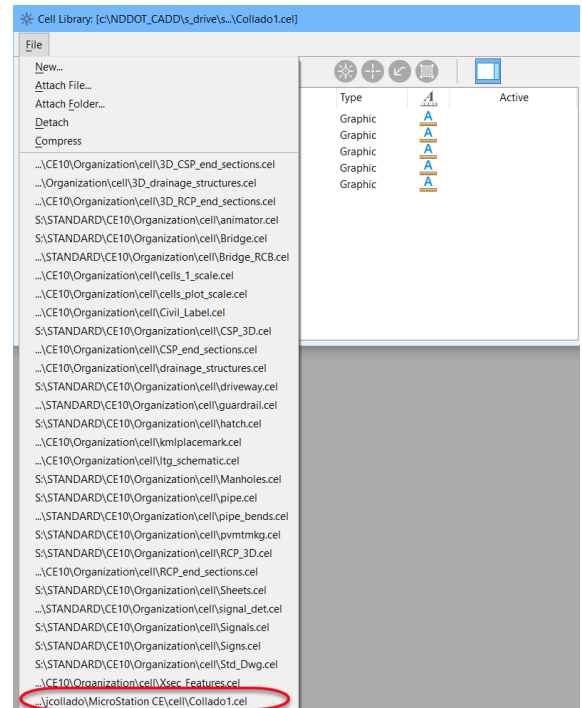
Many custom user files should be stored in subdirectories within “C:\NDDOT_CADD\s_drive\Support\users”. A subdirectory named after your user name should have been created under this directory. In this explanation “jcollado” is used. But, everyone will have their own unique name. CADD standards have been created to help you leverage this directory without having to adjust configuration files.

The directory “c:\NDDOT_CADD\” has been structured the way it is for a couple reasons:

1. Modified local CADD files are grouped together for easier management. This standard workspace area helps automate many user processes.
2. Files are grouped for easier portability. NDDOT CADD Standards and project information can be used locally, such as on a laptop –that is disconnected from the network. See NDDOT CADD Standards for “Taking Electronic Drawings into the Field”.
3. Files are grouped the way they are to copy some of Bentley’s default paths.
4. Files are grouped the way they are to enable networked workspaces. A very small group of users keep workspace settings under “s:\Support\Users\”. Guidance for these users is not discussed in this reference.

Cells

If you put personal cell libraries in the cell directory (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\MicroStation CE\cell), they will automatically be added to your cell list. You should not have to search for your personal cell libraries.



Interface (Tools and Ribbons)

If you create a dgnlib for custom tools and ribbons for personal use, it should be stored in your GUI directory for each applicable CADD application (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\MicroStation CE\dgnlib\GUI\jcollado.dgnlib). Changes will be appended to the standards.

CADD Standards

Function Keys

If you create custom function keys, you should save your changes to the Interface subdirectory for the applicable CADD application and name the file after your user ID (Example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\MicroStation CE\Interface\jcollado.mnu) This file must be named using your user ID in order for it to be attached without editing configuration files.

Accudraw Shortcut Keys

If you edit Accudraw shortcut keys, you should save your changes to the Interface subdirectory for the applicable CADD application and name the file after your user ID and the appended “_shortcut.txt” (Example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\MicroStation CE\Interface\jcollado_keyboardshortcut.txt). This file must be named using your user ID and the appended “_shortcut.txt” in order for it to be attached without editing configuration files.

WMS Server List

If you want to edit and use your own WMS Server List, copy the following: S:\STANDARD\CE10\Organization\Data\WmsServerList.xml, and pasted it in your user\data directory (Example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\MicroStation CE\Interface\jcollado_WmsServerList.xml). This file must be named using your user ID and the appended “_WmsServerList.xml” in order for it to be attached without editing configuration files.

VBA Macros

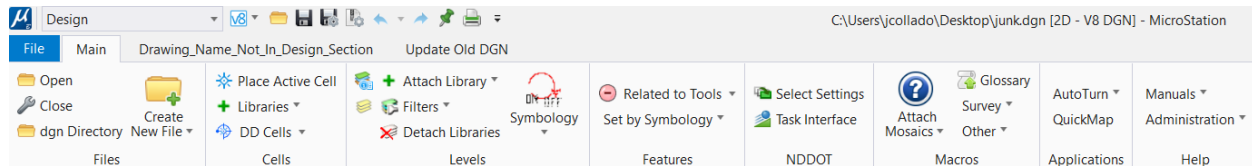
If you create personal VBA, you should save them to the VBA Folder (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\MicroStation CE\VBA\jdc_test.mvba). This is the first place MicroStation will look for your macros.

CADD Standards

2.9 NDDOT Custom Tools

April 2023

Most of the NDDOT Custom Tools can be accessed from a NDDOT custom workflow > Main (tab).



DD Cell NDDOT

This is a quick way of loading ddcell mdl and launching the NDDOT tool box for dimension driven cells.

Level Symbology

This tool is used for some typical level symbology overrides.

Features > Set by Symbology

This tool compares the level, color, weight, and style of elements. If the symbology of the element matches the symbology of a certain feature, then feature properties are assigned to the element. There are 4 categories that can be processed.

- Fence-Guardrail
- Right of Way
- Utilities
- Wetlands

Having graphics with the correct level, color, style and weight attributes is a prerequisite. Features are typically created from a 2D model. A managed model with linked 3D Features will be created later in the workflow. Use the Macro to set the applicable feature definitions. This macro can take over a minute to process.

CADD Standards

Tool Relationships

This tool adjusts the NDDOT commands used in most NDDOT tools that work with symbology.

Linear elements can have 1 of 4 following defaults.

- Simple Lines Only
- Simple Lines and Civil Features (ORD linear features if available)
- Smart Lines Only
- Smart Lines and and Civil Features (ORD linear features if available)

Cell elements can 1 of 2 of the following defaults.

- Cells Only
- Cells and Civil Features (ORD point features if available)

ORD users will have the full set of choices. MicroStation users will not have options to use civil features.

Attach Mosaics

This tool is only available to NDDOT staff. This tool gives you spatial hints to what aerial photos are available and help you quickly reference (attach) them to your drawing.

Glossary

This tool can be used to look up NDDOT abbreviations and send them to your clip board and MicroStation Text editor – Word Processor dialog.

Survey VBA on Import

This toggle switch enables a macro to place additional survey text on import.

ITL File Copy

This tool checks to see if you have the NDDOT.itl file in your working directory. If this file is not in your working directory, it is copied there.

Nudge Line Start Point

ORD Linear features can't be shapes or closed line strings. This tool helps convert ArcMap shapes to ORD open line strings. This tool edits closed line strings into a line string with a gap so that it can be turned into a linear feature.

Pipe by 3D Line

Draws 3D pipe by 3D Line. See [Appendix Q](#) – Drawing Production Guidance – DS_Util

Rotate Cells

This works with ORD alignments to rotate cells. It is provided in this menu for easier access. It is used in the “XSG_Utility_Cell_as_Lines” workflow.

Rotate Text

This works with ORD alignments or MicroStation linework to rotate text and text nodes. It is

CADD Standards

provided in this menu for easier access.

Shape to line with gap (Old V8i Tool)

ORD Linear features can't be shapes or closed line strings. This tool helps convert ArcMap shapes to ORD open line strings. This tool edits MicroStation shapes into a line string with a gap so that it can be turned into a wetland feature.

Select Sub Set

This tool can refine a selection set of lines by length and angle parameters.

Steel Sections

This tool places a steel section shapes.

Applications

Short cuts have been created to quickly turn on and off CADD related Applications such as AutoTurn, GuidSign, and QuickMap. Note these applications will not work if they are not installed on your computer.

Help

This panel contains shortcuts to common help references. The "Index Standard Files" tools is locate on the help panel under administration. This tool compares the active CADD standards to an Index of posted CADD standards

CADD Standards

2.10 WorkSpaces, Worksets and Roles

April 2023

There are 7 levels of Connect Edition configuration variables.

1. System
2. Application
3. Organization
4. WorkSpace
5. WorkSet
6. Role
7. User

This section will discuss how the NDDOT is applying the Organization, WorkSpace, WorkSet and Role levels. Most of the NDDOT CADD Standards are being applied at the Organization level. The WorkSpace level is being used for different work groups based on work place divisions and sections. The WorkSet level is being used for specific NDDOT projects. These levels are part of a hierarchy tree system where; a specific Organization can contain multiple WorkSpaces but a WorkSpace belongs to only one Organization, and a specific WorkSpace can contain multiple Worksets but a Workset belongs to only one WorkSpace.

The NDDOT uses 2 different grouping systems for CADD data, one based on specific NDDOT projects and one based on specific work groups such as survey, roadway design, traffic design, and bridge. Applying these groupings to the hierarchy tree system required that one grouping control the other. The NDDOT uses very few project specific standards. However, some work group standards are used at the NDDOT. These work group standards are usually applied consistently over different projects. This is why the work group was prioritized over the project and this is why the WorkSpace level was used for the work group.

The directories – folders used for Organization and WorkSpace level are self-described.

S:\STANDARD\CE*\Organization

S:\STANDARD\CE*\WorkSpaces

The folder for the Workset is a little more complicated. Under this hierarchal system there are many work group to NDDOT project combinations (example Project X for the Surveys and Project X for Bridge). There are multiple Worksets for the same project. There are separate directories for each of these Worksets. The NDDOT stores CADD Data the opposite way the NDDOT applies CADD standards. The NDDOT stores most project data first by project and then by work group (example, ...\\60002911.125\Survey\...). On the other hand, the work group CADD standards are applied before project CADD standards (...\\Survey\WorkSets\...).

It is desirable to keep all project related data under one parent directory. The NDDOT redirects all the different WorkSets used for the same project back into a single project folder. This folder structure is similar to previous (V8i) project folder structures (example, ...\\60002911.125\Survey\...).

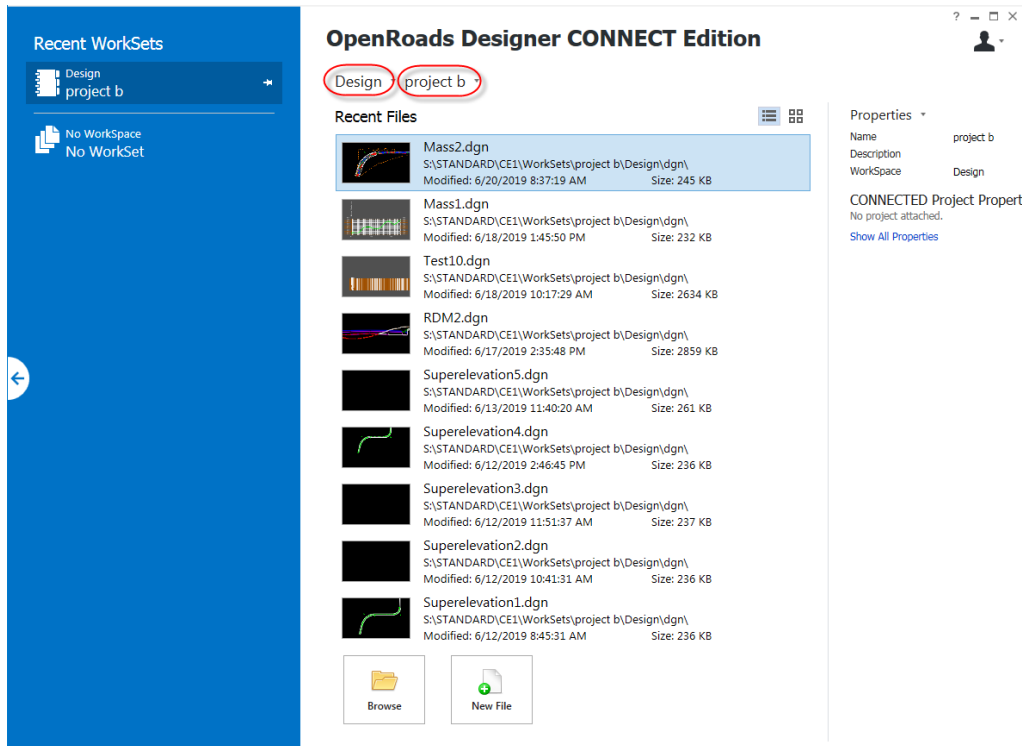
CADD Standards

The NDDOT uses a hybrid Workset structure. In this hybrid system most of the WorkSet files are redirected, but there are 2 files for each workset that are not redirected. The workset configuration file and workset properties file (*.cfg and *.dgnws) are stored at a different location. These 2 workset files are stored under a Workspace folder (example; S:\STANDARD\CE*\WorkSpaces\Design\WorkSets). The configuration file will typically be created and edited by administrative staff. The dgnws – properties file will be edited by CADD users and will be discussed in other areas of this document.

The following is an example list of workset files and the workset directory for a specific project:

```
S:\STANDARD\CE(XX)\WorkSpaces\Design\WorkSets\00000000.001.cfg  
S:\STANDARD\CE(XX)\WorkSpaces\Design\WorkSets\00000000.001.dgnws  
R:\project\00000000.001\...
```

The Workspace and WorkSet are selected and applied from the Work Page during an ORD session.



NDDOT staff will be able to select any Workspace\WorkSet combination stored on the NDDOT network, but they will only have write access to some of these combinations.

Workspace\WorkSet edit capabilities are controlled by Active Directory network permission set by NDDIT.

CADD Standards

WorkSet Creation (internal NDDOT staff)

1. Ask NDIT to create a project folder on the “R” drive with the applicable name and privileges (See *section 2.4* Project Directories). The project folder must exist before creating a WorkSet.
2. Open the ORD application and access the Work Page (Page where Workspace and Workset are selected and created).
3. Select the applicable Workspace for the workgroup (Division – Section). Confirm that the WorkSet has not already been created.
4. Create the new WorkSet. The WorkSet name must be the same as the name of the parent project folder. If the names don’t match the configuration variables won’t work correctly.
5. Once the WorkSet is created, review the workset parent directory, “S:\STANDARD\CE*\WorkSpaces\\$_(USTN_WORKSPACENAME)\WorkSets\”. The Workset creation process should have created a subdirectory, cfg file and dgnws file. The subdirectory should be bypassed with NDDOT workflows. Delete the subdirectory, named after the WorkSet, in order to avoid any future confusion on storage locations. The only files that should remain in the applicable WorkSets Folder are cfg and dgnws files.

CADD Standards

2.11 CADD Standard Revisions (When to Use Old Standards).

April 2022

CADD Standards often change while users are in the middle of a project. Productivity may be increased by switching to the new standard. However, continuing to use the previous standards may be more convenient. The previous or old CADD Standards can be used if all of the following occur:

1. The active project is presently incorporating the previous CADD standard.
2. Productivity, project uniformity, and/or plan readability are diminished by switching to the new standard.
3. The previous or old CADD standard is not considered a primary standard. Certain CADD Standards revisions must be implemented immediately. The following is a list of primary standards in which the most current version must be used:
 - a. Title sheet changes.
 - b. Standards needed to implement NDDOT software changes (example: OpenRoads Designer 23.00)

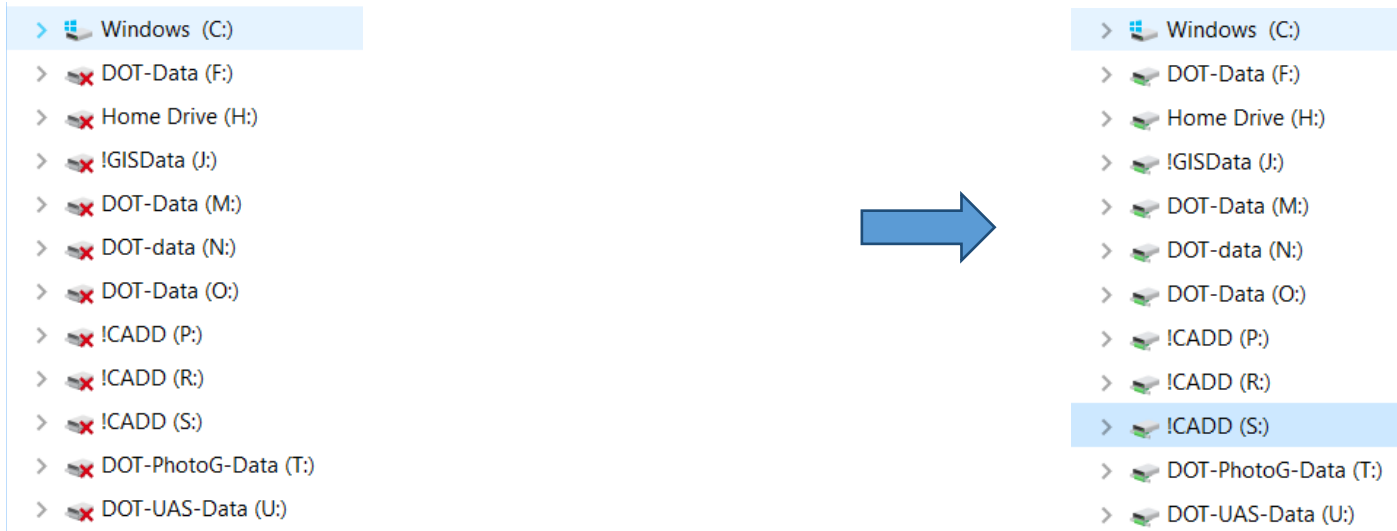
When a new project is started the most current version of the CADD standards are to be used.

CADD Standards

2.12 Global Protect

April 2022

There is an issue using Global Protect and CADD applications to connect to files on the R and S drives. The mapped drives are usually connected with Global Protect, but they also need to be opened before opening the CADD application. If the mapped drive is not opened before the CADD application is opened, the CADD application might not be able to find the applicable CADD standard files. Click on the applicable drives in Windows file explore to make the red x on the drive icon go away before opening CADD Applications. Drives with a red x icon may be connected but not opened.



This connection issue is also applicable to Axiom Users. If the M drive connection is not opened before launching a CADD application, Axiom tools may not be accessible.

CADD Standards

2.13 Virtual (Local) Drives

April 2022

Virtual drives are a way to temporarily map a drive letter to a specific folder. Virtual drives can be used in case where the CADD network is not accessible or access is slow. One example is using a laptop in the field. Field computers are not typically connected to the network (CADD Servers).

Several important resource files are stored on the network and if computers cannot find these resources they will not operate correctly. Some reference and raster files use a specific (full) path. These reference and raster files may not be properly attached when they are moved off the network ("R" drive). The following procedure discusses a method of copying and mapping resource files to a computer that is not networked or will not be networked when CADD tools and files are needed.

This procedure involves:

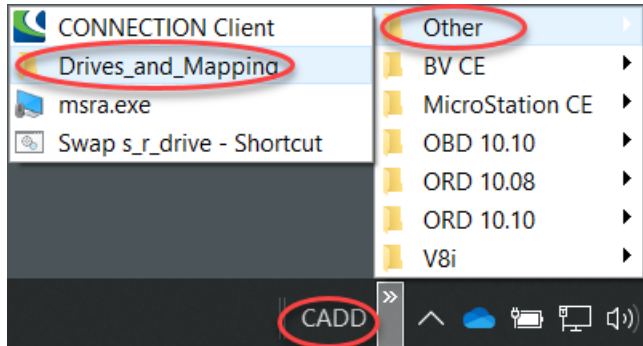
1. Copying the resource files to "C" drive. These files must be stored in a specific location.
2. Copying the needed project drawings and files to "C" drive. These files must be stored in a specific location.
3. Learning to use the appropriate batch file - shortcuts. These shortcuts maps the resource files and project files in a manner that is similar to the way the files are mapped on the network. The shortcut creates a local "S" and "R" drive.
4. Updating resource files and project files as needed (as they change).

Step 1 can be accomplished by running a batch file or manually copying files. Running the batch file is the preferred method. The computer must temporarily be connected to the network ("S" drive). After the computer is connected to the network, double click on the batch file **S:\STANDARD\CE**\Install\CopyStandardsLocal.bat**. This file will copy the needed files locally (on the computer's hard drive) to the directory "C:\NDDOT_CADD\s_drive\STANDARD".

Step 2 involves copying the project files needed for field work. CADD project files are stored on the "R" drive. Files should be copied from "R:\project*.*" to "C:\NDDOT_CADD\r_drive\project*.*". Similar - relative paths should be used when files are copied. Example: if the file R:\project\10083088.059\Design\Design.dgn is going to be taken into the field, it should be copied to C:\NDDOT_CADD\r_drive\project\10083088.059\Design\Design.dgn.

CADD Standards

Step 3 uses a batch file to temporarily create “S” and or “R” drives on your computer and start MicroStation. Caution, local “S” and or “R” drives cannot be created if networked “S” and or “R” drives are already connected. Make sure your computer is disconnected from the network R and S drive before proceeding with step 3. The batch files for Drives and Mapping can be accessed through the CADD Administrative tools within the “Other” folder.



The Swap_r_drive and Swap_s_drive batch files can be used to map the applicable virtual drives. The batch files run a “Command Prompt” script, typically in a black dialog box. A new path “S:\” will be created. The files in C:\NDDOT_CADD\s_drive and S:\ will be the exact same files. They will just have different paths. The local “R” drive will have a similar relation to C:\NDDOT_CADD\r_drive.

Step 4 is to remember to update the standard resource files on “C” drive as needed. This should be done at least seasonally. To do this, just repeat step 1. Project files should also be updated on the “R” drive as required. The “R” drive is the official location to save project CADD files.

CADD Standards

2.14 Final Plan Delivery

April 2023

The “Final Plan Delivery” includes several products such as production drawings, resource files, supplemental design data, and pdf plan sets. Some requirements are provided in this section. Additional requirements are also listed in the “Scope of Work for Consultants Performing Preliminary Highway Surveys” and in other areas of the Design Manual.

1. Production Drawings – These files are typically MicroStation Drawings (dgn). Production Drawings are required on projects under a direct contract with the NDDOT.
2. Resource Files - These files are not directly used in the plans but are used to design projects or can be used to help build a project. Modeling files (itl, xml) are examples of resource files.
3. Supplemental Design Data – These files include a subset of production drawings and resource files. This subset of files excludes data that isn’t directly applicable to construction. Supplemental design data has an emphasis on Automated Machine Guidance workflows.
4. PDF Plan Sets – PDF’s (portable document format) are required on all projects.

Printed plan sheets are not required on digital signature pilot projects.

The “Final Plan Delivery” shall not include copies of the correspondence documents and preliminary reports. If the NDDOT Technical Support Contact person requests additional copies of the correspondence documents and preliminary reports, this information should be sent in separately.

CADD Standards

Production Drawings

Production drawings shall follow the NDDOT CADD Standards. They shall be developed with Bentley CADD applications.

Conceptual production (dgn) drawings should be delivered when the project is being developed by a consultant that is only responsible for developing the environmental document. If the same consultant is responsible for developing the final plans, most conceptual production (dgn) drawings should not be submitted. Drawings that are displayed for the public (environmental documents, public input meetings and hearings) are exceptions to this rule. Keep records of drawings that were displayed for the public according to the Design Manual (see II.03.02.04 Public Involvement Report).

Production drawings shall only include files required for the development of the final plans. All of the conceptual drawings are seldom desired (see above paragraph). The Production files shall only include the essential (CADD Standard) files. Temporary, junk, alternative drawings not used in the final plans, backups, and other interim drawings shall not be submitted. The goal is to make it easy to review the project files and avoid the transmittal and storage of unnecessary files.

Drawing display setting (levels, reference files, view attributes and other rendering settings) shall be set and saved as they were used to create the final printed plans. The goal is to make it easy to review and print files. The reviewer should not have to figure out what reference files need to be turned on and what display settings need to be used.

Consultants should use the directory structure discussed in [section 2.4](#) and they should use the “Save Relative Path” when referencing drawings. The goal is to make project files portable. Broken reference paths are CADD standards violations.

Production drawings should be set to read only before the plans are signed and stamped as required by the Board of Professional Engineers and Land Surveyors. The goal is to use the file modify date to flag and eliminate changes to the plans after they have been signed.

Resource File

Resource Files and Supplemental Design Data are required on projects under a direct contract with the NDDOT and that require substantial earthwork. Projects that don't involve earthwork (grading) will not require resource files to be delivered with the plans.

CADD Standards

Supplemental Design Data

Supplemental Design Data is provided to the contractor in order to help them prepare a bid and construct the project. Supplemental Design Data includes AMG (Automated Machine Guidance) data such as surface files.

Since supplemental design data includes a subset of production drawings and resource files, the applicable files should be copied into a “Supplemental Design Data” folder under either the Design project folder or Consultant project folder.

Supplemental Design Data includes the following;

1. Supplemental Design Data Notification
2. Surface Files
3. AMG AReadme file for contractor
4. Earthwork_End_Area Volumes Spread Sheet
5. Drawings

The following is an example list of file to provide as supplemental design data.

| | |
|------------------------------|--------------------------------|
| Supplemental Design Data.pdf | Earthwork_Volumes.html |
| AAReadMe.docx | Earthwork_Volumes.xlsx |
| Alignment.xml | Earthwork_Cut-Fill_Volumes.dgn |
| Terrain_Exst.xml | Control.dgn |
| Terrain_T.xml | Design.dgn |
| Terrain_B1.xml | DS_Align.dgn |
| Terrain_DG.xml | RW_Bndry.dgn |
| Terrain_Exst.dgn | Topog.dgn |
| Terrain_T.dgn | 200XS.dgn |
| Terrain_B1.dgn | RDM.dgn |
| Terrain_DG.dgn | |

Supplemental Design Data Notification

See the following:

<http://www.dot.nd.gov/manuals/design/caddmanual/SDD/Posting%20Supplemental%20Design%20Data.pdf>

Consultant staff only need to create the notification pdf. Technical support staff will post the actual documents.

Surface Files

Surface files are provided to the contractor as MicroStation terrain elements and xml files.

Alignment Information

Alignment Information is provided to the contractor as MicroStation civil geometry elements and xml files.

CADD Standards

Drawings Provided to Contractor

The following drawings should be provided to the contractor if available. These drawings do not need to be created if they are not needed for plan preparation.

1. Control
2. Design
3. DS_Align
4. Earthwork_Cut-Fill_Volumes
5. RW_Bndry
6. Terrain_T
7. Terrain_B1
8. Terrain_DG
9. Terrain_Exst
10. Topog
11. 200XS_*
12. RDM

Supplemental Design Data AAreadme file for Contractor.

An informational text file shall be provided to the contractor. This AAreadme file should include the following information as a minimum.

- Alignment Key (description information, see section 5.3)
- Modeling Limitations
 - The aareadme file should also describe general limitations with the model (examples; driveways were not modeled, the terrain near bridge XYZ was not modeled, approaches were modeled without the appropriate in-slopes – use plan information to build approaches, etc). Include the following phrase.
 - “This aareadme file does not list all limitations with the model. It is only provided as a place to start your review. The contractor is responsible for reviewing model information and determining if and where it may be applicable.”
- CADD Standard Overview for Contractors (Include link to Appendix J)
- List Non-Standard Files (not described in Appendix J) that are included in Supplemental Design Data.

CADD Standards

PDF Plan Sets

Sheet Size

The paper size format for the pdf must match requirements for paper delivery (example, plan sheet intended to be printed on 11x17 inch paper should be formatted to be printed on 11x17 inch paper). PDF's should be created at 600 dpi. Supplemental images - Rasters may be printed at a lower resolution.

The overall electronic files size of the PDF plan set is a concern. There may be problems downloading very large pdf files.

File Size and Volumes

PDF files used for electronic distribution (posted on internet for bidding purposes) shall be less than **300 MB**. If needed, divide the plan set into separate volumes to avoid individual files over this limit. The individual sections, as defined by section numbers, shall not be split between volumes. The volumes may be split where the section numbers change. Designers shall use their discretion when deciding where the splits occur.

Cross Sections are typically published as a separate volume.

Separate volumes are not required for other phases of project development such as PS&E review or the original digital signature version of plans.

The PDF shall be optimized with Adobe Professional. Most NDDOT Plan Sets are less than 300 MB if optimized correctly.

Please notify a CADD standard representative if a plan set exceeds 300 MB.

PDF Optimizer

The "PDF Optimizer" tool usually reduces the file sizes. The following is an overview of the Optimizer Settings.

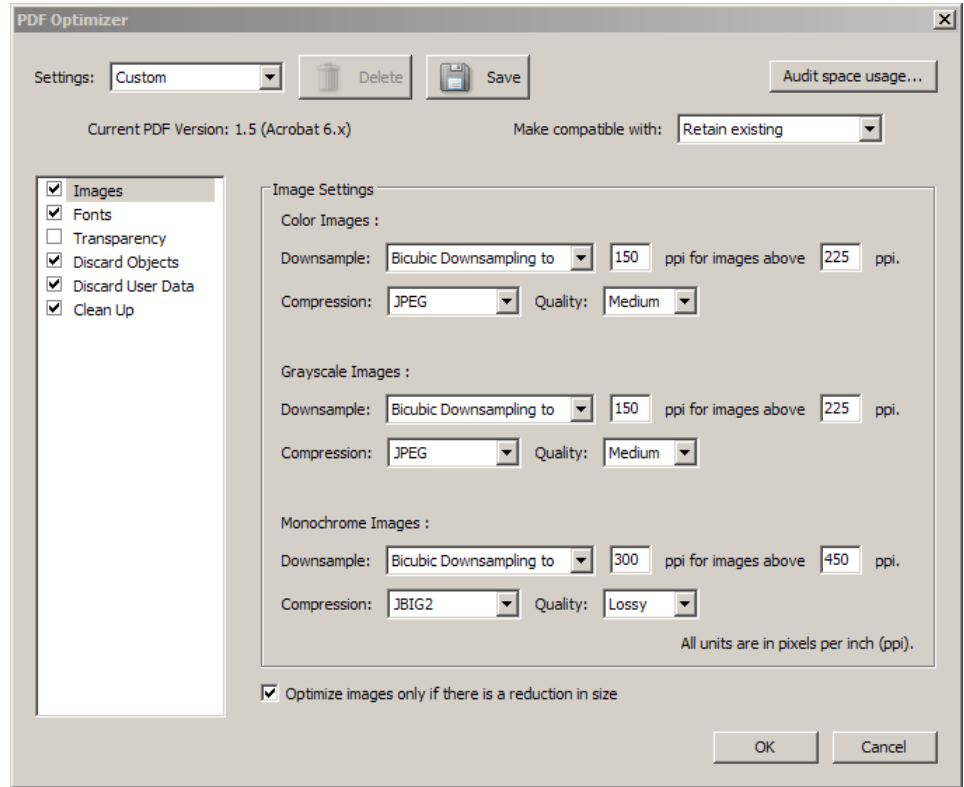
The "PDF Optimizer" tool is found in the Adobe Acrobat Pro menu under "Save As Other> Optimized PDF". Optimizing a file can take several minutes. Copy the pdf to a local drive before using the "PDF Optimizer" tool in order to improve performance.

CADD Standards

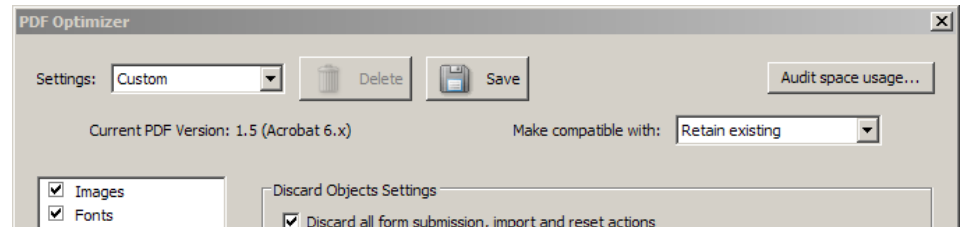
The standard-default “Images” settings should be used.

In the Fonts category, “Do not unembed any font”. **Fonts must be embedded within the PDF.**

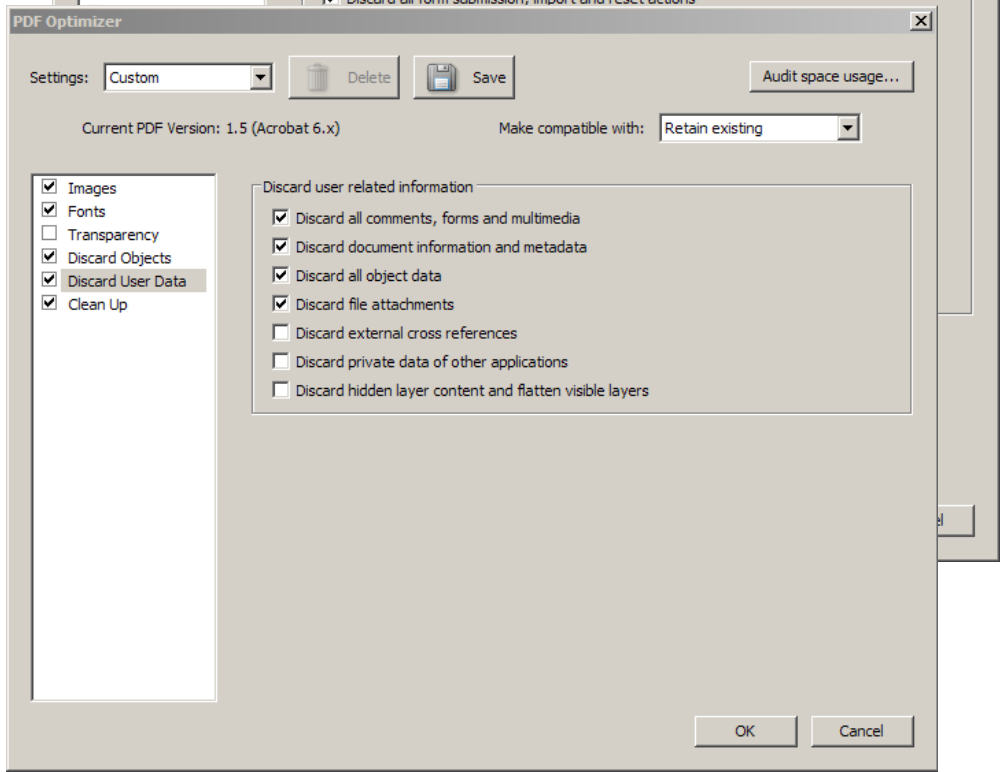
Optimization settings for “Transparency” aren’t enabled.



Discard Object Settings are as shown.



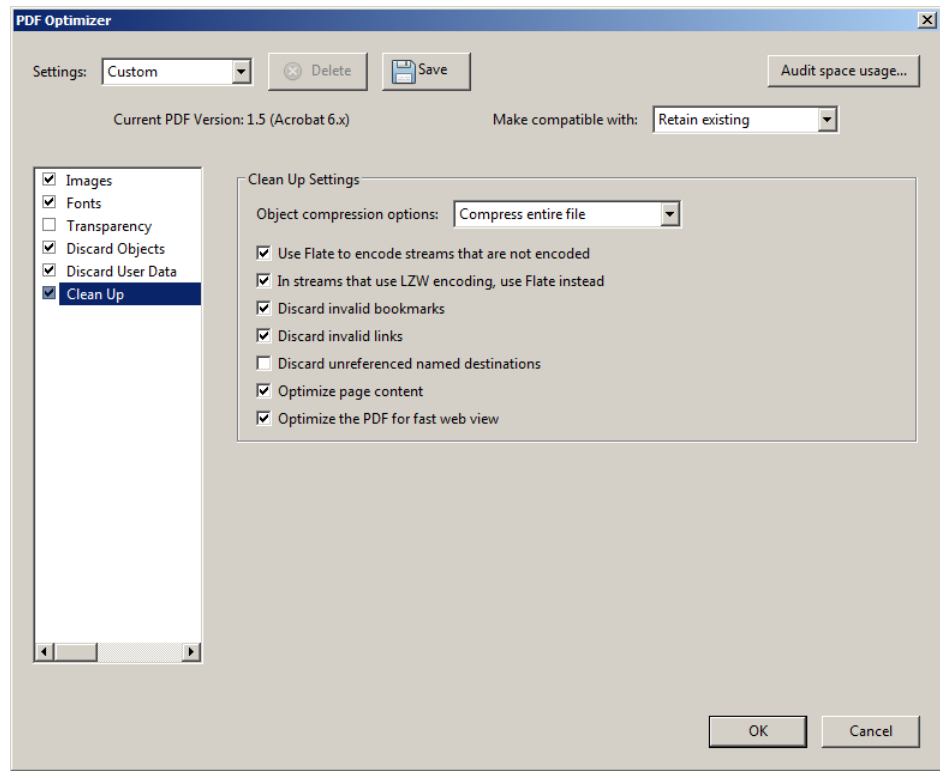
Discard User Data



CADD Standards

Settings are as shown.

The standard-default
“Clean Up” settings
should be used.



CADD Standards

PDF File Names

The pdf plan set files must be named according to a standard naming convention. PDF files should be named by combining, in the order shown, the following information:

1. “Project Number”
 - a. If the plan set includes multiple project numbers (multiple project numbers shown on title sheet) the project numbers should be included in the name separated by a space character, “and” (text), and another space character (example: “SS-3-001(015)128 and SS-3-020(071)044 Final Plans 1of3 ED.pdf”). The space characters are needed for the proper word wrapping when the document gets posted on the web.
 - b. If naming the pdf using multiple project numbers will create a very long name (over 100 characters long), then only the first project number listed on the title sheet should be used follow by the phrase “and Other Projects” (example: “STM-SU-1-988(024)036 and Other Projects Final Plans 1of2 ED.pdf”).
2. Project phase such as
 - a. Preliminary
 - b. PS&E – Use The suffix “PSE”. The character “&” will cause complications on an Adobe Shared Review.
 - c. “Final Plans”
 - d. Addendum1, Addendum2, etc – Use the suffix “AD1”, “AD2”, etc
 - e. Change Order1, Change Order 2, etc – Use the suffix “CO1”, “CO2”, etc
 - f. Asbuilt – Use the Suffix “AB”
3. The specific volume number and total number of volumes shall be included in the file names (example “1of3”). Every volume shall be counted, including cross sections and standard drawings. The volume suffix is only required for final plans used for bidding purposes (electron distribution version).
4. If the project requires cross sections, they must be included as a segregated file. The file name for cross sections shall include the abbreviation “XSEC”.
5. “Color” if the plan set is in color. All other sets will be assumed “black and white”.
6. “ED” (for electronic distribution) or “DS” (for Profession Engineer signing and stamping using Digital Signatures).

CADD Standards

The following is a list of example names.

IM-2-094(070)275_Preliminary
IM-2-094(070)275_PSE
IM-2-094(070)275_ED_Final Plans_#of#
IM-2-094(070)275_ED_Final Plans #of# XSEC
IM-2-094(070)275_DS_Final Plans
IM-2-094(070)275_ED_AD1
IM-2-094(070)275_DS_AD1
IM-2-094(070)275_ED_AD2
IM-2-094(070)275_DS_AD2
IM-2-094(070)275_ED_CO1
IM-2-094(070)275_DS_CO1
IM-2-094(070)275_ED_CO2
IM-2-094(070)275_DS_CO2
IM-2-094(070)275_AB

(Replace # with actual numbers, example 1of3)

At this time, color final plans are not posted on the internet for bidding purposes. They may be used by field personnel as an added convenience. A Black and white version of the PDF Final Plans and Addendums shall be used for the internet.

Optically scanning the original paper plan set in order to create a pdf plan set is discouraged because the image quality is degraded.

CADD Standards

2.15 Plan Submittal and Distribution

April 2022

Refer to the Design Manual for information on Plan Submittal and Distribution;

Digital Signatures for Plan Production Using DocuSign

<https://www.dot.nd.gov/manuals/design/caddmanual/DigitalSignatures/Plan%20Production%20Using%20DocuSign.pdf>

Plan Review Distribution List

<http://www.dot.nd.gov/manuals/design/designmanual/Plan%20Review%20Distribution%20List.pdf>

I-08.03 Final Plan Submittal

<http://www.dot.nd.gov/manuals/design/designmanual/Chapter%201.pdf#page=109>

I-09 Plan Revisions and Change Orders

<http://www.dot.nd.gov/manuals/design/designmanual/Chapter%201.pdf#page=119>

I-11 Cost Estimates, Bid Items and Incidental Work

<http://www.dot.nd.gov/manuals/design/designmanual/Chapter%201.pdf#page=127>

CADD Standards

2.16 AAREADME File for Survey Folder

April 2023

The project “Survey” folder should have an AAREADME file in it. The AAREADME file should be a Microsoft Word file that helps users find data within a project folder. This file is simply a text file that describes the folder contents.

All AAREADME files should contain:

1. Directory being described.
2. Project Number(s)
3. PCN Number
4. County Name
5. Brief Project Description
6. If a project was abandoned or shelved, a history of what was designed should be detailed.
7. Names of staff who worked on the files within the directory.
8. File Index
 - a. File Name
 - b. Progress
 - c. Description
9. Journal (in paragraph format)

It might include a dated description of how the data was collected, where it came from, or what needs to be done in the future. Each entry should be dated and the author should attach their name to the information in case someone has questions.

CADD Standards

Example for a Survey Folder

R:\project\70002091.065\SURVEY\EFB>
NH-7-002(065)091
PCN 14794
Reconstruction, Palermo Section, Stanley, east 10 miles
Mountrail County

| | | |
|----------------------|------|-------------------------------------|
| 081CD_001.dgn | 98% | Curve and Coordinate data sheet |
| AAreadme.docx | N/A | Project Journal |
| Control.dgn | 98% | Alignment and boundary graphics |
| DTM.dgn | 100% | Digital Terrain graphics |
| Terrain_Exst.dgn | 100% | Terrain with US 2 profile |
| Terrain_Exst_Alt.dgn | 100% | Terrain includes alternate graphics |
| Topog.dgn | 95% | Utility and topographic graphics |

18 March '22 [J. Doe].... Tammy Doe e-mailed in five (5) .dat files, and an excel file with the observation of the station information. These data files are the GPS observations of the control points for the above said project. I sent these .dat files into the NGS OPUS processing center and received back the OPUS derived coordinates. The dat files and opus results (*.doc) documents can be found under

25 March '22 [E-mail from ABC engineering]

Good morning John,

We have completed the first segment, project number PCN14794. There are several things to note. I changed the point numbers of the targets we discussed last week. Point numbers 312 and 313 had already been used for ... Tioga and heads east next week. Thanks for all your help.

Tim Smith, ABC Engineering
(701)555-1234

30 March '22 [J. Doe].... The editing for this project is almost complete. I provided a set of questions for the survey field crew. When the questions are answered we should be able to transmit this project.

CADD Standards

2.17 Directory Cleaning

April 2022

CADD Files should be cleaned (organized and purged) regularly during project development. Some CADD files should also be purged after the following milestones:

1. Final Plans Have Been Submitted
2. Final Construction Records Have Been Completed (including as-built drawings)
3. Three Years After Project Completion – Final Construction Records Have Been Completed.

Preliminary files that were only used for conceptual planning, like environmental documents, should be kept through the design phase. The main environmental document should be stored on FileNet. However, most conceptual planning documents on the r: drive should be purged after the **Final Plans Have Been Submitted** for construction.

Microsoft Word and other word processing documents should also be purged after the **Final Plans Have Been Submitted** for construction. Only documents that directly support the plans, like plan notes, should be archived in the project directory. Other documents such as correspondence and reports should be in FileNet. These documents should not be archived with the project directory.

The only conceptual drawings that should be kept after the final plans have been submitted are drawings that were displayed at a public meeting. Drawings displayed at public meetings should be kept until **Three Years After Project Completion** and then discarded. Drawings displayed at public meetings should be grouped in a project sub directory for easy identification and protection (example r:\project\30002269.080\DESIGN\Public Hearing\). Remember that drawings displayed at public meetings should not be edited after the meeting. You must keep an unedited version of the drawings (including reference files). All files stored in a directory named like “Public Meeting”, “Public Input”, “Public Hearing” or “Public Information” will be deleted three years after the project is completed.

After the **Final Plans Have Been Submitted**, the only files that should be in the design folder are files that directly support the final plans. Temporary files and files detailing alternates that were not advanced should be deleted after the final plans have been submitted. Alternates or options advanced as part of the plans (bidding options like a steel bridge vs. a concrete bridge) should be archived.

After the final plans have been completed, the pdf plan set for preliminary review and PS&E review should be deleted. The PS&E review version of plans with archived Adobe shared review comments should be stored in FileNet.

Consultants submitting final plans should clean the project directory before the electronic files for final plan submittal are packaged and delivered to the NDDOT.

CADD Standards

MicroStation

3.1 Seed Files

July 2023

Seed files are used to set several DGN file parameters. When creating a new DGN, the correct seed file needs to be selected. Presently the NDDOT is using 4 different seed files;

1. NDDOT_seed.dgn
2. NDDOT_seed_Ft&In.dgn
3. **NDDOT_seed_Photog2D.dgn**
4. NDDOT_seed_3D.dgn
5. **NDDOT_seed_Photog3D.dgn**
6. NDDOT_seed_GuideSIGN.dgn

The following are some of the features adjusted in the NDDOT seed files.

| Design File Settings | |
|---|---|
| Angle Readout Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed.dgn • NDDOT_seed_3D.dgn • NDDOT_seed_Ft&In.dgn • NDDOT_seed_GuideSIGN.dgn | DD MM SS Accuracy 0.1 Bearing |
| Angle Readout Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed_Photog.dgn • NDDOT_seed_Photog3D.dgn | DD MM SS Accuracy 0 (no decimal) Bearing |
| Color | Element Highlight Color: Yellow Selection Set Color: Yellow |
| Civil Formatting | Coordinate Settings Format X,Y Precision 0.12 Ration Settings Format D:1 Precision 0.12 Station Settings Format sss+ss.ss Format Delimiter + Precision 0.12 Equation By Index Radius Settings Degree of Curve Method Arc Degree of Curve Length 100' Radius Toggle Char d Profile Settings Elevation Precision 0.12 |

CADD Standards

| | |
|---|--|
| | Slope Format Percentage Slope Precision 0.12 Ratio Format Run:Rise Ratio Precision 0.1 Vertical Curve Parameter Format $K=L/(G2-G1)$ |
| Locks | Level Lock: Off Graphic Group: Off |
| Snaps | Snap Lock: On Mode: Keypoint Divisor: 2 Association: On |
| Working Units > Linear Units Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed.dgn • NDDOT_seed_3D.dgn | Format = MU Master Unit = Feet (Label = ‘) Sub Unit = Custom (Label = th) (1000 th = 1 feet) Accuracy 0.1234 |
| Working Units > Linear Units Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed_Ft&In.dgn • NDDOT_seed_GuideSIGN.dgn | Format = MU:SU Master Unit = Feet (Label = ‘) Sub Unit = Inches (Label = “) Accuracy 0.1234 |
| Working Units > Linear Units Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed_Photog.dgn • NDDOT_seed_Photog3d.dgn | Format = MU Master Unit = Feet (Label = ‘) Sub Unit = Custom (Label = th) (1000 th = 1 feet) Accuracy 0.12 |
| Working Units > Advanced Settings | Resolution = 304800 per Foot Solids Area = 10 Miles |
| Other Design File Settings | |
| View Attributes | ACS Triad: Off Clip Volume: Off Data Fields: On Fill: On Grid: Off |
| “Place Note” tool | Start at “Terminator” |
| “Scaling” tool | Scale Dimension Values: Off Scale Annotations: On |
| Model Properties > Line Style Scale | Annotation Scale |
| Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed_GuideSIGN.dgn | Embedded Text Style: TSText Zoom Adjusted Closer to 0,0 Annotation Scale Toggle: Off |
| Default Drawing Scale Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed.dgn • NDDOT_seed_3D.dgn | 1” = 200’ |
| Default Drawing Scale Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed_Ft&In.dgn • NDDOT_seed_GuideSIGN.dgn | 1” = 5’ |
| Only Applicable to <ul style="list-style-type: none"> • NDDOT_seed_Photog.dgn • NDDOT_seed_Photog3d.dgn | The Level Filter Used was set to default. The standard Survey level filters were imported. Place Note, association to element is turned off. |

CADD Standards

3.2 Global Origins

April 2022

Drawings created with very old CADD standards seed files may have used a Global Origin other than 0,0,0. All current drawings should leave the Global Origin at the 0,0,0 value.

The global origin in a MicroStation design file will not need to be changed if referencing is done with the “Coincident –World” option. This option has been set as the default in the NDDOT Standards and will automatically be selected for most users.

If this option is not used and the active file has a different global origin than the reference file, the data may appear to reference into the active file correctly, but the coordinate values of the referenced data may change!

To check the existing global origin of a file, key ‘GO=?’ into the key-in box. The value will appear in the bottom right-hand corner of the screen. **Do not key in any other GO commands - except ‘GO=?’, the coordinate values of existing points in the design file could change!**

3.3 Coordinate Systems

April 2022

When creating a new plan view drawing, assumed drawing coordinates should be avoided. Plan view drawing elements should be drawn as close to real ground coordinates as survey data allows. Using real ground coordinates will help with the exchange and comparison of data with other sources (example; wetland delineations can be compared to all plan view drawings if real ground coordinates are used, GIS data can easily be imported into MicroStation).

If real ground coordinate survey information is not readily available for projects such as ones that use 90-1 surveys, spatially correct base maps should be used to get reasonably close to real ground coordinates. MicroStation base maps can be referenced from the directory R:\project\BaseMaps\. Each county has its own base map because each county has a slightly different projection. Highway centerlines, Mile Points, and Section lines are some of the drawing features that can be used to tie plan information to real ground coordinates. The base maps are exported into MicroStation with a high degree of accuracy, but the accuracy of the GIS data varies considerably. Users should be conscience of the degree of accuracy when comparing information. Just because information is very close doesn’t always mean it is acceptable.

CADD Standards

3.4 Symbology

April 2022

Symbology is the study of symbols. CADD Symbology is the representation of real-world elements in a CADD environment. These representations includes both graphical and non-graphical properties. Color, line weight, and line style are examples of graphical symbology. Level and display class are examples of non-graphical symbology.

Symbology (properties) management is a large part of CADD standards. There are many tools to manage and use CADD symbology. Understanding the tools that manage symbology can simplify the application of symbology. Example, you might not need to know all the properties for a concrete line if you understand the tools to draw the edge of concrete.

Sometimes it is helpful to take a backward approach to learning about CADD standards. Instead of starting with the fundamentals of symbology (properties), it may be easier to learn **where** tools are located, **why** they were organized the way they were, **how** to use the tools, and finally **what** do the tools produce (elements of a particular symbology).

“Where” will be discussed with the section on “Workflows, Ribbons and Task Groups”.

“Why” is partly discussed with the sections on “Named Expressions”, but “why” is usually for a specific work product.

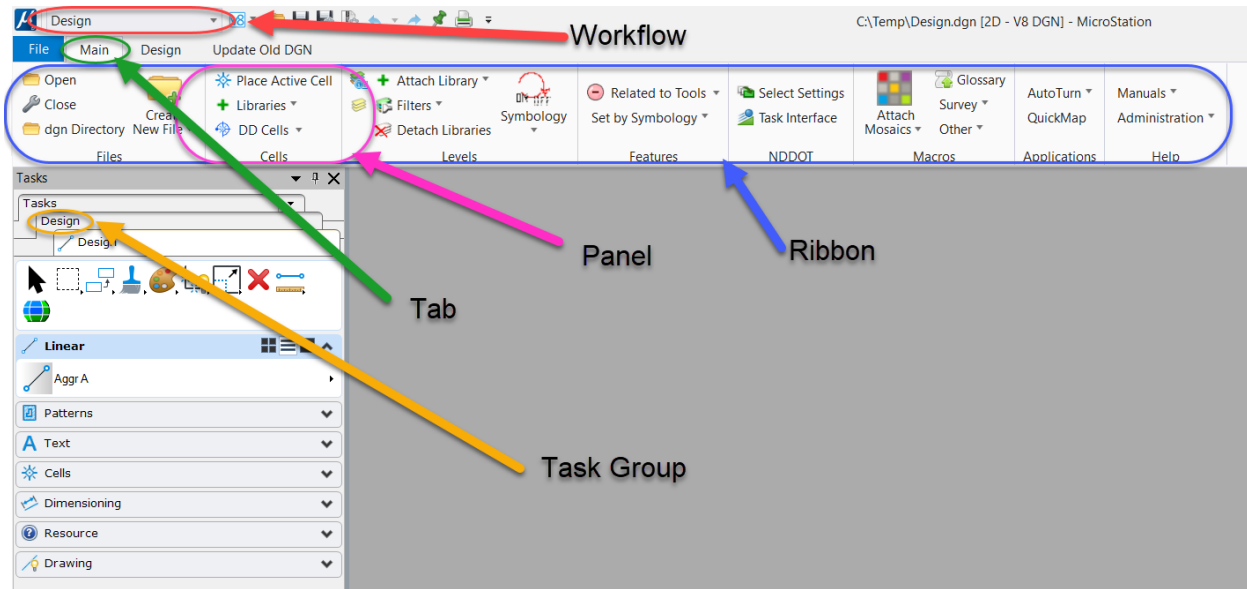
“How” and “What” will be discussed with the sections on Level, Line Styles, Cells, Annotation and Dimensioning.

CADD Standards

3.5 Workflows, Ribbons and Task Groups

April 2022

- Workflows are containers for Tabs.
- Tabs are containers for Ribbons.
- Ribbons are containers for Panels.
- Panels are containers for tools.
- Task groups are also containers for tools. Task groups are containers independent of Workflows, Ribbons, and Panels.

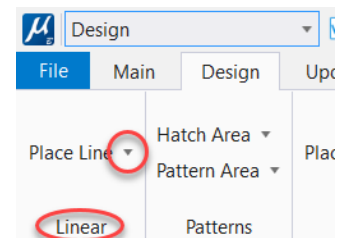


The NDDOT uses many custom workflows. The various Bentley applications also include default workflow. Some of the NDDOT workflows are always visible while others are only visible when certain drawing names are active. The following are some NDDOT custom workflows that are always visible.

- Bridge
- Design
- Materials
- Photo (Preliminary Surveys and Right of Way)

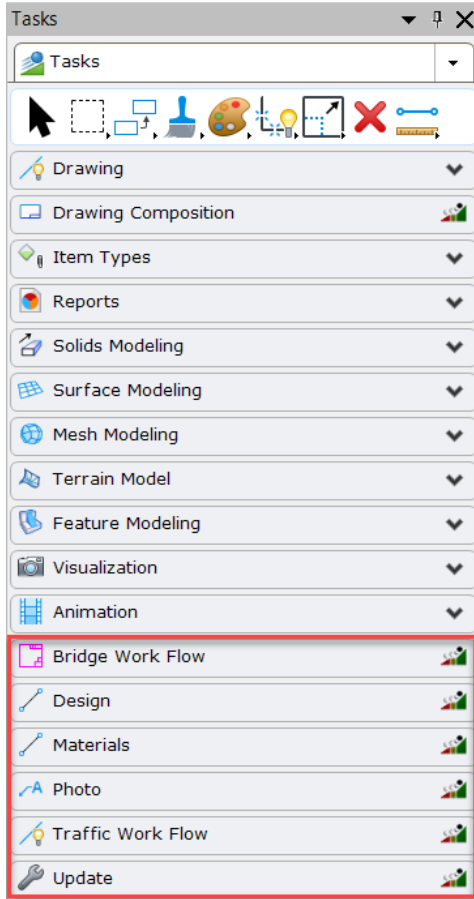
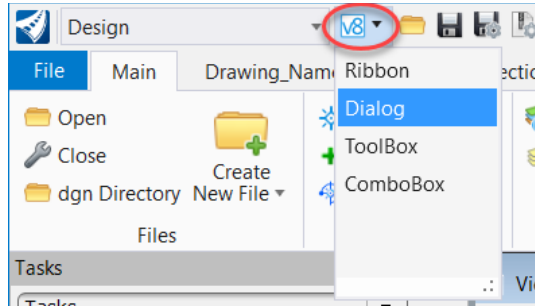
Note there are several traffic workflows that will be discussed in the “Named Expressions” section of this manual.

Each workflow displays a set of tabs, and each tab is associated to a ribbon. Ribbons contain panels that are used to organize tools. The name of the panel is displayed at the bottom of the panel (example, Linear). Note the little triangles near the tool icons or tool labels. These triangles are split or drop-down buttons that contain additional tools. Click the triangle to see and select from these additional tool.



CADD Standards

The task groups dialog box is not displayed by default. The dialog can be turned on through the “Select V8i Mode” button near the workflows menu.



There are numerous Task groups. Some are delivered with MicroStation, other groups have been created by the CADD standards.

**NDDOT
Task
Groups**

CADD Standards

3.6 Tool Organization and Named Expressions

April 2022

Most NDDOT custom ribbons and task groups are organized to draw specific elements in a specific drawing or group of drawings. This organization promotes drawing with the correct standard in the correct drawing. For example, existing power poles are found in the Topog ribbon or task group and they should be drawn in the file named Topog.dgn. Several ribbons and task groups are intended for only one particular type of drawing. Some ribbons and task groups are intended for a group of drawings. [Appendix A](#) explains which ribbons and task groups are used with which drawings.

The standard NDDOT interface hides some workflows, ribbons and task groups based on the active drawing name. The standard interface makes it easier to pick the appropriate group of tools while promoting the use of standard drawing names. For example; to display the Topog task group, the active drawing typically needs to have a name starting out with the word “Topog”. If you were in a drawing named “Design.dgn” you would not typically be able to see the Topog task group. The hiding of workflows, ribbons and task groups uses a function called “**Named Expressions**”.

Most of the NDDOT custom ribbons and tools are setup with similar tool. Example the “topog” ribbon contains most of same tools as the “topog” task group. The custom ribbons tend to include additional common tools such as a Main, Drawing and Utilities panels. While task groups have a main task toolset.

Task groups can be organized in a directory structure with parent child relationships. For example the Topog task group is found under the Photo task. The Photo task is the parent task and the Topog task is the child task. The next page lists standard task group parent child relationships.

CADD Standards

Bridge Work Flow

Section 170

Design

001TS Title
004SW Scope
011DT Data Tables
020GD Details
030TP Typical
100WZ_ConSign
AutoTurn
Consign
Countour
Cut Sheets Design
Design
DS Align
DS Util
DTM
Environmental
Fencing
Paving
Profile
Removal
P_Erosion_C
T_Erosion_C
Shape
Wetland Impacts
Xsec

Materials

Materials
180PT_PitPlat

Photo

081CD_Survey
Control
RW Bndry
Topog
DTM

Planning

Planning

Traffic Work Flow

Section 100

ConSign
CSDtl
DTmpLtDe
LTmpLt
DIntDe
Lint

Section 110

DOHDet
DSignDet
LOH
LRemSign
LSign

Section 120

LPvmt
DPvmtDet

Section 130

LGdrl
LJBar
GdrlDe
DBarrier

Section 140

DHMDet
DLitDe
DLitOH
DULDet
LHM
LLight
LLitOH
LUL

Section 150

DFlsh
DIntDe
DSigDet
DATRDet
LFlsh
LInt
LRemSgl
LScop
LSgnl
LATR

Section 160

DITSDet
LITS

CADD Standards

3.7 Element Templates

April 2022

Element templates manage symbology. Element templates associate many different properties for a specific CADD element. The template can be used to apply these different properties a one time. There may be times when a CADD user needs to access an element template directly, but usually templates are used indirectly through other tools.

Tools often reference the symbology in a template. Tools also offer some additional control of symbology that might not be available in the template.

NDDOT custom tools simplify the placement of most drawing elements. These tools are used to change several settings at one time while executing commands. Example; the level, color, line weight and style, text height and width and justification could all be switched and the place text tool could all be activated with one click of a button.

CADD Standards

3.8 Levels

April 2022

Many levels are named with the noun first and then the adjectives, example “Pole Wood Cell Exst”. Abbreviations are often used. The “Exst” (Existing) adjective is used at the end of level names when applicable. Level names without the “Exst” adjective are intended to indicate an undefined or proposed state of presence.

Levels have been set up for specific pay items. The names and descriptions for these levels are based on the pay item spec-code number and description, example “722-3690 INLET SPECIAL 42IN”

Level descriptions are similar to level names except the “Exst” adjective, when used, is first and the element type is not used, example “Exst Pole Wood”.

Level numbers have been set up as an identification number. The digits in the number represent attributes of the items on that level. Most standard levels are numbered from 1,000,000,000 to 4,294,967,294. The numbering system is as follows: “A,BCC,CDD,DDE”

A – 1 digit – Type of element

1= Points, Lines, Curves, and shapes 2=Cells, 3=Text and Dimensions, 4=Patterns

B – 1 digit – Presence

0=Undefined, 1=Existing, 2=Proposed

C – 3 digits – Closest NDDOT Specification Number

Some CADD specific specifications have been added.

D - 4 digits – Subsection or NDDOT Code.

When used as subsection it helps ensure uniqueness.

E – 1 digit – Pay Item Use

0=No, 1=Yes

Notes

- The maximum level number is $2^{32}-2= 4,294,967,294$.
- Component names are usually based on the level names except that the element type is not used in the component name.
- Special levels have been set up for raster attachments.

| <u>Level Name</u> | <u>Level Number</u> |
|-------------------|---------------------|
| “Raster Group 1” | 101 |
| “Raster Group 2” | 102 |
| “Raster Group 3” | 103 |

Rasters should be attached to the level named “Raster Group 1”. The levels “Raster Group 2” and “Raster Group 3” can also be used if you desire to stratify rasters by level.

CADD Standards

Level Libraries

The level information is stored in drawing libraries (dgnlib) files. Most levels are automatically attached with the NDDOT standards.

ByLevel

The standard Levels have been set up for “ByLevel” use. However, the linestyle scales have to be manually set by the user.

A Few element templates use “ByLevel” settings directly such as manhole cells. “ByLevel” settings are only recommended when they are used by the NDDOT custom tools.

CADD Standards

3.9 Line Styles

April 2022

Users are strongly encouraged to use NDDOT custom tools and Annotation Scale to set the appropriate line style settings. A user could individually set the Level, Color, Weight, Style and Style Scale for each element. However, this is not recommended because changing each setting individually/manually takes more effort and time and has a higher potential for user errors.

Many line styles use both a line style scale factor and Annotation scale. One of the common line style scale factors is $1/240 = 0.004167$. This factor is based on how the original line styles were created. The displayed line style uses the product of line style scale and Annotation Scale. NDDOT custom tools automate the line style scale factor.

There are a few line styles that are not plotted with a “Scale Factor”. These line styles typically represent the true physical size of a feature such as guardrails, curbs, curb and gutter and dowel joints. These features are always drawn at the same scale and will be plotted on paper proportional to the plotting scale. These line styles are digitized by turning off the scale factor toggle and ignoring the Annotation Scale. Again, NDDOT custom tools automate the line style scale factor. The line styles that are drawn to a physical size are highlighted with an asterisk in [Appendix B](#).

Certain line styles are directional, in that their pattern component is not symmetrical. An example would be the ‘Exst Wetland Delineated’ custom line style. The small filaments that represent vegetation and grasses should point in toward the water side of the wetland. Consequently, the line needs to be digitized in the direction that will produce this effect (counter-clockwise on a closed shape.) Check [Appendix B](#) for directional information.

Tech Tip: Use the “change curve direction” tool to change the direction of a line style. This tool can be located in the Drawing (workflow) > Curves (tab) > Curve Utilities (panel).



CADD Standards

3.10 Cells

April 2022

NDDOT cell libraries are located at “S:\STANDARD\CE10\Organization\Cell”. The following is a list of the active NDDOT cell libraries:

| | |
|-------------------------|---|
| Bridge.cel | Bridge items |
| Cells 1 scale.cel | General cells placed at 1 scale |
| Cells plot Scale.cel | General cells placed at plot scale |
| CSP_end_sections.cel | Corrugated steel pipe end sections |
| drainage_structures.cel | Drainage structures |
| Driveway.cel | Dimension driven driveway cells |
| Guardrail.cel | Guardrail items |
| Hatch.cel | Patterning items |
| Ltg schematic.cel | Lighting schematic items |
| Manholes.cel | Manholes |
| Pipe.cel | Pipe End View |
| pipe_bends.cel | Pipe Bends |
| Pvmtmkg.cel | Pavement marking |
| RCP_end_sections.cel | Reinforce concrete pipe end sections |
| Sheets.cel | Sheet borders (see Appendix H) |
| Signal_Det.cel | Signal Detail Items |
| Signals.cel | Signal items |
| Signs.cel | Signing items |

For a comprehensive listing of the available cells (see [Appendix C](#)).

CADD Standards

3.11 Annotation and Fonts

May 2016

All features on plan sheets should be annotated whenever possible. To ensure the final plans have a consistent and clear readability, operators must follow the standard guidelines for upper and lowercase letters, font type, annotation size, underlining and bolding, use of levels and abbreviations.

Lowercase annotation is used for all annotation except for:

- Capitalization at the beginning of a description (e.g. Bridge begins 1200+65.0)
- Abbreviations for separate words (e.g., the abbreviation for power pole is PP, for cable guardrail is C Gdrl, for corrugated metal pipe is CMP).
- Utility Companies Abbreviations are all capital letters.
- Pay Item Headings and Descriptions

The most common text font used for NDDOT plans is “NDDOT” (true type font). Some standard annotation is placed with font “engineer” or true type font “Dot Matrix”. The use of the “engineer” and “DotMatrix” fonts are for unique situations as programmed into the Templates or other NDDOT standard tools. Engineer font is used with some documentation to avoid formatting problems such as spacing and special characters. “DotMatrix” font is used with particular labels used on ROW plats. The only fonts to be used on NDDOT plans and related drawings are fonts “NDDOT”, “engineer”, and “DotMatrix”.

Annotation should be underlined when it is in a title that is outside of a title block, or when it is a Pay Item. Slanted or italicized text will not be used on plan sheets.

Pay Items that are itemized on sheets should use the following format.

1. Include heading labels in capital letters on each sheet at the beginning of a pay item list. The headings are; SPEC, CODE, BID ITEM, QTY, and UNIT.
2. Include Spec and Code Numbers. A hyphen should not be used between the spec and code. Always use 7 digits for the spec and code (example: 123 0001).
3. Include Pay Item Name In All Capital Letters.
4. Underline the Spec and Code and Pay Item Name. The underline should extend through the quantity and unit columns.
5. The itemized quantity information should be indented from the spec and code. The itemized quantity information should be left aligned with the bid item name.
6. Include measurement units with the quantities.
7. Use the font size specified by the MicroStation task group for the applicable sheet.
8. Individual sheet subtotals should not be used.

Designers should use their discretion for pay item location descriptions. Station and offset information doesn't have to be used for all quantities.

CADD Standards

This formatting is not required for pay item used in tables such as the “Traffic Control Device List” and earthwork summary tables.

The following is an example of Pay Item formatting.

| SPEC | CODE | BID ITEM | QTY | UNIT |
|------|------|--------------------------------|-----|------|
| 867 | 5309 | GARBAGE CAN | | |
| | | Sta 6+00 83' Rt | 1 | Ea |
| | | Sta 7+00 97' Lt | 1 | Ea |
| 328 | 1722 | EXTENSION CORD | | |
| | | Sta 6+00 83' Rt to 7+00 97' Lt | 145 | LF |
| | | Sta 7+00 97' Lt to 8+00 97' Lt | 100 | LF |

Additional characters have been added to the font tables to enable the placement of such characters as fractions, Greek symbols and mathematical symbols. [Appendix L](#) lists the available characters. To draw a special character into a MicroStation drawing, open the “Place Text” box and enter back slash (\) followed by the special character number designation (from 0-255). The special character will be visualized on the screen and it can be placed by left mouse clicking.

A special character was added to the NDDOT true type font library in March, 2014. This character looks like a question mark with a box around it. This character is located after the square root symbol. The character is in keystroke \208 which is not normally programmed on most keyboards.

This character is used to describe some surveyed items that “Indicate a feature that has an unknown characteristic, potentially based on: lack of description, location accuracy or purpose.” This special character will simplify CADD labeling.

True type fonts are not resources that are directly installed on the network. Users will need to have the fonts installed or updated on their computer every time there is a font update.

Standards have been set for the size (height and width) of annotation. Task Navigation – Templates have been programmed with the standard sizes and should be used for the placement of most annotation. The typical annotation heights used on NDDOT plans range from 0.05 to 0.17 inches when plotted to paper.

Plan Note sheets should use a 0.12” text height - (12) Arial font. The summary of “Estimated Quantities” should use a 0.09” text height - (9) Arial font.

CADD Standards

3.12 Abbreviations

April 2023

When so many features are annotated in a set of plans, space is at a premium. To generate more available space, operators should use abbreviations as often as possible. We have established a comprehensive list of abbreviations that are commonly used by the DOT. These abbreviation lists can be found in *Appendices E and F*.

The NDDOT also has a glossary tool (macro). This is used to look up NDDOT abbreviations and send them to your clip board and MicroStation Text editor – Word Processor dialog. This macro can be accessed from the main pull down menu NDDOT>Tools>Glossary. It is also accessible with short cut key combination “Ctrl + F10” if the NDDOT function key menus are used.

Most abbreviations are placed without any punctuation (e.g., CI is 23.9' Lt of Hyd at Elev 1800.6'). The only time a period (.) is used in an abbreviation is when the abbreviation matches an unrelated word. Example Bus. is the abbreviation for “business”.

CADD Standards

3.13 Dimensioning

Sept 2010

Commonly used dimension settings are grouped and stored in dimension styles. Dimension styles are available to the designer through the "Dimension and Text Styles" dgn library file. A complete list of styles and their settings can be found in [Appendix P](#).

There are several settings within the standard dimension styles that can be modified based on clarity and space. The following is an overview of these settings.

Tool Settings

Alignment: Determines the axis along which the dimension is aligned (View, Drawing, True, or Arbitrary)

Location: Controls the location of dimension text (Automatic, Semi-Auto, or Manual.)

Dim Offset: Sets a standard offset for the placement of a dimension.

Style Settings

Fit Options

Text/Terminator: Selects the minimum fit dependent on the text, terminator or combination (Text Moves First, Terminator Moves First, Smallest Moves, Both Move, Text Inside, Term. Outside, Term Inside, or Term. Reversed.)

Angle Format

Units: Sets the units of measurement for angular dimensions (Length or Angle.)

Display: Sets the display format for angular dimension text (D.DDDD, DD^MM', DD^MM'SS", C.CCCC, or Radians.)

Accuracy: Sets the number of decimal places to display for angular dimensions.

Text Format

Orientation: Sets the orientation of dimension text relative to the dimension line (Aligned or Horizontal.)

Location: Sets the location of the text relative to the dimension line (Inline, Above, Outside, or Top Left.)

CADD Standards

3.14 Patterning and Hatching

April 2022

Patterning and hatching are used for drawings that require material definitions, such as concrete, rock and excavations. A list of patterns is shown in [Appendix G](#).

Users are encouraged to use NDDOT custom tools for patterning and hatching because several of the settings are automated. If NDDOT tools are not used, settings such as scale, row spacing, column spacing, and angle will have to be manually calculated and entered.

The standard patterns are stored in the cell library Hatch.cel.

Tips

- If an operator is working in a file with a lot of hatching or patterning, they should probably toggle off “Patterns” under “View Attributes.” This will help with refresh speed.
- If they toggle on “Associative Pattern” in the “Pattern Area” box, the operator will be able to manipulate the closed shape and still have the pattern fill the altered shape.

CADD Standards

3.15 Print Drivers

Sept 2010

NDDOT customized print drivers have been setup for printing. These print drivers files have the extension “pltcfg”. These files work together with the Windows system print drivers. These files adjust many configurations for NDDOT work. The following is an overview of some of the adjusted print configurations.

Printers

The drivers in the “...\plotdrv\Manually_Pick_Printer” folder don’t force a certain printer. You need to select a printer during the printing process or your default windows printer will be used. The drivers in the “... plotdrv\Printer_Specific” folder automatically select a designated printer.

Forms and Sheet Sizes

Some printer drivers work more efficiently with designated form names and sheet sizes. These have been adjusted accordingly.

Pen Tables

Several pen tables have been set up to control the way some drawing elements are printed such as sheet stamps, tags, border comments and general color control.

Print Styles

Print Styles can control most of the same settings found in plot drivers. One key feature of print styles is automatically coordinating the print area with the sheet cell boundary.

Color Settings

Print drivers control what is printed in color, black and white, and gray scale.

Points Size

Most NDDOT print drivers don’t display points in output.

CADD Standards

Weights

The table on the right is a line weight guide. It is provided as a cross reference for evaluating your printer output. These widths have been used to develop the CADD standards.

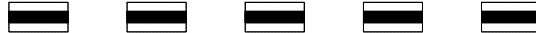
| MicroStation Line Weight | Millimeter |
|-----------------------------|------------|
| 0 | 0.0423 |
| 1 | 0.1270 |
| 2 | 0.2540 |
| 3 | 0.3810 |
| 4 | 0.5080 |
| 5 | 0.6350 |
| 6 | 0.7620 |
| 7 | 0.8890 |
| 8 | 1.0160 |
| 9 | 1.1430 |
| 10 | 1.2700 |
| 11 | 1.3970 |
| 12 | 1.5240 |
| 13 | 1.6510 |
| 14 | 1.7780 |
| 15 | 1.9050 |

Line Caps and Joins

The "NDDOT print drivers" print lines with the following attributes:

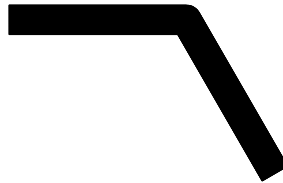
Endcap = Butt

This setting keeps the spaces in linestyles constant as the weights are increased



Linejoin = Round

This setting rounds the corners of joined lines



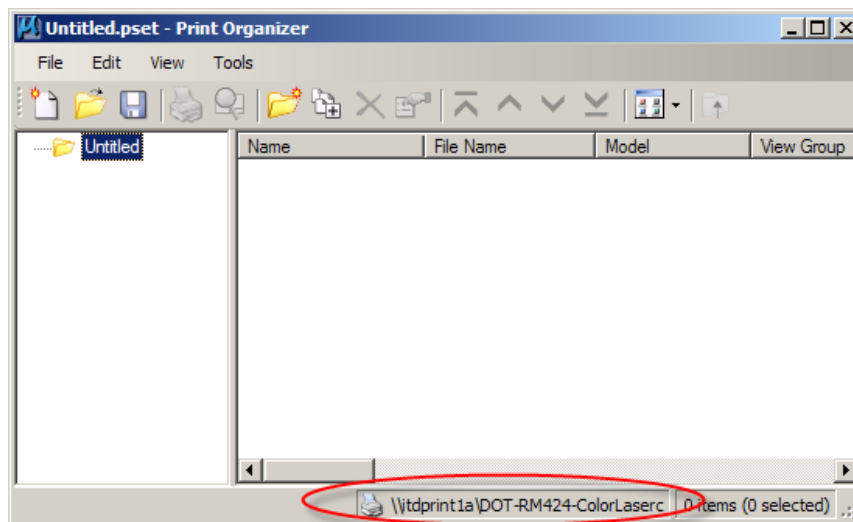
CADD Standards

3.16 Print Organizer

April 2022


Print organizer is a utility for plotting one or more design files at a time. A single print organizer job can print drawings from multiple directories. This section only discusses the NDDOT standards set up for print organizer. The following is a quick guide.

1. Use the NDDOT standard sheet cells.
 - a. The NDDOT standards for print organizer use a plot boundary defined by a particular shape. These shapes are included in all of our sheet cells. The shape is the outer box with attributes; level = Sht Lines, color = 102, Weight = 1, Style = 1.
 - b. Do not use the “Use Shared Cells” option when placing sheets. Printing will not work correctly if this option is used.
 - c. Borders in reference files will not be found.
2. Invoke print organizer under MicroStation file commands.
3. Check the current assigned printer in the lower right of the screen. If it is correct, skip to step 5, if not, follow step 4.



4. Under the File command, select Printer Setup. In the new window, choose printer from the drop down box. Click OK.
 - a. If the file you intend to print contains multiple sheets within on drawing, such as a cross-section file, changing printers later in the process will be more complicated.

CADD Standards

5. Select files to batch plot under the print organizer “add files to set” icon. Click the Add button to browse for files. Select desired files and click Done. You may click the Add button again to browse for files in other directories. When all files have been selected, browse for the print style name that matches your printer and desired output format. Click OK.
 - a. Print style must match the chosen printer or output errors may occur. The drawings will print to the printer indicated in the lower right, see #3. If the print style does not match the printer; paper size or color output may be incorrect; ex. a color drawing may print in grayscale.
 - b. If the file you intend to print contains multiple sheets within one drawing, changing print styles later in the process will be more complicated.
6. Sort the files into the correct order by clicking on the File Name in the left-hand column. The up and down arrow icons in the tool bar will now be active. The same options are available under the Edit command.
7. Click “File>Save As” on the menu bar and save the print set into a working directory, in case you need to make any changes later. The print sets should be saved in the corresponding ePlan folder under the project directory. For example, you are in Bridge and are working on PS&E plans. First you would navigate to the PS&E folder under the ePlan directory. Next create a new Bridge folder by clicking on the Create New Folder  button. Double click on the newly created Bridge folder. Type “Bridge PSE01” in the File name field and click the Save button.
8. Selecting the print command will give you a pop-up box.
 - a. There is a box that allows a choice of “send to printer”, “create print file”, and “create Windows metafile”. For paper copies, the “send to printer” option should show. For PDF or electronic files, this box should be grayed out.
 - b. There is also a box that allows a choice of “single print job” or “separate print jobs” when a PDF or electronic file is to be created. “Single print job” should be selected to create a single file that contains all the pages. This box will be grayed out for paper copies.
 - c. Review the Destination box for desired location and name for PDF or electronic files.
 - d. Click OK when ready to print.

CADD Standards

9. Changing Printer or Print Style
 - a. If NONE your drawings contain multiple sheets, you may change either of these items at any time. Printer may be changed from Printer Setup under the File command. Print Style can be changed by using “apply print style” under the Tools icon. Be sure to match printer and print style. If you do this step to change printer or print style for a file that contains multiple sheets, you will receive a single sheet printed multiple times.
 - b. If any your files contain multiple sheets and you must change the printer or print style, follow these steps:
 - i. Delete only the files with multiple sheets
 - ii. To change the printer, follow step #4 above.
 - iii. To change the print style:
 1. If you have other files still existing, select the Tools icon and “apply print style” to apply your new selection, otherwise skip to step B.
 2. Re-add the deleted files following step #5 above, being sure to use the correct, new print style.
 - iv. Follow steps #6 - 8 as necessary.

CADD Standards

3.17 Referencing Drawings and Attaching Rasters

July 2024

Reference Paths

Use the “Save Relative Path” options when referencing files. The “Save Relative Path” option will help keep the reference path integrity when the files are moved from one drive to another. The “Save Relative Path” option requires that the original directory structure is similar to the final directory structure. Reference paths must be the same through a common parent directory (higher level directory).

Referencing by “Primary Search Paths” or by “Configuration Variables” is not the preferred method to reference drawings and attach rasters. Sometimes rasters are referenced from drawings in multiple directories. If this type of raster attachment is necessary, a project configuration variable file can be used. This project configuration file must be submitted with the project files. Consultants must discuss their use of “Primary Search Paths” and “Configuration Variables” for referencing with their assigned “Technical Support Contact”.

Broken reference paths are CADD Standard violations even if the references are not important. Unimportant-Temporary-Junk references and raster attachments should be deleted when final plans are completed. Consultants and District users should do this before the electronic files are submitted.

Reference Transparency

Reference Transparency settings for the following sections and reference files are an option to be used at the designer’s discretion. In sections 40, 55, 60, and 80 the reference files Topog.dgn and RW_Bndry.dgn can be referenced with a transparency setting of 50%. These optional setting can help clarify dense urban drawing. Using transparency will lighten up some reference files, allowing other files to have more of an emphasis.

Note, The NDDOT is using transparency as interpreted by Adobe which doesn’t require the rasterized option. In order to print with transparency with only MicroStation, the rasterized option needs to be used.

Note, “Print Adjusted Colors” is turned on with NDDOT CADD standards in order to print reference files with transparency.

CADD Standards

Live Nesting

“Pointer Files” are encouraged because they can simplify revisions in drawings that use nested referencing. The following is an overview of “Live Nesting” referencing and “Pointer Files”.

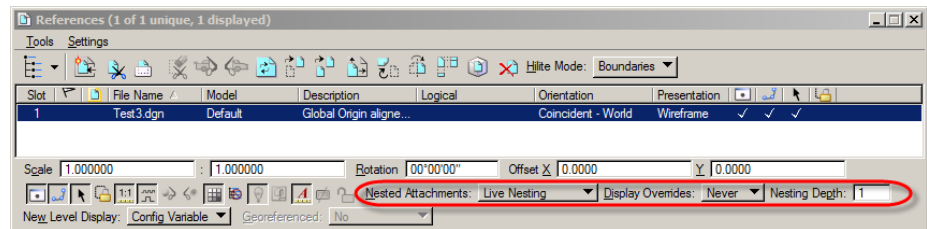
A nested reference file is a reference file that is referenced by way of at least one other reference file. If file “A” is referenced by file “B”, and then file “C” references file “B” with a nested depth of 1, then file “A” would be a nested reference file when viewed in file “C”.

“Pointer Files” are drawings that should have nothing drawn directly in them. They consist of only references to other files. These files are used to manage reference files for sheet drawings in the plans. Each section of the plans could have its own pointer file (“Pointer_” and Section Number); Pointer_040.dgn, Pointer_055.dgn, Pointer_060.dgn, Pointer_070.dgn, Pointer_075.dgn, Pointer_076.dgn, Pointer_077.dgn, Pointer_080.dgn, Pointer_082.dgn, Pointer_090.dgn, Pointer_100.dgn, Pointer_110.dgn, Pointer_120.dgn, Pointer_130.dgn, Pointer_140.dgn.

NDDOT process for ORD sheets use a pointer model within the applicable sheets drawing. Example 060PP_*.dgn would contain a pointer “design” model and separate “drawing” and “sheet” models. Files named “Pointer_*.dgn” are not typically needed in ORD workflows because the “design” model with referencing is that actual pointer model.

The Pointer file controls which reference files and level will be displayed in your sheet models. The Pointer file can be used to turn on and off levels in multiple models. They can also be used to attach or detach reference files in multiple models. The Pointer file makes it easier to consistently adjust what is displayed in your sheet models. Multiple sheet models can reference the pointer model and reference adjustments including level display can be made in one place.

Level display settings can be changed for the active file, a reference file and a nested reference file. MicroStation has “Display Overrides” for “nested” reference files. The “Display Overrides” are not applicable to regular reference files. This is an important difference between reference files and nested reference files. Whenever you reference a “Pointer” file, “Live Nesting” should be set, Display Overrides should be set to “Never” and the Nesting Depth is usually set to “1”.



When you reference files into the pointer model, Live Nesting is not typically used because the Pointer model is usually referenced by others with nesting depth of 1. If the Pointer file is referenced with a Nesting Depth of 2 or more then the Live Nesting and Display Override options within the Pointer file are also important. The Nesting Option outcomes become more complicated as the Nesting Depth increases.

CADD Standards

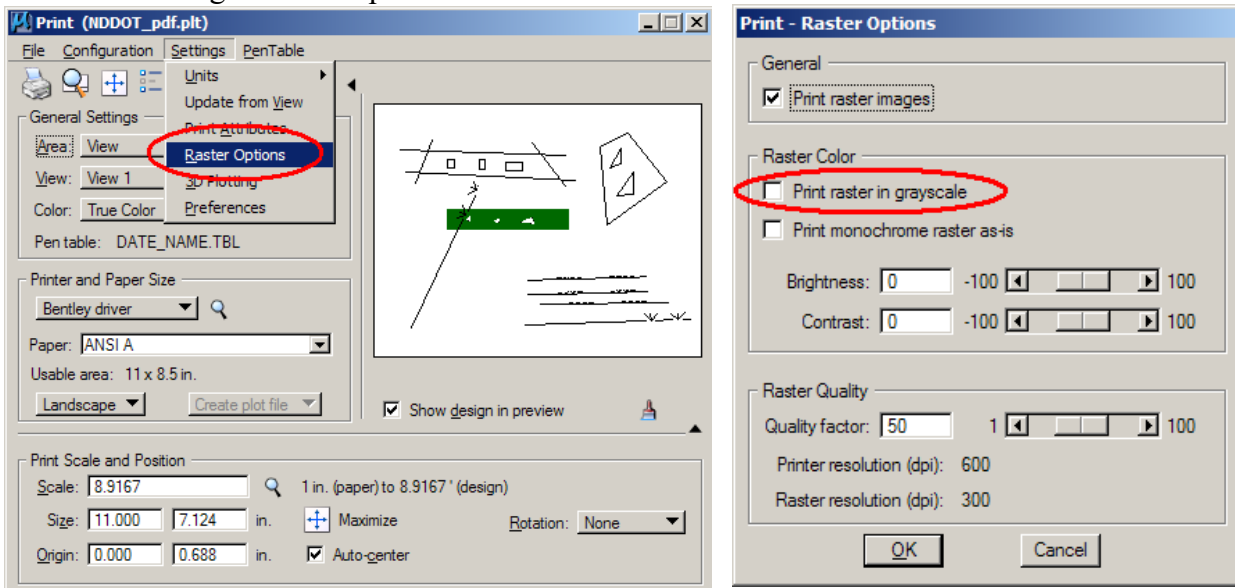
3.18 Printing Rasters (Pictures)

Oct 2008

Embedding pictures within a MicroStation drawing is discouraged. Don't cut and paste pictures into MicroStation. Pictures should be attached to drawings using Raster Manager. Pictures attached with raster manager are easier to adjust than embedded pictures.

Printing color pictures in grayscale is easier to do with raster manager than with embedded pictures. Color Pictures should be printed as grayscale when creating black and white plan sets.

The raster settings for printing with just MicroStation can be found in the "Print" dialog box under "Settings>Raster Options.



CADD Standards

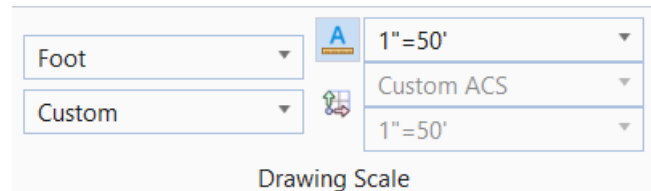
3.19 Annotation Scale

April 2022

The NDDOT CADD standards use annotation scale. Standards have been set up for placing cells, custom line styles, text, patterns, etc. to insure uniformity in all prints. Most of these settings are automated in the NDDOT custom tools. For example, one user is creating a border sheet set to plot at 1"=40' and another user is creating a border sheet set to plot at 1"=200'. If both sheets were plotted and compared, the text in the title block should be the same size even though they were plotted using different scales. By using NDDOT's custom tools, a user can place cells, custom line styles, text, patterns, etc. quickly and easily, because the individual element scale factor are adjusted by the drawing scale.

Annotation scale (for placement) should be on for most elements. Annotation scale affects more than just annotation. Annotation scale affects the scale for line styles, cells, text, dimensions, hatching and patterning.

Annotation Scale is part of the Drawing Scale. The Drawing scale also contains the working units settings and Annotation Scale Lock toggle. The Annotation Scale can be selected from the "Drawing" workflow, under the "Utilities tab.



MicroStation drawing elements that directly use annotation scale will automatically change scale when the Annotation scale is changed. One drawing model can use only one Annotation scale at a time. Example, you can't correctly draw two different scaled typical sections in one model. The annotation scale for one of the typical sections will be off.

There are a lot of settings related to annotations scale. Most of these settings are AUTOMATED in the standard NDDOT tools.

Annotation Scale for Line Styles

- This is a model property. NDDOT Standards use "Annotation Scale" for Line Styles Scale.
- The standard resource file (dotlst.rsc) uses a property named "physical" to indicate which line styles should not be adjusted by annotation scale such as "24 inch RCP".
- Custom Line Style scale factor.
 - Annotation Scale and line style scale factors are different properties.
 - Line styles that should not be scaled will use a factor of 1.
 - Line styles that should be scaled, dependent on annotation scale, will use a factor of 0.0041666 (1/240).
 - Line Style Scale Factor is it used in conjunction with annotation scale. What you see is the product of the two different factors (annotation scale x line style scale).
 - NDDOT custom tools will automatically adjust the line style scale factors as

CADD Standards

needed.

Annotation Scale for Cells

- Annotation Scale for Cells consists of two properties; model and placement (“Annotation Purpose” and “Is Annotation”).
- Both of these properties need to be on if the cell is to be directly adjusted by annotation scale.
- The cell property “Annotation Purpose” (model) is set by CADD standards. User will not adjust this setting.
- The cell property “Is Annotation” (placement) can be toggle on or off during placement. Users could change is setting but typically shouldn’t. NDDOT tools automate this setting.

Annotation Scale for Text (Text Styles)

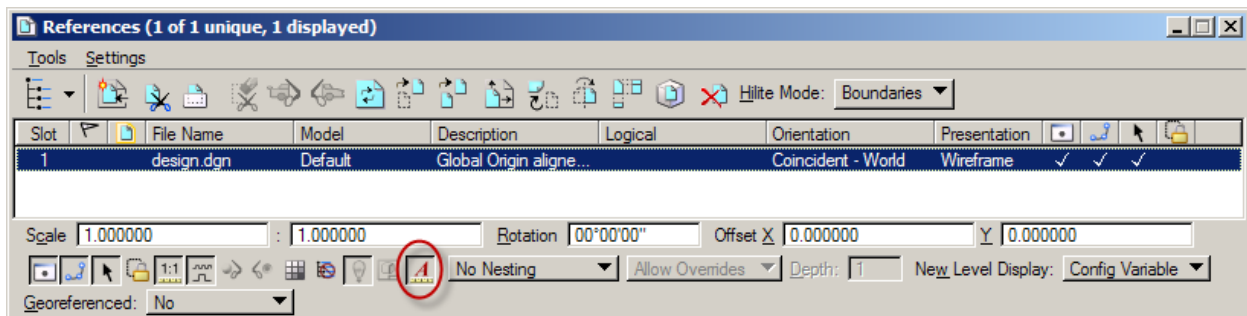
Text Styles are used to help implement annotation scale for text. The actual paper scale values are used for text height and width. Many NDDOT custom tools note the text size by the unit of inches (example (07) for 0.07 inches tall. The actual values will be in master units – feet. The style “text 0.07” will display a text height and width of 0.0058 feet. The actual drawing text height and width will be a product of the text style values x the annotation scale. At an annotation scale of 1” = 40’, the actual drawing height, not the value shown in the tool settings, will be 2.8 Feet ($0.07 \times 40 = 2.8 \approx 2.784 = 0.0058 \times 12 \times 40$).

Annotation Scale for Dimension Styles

Dimension settings are dependent on text height values. The NDDOT Dimension Styles have been set up using text styles.

Annotation Scale and Referencing

In the references dialog box the “Use Active Annotation Scale” toggle can make the reference file use the active model’s annotation scale.



CADD Standards

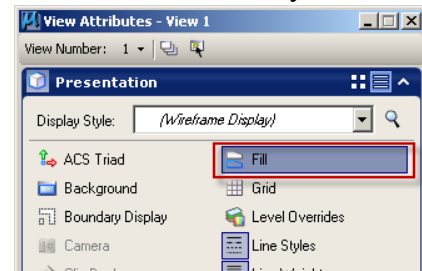
3.20 Priorities and Masking Elements

Jan 2017

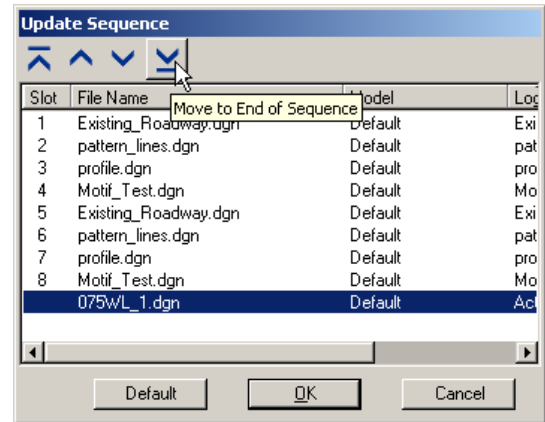
MicroStation shape elements with an opaque color matching the background color (number 255) are being used as masking elements within many sheet cells. These masking items are being used to hide referenced elements that might overlap a title block. These elements are being used with MicroStation “priority” attributes. Reference elements with a lower priority are covered up and hidden by the masking element.

There are a few things to remember when using these masking elements. First, masking elements are on their own level (Mask Lv Priority 100). The level can be turned off if you don't want to use the masking elements.

Second, the “Fill” view attribute must be turned on.



Third, the reference update sequence may need to be changed if a 3D drawing is referenced. This step isn't needed if all references are 2D. Note, most “Topog” drawings are 3D.



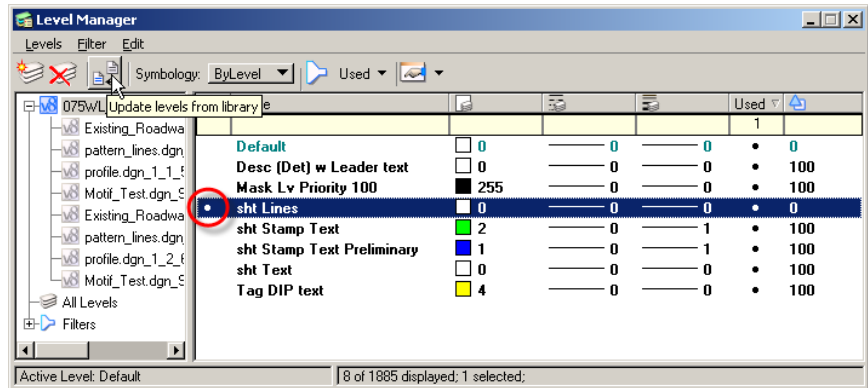
If a 3D drawing is referenced, all of the cut sheets – sheet drawings will need to be edited. With the sheet drawing active, open the reference dialog box and select “Settings > Update Sequence”. Move the active sheet drawing to the end of the update sequence list. Be sure to save settings after the update.

If a drawing with opaque shapes are referenced, they should be first in the update sequence. Next should be any 3D drawings, then regular 2D references, and lastly the active sheet drawing. This adjustment is typically need for sheets in sections 075 through 077.

Fourth, if the sheets are being created from a drawing that used an older level priority definition for sheet lines, this level priority definition will need to be updated. Do this before cutting sheets if possible. If done after, all cut sheets will need to be edited.

CADD Standards

Within Level Manager, select the “sht Lines” level. Then select the “update levels from library” button. Level definitions not matching the present CADD Standard definition will be marked with the modified attribute as shown.



Most users will not need to change priority setting. The following is a summary of NDDOT standard priority attributes. Display priority is determined by a combination of element, level and reference priorities. Reference priorities are a 1000 times that of level priorities and level priorities are a 1000 times that of element priorities.

Display priority = (1,000,000 x reference priority) + (1000 x level priority) + element priority.

Most CADD standards don't use reference and element priorities. Most CADD standards have a level priority of 100 (display priority 100,000) or less. Many sheet cells have display priorities greater than 100,000. The following are some of the sheet display priorities. Bigger display priorities display on top of smaller display priorities.

| Items | Level Priority | Element Priority | Display Priority |
|-----------------|----------------|------------------|------------------|
| Masking Element | 100 | 10 | 100,010 |
| Sheet Lines | 100 | 20 | 100,020 |
| Sheet Text | 100 | 30 | 100,030 |

CADD Standards

3.21 Geographic Coordinate Systems (GCS)

Feb 2023

The NDDOT has assigned a special coordinate system to each county. Most NDDOT projects use one of these county coordinate systems. Three libraries of coordinate systems are included in the CADD Standards;

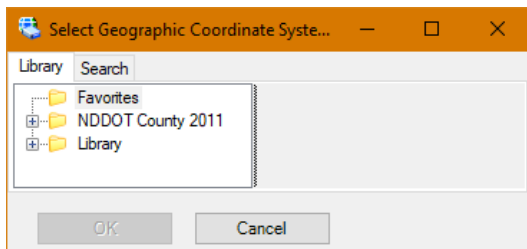
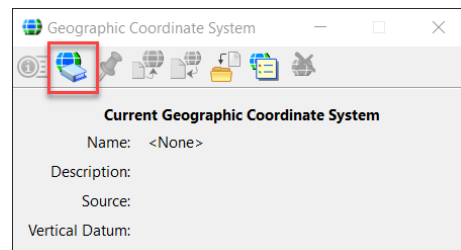
- NDDOT_County_Coordinates.dty
- NddotCountyNAD83-CORS96.dty
- NddotCountyNAD83-2011.dty

The library NDDOT_County_Coordinates.dty and NddotCountyNAD83-CORS96.dty are no longer used. These are older libraries that were used with MicroStation SS2 and other older projects. These are kept with the standards incase work needs to be done with older software. These libraries are not attached by default.

By assigning a GCS to each drawing you enable additional capabilities. MicroStation can use these GCS to project and re-project data from different geographic coordinate systems. This data includes Bentley data and many other formats such as pictures and ESRI formats.

The GCS's are not set with the default NDDOT seed files. They need to be set up on an individual drawing basis. The Coordinate System tool can be found in the Drawing (workflow) > Utilities (tab) > Geographic (panel).

This will bring up the "Geographic Coordinate System Dialog. Select the second button "From Library".

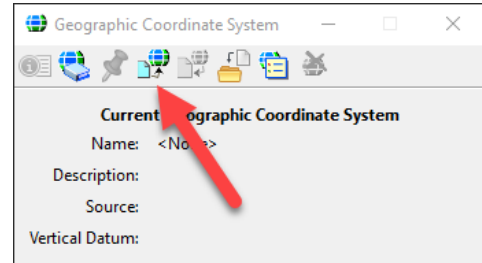


Select the Coordinate system to apply to the DGN file from the available selections. Most Projects within the DOT will use one of the NDDOT county systems. After selecting the appropriate Coordinate System, click OK.

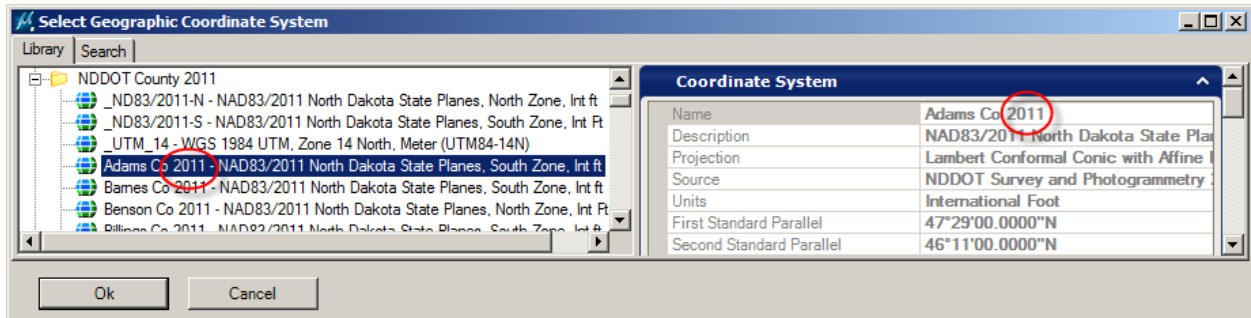
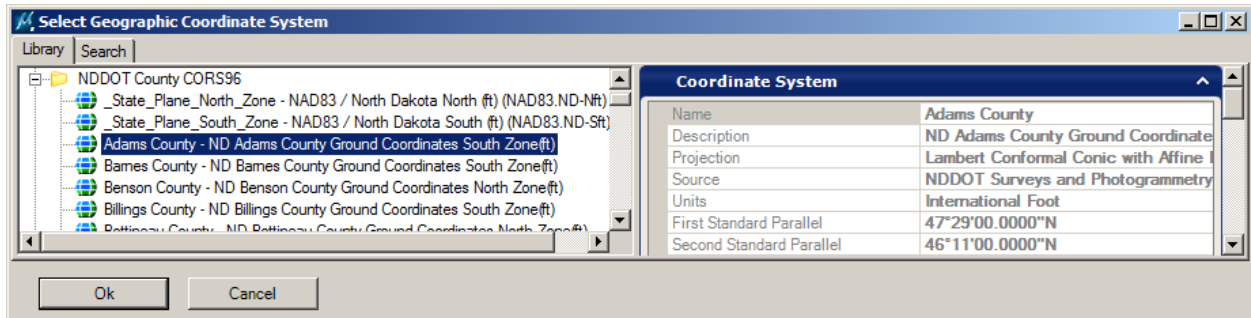
CADD Standards

Typically the Preliminary Survey section will determine what coordinate system to use. Review their AReadme file to determine which coordinate system to use. Their files can also be reviewed in order to determine the applicable coordinate system.

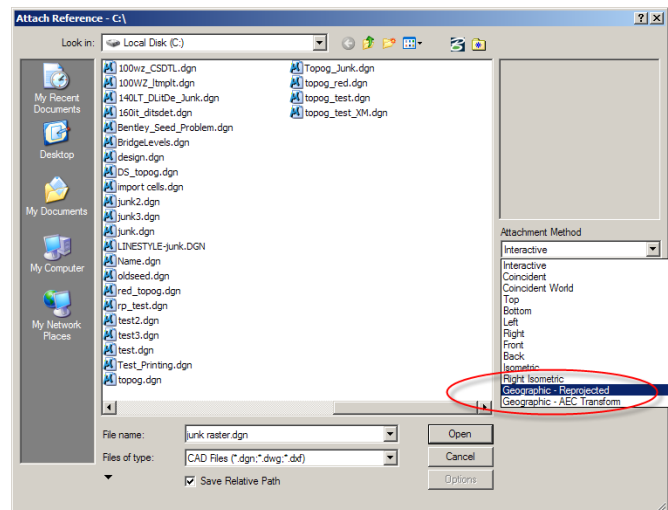
Hint: The set Geographic Coordinate System from Reference File tool is a quick way to lookup the GCS from another related project file and set it at the same time.



Hint: When working with older Geographic Coordinate Systems, note the slight variation in names. The CORS96 GCS's will not have a year listed in the name. The 2011 GCS's will show the year in the name.

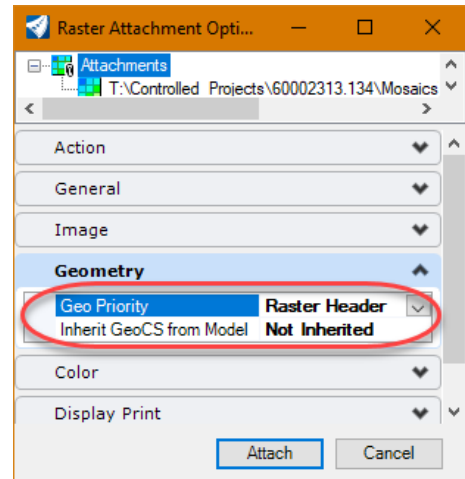


Hint: When working with different GCS's, look for and use the option "Geographic – Reprojected" when using tools such as referencing.



CADD Standards

Hint: When working with different GCS's and rasters, the user preferences discussed in **Section 2.7** of this manual are relied upon to reproject the raster (Geo Priority = File [Raster Header]). Make sure the GCS is set before attaching rasters.



CADD Standards

3.22 Item Types

April 2023

Item types are a property type that can be attached to an element. They can provide for a vast amount of input and can autogenerate fields such as station, offset, fundamental geometry measurements and other calculations based on user input. Some common uses are to populate plan sheet fields such as project number, project description, and to generate tables. The item type values are visible and can be manipulated by accessing the properties for an element.

Notes:

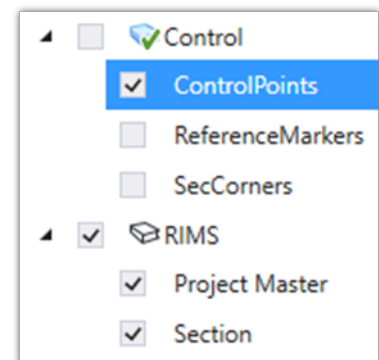
- Item Types are available for MicroStation CE, OpenRoads Designer and OpenBridge Designer. However, some item types work directly with civil properties (civil tools). Item Types referencing civil properties may not update when opened in MicroStation CE. Full functionality of an item type property such as stationing requires that file be opened in the applicable civil software.
- The Control and RIMS item types will automatically be attached to the appropriate graphics in ORD 10.11 and later. If you are working with graphics produced in earlier versions, then you will need to manually attach the item type properties.

Available item type properties can be attached to an element from multiple locations.

- Survey (workflow) > Utilities (tab) > Item Types (panel) > Attach Item
- Drawing (workflow) > Attach (tab) > Item Types (panel) > Attach Item

The Attach Item dialog will show you the available item types that you can attach to an item on the left-hand side. You can choose to select a single item type like ControlPoints or an entire group like RIMS. The act of attaching an item type works by selecting multiple items before you activate the tool or by activating the tool and then selecting an element.

An item type may need to be embedded in the DGN before you can attach it to multiple items at once. A quick technique to accomplish this is to create a sacrificial element to attach all the item types that you want to use in your file. You can delete the element as soon as you are done attaching the item types to it. A second option is to simply import the particular item type property(s) you need using the Item Types dialog.



CADD Standards

The properties that will be attached to an item will display on the right once an item is selected on the left. Fields you can populate will be white like various field in the Control item type set. Field that cannot be manually populated are grey like all the fields in the RIMS item type set. Populating some fields before attaching them can be very efficient. For instance, the ControlPoints and ReferenceMarkers item types both contain a ReferenceAlignment field. If you populate the field with the name of your alignment you will be using, then every element you attach it to will automatically receive the correct station and offset based on that alignment input. This mass edit can also be done after they are attached by selecting multiple items with the same item type and accessing the properties.

Access the properties of an element to manipulate or review the item types after they are attached, if needed. Each item type attached to an element will appear in its own ribbon within the properties dialog. A field that appears with a greyed out name cannot be edited.

CADD Standards

Section 4 is intentionally blank (reserved)

CADD Standards

OpenRoads

5.1 OpenRoads Survey

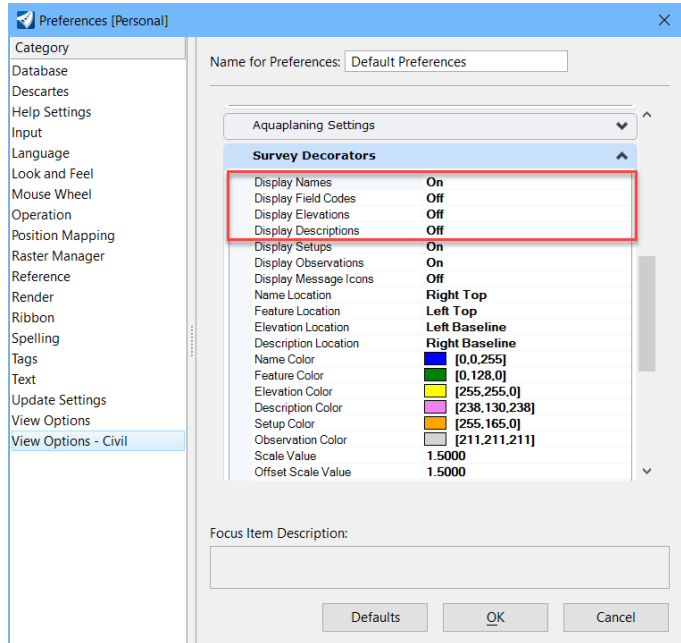
April 2023

Survey Decorators

Survey decorators are text labels that are typically temporary and dynamic. They label imported survey elements. These labels include Names, Field Codes, Elevations and Descriptions.

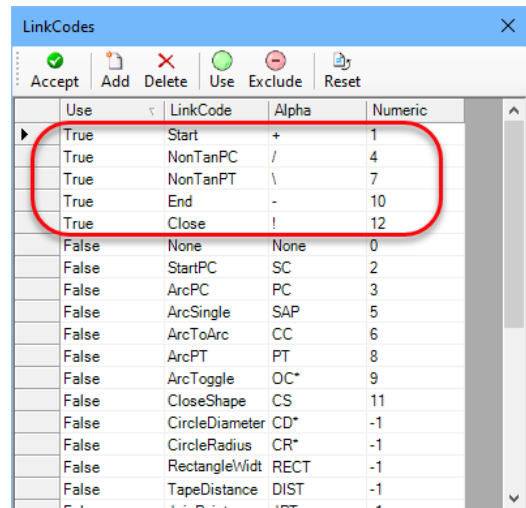
The settings for survey decorators are adjusted within the Preferences dialog (File > Settings > User > Preferences > View Options – Civil > Survey Decorators).

The decimal settings for elevation text is controlled by the Design File Settings (File > Settings > File > Design File Settings > Working Units).



Survey Link Codes

Survey Link Codes are setup in the NDDOT standard files (Survey_Settings.dgnlib). Most users will not need to adjust these settings. They only need to ensure that the NDDOT standards are correctly enabled. Survey settings can be reviewed through Explorer > OpenRoads Standards > Survey Settings > Link Codes. Note that you must click in the “Link Codes” field and then click on the “...” to open the LinkCodes dialog box.

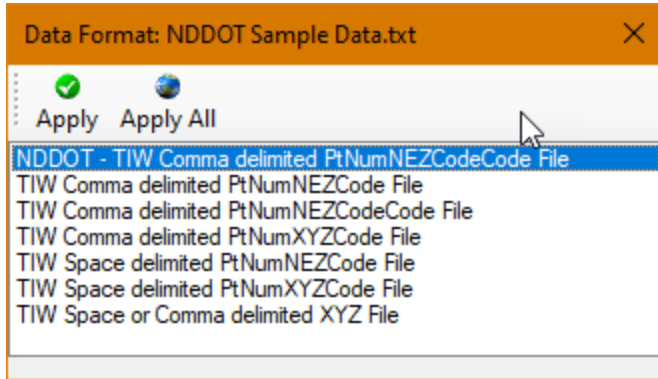


CADD Standards

Survey TIW (Text Import Wizard)

The NDDOT text import wizard file is setup for survey text information in the following format.

Point Name, Northing, Easting, Elevation, LinkCode PointCode, Note



Survey Macros

The NDDOT OpenRoads settings for importing survey data is supplemented with macros that can expedite CADD editing. These macros add additional labels. Many of these labels will need additional editing and all will need to have their locations manually adjusted. The following are some examples.

The feature “FNW” will include the label “Wood” if the macro is active.

The feature “GM” will include the label “OWNER?”. The CADD editor is expected edit this label with the gas main owners name.

The feature “24RCPF” with a survey comment of “gf” will include the label
24” x ‘ RCP (good) – RCFES (fair)

The CADD editor is expected to manually edit the length and add the station and offset to the alignment.

24” x 64’ RCP (good) – RCFES (fair)

Using the macros during import will take longer for the computer. If the macros are off (unloaded) the import will still work but the additional labels will not be included. Tools to load and unload the survey macros are located in the Photo (workflow) > Main (tab) > Macros (panel) > Survey > VBA on Import > On or Off.

The Survey Macro VBA creates text that is linked to the survey graphic. There are many things that will cause the survey graphic to refresh. When a graphic refreshes/redraws, then the label will be redrawn into the file with the original VBA text. Example, the default VBA label for a gas main is "Owner?". If this label is edited to "ACME PL" and moved to an appropriate location, this edit may later be undone. If the gas main line is edited to remove a stray point, then the "ACME PL" annotation will be moved back to its original location and be change back to "OWNER?".

CADD Standards

5.2 OpenRoads Feature Definitions

April 2023

Most of the NDDOT Feature Definitions for OpenRoads are stored in the file “Features_Annotations_Levels_Elem Templates.dgnlib”. This file is referenced with the CADD standards. Most users will only need to access feature definitions.

Note the structure for Feature Styles, Feature Definition and Element Templates is intended to be the same. This should simplify user navigation and standard maintenance.

Feature Definition Macro

The “Tool Relationships” macro is briefly discussed in *Section 2.9* of this manual. Some of the NDDOT custom tools work with feature definitions. Several NDDOT drawing elements are directly related to NDDOT feature definitions.

Dependent on the “Tool Relationships” setting, accessing a NDDOT tool for a drawing element may also set a feature definition if applicable. If there is no applicable feature, the feature definition will not change.

For example, if Tool Relationships” has Civil Features “on” and “Aggr A” is selected from the NDDOT tools, the Feature Definition Toggle Bar should open and also switch to “Aggr A”.

Note, some tools don’t automate feature definitions. Example, the feature definitions for elements such as terrains will need to be manually set at the time of creation.

CADD Standards

5.3 Civil Geometry

July 2024

Horizontal Alignments

There are 3 groups of NDDOT CADD standards for alignments; Large Scale, Small Scale and Survey Centerline. Within the small and large scale groups there are 8 different alignments that are similar but use different levels and colors.

Small scale alignments are typically used on urban projects where most plan sheets are 80 scale or smaller. Large scale alignments are typically used on rural projects where most plan sheets are 100 scale or larger. The main difference between these 2 formats is the station labels. Large scale uses a +00 format every 500' and uses a large offset that places the label outside of the roadway. Small scale uses an abbreviated station format (without +00), is placed at a 100' interval, and uses a small offset that usually places the label within the roadway.

Survey Centerlines are existing alignments that have been used in legal descriptions such as right of way plats. There is both a large scale and small scale version of survey centerlines. The main difference between Survey Centerlines and other alignments is that the bearing of lines is labeled. Survey centerlines should not be used for Office Location alignments.

ORD software has a few limitations that need to be manually adjusted.

1. The software does not distinguish between a point of intersection (PI) without curves and point on tangent (POT). Both types of these points have been set up with a PI label. POT's must be manually identified and the labels will need to be manually corrected.
2. The deflection of all PI's should be labeled on Survey Centerlines. This includes PI's without curves. The software doesn't automate this label because the angle is derived from "two" lines, whereas PI's with curves can derive the angle from "one" element (the curve). The deflection should be labeled with the tie line. Example:

¼ Line Xing
6655+64.80
#8 Rebar
 $\Delta = 0^\circ 00' 01'' \text{ Rt}$

3. The Combination PI label orientation will need to be manually rotated 180 degrees on curves that turn right. The software doesn't distinguish between right turning and left turning Combination PI.

CADD Standards

4. Combination PI labels and leaders should be used anytime there is a spiral. Combination PI labels and leaders should not be used on simple curves or PI's without curves. The software uses an all or nothing approach for Combination PIs.
 - a. The automation for the combination leaders has been turned off. These leaders will need to be manually placed.
 - b. The automation for the combination labels has been turned on. These labels will need to be deleted for PI's without spirals. Note these labels are on their own level.
 - c. The individual spiral data tables should only be kept if the spiral was stored as an independent component. If the spiral was stored as a curve combination, a "Curve Combination" table will be created with the annotation group. If a curve combination is used, the simple curve table and the spiral curve table for the combination should be deleted. Also note that Curve Combination tables include both entry and exit spiral information. For spiral curve spiral combinations that uses symmetric spirals, the exit spiral info should be deleted from the curve combination table.

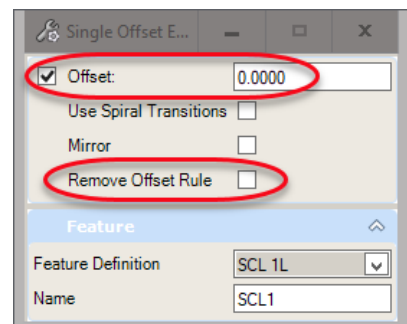
Sometimes the Combination PI label and leader overlap the curve PI label and leader. Manual adjustment are sometime needed for these labels anyway.

5. ORD alignment curves don't have names. If curve names are desired, they will need to be manually named.
6. If there is a station equation between PC and PI, ORD will document the stationing for the PI with the "Ahead" (next Region). Typically the PC and PI stations are document from the same region. The PC station + tangent length should equal the PI station. The station of the PI will need to be manually document based on the PC region.

Profiles

Profile data is stored with its associated horizontal alignment. Therefore, profiles are stored in the alignment drawings. Designers will typically need to work with existing alignments, including profiles. Designers may need to create proposed profiles for existing horizontal alignments. They may also need to change display settings for existing profiles. Designers will need write access to the existing alignments. Survey data is often set as read-only to staff outside of the survey section.

Designers may need to copy an existing alignment into a drawing (DS_Align.dgn) to which they have full access and control. Using the tool "Geometry > Horizontal > Single offset Entire Element" is one way to do this. The existing alignment drawing can be referenced, and the "Single Offset Entire Element" tool can be used with a 0' offset. Designers may want to "Remove Offset Rule" to eliminate direct dependencies to the existing alignment.



CADD Standards

There are 5 feature definitions for existing profiles and 5 for proposed profiles. There are 3 variations of “Profile Existing 1” and 3 variations of “Profile Proposed 1”. The profile - 1 versions are setup for elevation “Strip Grades” when used with plan and profile sheets.

- SG020 – Strip Grade every 20 feet – 40, 60 and 80 Scale Plan and Profile sheets
- SG050 – Strip Grade every 50 feet – 100 Scale Plan and Profile Sheets
- SG100 – Strip Grade every 100 feet – 200 Scale Plan and Profile Sheets

The strip grades settings are not used in the dynamic profile view. The strip grades are used in the drawing models.

The Profile - 2 and 3 versions don’t use strip grades. They just use different symbology.

Alignment Naming Convention

Horizontal

- OL_* = Office Location _ Descriptive Suffix
- OCL_* = Office Location Centerline_ Descriptive Suffix
- SCL_* = Survey Centerline_ Descriptive Suffix

Vertical

- Terrain Profiles are named by ORD application after the Horizontal Alignment
- Use “EX” for existing profiles that are created independent of a terrain.
- Use “PRP” for proposed profiles.

CADD Standards

Alignment Key

Include an “Alignment Key” in the AAreadme file for supplement design data.

Example Alignment Key

| Horizontal Alignment Name | DGN File Name | Extended Description | Derivation |
|----------------------------------|----------------------|--|------------------------------------|
| OCL_WB104OS | DS_Align.dgn | Highway 2 West Bound 104' Offset from East Bound | Newly created project alignment |

| Vertical Alignment Name | Parent Horizontal Alignment | Extended Description |
|--------------------------------|------------------------------------|------------------------------------|
| OCL_WB104OS | OCL_WB104OS | Existing profile from Terrain Alt |
| PRP_Surcharge | OCL_WB104OS | For temporary surcharge embankment |
| PRP_Median | OCL_WB104OS | For highway center median ditch |
| PRP_WBML_N_Ditch | OCL_WB104OS | For Hwy 2 north ditch |

Other examples of horizontal alignment “Derivation”

- copied from ..\Survey\Control.dgn
- imported from ..\Survey\job001.gpk.
- copied from a different Project ..\00000000.001\Survey\Control.dgn

CADD Standards

5.4 Terrains

April 2023

Preliminary Survey Terrains

The existing ground surface may be represented by different types of terrains. Standard drawing, terrain and feature definition names have been assigned to communicate the differences between these terrains.

Separate drawings are required for each terrain. The DTM drawings should not include any terrains. These drawings should only include the information used to create the terrains. The actual terrains should be stored in separate drawings by themselves.

| 1. Drawing Name 2. Terrain Name 3. Feature Definitions | Description |
|---|--|
| 1. Terrain_Exst 2. Exst 3. Terrain Boundary Exst | Continuous Along Primary Road Alignment - Used to create continuous existing profile for primary design road. |
| 1. Terrain_Exst_Alt 2. Exst_Alt 3. Terrain Boundary Alt Exst | Discontinuous Along Primary Road Alignment - May include underpasses, overpasses or exclude primary alignment structures. Used for alternate profiles and earthwork calculations. |
| 1. Terrain_Exst_No_Voids 2. Exst_No_Voids 3. Terrain Boundary No Voids Exst | Similar to "Exst" terrain except voids are modeled as break lines and obscured data may be considered |
| 1. Terrain_Exst_Alt_No_Voids 2. Exst_Alt_No_Voids 3. Terrain Boundary Alt No Voids Exst | Similar to "Exst_Alt" terrain except voids are modeled as break lines and obscured data may be considered |
| 1. Terrain_Exst_Drape 2. Exst_Drape 3. Terrain Boundary Drape Exst | Extended terrain coverage is obtained with less regard to accuracy. Used to drape features along surface, Voids modeled as break lines, Supplemental data is used to increase extent of terrain, Do not use for earthwork calculations |

The Terrain_Exst drawing is required for all earthwork projects. The requirements for the other terrain drawings are dependent on project complexity.

The "Terrain_Exst" and "Terrain_Exst Alt" drawings are the only drawings that meet the NDDOT survey accuracy requirements.

CADD Standards

The “Terrain_Exst_No_Voids” and “Terrain_Exst_Alt_No_Voids” may use obscured data under certain circumstances. Additional project documentation and direct coordination with the NDDOT Survey Section is required when incorporating obscured data. Examples of obscured data may include data such as photogrammetric elevations obtained in dense vegetation. Designers should compare the Exst to Exst_No_Voids and the Exst_Alt to Exst_Alt_No_Voids terrains. Designers are responsible for understanding the limitations and complications with using obscured data.

The “Exst Drape” terrain should not be used for earthwork calculations. The “Exst Drape” terrain includes information from automated elevation software that has not been refined. The “Exst Drape” terrain may contain surface data on top of features like buildings, cars and vegetation. In order to stress accuracy concerns with “Exst Drape” terrains, the DTM information used for the Exst_Drape terrain and the actual Terrain_Exst_Drape drawing shall be segregated into its own “Drape” folder under the “Survey” folder.

Design Terrains

Terrains for proposed surfaces shall be created for most earthwork projects. Three surfaces are usually provided for AMG: Dirt Grade (DG), top of Base (B1), and the top surface (T).

Exterior Triangles that don’t accurately represent surfaces should be removed. At a minimum, a reasonable triangle side length should be used in order to remove the majority of bogus exterior triangles. Additional break lines may be required to prevent gaps in surfaces. These gaps typically occur at the corridor beginning, corridor ending and at intersections. A terrain boundary feature may also be used to eliminate all bogus exterior triangles.

Terrain anomalies within the primary roadway pavement and under it (base and dirt grade) should be eliminated or thoroughly documented in both the drawing and the AAreadme file for contractors. A perfect terrain representation of the proposed design is desirable but may be time and cost prohibitive to create. Minor anomalies within the inslope, backslope and with intersections should be avoided but can be tolerated.

CADD Standards

Graphical Filters for Existing Terrains

Graphical filters standardize the terrain generation. The graphics are filtered based on their symbology such as feature definition, level name, and cell name. These make up the Filter Groups that are used to extract graphical data into a terrain.

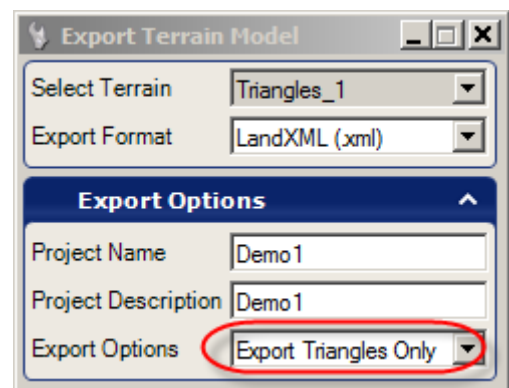
Graphical filters are accessed from Open Roads Modeler or Survey (workflow) > Terrain (tab) > Create (panel). When launched you will need to select the ellipsis button for the Graphical Filter Group. The existing surface filters are stored in the Survey_Terrain_Filters.dgnlib, while the proposed surface filters are stored in the Corridor_Model_Terrain_Filters.dgnlib. Select the appropriate filter group that relates to the graphics that will be extracted into the terrain.

The Terrain Filter Manager can be used to review what graphics will be extracted by a filter group. Find the filter group in the list and expand it to see its individual components. For an example you can access the proposed filter group Base 1. Within the filter group there is a Boundary and a Break component. If you select the component Base 1 – Break, then you can see basic information about the component. You can see additional details by selecting Edit Filter. On the left side of the Edit Filter dialog will be a list of symbology parameters. Only the Civil Features is being used for this component. When Civil Features is selected the full extents of the graphics used for this component are listed. Some filters may use multiple symbology parameters for a single component.

Creating XML Files from Terrains

Contractors might not have software that can work with MicroStation terrain elements. The terrain elements should also be saved as XML files for a broader range of compatible software formats.

1. Select the “Export to File” tool from OpenRoads Modeling (workflow) > Terrain (tab) > Miscellaneous (panel).
2. Select the terrain in MicroStation.
3. Set the Export Options. Typically the Triangles are exported without the terrain Features.



CADD Standards

5.5 Corridor Modeling Templates

April 2023

Notable Differences Between ORD and V8i

The following notes discuss general changes between the SS10 and ORD template libraries.

1. SS10 corridor template libraries are not directly compatible with ORD feature definitions.
2. Template preferences are now stored in the active template library (*.itl). There are no longer stored in a xin file.

RDM and RDPG (“Roadway Design Model” and “Roadway Design Plan Graphic”)

Corridor models shall be saved in the RDM_*.dgn (roadway design model) drawing. Multiple “RDM_” files are recommended for large project in order to simplify corridor processing. Descriptive suffixes for these files are strongly encouraged.

RDM_All.dgn is a file that doesn’t directly contain any corridor models. This file is used as a pointer file that references all project applicable corridor models into one file.

Corridor feature reference graphics can be drawn in a drawing named rdpg_*.dgn (roadway design plan graphics).

Template Library (Inroads Template Library - *.itl)

Each project that uses corridor modeling should use a project specific template library. This library is usually copied from the NDDOT standards.

- S:\STANDARD\CE*\Organization\Template Library\NDDOT-ORD.itl

ORD will look for the project template in one of two places. Copy the itl file to one of the following applicable directories.

If you used a workset, ORD will first look in the workset standards directory for the itl file.

- CIVIL_ROADWAY_TEMPLATE_LIBRARY = \$(_USTN_WORKSETSTANDARDS)NDDOT-ORD.itl
- Example, R:\project\00000000.001\Design\Standards\NDDOT-ORD.itl

If a workset is not used, ORD will look in the active dgn directory for the itl file.

- CIVIL_ROADWAY_TEMPLATE_LIBRARY = \$(_DGNDIR)NDDOT-ORD.itl
- Example, R:\project\00000000.001\Design\dgn\NDDOT-ORD.itl (assuming dgn file is in dgn directory)

CADD Standards

The NDDOT template library contains the following main folders.

1. Components (No End Conditions)
2. End Conditions
3. Linear Templates
4. Surface Templates
5. Example Templates
6. Project Specific
7. Training

Copy the templates to be used for your template drops into the “Project Specific” folder. Project templates are typically customized. This folder will help manage edits.

The right side of the road is used as the default for individual roadway components and templates.

Use the underscore (_) to delineate affixes. Hyphens (-) can be used to tie phrases together, but spaces are also acceptable.

Parametric Constraints (Template Variables)

Parametric Constraints such as `Inslope1_R` will have to be manually edited to `Inslope1_L` if mirrored.

Default variables values should be used in the library. This makes editing and building templates easier. See [Appendix R](#)

Parametric constraints are rounded to the accuracy set in user preferences. Four decimal places are used in the template library for consistency purposes (example, 4” = 0.3333’, 4” is not equal to 0.33’)

Widths on the right side are typically positive values. Widths on the left side are typically negative values.

Parametric Variables are case sensitive. Parametric Variables should be title case.

CADD Standards

Point Names

Standard point names aid with point styles, template transitions, point controls, labeling and alternate surfaces. The Names also provide a partial description. The names have up to 5 parts. The standard point name is the combinations of the parts:

1. Layer Description
2. Horizontal Description
3. Repetitive Affix (count)
4. Parent Component Name (Optional-use to avoid duplicate names)
5. Right or Left Side Affix

There are 3 common layer descriptions:

- T (Top - Finished Grade),
- B1 (Top of Base 1),
- DG (Dirt Grade)

A variation of the T and DG series is included (T_A_* and DG_A_*). These points use the same feature styles as T_* and DG_*. The intent for these points is to provide more flexibility in cross section labeling. For example, there may be 2 template drops in a set of cross sections having similar points. On one of the template drops a label may be desired, on the other the label may not be desired. One template could use a T_A_* version and the other could use a T_* version. This way labels can be applied discriminately to the different versions.

Some points don't belong to a surface. These points still have a layer description.

- DNC (Do Not Construct – This is a marking point)
- Find (This point is usually part of an end condition looking for a feature)

The “Horizontal Location” describes common horizontal markers. If one of the following points doesn't adequately describe a point this part of the name is optional, and the Repetitive Affix (count) is used.

- CL (Center Line)
- EOL (Edge of Lane)
- Shldr (Shoulder)
- EOSP (Edge of Sluff Pavement)
- EOSB (Edge of Sluff Base)
- Gutter
- FOC (Face of Curb)
- BOC (Back of Curb)
- Tie (Tie Between Finished and Existing Grade)
- Bnch-Front (Bench Front)
- Bnch-Back (Bench Back)
- Ditch

CADD Standards

The number –repetitive affix or count part of the name is used to keep the name unique. If the name would be unique without the count part of the name, this part of the name is unnecessary and should be omitted. Points are typically number away from center line (bigger number used when it is further from center line).

The component part of the name is used for points in different end conditions within the same template. Again, if the name would be unique without the component part of the name, this part of the name is unnecessary and should be omitted.

Sometimes boundary suffixes are used (_Bndry1 and _Bndry2). These points are setup in the graphical filters to be used as boundaries for terrains.

The last part of the name is the right or left affix. This affix can be automatically included in the name by the Roadway Designer tools. It is often used to keep the point names unique when a component is mirrored.

CADD Standards

Components and Volume Options

Corridor modeling components use mesh feature definitions to create material volumes. Mesh feature definitions have a “Volume Option” property that affects how the volume is addressed in earthwork calculations. The “Volume Option” setting is one reason why selecting appropriate feature definitions for your template components is important.

The following is an overview of the “Volume Options” used in mesh feature definitions.

| Volume Option | Description | Earthwork Pitfall |
|----------------------|---|--|
| None | The mesh/terrain is totally ignored when the earthwork is computed. | |
| Existing | Lowest existing or unsuitable mesh defines suitable grading surface. Corridor template end conditions tying to existing or unsuitable surfaces will use the lowest existing mesh. | When used to define an existing volume such as existing pavement, it is treated as unsuitable and is removed. An Asphalt overlay over an "Existing" volume (existing pavement) will not work correctly because the existing pavement will be removed and replaced by fill. |
| Cut | Material above or removed by a design mesh-volume and below lowest existing mesh. | |
| Unsuitable | Like "Existing volume". If used with split option, volumes will be track in 2 groups (removed and replaced with proposed construction materials; and removed only) | Unsuitable split can identify material that is replaced with design or fill material. However, this is not the same as remove as needed. In cut situations there can be material that needs to be removed but not replaced with another material. Unsuitable meshes is the most direct way of doing removal calculations. However, the limits of unsuitable modeling must be coordinated with design meshes edges. |
| Substrata | Existing material that can be built on top of with fill or design volumes. Substrata cut can be tracked separately. | This can be used for removals such as pavement removal on a widening project if the removed material is always replaced by a design volume- mesh or cut. However, it can create undesirable results in fill situations. Example, on most projects we cannot build over topsoil. |
| Design | Mesh/Terrain that are proposed construction. | CE "design" meshes-volumes no longer have provisions to be included in the mass ordinate. Embankment above subgrade will require a work around to include it in the mass ordinate. See section 5.11 . |
| Fill | Volume typically created between lowest design mesh and lowest existing or unsuitable mesh. | |
| Custom | Both an Existing and Design Volume. Provides an existing volume from volume replace by custom material. | |
| Subgrade | Defines construction volumes but not at finished grade. | |

CADD Standards

| Volume Option | Defines Proposed Construction Volume | Defines Existing Volume | Mass Ordinate | Splitable | Used in NDDOT Standards |
|---------------|--------------------------------------|-------------------------|---------------|-----------|-------------------------|
| None | no | no | no | no | yes |
| Existing | no | yes | no | no | yes |
| Cut | no | yes | yes | no | yes |
| Unsuitable | no | yes | no | optional | yes |
| Substrata | no | yes | optional | no | yes |
| Design | yes | no | no | no | yes |
| Fill | yes | no | yes | no | yes |
| Custom | yes | yes | optional | optional | no |
| Subgrade | yes | no | no | no | no |

A corridor Model that represents the existing roadway can be used to calculate removals. Usually, the existing and proposed corridors are drawn in separate models and then referenced together before drawing cut fill volumes and performing earthwork calculations.

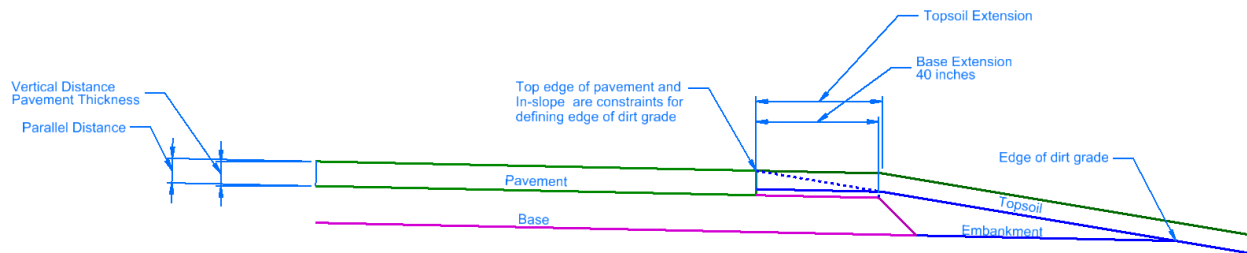
The feature definitions for proposed construction components use a setting for “Volume Option” that is set to Design.

The corridor models for the existing conditions use feature definitions that have their “Volume Option” set to Existing, Unsuitable, or Substrata.

CADD Standards

General Geometric Rules for Templates and Typical's

1. Material thicknesses such as pavement, base and topsoil are measured vertically. The distance value used in the MicroStation command "Move/Copy Parallel" is not the same as a material thickness if the line has any slope.
2. The base extension for concrete paving sections has increased to 40 inches.
3. The offset for the edge of dirt grade is determined by projecting a line from the top edge of pavement (top of sluff) to the bottom of the base line at the in-slope rate. Topsoil will be projected up from this line.
4. The offset for the edge of dirt grade will be variable with changes in super-elevation. The offsets are controlled by slope rates.
5. Topsoil extensions should be used to develop full topsoil thickness on asphalt sections. Topsoil extensions also accommodate base extensions on concrete sections. The topsoil extensions should be tied to the top edge of pavement, and they should be parallel to the pavement. The top of topsoil grade breaks to the in-slope at the end of the topsoil extension.



Super Elevation and In-slope Relationships

Super elevation and inslope rates are project variables that indirectly affect dirt grade widths. Consistent relationships between these slope rates help facilitate template transitions and the comparison of alternates. The development of the NDDOT template library uses the following philosophies:

1. The top edge of dirt grade offsets will be variable through a super elevated curve. These offsets will be controlled by slope rates.
2. The edge of the roadway dirt grade will be determined by projecting a point from the top edge of pavement (top of sluff) to the bottom of base line at the in-slope rate for both concrete and asphalt templates. Topsoil will be projected up for both asphalt and concrete templates.
3. The templates will address safety edges and traversable stuffs.
4. Topsoil extensions that are parallel to the roadway pavement are desirable. Topsoil should tie to the top of asphalt sluff pavement.

CADD Standards

5.6 Corridor Modeling Requirements

Jan 2019

1. Corridor modeling break lines (feature styles) are required deliverables. These break lines are drawn with the corridor within the RDM file. Some break lines are optional other are required. Some of the break lines don't need to be created. Points used to calculate and mark points such as a minimum ditch depth where it isn't used as a break point, can be omitted from the terrain. Other break lines should be included even if it doesn't represent a break point. The following are required break lines and shall be included in the terrains:
 - EOP – Edge of pavement for all surfaces (T, B1, DG)
 - SHLDR - Shoulder for all surfaces (T, B1, DG)
 - EOL – Edge of lanes for all surfaces (T, B1, DG)
 - B1-EOSP – Edge of sluff for pavement
2. The following intersections must be modeled in areas to be constructed.
 - a. Highway to Highway Intersections
 - b. Principal Arterials
 - c. Minor Arterials
 - d. Collectors (includes County Major Collectors)

Note, modeling lower classification intersections may be desirable but is not required

See County Classification Maps

<http://www.dot.nd.gov/business/maps-portal.htm#countyfunctionalclass>

See Urban Classification Maps

<http://www.dot.nd.gov/business/maps-portal.htm#urbanfunctionalclassandsystem>

3. If multiple models are used with one construction project, they should have coincident adjoining edges if they connect. Avoid overlapping model areas. Example, two roads intersect. One of the models includes the intersection the other model should stop at the beginning of the intersection modeling.
4. Models for work zone traffic control such as median cross overs, ramp connections and temporary bypasses are required if cross sections for these same areas are required.

CADD Standards

5. If a proposed surface has gaps in it, then the model should also reflect these gaps, Example, a widening project has shoulders added to both sides of the road but the center is unchanged. The proposed surfaces should not cross over unaffected areas. The follow are ways to create the applicable gaps.
 - a. Rename the points and alternate surfaces to simplify the creation of a separate base surface. Example the base surface on the left side of the road could use “B1” points, alternate surfaces and graphical filters. The base surface on the right side of the road could use “B2” points, alternate surfaces and graphical filters.
 - b. Separate corridors could be used to segregate the left and right side of road. Surface that need to be merged could be done as a separate step.
 - c. Terrains can manually be created from the applicable proposed break lines and boundaries.

6. Break line and boundary prefixes must match the related surface. Example, a “B1” break line must belong to a “B1” terrain, the “B1” break line shouldn’t be used in a “B2” terrain even if the terrain is correct. Rename template points to avoid mismatched prefixes. Matching prefixes are required for the standard graphical filters for terrains. Matching prefixes also simplifies model review.

CADD Standards

5.7 Template Drop Interval and Design Stages

April 2023

The maximum template drop interval for NDDOT projects is 25'. However, this drop interval may not provide enough detail for some corridor references such as intersections and approaches. Shorter distances are recommended for better accuracy.

Short corridor references also require a shorter template drop interval. All components must start with a template and end with a template. Components reflected with just one template will not be drawn correctly when cut into cross sections. Example: if there is only one template (drop) for a driveway, it may appear in the dynamic cross section but it won't appear in the cross section for sheets.

Processing requirements (time) increase as the template drop interval is shortened. Designers need to balance the requirements for accuracy with the time needed to process a corridor. A 5' template drop may seem like an easy way to promote accuracy, but it isn't usually feasible.

Consider the cross section sheet interval when selecting a template drop interval. If there isn't a template drop where there is a cross section for sheets, the sheet information will be interpolated. Example, an end condition tie point will be interpolated (close but not actually tying). If the template drop started at an even station with a 10' interval and the sheet interval started at an even station with a 25' interval, then the sheet sections at +25 and +75 would be interpolated. The interpolated section might be acceptable for a sliver grading inslope, but an interpolated section may be problematic for a bridge tie point. In this example adding a key station for the bridge tie point would be a simple solution.

A 25' template drop interval with the corridor design stage set to "Critical Sections" works for most mainline models. The template interval will be shortened as needed with this corridor design stage.

The corridor sections (actual template drops) are determined from a combination of settings including;

- Template Drop (Distance)
- Key Stations
- Template Drop Interval Multiplier
- Critical Sections

Two of these settings can be quickly changed for an entire corridor by changing the "Corridor Design Stage"; Template Drop Interval Multiplier and Critical Sections.

The "Conceptual" corridor design stage has the template drop interval multiplier of 2. This increased distance simplifies the corridor and process faster, but may overlook some necessary detail. This is the only NDDOT standard corridor design stage with a template drop interval multiplier other than 1.

CADD Standards

The NDDOT standard corridor design stages include critical sections in varying degrees. Design stages that use more critical sections settings general have a shorter template interval.

| Corridor Design Stage | Horizontal Cardinal Points | Vertical Cardinal Points | External Control Points | Densify Horizontal Curves | Densify Vertical Curves |
|-----------------------------------|----------------------------|--------------------------|-------------------------|---------------------------|-------------------------|
| 1 - Conceptual | no | no | no | no | no |
| 2 - Design – No Critical Sections | no | no | no | no | no |
| 3 - Design – Control Points | no | no | yes | no | no |
| 4 - Design – Critical Sections | yes | yes | yes | yes | yes |

When “Densify Horizontal Curves” is used, the NDDOT standards use a maximum chord height of 0.05’. The following are example curves and template spacing that accommodate this chord height.

| Degree of Curve | Template Drop Interval |
|-----------------|------------------------|
| 1 | 45’ |
| 2 | 30’ |
| 5 | 20’ |
| 10 | 15’ |
| 20 | 10’ |

When “Densify Vertical Curves” is used, the NDDOT standards use a maximum chord height of 0.05’. The following are example curves and template spacing that accommodate this chord height.

| Rate of Vertical Curve, K | Template Drop Interval |
|---------------------------|------------------------|
| 300 | 100 |
| 100 | 60 |
| 50 | 40 |
| 25 | 30 |

Most rural main line alignments meet a 0.05’ chord tolerance by using a 25’ template drop interval.

Projects that use an existing profile might have VPI’s (vertical points of inflection) that are very close together. The profile may cause numerous corridor sections if the “Vertical Cardinal Points” or “Densify Vertical Curves” critical sections are used with the design stages. Consider avoiding or manually overriding these options if your corridor uses an existing profile. Example, use the design stage “3 – Design – Control Points”.

CADD Standards

5.8 Super Elevation

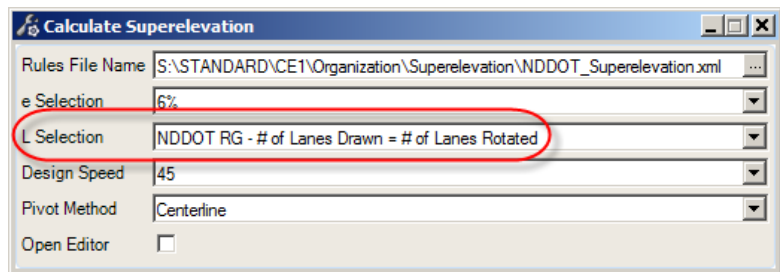
April 2022

The Superelevation tools are in the OpenRoads Modeling workflow, Corridors tab, and Superelevation group. There are 4 main steps in using superelevation.

1. Create sections
2. Create lanes
3. Calculate Superelevation
4. Assign Superelevation to corridor

The “Minimum Tangent Length” value is used to control where there are breaks in sections (multiple sections for one alignment). Separate sections are typically used when different parts of a corridor are designed for different speeds. Use a large “Minimum Tangent Length” such as 10000’ if separate sections are not desired. Use a small value if separate sections are desired.

The NDDOT uses the “NDDOT_Superelevation.xml” Rules file. This rule file only uses modified 6% tables and modified relative gradients. The NDDOT version contains only 6% tables and is incremented at 0.1% instead of 0.2%.



There are 3 choices for transition method (L Selection):

1. NDDOT relative gradient where the number of lanes drawn equals the number of lanes rotated
2. NDDOT relative gradient where the 2 lanes drawn equals 1.5 lanes rotated
3. NDDOT relative gradient where the 3 lanes drawn equals 2.5 lanes rotated

Most sections will use the first option. The second and third options have been setup for half lane conditions. The NDDOT CADD standards have be setup so the half lane is a separate skinny lane, often 6 feet wide. For example a roadway with an eastbound lane, westbound lane and a center turn lane would actually be draw with 4 total lanes;

- 18’ to -6’
- 6’ to 0’ Centerline
- 0’ to 6’
- 6’ to 18’

In this example, option 2 should be used (...2 lanes draw equals 1.5 lanes rotated).

Caution, the lane width is used in runoff and runout calculations. Users may want to use 12 feet for a lane width even if the actual lane width is different in order to maintain standard transitions.

CADD Standards

The NDDOT uses a table based on table 3-9 of “A Policy on Geometric Design of Highways and Streets” (Green Book), 2018 to calculate super elevation. The 6% e max table is used for most highway designs. Intermediate values for every tenth of a percent have been interpolated into this table.

Super elevation runoff and tangent runout are based on a “relative gradient”. The NDDOT uses relative gradient values that are flatter than the 2018 Green Book (second to last paragraph of page 3-62). The table on the right shows desired relative gradients used by the NDDOT.

The Maximum Relative Gradients shown in the table are from the 2011 Green Book (table 3-15). The NDDOT Relative Gradient is 83.3% of the “Maximum Relative Gradient”. The NDDOT relative gradient results in runoff and runout lengths that are 120 % of the minimum lengths (120 % = 1 / 83.3%).

These values are the same values used prior to the 2018 Green book.

| Design Speed | Maximum Relative Gradient (%) | NDDOT Relative Gradient (%) | Equivalent Relative Slope |
|---------------------|--------------------------------------|------------------------------------|----------------------------------|
| 15 | 0.78 | 0.650 | 1:153.85 |
| 20 | 0.74 | 0.617 | 1:162.07 |
| 25 | 0.70 | 0.583 | 1:171.53 |
| 30 | 0.66 | 0.550 | 1:181.82 |
| 35 | 0.62 | 0.517 | 1:193.42 |
| 40 | 0.58 | 0.483 | 1:207.04 |
| 45 | 0.54 | 0.450 | 1:222.22 |
| 50 | 0.50 | 0.417 | 1:239.81 |
| 55 | 0.47 | 0.392 | 1:255.10 |
| 60 | 0.45 | 0.375 | 1:266.67 |
| 65 | 0.43 | 0.358 | 1:279.33 |
| 70 | 0.40 | 0.333 | 1:300.30 |
| 75 | 0.38 | 0.317 | 1:315.46 |
| 80 | 0.35 | 0.292 | 1:342.47 |

For non-spiral curve combinations, 1/3 of the runoff is placed on the curve and 2/3 of the runoff is placed on the tangent. For spiral curve combinations, all of the super elevation runoff is usually placed on the spiral. Often, the super elevation runoff used in spiral curve combinations is changed to match the spiral length. Tangent runout should be directly proportional to runoff. On very long spirals, the tangent runout can be placed on the spiral if the maximum relative gradient is not exceeded.

CADD Standards

Simple Curve Example

Given

PI = 1409+95.59
PC = 1403+11.54
PT = 1416+73.20
Delta = 13d 37m 0s left
R = 5729.58
V = 75 mph

Solution

$e = 3.8\%$ interpolated from 6% max table
(Preferences are set to use "Radius Interpolation" as "Conservative Entry")
(5560' = 3.8%, 5745' = 3.7%, 5729.58' => 3.8%)

NDDOT Relative Gradient (from table) = 0.317%

Runoff on high side = $e * \text{width of traffic lane} / \text{relative gradient}$
Runoff on high side = $3.8\% * 12' / 0.317\% = 143.84' \Rightarrow 144'$
(Preferences have been set to round runoff to the even foot.)

Runoff on low side is proportional to runoff on high side.
Runoff on low side = $(e - \text{normal crown}) / e * \text{Runoff on high side}$
Runoff on low side = $(3.8 - 2.1) / 3.8 * 144.0' = 64.42'$

Runout is proportional to runoff on high side.
Runout = $\text{normal crown} / e * \text{Runoff on high side}$
Runout = $2.1\% / 3.8\% * 144.0' = 79.58'$

Begin e on right side (high side) = $PC - 2/3 * \text{Runoff} - \text{Runout} = \text{sta } 1401+35.96$
Begin full e = $PC + 1/3 * \text{Runoff} = \text{sta } 1403+59.54$
End full e = $PT - 1/3 * \text{Runoff} = \text{sta } 1416+25.20$
End e on right side (high side) = $PT + 2/3 * \text{Runoff} + \text{Runout} = \text{sta } 1418+48.78$

Begin e on left side (low side) = $\text{Begin full e} - (\text{Runoff on low side}) = \text{sta } 1402+95.12$
End e on left side (low side) = $\text{End full e} + (\text{Runoff on low side}) = \text{sta } 1416+89.62$

CADD Standards

5.9 Linear Features Represented as Cells in Cross Sections

Feb 2023

OpenRoads cross sections show information from a 3D model. Some of the 3D information is drawn as linear elements. Most linear elements when cut into cross sections show up as a point. Standards have been setup to replace this point symbolization with a cell in the cross section view. These cells usually have a label and are much more identifiable. Additional work may be required to display features in cross sections.

Additional drawing versions are usually required for OpenRoads Cross Sections. The most common drawings needed include;

- XSG_Guardrail.dgn
- XSG_RW_Bndry.dgn
- XSG_Utility_Cells_as_Lines.dgn
- XSG_Utility_Crossing.dgn
- XSG_Utility_Linear.dgn
- XSG_Wetland.dgn

These drawings contain civil feature elements that can be referenced into the cross sections. The civil features have Plan (2D), 3D, Profile and Cross Section components.

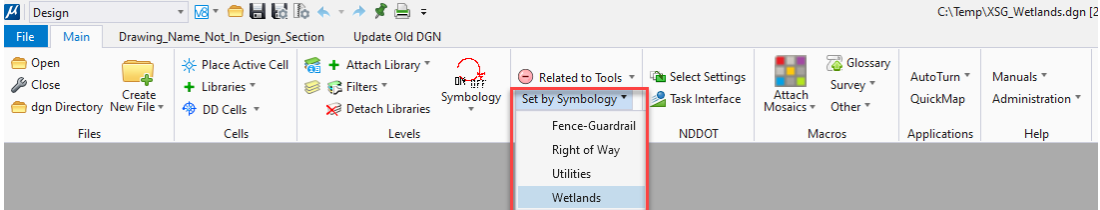
XSG drawings require linear geometry features with both 2D and 3D components. Simple lines and line strings (non-features) will not work.

The following is a general overview of creating an XSG drawing. Additional notes for specific XSG drawings are provided in [Appendix Q](#) – Drawing Production Guidance.

1. Create a XSG drawing from a 2D seed drawing. Linear Geometry uses a 2D model. It is usually easier to let the civil geometry tools create the 3D model from the 2D model.
2. Import graphics. Simple lines and line strings (non-features) can be referenced and copied. Copy only the elements to be converted to features. You probably don't need to copy elements like text and dimensions.
 - a. MicroStation shape elements will not work as linear features. The shape surface will display in the cross section view instead of the desired cross section feature. MicroStation shape elements will need to be dropped down to simple lines and line strings for this conversion process.

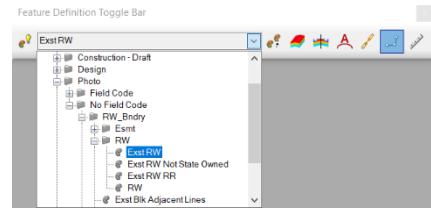
CADD Standards

3. Set features and drape them to the existing ground terrain.
 - a. The “Set by Symbology” macro can be used to set feature definitions to multiple lines and line strings in the drawing. See *section 2.9* of the CADD Standards for a description of this macro.

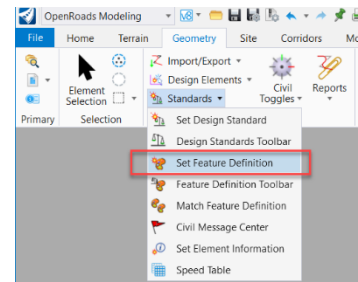


- b. Alternately, feature definitions could be set manually.
 - i. Select all drawing elements that you want to convert to a specific type of feature. Each feature type will be processed separately, one at a time. Example, New RW will be processed separately from Existing RW lines.

- ii. Select the appropriate Feature Definition.



- iii. Set the feature definition. The “Set Feature Definition” tool is located in the OpenRoads Modeling (workflow) > Geometry (tab) > General Tools (panel).



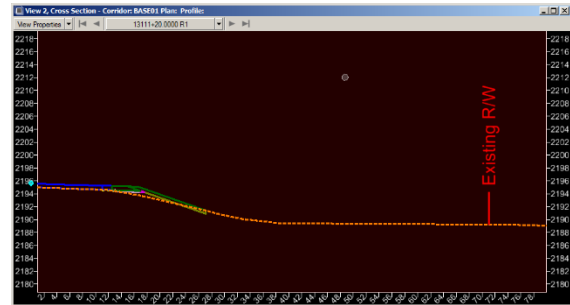
- c. Reference in the existing ground terrain. If available, use a terrain that covers the same areas as the elements that you are converting to features. If you don't have coverage or if a void is overlapped, features may be missed in your cross sections. Reference in the terrain model and then make this terrain your active terrain model. A Default-3D model should have automatically been created by setting your active terrain.



CADD Standards

- d. Use the “Profile from Surface” tool to create both a profile element and 3D Linear Element. This tool is located in the OpenRoads Modeling (workflow) > Geometry (tab) > Vertical (panel). **Note the “Quick Profile from Surface” tool doesn’t create the needed 3D Linear Element.**
 - e. Switch to the Default-3D model. You should see the 3D Linear elements.
4. Reference XSG drawings into models used for cross sections and use annotation groups to display cell representations in cross sections.

- a. When Dynamic cross sections are viewed, the features should appear with the NDDOT CADD standards as a feature cell (example, Existing R/W). Note the scale of the 3D reference XSG model affects the scale of the label in the Dynamic cross section.



Note Defect 1042141 - Dynamic Cross Section elements from linear features with cross section symbology don't display when the dynamic cross section is created from an alignment. These elements will display if the dynamic cross section is created from a corridor.

- b. Display of linear feature in the sheet models for cross sections is not automatic. The linear features need to be displayed with an annotation group. See section 5.10 of the CADD Standards manual for information on “Drawing Model Annotation”.

3D solids can also be reference directly into the model and cut into cross sections. These 3D solids don’t need to be featurized. Note, some surfaces don’t cut into cross sections. Solids, terrains and meshes work better.

The drawing DS_Util.dgn should contain a 3D representation of drainage pipe and structures. (See also [Appendix Q](#) – Drawing Production Guidance – DS_Util)

CADD Standards

5.10 Cross Section Annotation Groups

April 2022

Cross sections sheets should be labeled. Several Annotation Groups have been set up for labeling. Annotation Groups automate many labeling tasks.

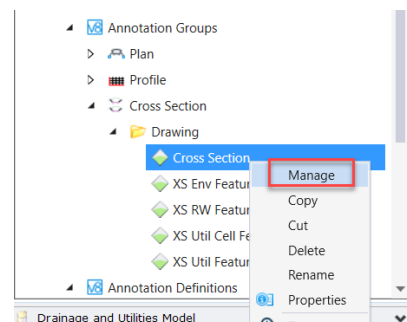
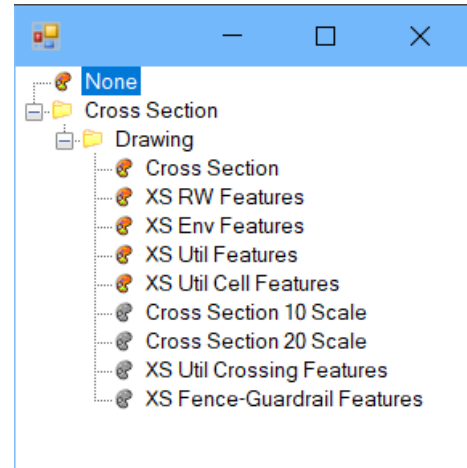
The “Cross Section * Scale” annotation groups are applied when sheets are created. The other annotation groups are applied separately. Use the “**Drawing Model Annotation**” tool to apply the annotation groups (OpenRoads Modeling (workflow) > Drawing Production (tab) > Annotations (panel)). Remember this tool works in the Drawing models and not the Sheet models.

The Drawing Model Annotation usually needs to run multiple times for all the different Annotation Groups.

The default “Cross Section * Scale” annotation groups may need to be edited for your specific templates. The standard Annotation Definitions will most likely work but the specific points labeled may need to be edited. The default groups use (on_top) and (on_bottom) location placement. However, this typically labels too many points that cause overlaps making labels difficult to read.

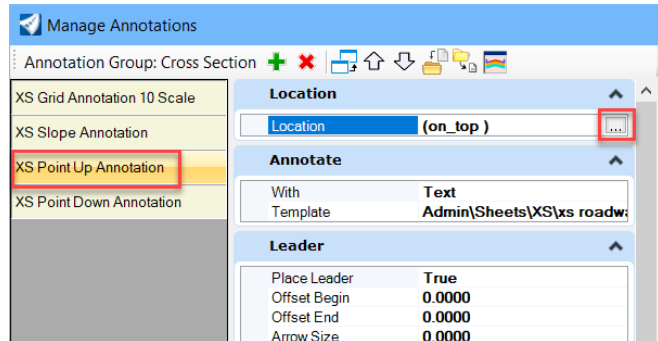
When an Annotation Group is first used, the Group and its Definitions are copied from the standards dgnlib and placed in the active drawing. The local version of the Annotation Group can be edited independent of the CADD standard. **Note the local Annotation Group can not be edited from a Drawing or Sheet Model.** The local Annotation Group is edited from a Design model.

From Project Explorer right click on the local Annotation Group to be edited. Select manage from the popup menu.

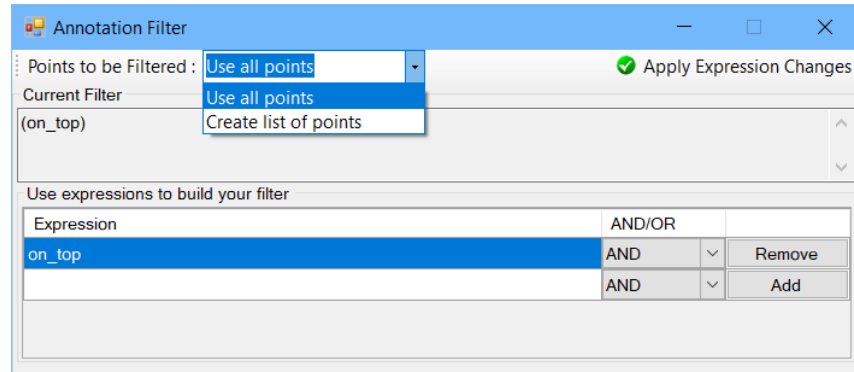


CADD Standards

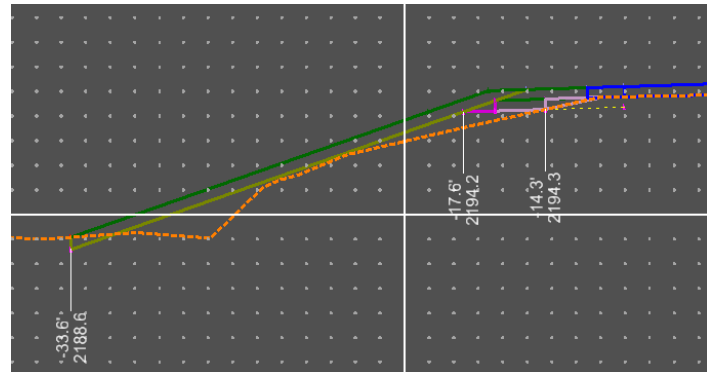
The “Location” placement for “XS Point Up Annotation” and “XS Point Down Annotation” may need to be adjusted. Select the applicable Annotation Group. Click in the Location field and then click on the ellipses.



Use the Annotation Filter to select the points to be labeled (important break points). The Annotation Filter dialog can be used to filter points from a list (“Create list of Points”) or “Use all Points”. Boolean expressions can also be created to fine tune your filter.

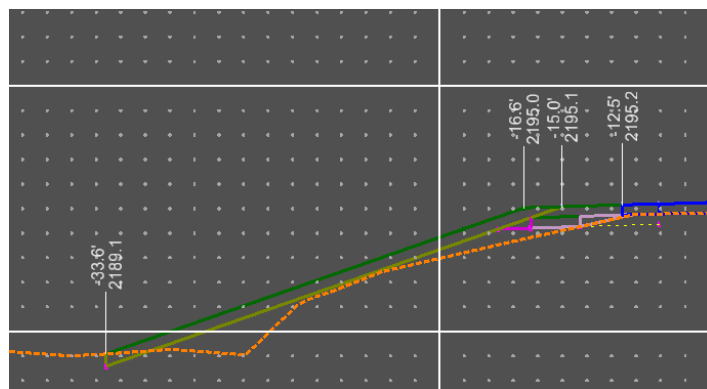


The “XS Point Down Annotation” is intended to be used for dirt grade points.



The “XS Point Up Annotation” is intended to be used only for surface (top) points.

Top of base points are not typically labeled because sheet space is limited. End users may need to deduce base point elevations from the top of pavement elevation, dirt grade elevations and typical sections.



CADD Standards

5.11 Earthwork

April 2023

Unsuitable Materials

Removed materials such as pavement removals and existing topsoil need to be modeled in order to accurately calculate earthwork. See **Section 5.5** Corridor Modeling Templates – “Components and Volume Options” for a discussion on unsuitable and modeling considerations.

Create Cut Fill Volumes

The “Create Cut Fill Volumes” tool is used to draw volumes for earthwork calculation. The tool is in the OpenRoads Modeling (workflow) > Home (tab) > Modeling Analysis and Reporting (panel).

NDDOT standards include 2 feature definitions for cut (Volumes_Cut, Volumes_Cut_Alt). The Alt version can be used to segregate volume such as wetland excavation versus roadway excavation. Both definitions use a cut factor of 1.

NDDOT standards include 5 feature definitions for fill (Volumes_Fill, ...Fill_Alt, ...Fill_020, ...Fill_025, ...Fill_030). The Alt version can be used to segregate volumes such as bridge surcharge versus roadway excavations. The ...Fill_020, ...Fill_025, and ...Fill_030 versions use the respective Fill Factors of 1.2, 1.25, and 1.3. The feature definitions with adjusted fill factors may not need to be used if calculations are adjusted outside of the ORD application. In some cases, it may be easier to make all adjustments within an Excel spreadsheet.

Calculation Methods

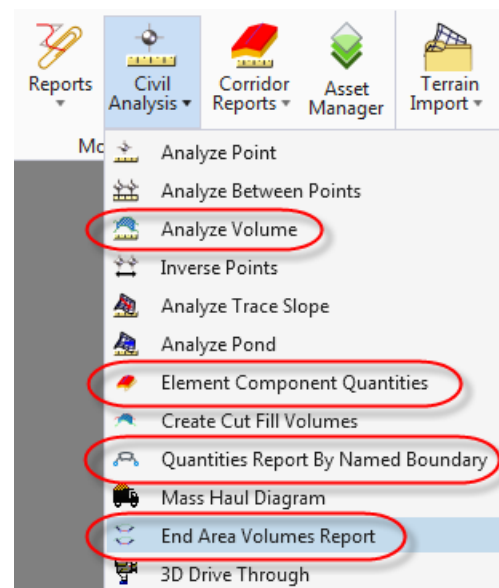
There are 4 main methods to Calculate Earthwork:

1. Analyze Volume
2. Element Component Quantities
3. Quantities Report By Named Boundary
4. End are Volumes Report

“Analyze Volume” is for basic terrain to terrain or terrain to elevation calculations.

“Element Component Quantities” can provide a summary of component quantities for a corridor, but it provides no details by station range.

“Quantities Report By Named Boundary” uses plan view boundaries to clip component quantities. Drawn Cut-Fill Volumes are required for earthwork Calculation. Quantities by an interval can be provided by this tool but no end area quantities are provided.



CADD Standards

The “End Area Volumes Report” tool is based off cross section sheets. The cross-section sheet boundaries are needed to use this tool.

Earthwork Tables

Earthwork tables shall be created for all projects that calculate volumes. The earthwork table that shows volumes by station is no longer included in the plans. However the earthwork “summary” table is still included in the plans.

The earthwork table that show volumes by station are stored in an excel spreadsheet that shall be made available as supplemental design data.

Embankment above Subgrade

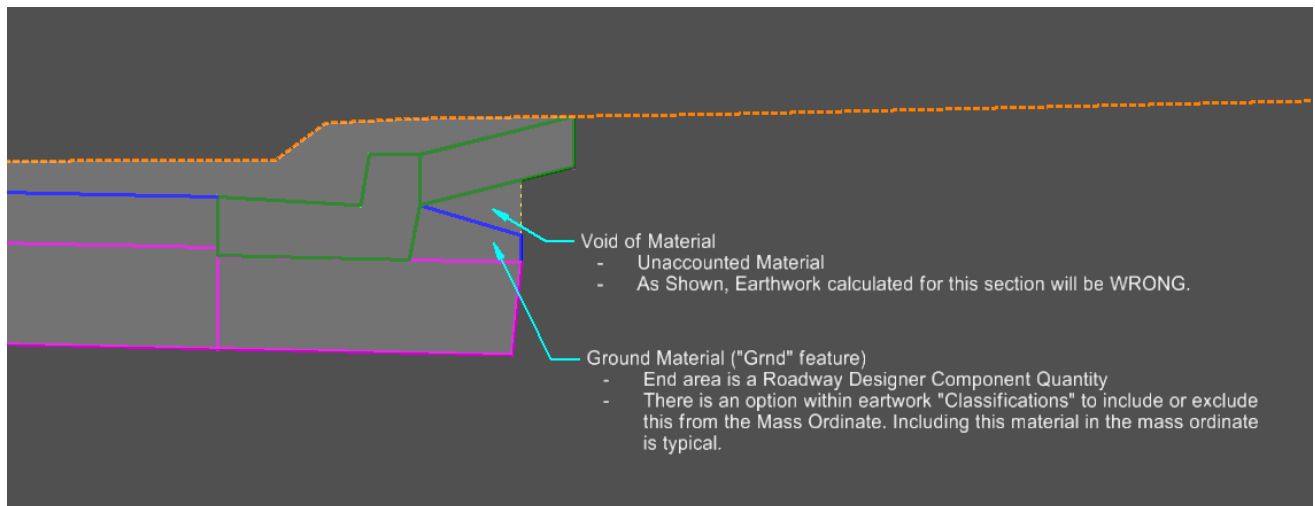
Cross sections that use a closed shape component (from template) to account for embankment are sections that have “Embankment above Subgrade”. This material is usually handled twice. It is placed after the subgrade has been established.

The feature definitions “Grnd A” and “Grnd B” have their volume options set to “Design” not “Fill”. Volume Options set to Design are not automatically included in the mass ordinate. These features are intended to be tracked separately and used in calculations outside of the ORD application. They are usually incorporated into Excel spreadsheet calculations.

All projects that have embankment above subgrade shall include a note with the summary of earthwork that explains special handling requirements such as double handing or separate construction operations. Indicate whether the mass ordinate includes or excludes embankment above subgrade. Including embankment above subgrade usually simplifies the mass diagram. State that this work is paid as --- and there is no other compensation.

Unintentional Earthwork Voids

With OpenRoads earthwork, it is possible to unintentionally design voids between Roadway Designer Components. A void can be created when material needs to be removed for constructability and it isn't replaced by another material.



CADD Standards

5.12 Earthwork Reports

April 2022

The NDDOT has a customs earthwork reports. The default earthwork reports are under the “NDDOT” Folder. The NDDOT reports are in the “NDDOT” folder near the bottom of the list.

EndAreaVolume-NDDOT.xml

This custom report addresses multiple types of Excavation and Embankment. An Alternate excavation feature definition can be used to keep track of two separate excavation work items. This report also addresses feature definitions with different compaction factors. All of the different excavation and embankment feature are included in the mass ordinate.

Roadway component quantities usually don’t address all quantities needed for the project. This report excludes quantities from civil cells and other manual calculations. In order to avoid confusion and misunderstandings, only the “EndAreaVolume-NDDOT” report (without added roadway components) should be distributed with the supplemental design data.

VolumesOnly- NDDOT.xml

This report is includes common roadway component volumes. It does not include end areas. This report is intended to be run from the “Quantities Report by Named Boundaries”.

Saving Reports

Earthwork Reports should be saved in both the xml and xlsx formats. Within the “Bentley Civil Report Browser” dialog box, select File > Save As. Then change the “Save as type” option to xml File. The final posted report should be named “**Earthwork_Volumes*.xml**”

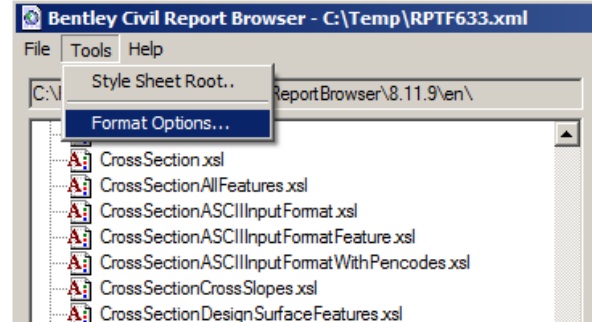
A file name suffix can be used to describe multiple reports. Repeat this workflow a second time while using the “Save as type” option of html and name of “**Earthwork_Volumes*.xlsx**”

CADD Standards

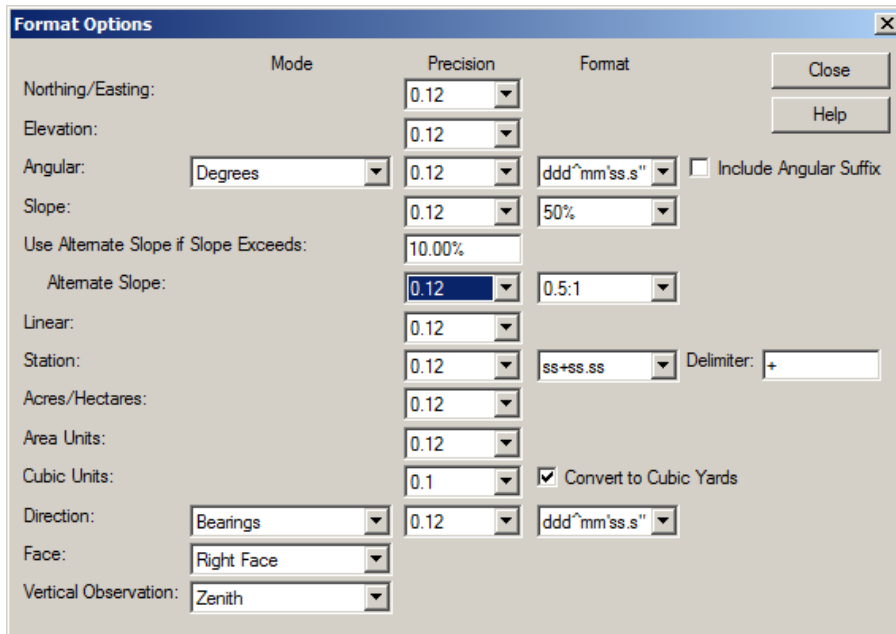
5.13 Bentley Civil Report Browser

April 2022

Bentley Civil Report Browser is used to generate many different types of OpenRoads Reports. This includes alignment and earthwork reports. Users may need to adjust measurement format setting for these reports. This can be done within the Bentley Civil Report Browser by selecting “Tools > Format Options”.



The settings shown are some common formats for the NDDOT.



Presently the only custom reports for the NDDOT pertains to Earthwork Quantities. Users may need to cut data from the default Bentley reports and reformat data for other plan production tables.

CADD Standards

5.14 Mass Diagrams

April 2022

A mass diagram shall be included in the plans for most rural grading, sliver grading and widening projects. A mass diagram is not needed if any of the following conditions apply:

- Urban projects - The earthwork hauling on urban project is largely controlled by project phasing and traffic control.
- Projects that are shorter than ½ mile, require no excavation, use only one borrow source and have a single balance in the mass diagram - These short projects may include independent turn lane projects, intersection improvements and small grade raises.

Calculate and document the “average haul for project” on all required mass diagrams.

The NDDOT uses 2 different ways to draw Mass diagrams, ORD default tools and Mass Diagram by Profile.

The ORD default tools have a couple of deficiencies.

1. All volumes must be modeled including borrow, waste and miscellaneous additions. Earthwork from a borrow or waste site cannot be added without a graphic volume. These volumes must be manually drawn as needed or the mass diagram must be manually edited.
2. Creating a mass diagram from multiple earthwork runs is not automated. Example, if earthwork is calculated from multiple earthwork – named boundaries, multiple mass diagrams can be drawn but they will need to be manually merged and edited with basic drawing tool.

Drawing Mass Diagrams with Profile tools is more involved, but it has a couple advantages.

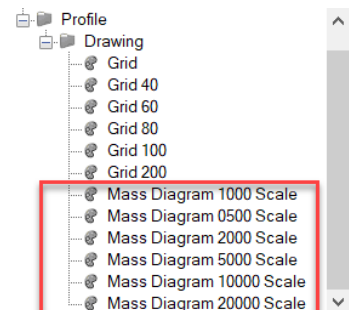
1. Calculations from ORD can be edited in Excel before being drawn. This allows for merging multiple earthwork reports, handling compaction factors outside of ORD, and volume edits independent of graphics.
2. Profile text favorites can be used to label critical mass ordinates needed in average haul for the project calculations.

ORD Mass Diagram Default Tools

The Mass Haul Diagram tool is in the OpenRoads Modeling (workflow) > Home (tab) > Model Analysis and Reporting (panel).

Multiple annotation groups for mass diagrams are included in the NDDOT CADD Standards. Incorporating the mass diagram on one sheet is desired. Use a scale that will allow project length to be printed on one sheet. Example a project length of 6000’ at 500 scale will be 12 inches long at paper scale ($6000/500 = 12$).

Modest adjustments to the mass diagram drawing scale can easily be



CADD Standards

made. If too big of an adjustment is made, the text in the **axis** will overlap or be sparsely labeled.

The Vertical Exaggeration is project dependent. Use an exaggeration factor small enough so that the largest and smallest project mass ordinated fit on a single sheet. Remember to use the exaggeration factor in haul calculations.

Mass Diagram by Profile

An Excell spreadsheet can be used to calculate mass ordinates and profile tools can be used to draw a mass diagram. The entire process for drawing a mass diagram from a spreadsheet will not be covered in this document. Only a few key points will be discussed.

Recalculating volumes in Excel may require converting station values to numbers. Example, convert the text string “14983+00.00 R1” to a number using the formula.

`=VALUE(SUBSTITUTE(LEFT(A1,LEN(A1)-3),"+",""))`

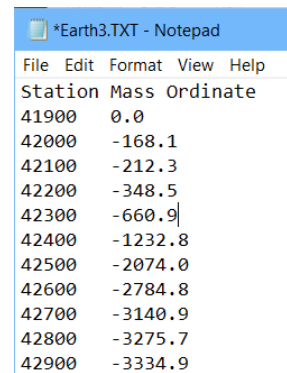
- A1 is the excel cell for the station as text.
- The blue part of the formula trims off the right 3 characters “ R1”, removing the region information.
- The red part of the formula removes the “+” character. The purple part of the formula change the text to a number.

Showing a number value in the stationing format may be desired. Use custom excel formatting to show numbers as stationing (Examples; ##+##0, ##+##0.00)

A txt file with Station and mass ordinates is used to be imported as a profile.

Do not include the mass diagram in the same drawing as the actual profiles. Copy the applicable DS_Align drawing, rename it to 0011DT_*. The profile reference and setting can then be cleaned and edited without affecting the main profile drawings.

Use the “Import Vertical Geometry from ASCII File” tool to import the profile. This tool is in the OpenRoads Modeling (workflow) > Geometry (tab) > General Tools (panel).



| Station | Mass Ordinate |
|---------|---------------|
| 41900 | 0.0 |
| 42000 | -168.1 |
| 42100 | -212.3 |
| 42200 | -348.5 |
| 42300 | -660.9 |
| 42400 | -1232.8 |
| 42500 | -2074.0 |
| 42600 | -2784.8 |
| 42700 | -3140.9 |
| 42800 | -3275.7 |
| 42900 | -3334.9 |

Manually create a profile drawing (mass diagram). Use an applicable annotation group as discussed in the default mass diagram tool workflow. The profile drawing and scale should be set up so that the diagram will fit on one sheet.

Haul Calculations

Measure haul, calculate excavation hauled and average haul distance for the project. Labeling average haul for each balance is not recommended.

CADD Standards

1. Calculate and label the Haul for each balance.
 - a. The haul for each balance is the adjusted area between the mass diagram and the neutral axis.
 - b. $\text{Haul} = \text{Adjusted Area} = \text{MicroStation Area} / (\text{exaggeration factor})$**
 - c. The “Adjusted Area” from the mass diagram is in the measurement “CY*Ft”. Haul is usually noted in “CY*Sta” or “CY*Mile”. Convert the measurement as necessary (divide by 100 or 5280 respectively).

2. Calculate and label the “Excavation Hauled” for each balance. The “Excavation Hauled” for each balance is the sum of all upward movement in the mass diagram.
 - a. Excavation Hauled within the balance =**
Sum Mass Ordinates of all peaks or highs within the balance
- (minus)
Sum Mass Ordinates of all valleys or lows within the balance

3. (Optional) Calculate and label the “Average Haul Distance for the Balance”.
 - a. Average Haul Distance for the Balance =**
Haul for the Balance
/ (divide)
Excavation Hauled within the balance

4. Calculate and label the “Haul for the Project”. This is the sum of haul for all balances or the sum of adjusted area between the mass diagram and the neutral axis.

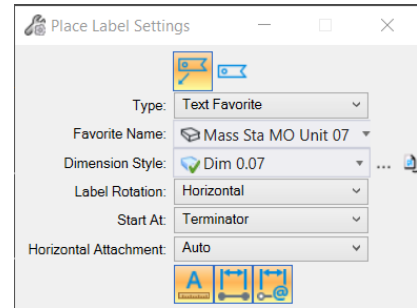
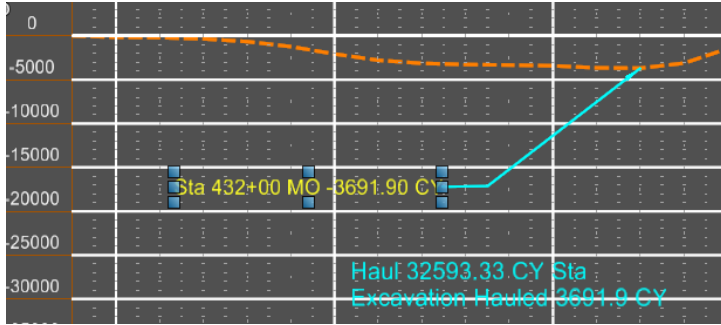
5. Calculate and label the “Excavation Hauled for the Project”. This is the sum of Excavation Hauled for all balances.

6. Calculate and label the “Average Haul Distance for the Project”.
 - a. Average Haul Distance for the Project =**
Haul for the Project
/ (divide)
Excavation Hauled within the Project

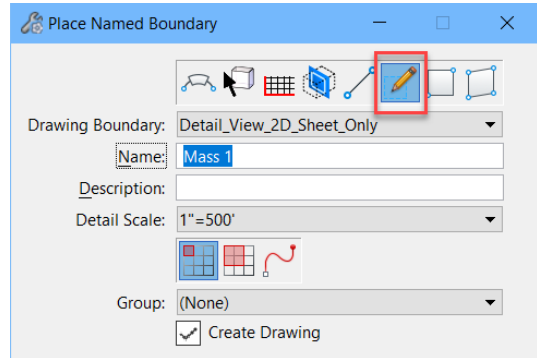
CADD Standards

Annotate Mass Diagram

Annotate mass diagram with haul and key mass ordinates (excavation hauled). The NDDOT standards include at text favorite to label key mass ordinates.



A sheet model with the applicable sheet cell will need to be manually created. Using the Named Boundary tool by Drawing Boundary (Detail_View_2D_Sheet_Only) is a good way to make the sheet model.



CADD Standards

5.15 Sheets (Named Boundaries)

Aug 2022

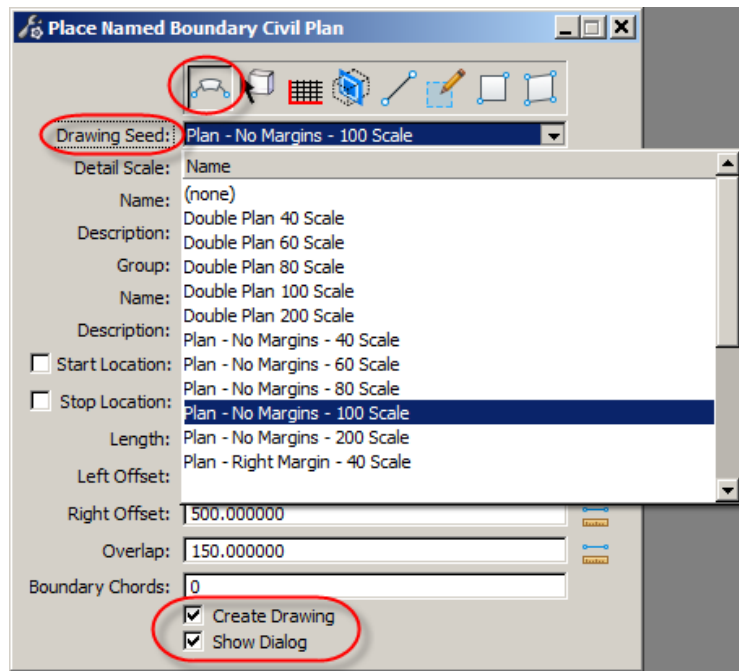
ORD Sheets are created with the Named Boundary tool found under the OpenRoads Drawing Production (workflow) >, Drawing Production (tab).

Plan sheets can be cut with or without an alignment. Plan and profile sheets require an alignment with a profile. Cross Sections require an alignment and a 3D model.

Creating sheets from an empty dgn that references other files is a recommended workflow that can help you manage files. Example, create a 060pp* drawing that is used as a pointer file.

Plan Only Sheets Using an Alignment

1. Create a dgn such as 090PL.dgn and reference in applicable dgn's for the sheets.
2. Access the Named Boundary Tool (OpenRoads Drawing Production > Drawing Production).
3. Set the type of boundary to "Civil Plan". Then pick an applicable Drawing Seed. Note plan and profile sheets are also included in "Civil Plan" boundaries, but these types of sheets will be discussed later in this chapter.
4. Selecting a "Drawing Seed" will adjust many of the Named Boundary settings such as:
 - Detail scale
 - Name
 - Group
 - Length
 - Offsets
 - Overlap
 - Boundary Cords



The first (top) "Name" in the dialog box is for the drawing model name. This can be changed if desired or left as the default. Make sure the "Create Drawing" and "Show Dialog" options are selected.

CADD Standards

5. Follow the prompts shown in the ORD (MicroStation) status bar (lower left).
 - Identify path element – Pick Horizontal Alignment
 - Identify path start point to place boundary - Start location
 - Identify path end point to place boundary – Stop location
 - Data point in plan view to place boundary

The start and stop locations – stations could also be typed in the dialog box.

6. After the “Data point in plan view to place boundary” prompt is completed, the Create Drawing dialog box will open. The settings in this dialog have been setup with the CADD standards (sheet seeds settings). The “Add to Sheet Index” and “Open Model” optional settings that are sometimes adjusted. The other settings are usually left as is. Select the OK button to create sheets.

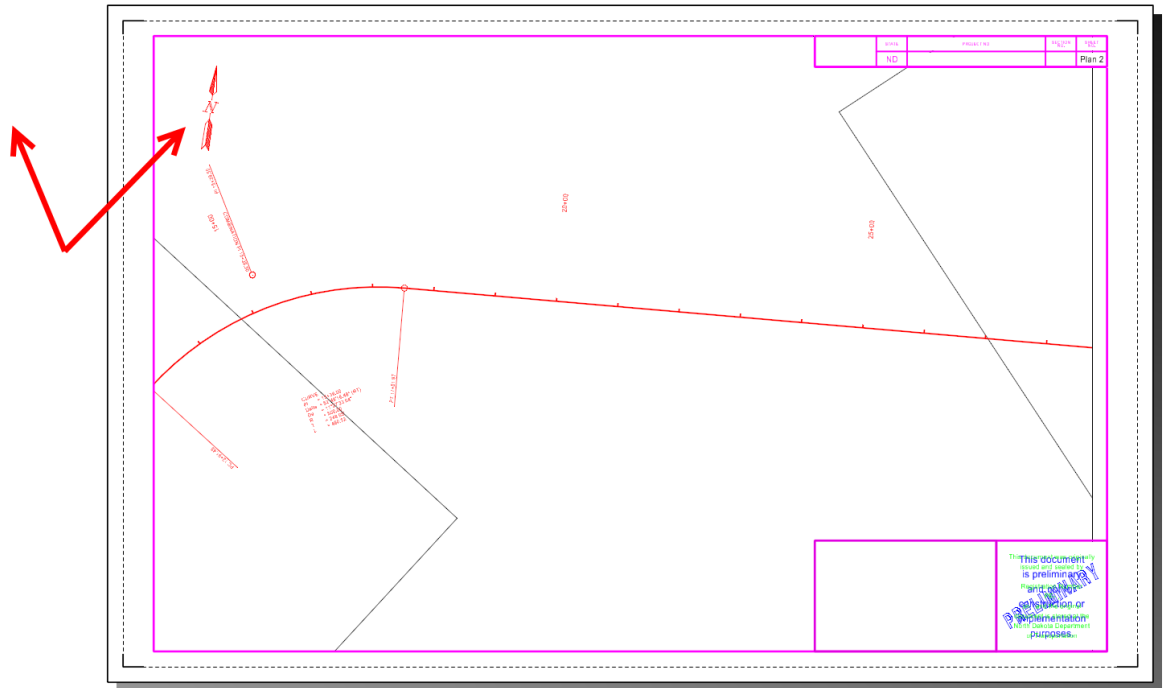
The screenshot shows the 'Create Drawing' dialog box with the following settings:

- Mode: Plan
- Name: Plan 1
- Drawing Seed: Plan - No Margins - 100 Scale
- View Type: Civil Plan
- Discipline: Civil
- Purpose: Plan View
- Drawing Model
 - Seed Model: Plan - No Margins - 100 Scale.dgnlib, Pl
 - Filename: (Active File)
 - Scale: 1"=100'
 - Annotation Group: Plan Full Annotation
- Sheet Model
 - Seed Model: Plan - No Margins - 100 Scale.dgnlib, Pl
 - Filename: (Active File)
 - Sheets: (New)
 - Scale: 1"=100'
 - Drawing Boundary: Plan - No Margins - 100 Scale
 - Detail Scale: 1"=100'
- Options:
 - Add To Sheet Index
 - Make Sheet Coincident
 - Open Model

Buttons: OK, Cancel

CADD Standards

- The north arrow is placed using an offset from the alignment. The NDDOT CADD standards intended to place the north arrow in the upper left corner of the sheet. On tight curves, the north arrow will need to be manually moved. The north arrow has been placed in the drawing model. Move the arrow in the drawing model if it falls outside of the sheet boundary.



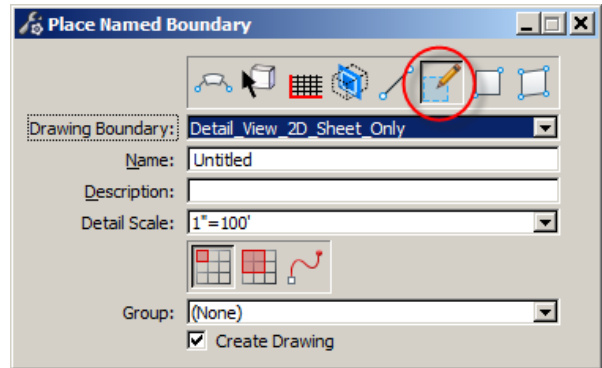
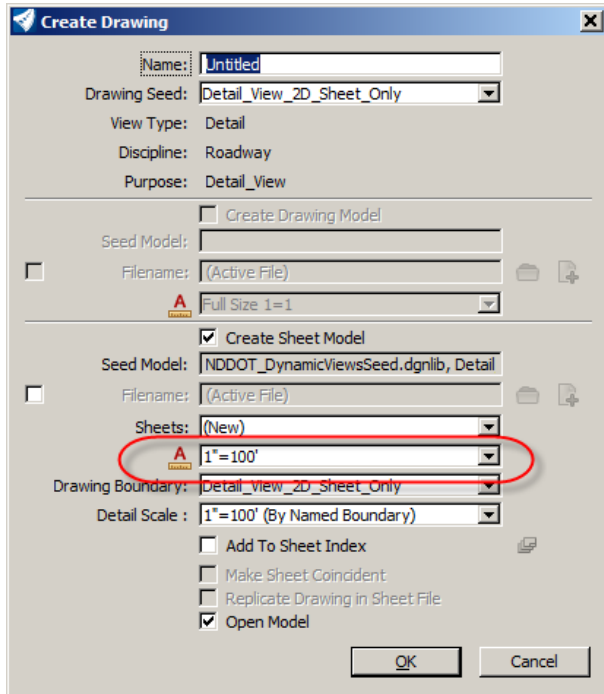
Note that in areas where the sheets are cut from curved alignments, there will be a gap on the right side of the sheet because a literal length is used to stop the boundary.

- Note, the named boundaries used for the sheets are on a dedicated level that is in the construction class. NDDOT pen tables will turn off construction class elements for printing.

CADD Standards

Plan Only Sheets Placed without an Alignment

1. Create a dgn such as 120MK*.dgn and reference in applicable dgn's for the sheets.
2. Access the Named Boundary Tool (OpenRoads Drawing Production > Drawing Production).
3. Rotate the view as desired for the sheet.
4. Set the type of boundary to "From Drawing Boundary". Then pick an applicable Drawing Boundary. Note the "...Sheet_Only" Drawing Boundaries do not use an intermediate "Drawing" model.
5. The "Name" can be changed to name the drawing or sheet model. The scale should be adjusted as needed. Turn on the "Create Drawing" option.



6. Place the boundary with your cursor. Then the Create Drawing dialog box will open. Adjust the sheet annotation scale to match the Detail Scale used for the Drawing Boundary. See the "Sheet Index" section of this document for information about the "Add to Sheet Index" option. Click OK to create the sheet.

CADD Standards

Plan and Profile Sheets

1. Create a dgn such as 060PP.dgn and reference in applicable dgn's for the sheets.
2. At least 2 view windows need to be open, one for the plan view including the alignment and another view for the profile. See the ViewSet Macro section of this manual for related helpful tools.
3. Access the Named Boundary Tool (OpenRoads Drawing Production > Drawing Production).

4. Set the type of boundary to “Civil Plan”. Then pick an applicable Drawing Seed.
5. Selecting a “Drawing Seed” will adjust many of the Named Boundary settings such as:

- Detail scale
- Name
- Group
- Length
- Offsets
- Overlap
- Boundary Cords

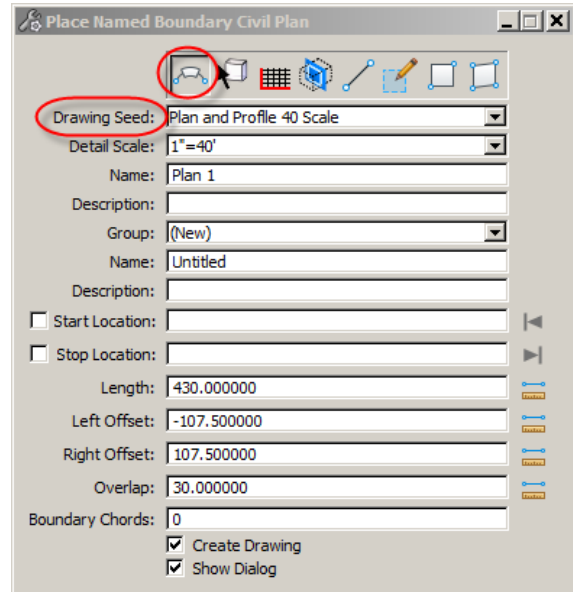
6. The first (top) “Name” in the dialog box is for the drawing model name. This can be changed if desired or left as the default.

The second “Name” is for the Named Boundaries. Renaming the Boundary group can help you manage multiple groups of sheets in one dgn. The “Create Drawing” and “Show Dialog” options **do NOT need to be selected**.

7. Follow the prompts shown in the ORD (MicroStation) status bar (lower left).
 - Identify path element – Pick Horizontal Alignment
 - Identify path start point to place boundary - Start location
 - Identify path end point to place boundary – Stop location
 - Data point in plan view to place boundary

The start and stop locations – stations could also be typed in the dialog box.

8. If you left the Create Drawing and Show Dialog setting turned on, the Create Drawing dialog will open. This dialog is not needed at this time. Cancel the dialog. At this point just the Named Boundaries have been placed, no additional models have been created.



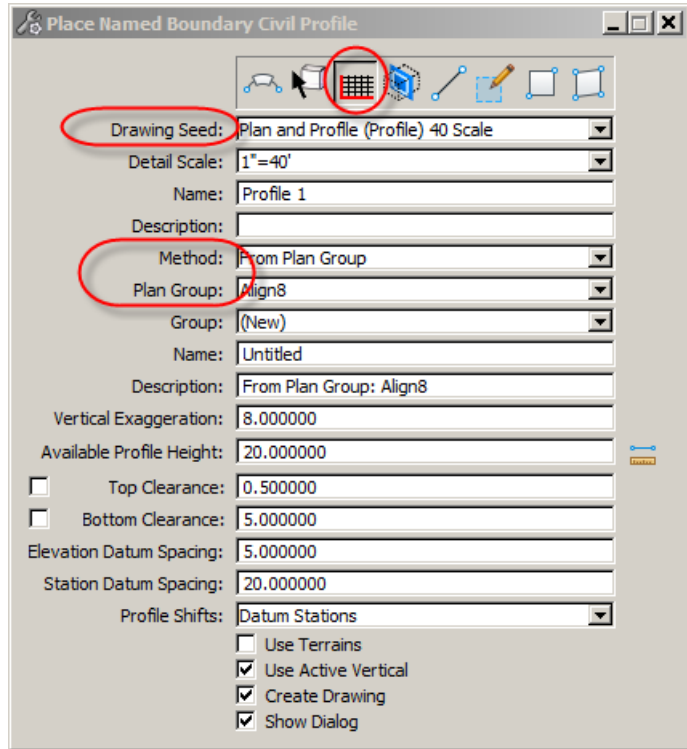
CADD Standards

9. Access the Named Boundary Tool a second time. This time set the type of boundary to “Civil Profile” and set the Drawing Seed to the applicable scale that matches the seed used for the “Civil Plan” view.

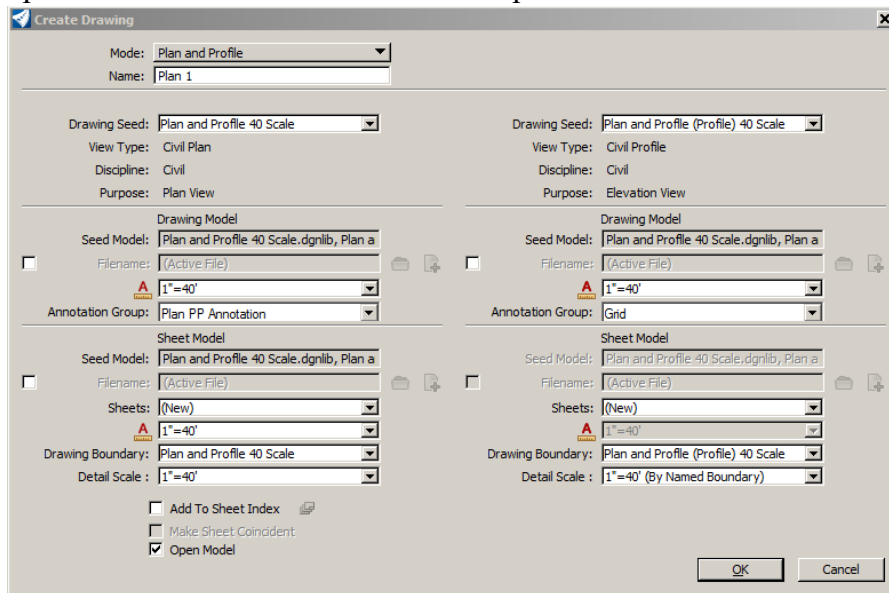
10. Many of the settings will be populated from the Drawing Seed. Set the Method to “From Plan Group” and select the Plan Group from the drop-down list.

11. Follow the prompts shown in the ORD (MicroStation) status bar (lower left).

- Identify profile view
- Data Point in profile view to place boundary
- Data Point in the profile view a third time to accept boundaries.



12. The Create Drawing Dialog box should open. Again, most of these settings will be correctly set by the previously selected sheet Seed. The “Add to Sheet Index” is an option to consider. See Sheet Index chapter. Click the OK button to create the sheets.



13. Once the plan and profile sheets are created, additional manual adjustments will be required similar to step 7 for “Plan Only Sheets Using an Alignment” instructions.

CADD Standards

Cross Sections Sheets

Cross Sections Interval

The following are recommended minimums cross section sheet intervals. These intervals are not the same as Template Drop intervals. Neither are these standards a construction field staking standard.

Recommended Minimums

- Rural projects should use an interval of 100' and 50' within super elevated curves and spirals.
- Urban (curb and gutter) projects should use an interval of 25'.
- Extra cross sections should be added for all centerline pipe.
- Extra cross sections should be added at all super elevation key stations such as; end normal crown, begin super, begin full super, end full super, end super, and begin normal crown.
- Extra cross sections should be added for wetland areas. The interval of cross sections through a wetland should be between 10' and 50'. If the wetland cross section is generally uniform in shape such as a linear ditch wetland, a long interval can be used. If the wetland doesn't have a uniform linear shape a shorter interval should be used to show changes in in-slope, width and depth. If there is onsite wetland mitigation or a wetland is to be moved, the cross sections need to show enough detail and use a short enough interval to properly construct the wetlands. Designers should also consider providing additional drawings in the plans if these changed wetlands have an irregular shape.

Other additional "Optional" cross sections have been considered in the CADD standards. The recommended minimum intervals are close together and address these "Optional" cross sections to a degree. Additional sections can be used at the designer's discretion. These additional – optional sections may include:

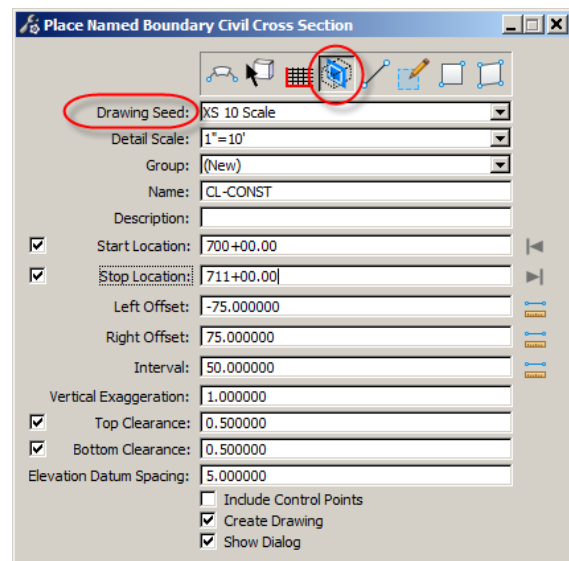
Optional (extra cross sections)

- Intersections, approaches and driveways
- Inlets, ADA ramps, building entrances
- Horizontal roadway breaks such as begin taper, end taper, begin lane, end lane, PC's, PT's, curve returns and others.
- Vertical curve breaks such as PVC's and PVT's.

CADD Standards

Creating Cross Section Sheets

1. Create a dgn such as 200XS.dgn and reference in applicable dgn's for the sheets. This should include the 3D - corridor model, terrain, and alignment.
2. Set the active terrain model. Setting the terrain model active will also create a Default-3D Model
3. At least 2 view windows need to be open, one for the plan view including the alignment and another for a 3D view of the corridor. See the ViewSet Macro section of this manual for related helpful tools (View Control > Views Plan/3D).
4. Access the Named Boundary Tool (OpenRoads Drawing Production > Drawing Production).
5. Set the type of boundary to "Civil Cross Section". Then pick an applicable Drawing Seed.
6. Selecting a "Drawing Seed" will adjust many of the Named Boundary settings such as:
 - Detail scale
 - Name
 - Group
 - Offsets
 - Interval
 - Vertical Exaggeration



CADD Standards

Follow the prompts shown in the ORD (MicroStation) status bar (lower left).

- Identify Path Element (horizontal alignment)
- Identify path start point to place boundary
- Identify end point to place boundaries
- Data Point in plan view to place boundaries

7. The Create Drawing Dialog box should open. Again most of these settings will be correctly set by the previously selected sheet Seed. The “Add to Sheet Index” is an option to consider. See Sheet Index chapter. Click the OK button to create the sheets.

Create Drawing

Mode: Cross Section
Name: 700+00.00

Drawing Seed: XS 10 Scale
View Type: Civil Cross Section
Discipline: Civil
Purpose: Section View

Drawing Model
Seed Model: XS 10 Scale.dgnlib, XS 10 Scale
Filename: (Active File)
Annotation Group: Cross Section

Sheet Model
Seed Model: XS 10 Scale.dgnlib, XS 10 Scale [Sheet]
Filename: (Active File)
Sheets: (New)
Drawing Boundary: XS 10 Scale
Detail Scale: 1"=10' (By Named Boundary)

Add To Sheet Index
 Make Sheet Coincident
 Open Model

OK Cancel

CADD Standards

5.16 Sheet Index

April 2022

The Sheet Index can store title block information for the individual sheets. The sheet index can be used to change title block information in multiple sheets at one time. Sheet Index information is stored in the workset parent folder in a dgnws file.

Example:

S:\STANDARD\CE(XX)\WorkSpaces\Design\WorkSets\00000000.002.dgnws

This file is created when the project workset is first created. The dgnws is originally created from a template file that is located at:

S:\STANDARD\CE(XX)\WorkSpaces\Template\WorkSetTemplate.dgnws

The dgnws should be setup before creating sheets. There will be complications using a sheet index that was created after the sheets were created. The dgnws only works with Sheet Models. Sheets that were setup in simple design models will not work with the dgnws.

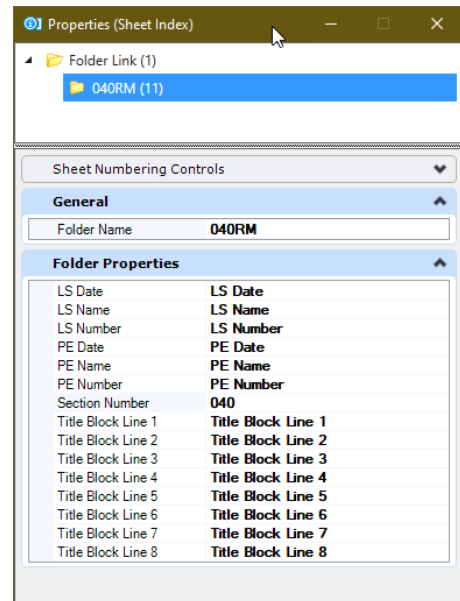
After the workset (dgnws) has been created, it is accessed by selecting the workset, opening a dgn, and opening ORD Explorer. The Sheet Index is a tab within Explorer.

Dgnws information is linked at different levels.

- Advance Properties
- Index Properties
- Folder Properties
- Sheet Properties

The following is an overview of where NDDOT standard values are stored.

- Advance Properties – NDDOT is not currently using.
- Index Properties
 - PCN
 - Project Number
- Folder Properties
 - LS Date
 - LS Name
 - LS Number
 - PE Date
 - PE Name
 - PE Number
 - Section Number
 - Title Block Lines 1 through 8
- Sheet Properties
 - Sheet Values 1 through 8

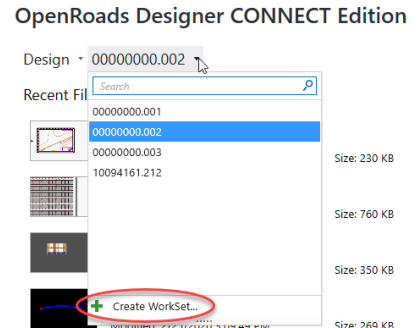


CADD Standards

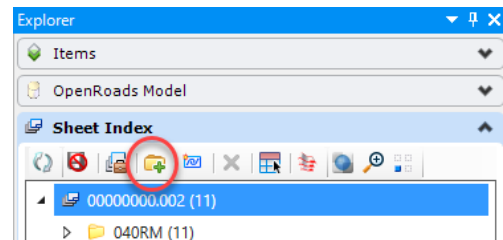
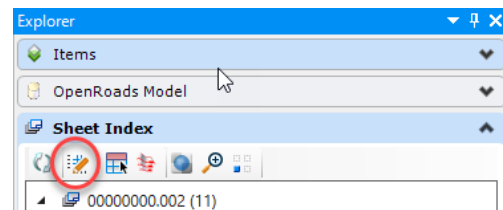
Additional index fields can be added. These are only the fields delivered in the NDDOT template. There is only one set of parent Index Properties per workset. Therefore, the PCN and Project Number are set at this level. The Folder Properties allow multiple sets of Index values. Each folder can contain another set of these values. The sheet properties are actual sheet model properties. They are usually unique to each model. These fields are not setup in the standard sheets but are provided for custom workflows and custom tables.

The following is an overview of using a sheet index.

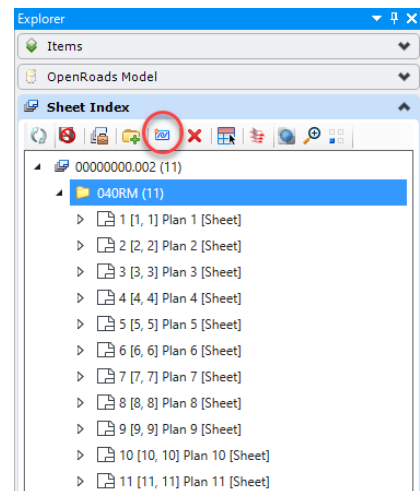
1. Create a project workset.
2. Create sheets within sheet models.



3. Open the Explorer and the Sheet Index tab.
4. Open the sheet index for Editing. By default, the Sheet Index is set to read only.
5. Create folders for different groups of Index values. Usually at least one folder is setup for each section of the plans. Note Element Information needs to be used in conjunction with Explorer to change field values.

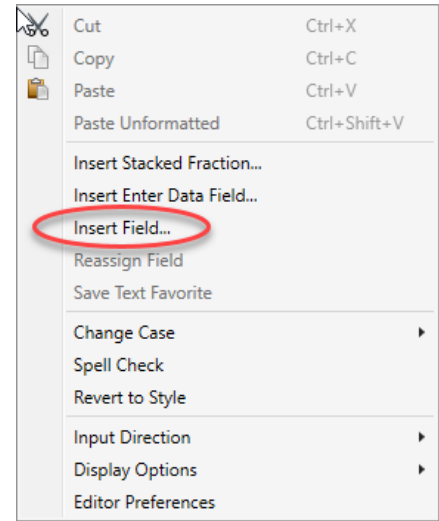
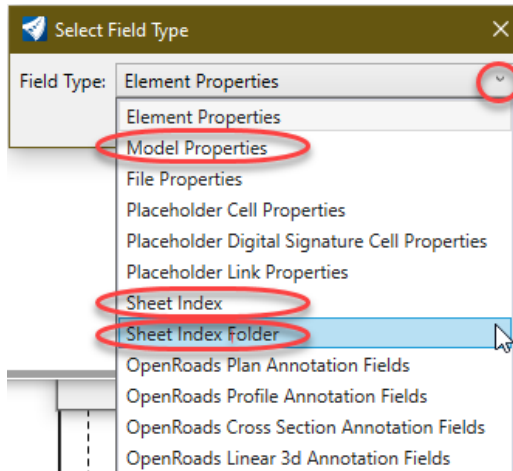


6. Adjust Index values by selecting folders or files and using Element Information. Note the order of this step and step 7 can be interchanged.
7. Add sheets to the appropriate folders. The sheet models will automatically inherit the sheet index values for the folder.



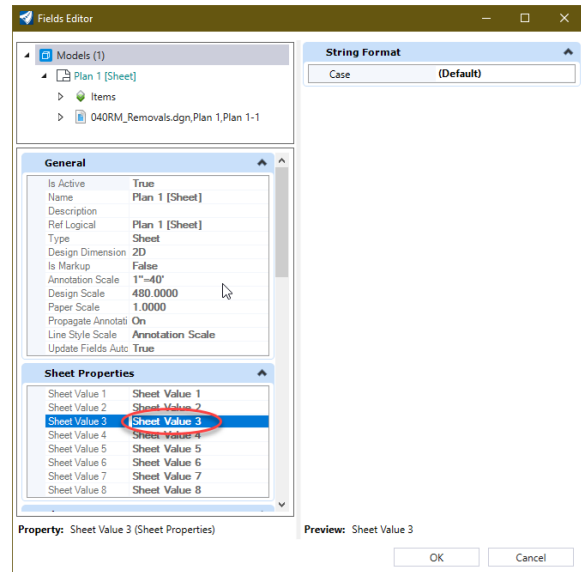
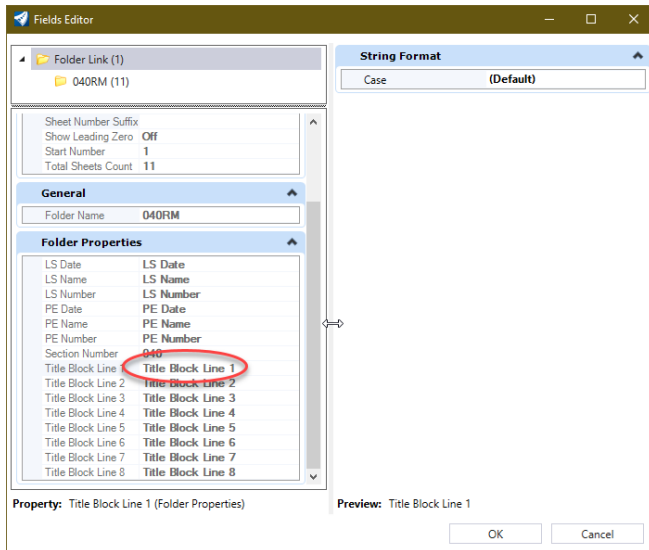
CADD Standards

8. Modify sheets with sheet values if desired. These Adjustments can be made with the Text Editor and Field Editor. Right click in the Text Editor and select Insert Field.

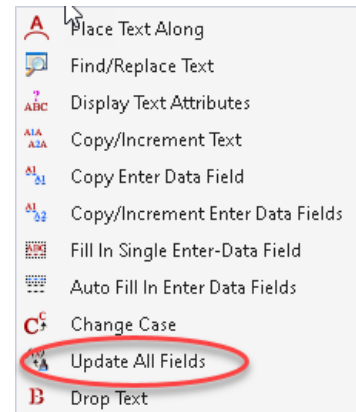


CADD Standards

9. From the Field Editor Select the property that is desired for the field.



10. Changes to the Sheet Index might not immediately change values in the active model. The active model can be updated by switching to a different model and then reopening the model were updates are desired. The “Update All Fields” tool can also be used to sync changes in the sheet index and the sheet model text. This tool can be found in the “Drawing” workflow, “Annotate” tab, “Text” panel. Its within a split menu.



CADD Standards

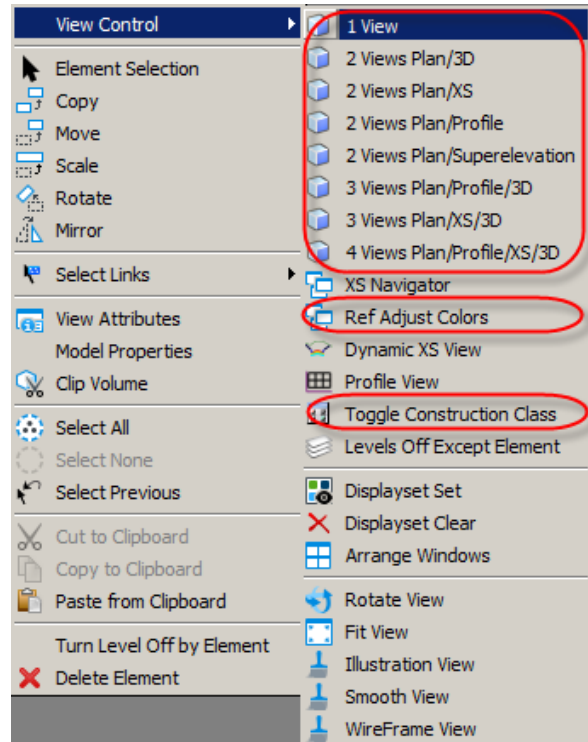
5.17 ViewSet and SnappableToggle Macros

April 2022

The ViewSet Macros are used to adjust views to common formats and perspectives. Some of these macros are available through a right click popup (Context Menu) menu, some of them are available through the default roadway design function keys and some are available in both context menu and function keys.

Right click and press on a view to open the popup menu. Several of the ViewSet Macros are under the “View Control” flyout menu.

Some of these tools prompt you to interact with microstation elements such as an alignment. These tools will coordinate with the microstation elements to open Multi-Model Views. Some Multi-Model Views are required for specific workflows like using named boundaries to create sheets. The ViewSet Macro is discussed in these workflows.



The SnappableToggle works with elements on levels “Sht Lines 2” to “Sht Lines 6”. The SnappableToggle enables or disables snapping or displaying for elements on these levels. It is intended to be used where sheet gridlines could complicate workflows.

CADD Standards

The default roadway design function keys access some of these macros. The following table lists the subroutines, function key (if any) and context menu tool name (if any).

| Subroutine | Key | Context Menu Tool Name |
|--------------------------|------------|-------------------------------|
| SnappableToggle | Shift+F1 | |
| LevelsToggle | Shift+F2 | |
| ExaggerateZForAttachment | Shift+F4 | Exaggerate Z for Attachment |
| FourView | Shift+F5 | 4 Views Plan/Profile/XS/3D |
| ToggleViewLineWeights | Shift+F6 | |
| ToggleViewConstructions | Shift+F7 | Toggle Construction Class |
| Toggle | Shift+F8 | Toggle |
| TwoView3DF9 | Shift+F9 | |
| SetActiveModeltoDrawLast | Shift+F10 | Ref Adjust Colors |
| AnalyzeTerrainModelPoint | Shift+F11 | |
| DeleteUnusedFonts | Shift+F12 | |
| OneView | | 1 View |
| TwoView3D | | 2 Views Plan/3D |
| TwoViewsPLPROF | | 2 Views Plan/Profile |
| TwoViewsPLSE | | 2 Views Plan/Superelevation |
| TwoViewsPLXS | | 2 Views Plan/XS |
| ThreeViewsPLPROF3D | | 3 Views Plan/Profile/3D |
| ThreeViewsPLXS3D | | 3 Views Plan/XS/3D |
| AccuDrawToggleOnOff | | |
| TwoView | | |
| ThreeViewsPLPROFXS | | |
| ThreeViewsPLSuperXS | | |
| | | |
| | | |
| | | |

CADD Standards

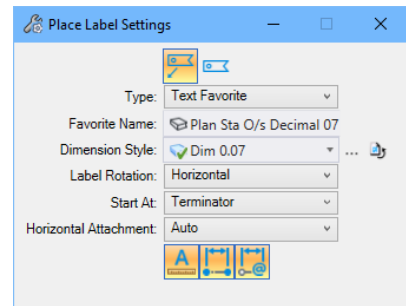
5.18 Text Favorites and Labels

Aug 2022

“Text Favorites” are annotation linked fields that can be stored for repetitive use. These linked fields can be used to automate civil labels like station, offset, and elevation as well as many other properties. The “Place Label” and “Civil Labeler” tools use text favorites fields to build labels from the “Text Favorite” settings. The “Place Label” and “Civil Labeler” tools are accessed from the “OpenRoads Drawing Production (workflow) > Drawing Production (tab)”.



The Place Label settings need to be manually coordinated. Only some combinations of settings are applicable CADD standards.



- Presently the NDDOT doesn’t have a cell library for Labels that include “text favorites”. The text favorites (without cells) are used.
- Many text favorites are view dependent (plan, profile or cross sections). Select a text favorite that is applicable to the active model.
- The Place Label tool doesn’t use the level for the cell or the dimension style. The Place Label tool uses the active level. Make sure you set the applicable level before using this tool.
- The Place Label tool uses the text styles stored with text favorite. Variations of similar Text Favorites have been created with different text style associations.

| Text Favorites | Format | Text Style |
|------------------------------|-------------------------|------------|
| Plan Sta O/s Plan Decimal 05 | Sta 0+00.00 O/s 0.00 Rt | Text 0.05 |
| Plan Sta O/s Plan Decimal 06 | Sta 0+00.00 O/s 0.00 Rt | Text 0.06 |
| Plan Sta O/s Plan Decimal 07 | Sta 0+00.00 O/s 0.00 Rt | Text 0.07 |
| Plan Sta O/s Plan Decimal 08 | Sta 0+00.00 O/s 0.00 Rt | Text 0.08 |
| Plan Sta O/s Plan Decimal 09 | Sta 0+00.00 O/s 0.00 Rt | Text 0.09 |

- Select a dimension style that matches the text style within the text favorite. Example Dim 0.07 for Plan Sta O/s Decimal 07.
- Look for prompts when using the labeling tools. Example, you may need to select a civil alignment to use a text favorite for stationing.

Place Label > Identify Element or DataPoint

CADD Standards

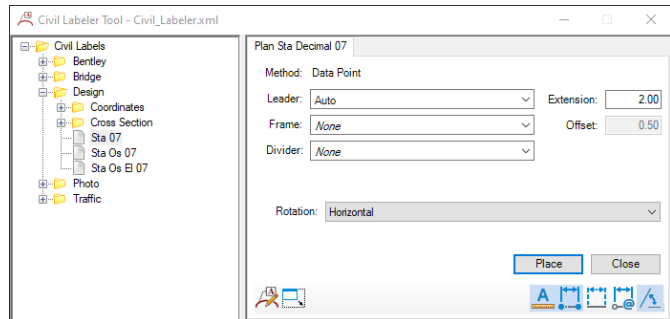
The “Civil Labeler” is like the “Place Label” tool, but it does some things better.

- Civil Labeler coordinates setting better.
 - Can use element templates
 - Use a hierarchy for text and dimension styles.
 - Settings are saved and organized in a folder structure.
- Civil Labeler can work with multiple targets at the same time. Example an intersection of alignments accesses both alignment stationing.
- Civil Labeler has additional association **locks** to control edits. Both tools have Element and Relative association. However, Civil Labeler also has Annotation and Rotation association locks.

The biggest advantage of the Place Label tool is that it works with **cells** that are built with text favorites.

Several Bentley labels are included with the NDDOT standards. The Bentley labels have not been fully standardized for plan production. The Bentley labels are included to show users what the tool can produce and to encourage expansion of the NDDOT standards.

The labels in the folders Bridge, Design, Photo and Traffic are more refined for NDDOT plan production. The Civil Labeler is a new tool for the NDDOT and these refinements are ongoing. The folders are intended to group standards by NDDOT organization sections. Certain sections are responsible for certain drawings and the applicable labels should be used accordingly.



Like the Place Label tool, look for prompts when using the Civil Labeler. Example, you may need to select a civil alignment to use a text favorite for stationing.

Data Point > Identify baseline geometry

CADD Standards

5.19 Alignment Data Sheets

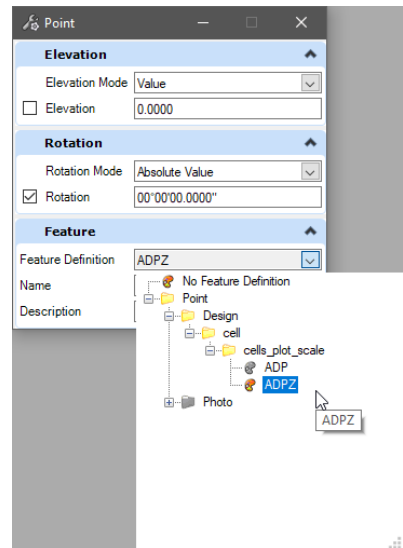
Aug 2022

Alignment Data Sheets (082SD_*.dgn) are plan sheets used to communicate alignment data and points for topographical features such as curb radii and Manholes. In this process, electronic text files (CSV – Comma Separated Values) are created that can be imported into survey equipment and corresponding paper documents are created. Surveyors should not have to key in this information. The following is an overview of the Alignment Data Sheet workflow.

1. Create an ADP*.dgn and reference applicable drawings.
 - a. Consider using managed models (civil coordinated 2D and 3D models).
 - b. Reference the applicable alignment dgn that the points will be associated within the tables.
 - c. Design*.dgn and DS_Util*.dgn are typical references.
 - d. Consider using the ADP*.dgn as a live reference for the 082SD sheets.

2. Place Civil Geometry Points.

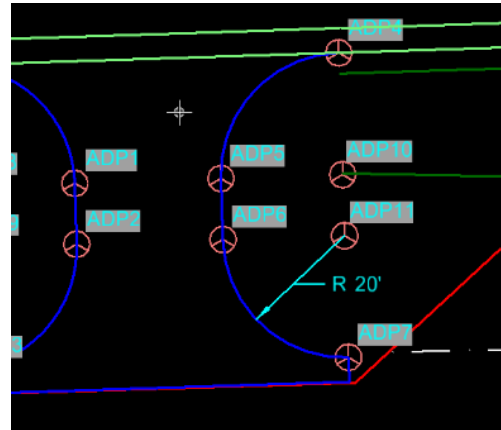
- a. See “OpenRoads Modeling (workflow) > Geometry (tab) > Horizontal (panel) > Points.
- b. The ADP feature can be used for both 2D and 3D Alignment Data Points. However, a second similar feature is also available if segregating 2D and 3D points is desired. The ADPZ feature (z = elevation) is intended for 3D Alignment Data Points. The ADP feature could be used for only 2D points and the ADPZ feature could be used only for 3D points.
- c. The Elevation Mode should be set to “None” for 2D points and “Value” for 3D points.



- d. After points have been placed, use Element Annotation to automatically place the point labels. Wait to move labels for clarity purposes until late in the workflow. Realize removing and replacing Element Annotations will negate previous repositioning of labels.

CADD Standards

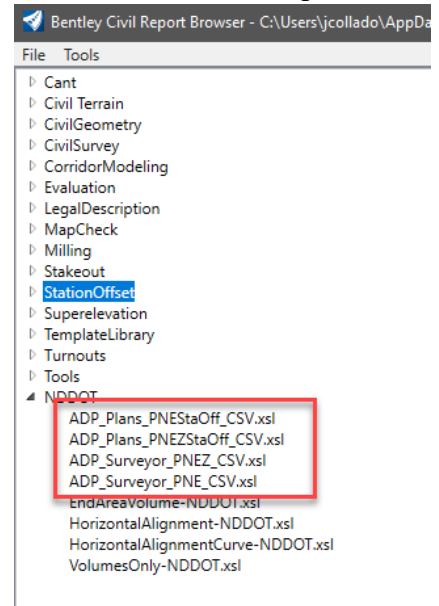
- e. Consider labeling applicable curve and radius point in a manner that lets people know the two are associated with each other. In this example ADP11 is the 20' radius point for the curve shown.



- 3. Create 082SD sheets for the plans. Laying out these sheets will help set boundaries for the individual sheet CSV reports. See *Section 5.15* for guidance on using Named Boundaries for sheet creation.

- 4. Create CSV reports for plan sheets and for construction surveying.
 - a. See “OpenRoads Modeling (workflow) > Home (tab) > Model Analysis and Reporting (panel) > Reports > Point Feature Station Offset Elevation Report.
 - b. The default report will open to a StationOffsetElevationFeature report. Other report formats are available. This Section will focus on NDDOT custom formats intended to create CVS files.

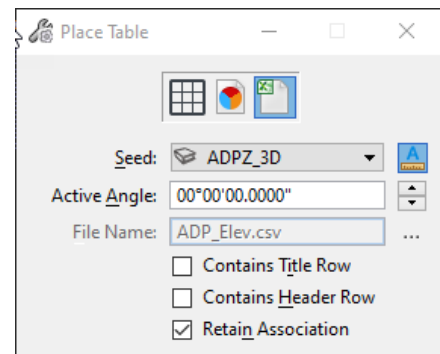
- i. ADP_Plans* reports are intended for plan sheet tables. Separate reports should be saved for each plan sheet table.
- ii. ADP_Surveyor* reports are intend to be given to surveyors for actual staking. One report can be created for the entire project. **Don't forget to supply this file in the project supplemental design data (Post on MFT Site).**
- iii. The reports with a *Z* in the name are intended for elevations.



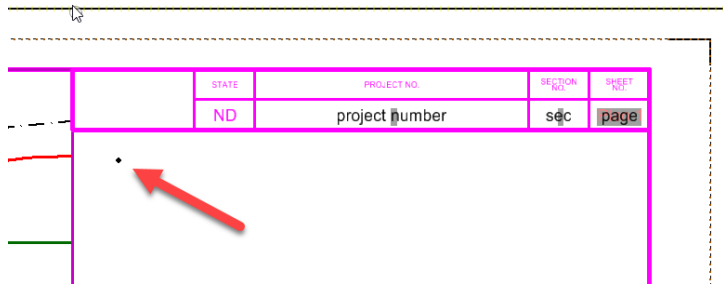
CADD Standards

- c. The report can be saved to the csv format but it is not listed as a File > Save As option.
 - i. Choose File > Save As > Microsoft word.
 - ii. Change the “Save as type” to Text File.
 - iii. Provide a File name with a csv extension.
 - iv. Save the document. Files saved in this format should not need to be reformatted for imports.
- 5. Using table seeds to import the sheet CSV reports (ADP_Plans*) into the individual plan sheets.

- a. Open the applicable plan sheet model.
- b. Select the Table tool. One of the locations the tool can be located is OpenRoads Modeling (workflow) > Drawing Production (tab) > Place Table.
- c. Within the Place Table dialog, select the “From file” option.
- d. Pick a table “Seed”. The table Seed sets headers and formatting.
 - i. ADP_2D is for files with no elevation column.
 - ii. ADPZ_3D is for files with an elevation column.
- e. Select a CSV report file that was created in the previous step.
- f. The table will be shown attached to the cursor.



Place the table on the sheet. There is a placement point in the sheet cell that can be used to consistently place text or tables.



CADD Standards

Axiom

6.1 Axiom Settings Files

April 2023

Axiom stores setting in “*.ini” (initialization) files. Currently the NDDOT has the default ini files.

- tbadmin.ini (title block administrator)
- office.ini (Office Importer for Quantities)
- office_RW.ini (Office Importer for RW sheets)

The following DOS batch file will copy the above files on your computer. NDDOT CADD standards will look for these files when using Axiom TBA or Office Importer.

S:\STANDARD\CE*\Install\Axiom\Copy_ini.bat

CADD Standards

6.2 Axiom Title Block Manager

Jan 2019 (minor edits)

The Axiom Title Block Manager (TBM) tool is used to edit (manage) MicroStation title blocks and tags. This tool allows multiple title blocks and tags from multiple drawings to be edited from one spreadsheet.

1. General Title Block Manager Setup
 - a. Only the Central Office has access to this tool. The tool “Title Block Administrator” should be available within MicroStation under the Axiom pull down menu.
 - b. TBM will work with a blank Microsoft Excel spreadsheet. Users can save a blank spread sheet to their project directory before they start TMB or this can be created while running TBM (see step 2c). Using a preformatted spreadsheet is not recommended.
 - c. Don’t Drop your Sheet Cells. Your Tags and Title Blocks will have to be recreated. Dropping cells should be avoided, because it takes time and can be complicated.
 - d. This section doesn’t discuss TBM in detail. For more information on TBM see Axiom’s User Guides;
M:\APPS\Production\Design\AxiomV10\TBAdmin\TBAdminV10.pdf

2. Update Title Block Manager Excel Spreadsheet from Selected Drawings
 - a. In Title Block Administrator’s main dialog box, Select Action: “Update database from selected design files.”
 - b. Click the <Select> button to the right of the “Design Files:” field. The dialog that opens allows you to select a batch of files for processing. Select the files that you want to manage. You need “write access” to these files and they should all use standard sheet cells. After selecting the files that you want to manage, click <OK> to return to the Title Block Administrator main dialog.
 - c. Select your database (Excel Spreadsheet). This could be an empty spread sheet that you created before you started TBM or you can have TBM create one for you now by typing in a path and file name. Remember Excel files have an xls extension. Also note that spreadsheet can’t be open while you run TBM.
 - d. Select a name and location for your report file. Example (c:\temp\TBM.rep). This file only documents what you have done.

CADD Standards

- e. This step is optional. If you want to work with just one type of tag set within one spread sheet, the specific tag set or sets can be specified in the TBM settings. Example, if you only want to edit just DIP tags in one spread sheet, you would select “Settings>Change Settings” from the TBM pull down menu. Then you would type “bordercell” in the “Tag sets to process” field. Note, the character “*” can be used in the “Tag sets to process” field. The “*” character means it will process all tags within the drawing.
 - f. CAUTION, if you process multiple tag sets at one time, your spread sheet may imply false tag relationships. Example, you may need to process a cell with the tag sets named “bordercell” and “titleblock”. The tag named “bridge” is part of the tag set named “bordercell”. However your spread sheet will contain a cell for the tag named “bridge” in the tag set named “titleblock”. This is a false relationship. Nothing will happen if you fill it in because it doesn’t exist within your drawing. These false fields are not important if you remember that they are not used. You must be aware of which tags belong to which tag set.
 - g. Click the Start button to begin the update. At the end of processing, you will see summary totals. Click <OK>.
 - h. Now you can select <Display Report> to see a summary of what was done.
 - i. Open the Excel by pressing the <Edit Database> button to see what was added.
3. Update Selected Drawings from Title Block Manager Spreadsheet
- a. If you just completed step 2, your file list is still there as <Edited File List>. If not, use the <Edit List> dialog to select your files.
 - b. Open database by clicking on the <Edit Database> button. You will see all of your design files represented one row per tag set. Note most sheet cells have multiple tag sets.
 - c. Edit the data fields as needed. The data fields have been grouped by tag sets. You may have to sort on the tag set name in order to edit groups of data fields. Note, page and section numbers should not use preceding zeros – place holding zeros in the title blocks.
 - d. Save and close the spreadsheet.
 - e. In MicroStation - Axiom, change the “Action:” to <Update selected design files from Database>. Make sure that your TBM spreadsheet is selected and you have specified a report file.
 - f. Now click <Start> to begin the update. At the end, you will see summary totals.
 - g. Click <OK> to those totals.
 - h. Open the MicroStation files to see your changes.

CADD Standards

6.3 Axiom Office Importer

April 2023

Axiom Office Importer relies on both Microsoft Office and Axiom setting to accommodate NDDOT CADD Standards. See section 6.1 for an overview of Axiom settings. The following is an overview of Microsoft Excel setting to be used with quantities placed in sheets such as 040RM, 060PP, and 090PL sheets. These sheets have a 4” wide area on the right side of the sheet for quantity tables.

Excel Settings

| | |
|-----------------------------------|--------|
| Font Size | 10 |
| Height | 15 |
| Width Column 1 (SPEC) | 6 |
| Width Column 2 (CODE) | 7 |
| Width Column 3 (BID ITEM) | 50 |
| Width Column 4 (QUANTITY) | 7 |
| Width Column 5 (UNIT) | 7 |
| Justification Column 1 (SPEC) | Center |
| Justification Column 2 (CODE) | Center |
| Justification Column 3 (BID ITEM) | Left |
| Justification Column 4 (QUANTITY) | Right |
| Justification Column 5 (UNIT) | Right |

Notes

- Place line spacing in MicroStation is approximately 2 (1.95) times text height.
- Some advanced characters might not work with the NDDOT true type font.
 - The following hardcoded characters don't work.
 - Left Single Quote
 - Right Single Quote
 - Left Double Quote
 - Right Double Quote
 - Simple “Single Quote” and “Double Quote” work.
- Office Importer for RW legal descriptions is set up for Microsoft Word with 11 point text size.

CADD Standards

Other Standards and Procedures

7.1 As-built Plans (Record Drawings)

April 2022

The “Construction Records Manual” (Section 7) discusses what is to be included in As-Built Plans. The decision document “NDDOT As-built Plan Process”, June 2018, provides additional guidance. Most As-Built information is documented with Adobe commenting tools. As-built cross sections are one of a few types of drawing where CADD tools are required.

Adobe Edit tools for As-builts

The as-built documents should preserve all as-design information. Adobe edits are often indistinguishable from original information. Therefore, Adobe Edit tools should be avoided for as-built documents.

Adobe Commenting tools for As-builts

Some adobe comments need to be expanded to be fully displayed or read. Sticky notes, attachments, and notes within other commenting graphics may not be fully visible when the document is first open. Today, Adobe commenting tools are common practice. In the distance future these tools may be replace by other technology. Therefore, compressed comments should be avoided for as-built documents.



Recommended Adobe commenting tools for as-builts include Add Text Comment, Add Text Box, and Drawing Tools are recommended.

Blue text and graphics are recommended for documenting As-built changes.

CADD Standards

CADD tools for As-builts

Cross sections are an example of when CADD tools may be needed to be used with adobe tools to create as-built documents. CADD tools can be used, but the ultimate As-Built deliverable is in pdf.

- All as built information that is different than the information from Design will be kept in an As-built subfolder located in the project directory, usually located under a district or consultant subfolder.
- The as-built changes should only be made to the new files within the as-built folder. Include only the features that have changed from the original design. Separate drawing will be needed to manage symbology overrides.
- Traditional as-builts are black and white except for the as-built information. As-built information should appear blue. When creating as-built drawings the ‘level symbology’ for all design drawings should be set to color “0” (black and White) and the “level symbology” for all as-built drawings should be set to color “1” (blue). This symbology should produce a black, white and blue set of plans.
- As-built drawings are the only drawings where a suffix modifier is mandatory. All as-built drawings are to be named with a suffix modifier “AB”.

Most as-built drawings reference the original design drawings. Referencing is usually preferred over copying because changes can be quickly identified, and it is less redundant. The as-built terrain is typically added to the cross sections. The as-design model is typically displayed with the as-built info.

CADD Standards

7.2 Design Division's Quick Maps

Jan 2019

This tool can be used to create maps for “Design Plan Title Sheets” and reports. The Design Division's Quick Maps are accessed through the web;

http://gis.dot.nd.gov/external/ge_html/?viewer=ext_quickmap

If you just want a simple county map, don't use this service. County maps as pdf's can be retrieved from <https://www.dot.nd.gov/business/maps-portal.htm#countybasemaps> .

CADD Standards

7.3 Tags, Professional Stamping and Signing

July 2024

Most Consultants and NDDOT Districts don't have Axiom Title block Manager (TBM). The "tag" elements contained in the sheet library (sheets.cel) can be edited with "Edit Tags" tool or TBM. Most of the title blocks for the sheet cells have been filled with "tags". Tags are special MicroStation elements that look like "text" elements.

Note, the pre-formatted tags are setup with the standard symbology. Tags are on a segregated level. If sheet index tools are used instead of tags, the level can be turned off.

In order to avoid having to maintain multiple versions of a drawing (preliminary and one for stamping), special print drivers and pen tables are being used to control when the "Preliminary" note is printed and when it is not printed. The following pen tables are used;

| Pen table | Tag Levels | Sheet Index Level | Color |
|------------------|------------|-------------------|-------|
| Preliminary.tbl | on | off | yes |
| Preliminary2.tbl | on | off | no |
| Preliminary3.tbl | off | on | yes |
| Preliminary4.tbl | off | on | no |
| PE Stamping.tbl | on | off | yes |
| PE Stamping2.tbl | on | off | no |
| PE Stamping3.tbl | off | on | yes |
| PE Stamping4.tbl | off | on | no |

The title sheet has several signature lines. These lines are left blank in the dgn file and are completed with digital signatures in the pdf file. The digital signature graphic includes typed name, signature graphic and date.

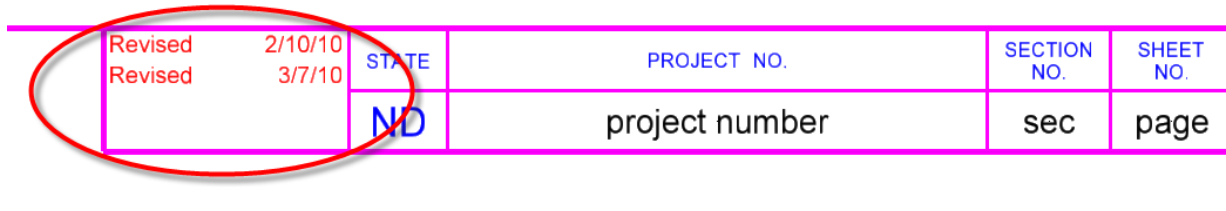
CADD Standards

7.4 Addenda and Change Orders

April 2022

Plan revisions before the Bid Opening are referred to as Addenda. Plan Revisions after the Bid Opening are referred to as Change Orders.

All plan sheets cells have an area (revision block) reserved for addenda and change order information. This revision block is part of the upper left title block.



| | | | | |
|-----------------|-------|----------------|-------------|-----------|
| Revised 2/10/10 | STATE | PROJECT NO. | SECTION NO. | SHEET NO. |
| Revised 3/7/10 | ND | project number | sec | page |

Addendum and Change Order plan sheets shall include the words “Revised” or “Sheet Added”, as applicable, and the date in this revision block. If the sheet was previously revised as an addendum or change order, keep the original revised note and add another one (example: Revised 2-10-10, Revised 3-07-10). If the project is moved to a later bid opening or if the project is rebid, the revision block should be reset to “null” entries (blank fields) and the sheet should be included in the plans as a normal sheet.

This revision block contains a MicroStation tag set Named “Revision_Box”. This block contains enough tags for 4 revisions. There are tags to describe the type of change (“Revision” or “Sheet Added”) and tags for the dates. The Revision_Box tag set can be edited with Axiom Title Block Manager or the standard MicroStation “Edit Tag” tool. The default tag values are empty. You cannot see the tags when the sheet cell is first placed, but they are still part of the cell.

If an addendum or change order added or voided a plan sheet, the plan sheet containing the table of contents must also be revised as part of the change. The table of contents does not need to be revised if the revised sheets are already listed.

If sheets need to be added in the middle of a section, alphabetical suffixes should be added to the sheet number (example: section 80 sheet 10A, section 80 sheet 10B, section 80 sheet 10C ...). Alphabetical suffixes should only be used for sheets added with an addendum or a change order. These suffixes should not be used in the original plans. The original plans should always be renumbered if sheets are added.

CADD Standards

When the plans are signed, all of the files should be set to read only. The read only setting shall not be turned off.

All plan revisions (addenda and change orders) shall never be made in the original files. The original files shall never be edited after they have been signed and sealed. If changes are needed, copies of the files should be made.

All plan revision information shall be kept in separate folders located in the designers' corresponding project directory. A separate folder shall be used for each addendum and change order that is issued. A new folder named "Addendum (followed by a letter) shall be added for each addendum that is issued (Ex. "Addendum A"). Likewise, a new change order folder (followed by a letter) shall be added for each change order that is issued (Ex. ChangeOrder A.) When the next revision is added, the folder should end with the next letter in the alphabet.

The dgn files use letters to indicate versions. Final pdf files use numbers to indicate versions. The dgn files use letters because the actual version "number" might not be known at the time it is created or it could change between the time it is started and when it is completed.

Examples: R:\project\80046083.017\DESIGN\Addendum_A
R:\project\80046083.017\DESIGN\Addendum_B
R:\project\80046083.017\DESIGN\Addendum_C
R:\project\80046083.017\DESIGN\ChangeOrder_A
R:\project\80046083.017\BRIDGE\ChangeOrder_A
R:\project\80046083.017\BRIDGE\ChangeOrder_B
R:\project\80046083.017\TRAFFIC\ChangeOrder_A

The original files should not be modified for addenda and change orders. If changes need to be made to a file, the file should be copied into the respective addenda or change order folder and a suffix modifier shall be added to the end of the filename. Addenda shall use the modifier "AD" followed by the group letter. Change Orders shall use the modifier "CO" followed by the group letter (example: 060PP_004_PP_AD-A or 060PP_004_PP_CO-A). If sheets were added, the sheet number suffix should be used in the file name (example: 060PP_004A_PP_AD-A).

If design details were documented in one drawing then referenced in cut sheets, then the revised details should be documented in one drawing then referenced in cut sheets.

Example: A driveway should not be built at the location shown in the original design plans. Originally the driveway information was specifically drawn in the file R:\project\80046083.017\DESIGN\design.dgn then referenced into R:\project\80046083.017\DESIGN\Sheets\060PP_006_pp_geelan1.dgn. The person creating the change order drawings should create new drawings named "design_CO-A.dgn and 060PP_006_pp_geelan1_CO-A.dgn. Note that the file name uses a suffix modifier "CO-#," where # is the change order group letter.

CADD Standards

The change order modifications should only be made to the new files within the Change Order folders. Include only the features that have changed from the original design.dgn file to the design CO A.dgn. The change order driveway would be drawn within

R:\project\80046083.017\DESIGN\ChangeOrder_A\design_CO-A.dgn and then referenced and clipped into

R:\project\80046083.017\DESIGN\ChangeOrder_A\Sheets\060PP_006_pp_geelan1-CO-A.dgn.

When changes are made to a drawing that is referenced into other drawings, all parties involved in making the original plans shall be notified of the changes and the location of the new revised drawing.

Most revised drawings reference the original design drawings. Referencing is usually preferred over copying because changes can be quickly identified, and it is less redundant. However, there are exceptions to referencing for addenda and change orders.

OpenRoads civil geometry, features and corridors may use reference paths that are difficult to reestablish. Some of these references are more than a graphic reference. They may include a civil (OpenRoads) reference such as the references used for corridor modeling. If the file involved with the plan revision includes civil (OpenRoads) references, then the original file should be backed up and then the original file can be edited. The backed-up files should use a suffix modifier similar to the one discussed for plan revisions, but they should include the phrase “Pre” (examples: RDM_Pre-AD-A, RDM_Pre-CO-A). The backed-up file should be placed in the Addendum or Change order folder.

Drawings that do not have reference files attached or drawings with extensive changes can be copied directly into the Change Order folder and do not need to be referenced back into the new change order drawing. All of the changes can then be made in the change order drawing. For example, a detailed drawing of a Lift station may have many revisions. This drawing could be copied from the design folder into the Change Order folder.

Remember to rename these copied drawings with the addenda “AD-#” or change order “CO-#” suffix modifier.

The element symbology for these revised drawings should be the same as the symbology used for the design plans.

Update the supplement design data such as AMG files to match the applicable plan revisions. Consultants should resubmit changed supplemental design data with the addenda or change order.

Refer to the Design Manual, Section 1-9, Plan Revisions and Change Orders, for additional administrative requirements.

CADD Standards

7.5 Incorporating Microsoft Word and Excel Documents in PDF Plan Sets

Oct 2008

Plan sets contain some sheets that are created from Microsoft Word and Excel. These sheets include the Table of Contents, Notes, and Traffic Control Devices List.

1. There are templates available for these sheets on the Plan Preparation Guide website at <http://www.ugpti.org/dotsc/prepguide/index.php>. These are special sheets that have macros built into them for printing.
2. Put the page numbers in the upper right-hand corner.
3. When printing these sheets, do not use the File => Print option from the menu bar. Instead use the following method to print the sheets:
 - a. The Table of Contents and Notes sheets have dialog boxes that launch when you first open the files. If you accidentally closed the dialog boxes, they can be opened by closing and then reopening the file.
 - b. The Traffic Control Devices List has a Print Plan Sheet button located at the top of the Input sheet.

CADD Standards

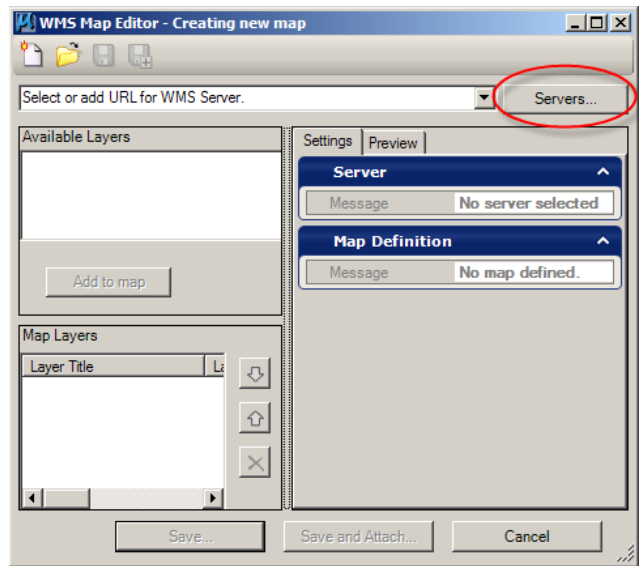
7.6 Web Map Services (WMS) and Raster Manager

July 2015

A Web Map Service can be used with MicroStation Raster Manager to reference existing data. Two different data source are discussed in this section; OnRamp and NAIP imagery. These data sources are used by many NDDOT ArcMap users. Now this data can be accessed directly from MicroStation.

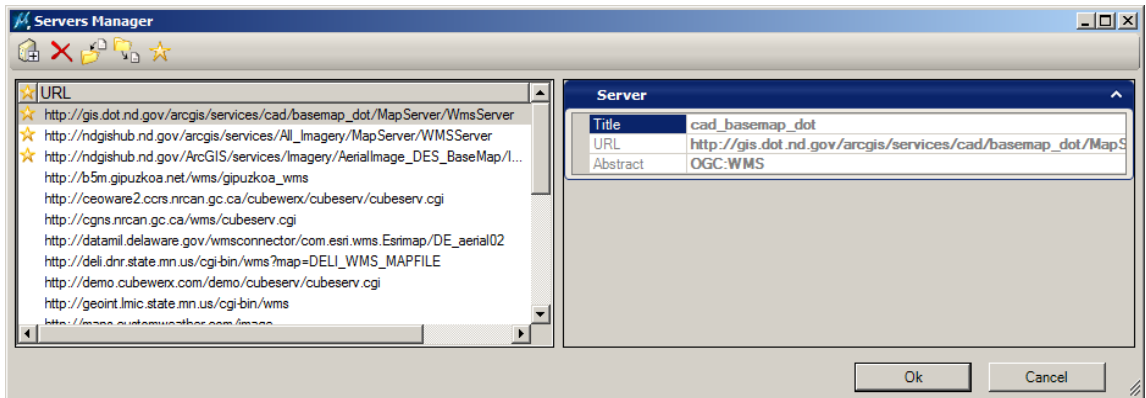
The following are instructions to reference a WMS.

1. Attach a Geographic Coordinate System to your drawing. See **Section 3.21** (GCS).
2. Open Raster Manager and select File>New>WMS from the Raster Manager Dialog. The WMS Map Editor dialog box should open.
3. Click on the “Servers” button. The Servers Manager dialog box should open. Several URL address should be shown in the left panel.



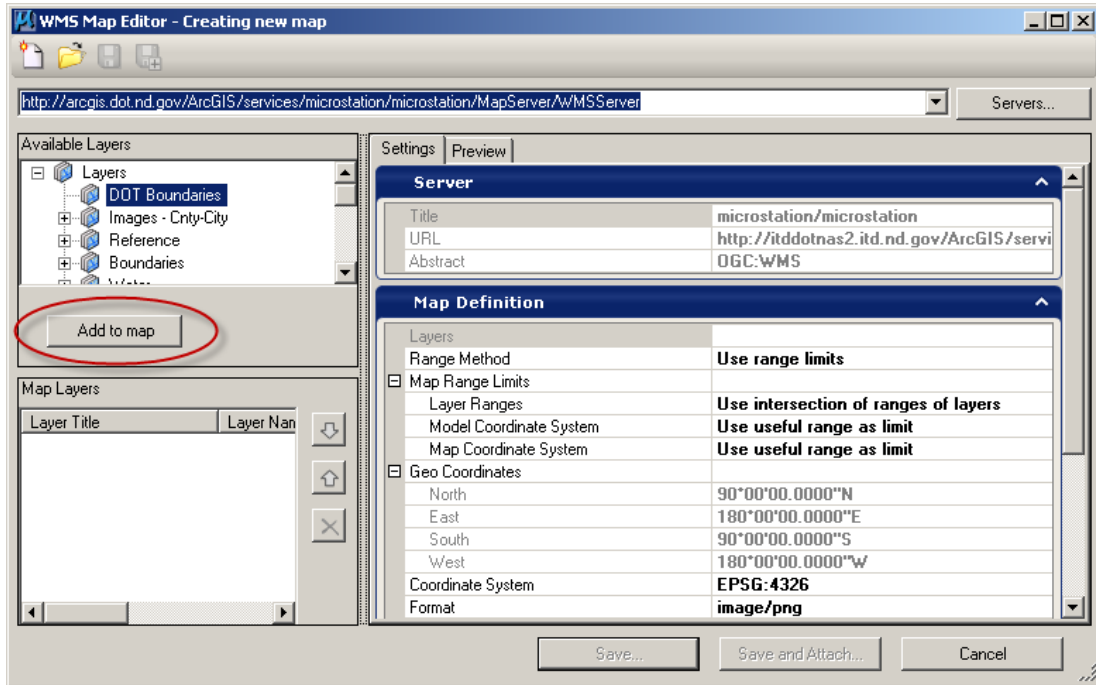
OnRamp data from the NDDOT GIS server

http://gis.dot.nd.gov/arcgis/services/cad/basemap_dot/MapServer/WmsServer



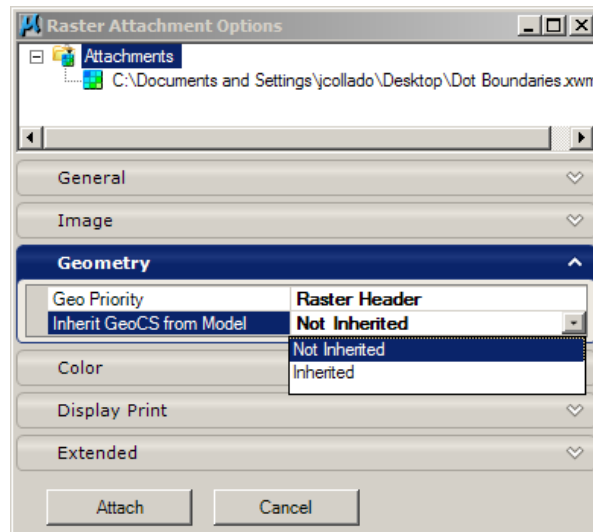
CADD Standards

4. Select one of these addresses and click the Ok button. The Servers Manager dialog box will close and the address will be entered into the WMS Map Editor dialog box. Near the upper left corner of this dialog box there will be a panel that shows a layer tree.
5. Select a desired layer (branch). Then select the “Add to map” button. The Layer will be added to the Map Layers panel in the lower left. This step can be repeated to add additional layers from the same server.



6. Select the “Save and Attach” button near the lower right. You will be prompted to name and save a file (.xwms) that contains the WMS linking information. After you have saved the .xwms file, the Raster Attachment Options dialog box will open.
7. Expand the Geometry panel within the Raster Attachment Options dialog. Within this panel set the property “Inherit GeoCS from Model” to “Not Inherited”. Then Click the Attach button.

Note re-projected rasters can't presently be clipped in MicroStation.



CADD Standards

7.7 Google Earth and Google Maps

April 2022

Google Map imagery from the “Free Addition” shall not be used for any documents that are used outside of the department. Don’t use a Google Map in a concept report or public meeting. The “Professional” version of Google Earth is required for sharing information externally.

If your using Google Map imagery for an internal purpose. Don’t remove the Google water marks. You are using copyrighted material. Note, the NDDOT has an Arc Internet Mapping Service that is available to all employees. Imagery from this tool is often better than Google imagery.

CADD Standards

Miscellaneous Help

8.1 Using MicroStation Files in Microsoft Word

April 2022

There are several ways to export a MicroStation drawing to a format that can be imported into Microsoft Word. The following is a list of some of the common methods.

1. Windows Cut and Paste
2. Print Screen
3. MicroStation Image Capture Tool
4. Print Drawing to an Image file
 - a. Tagged Image Format (.tif)
 - b. Joint Photographic Expert Group (.jpg)

Window Cut and Paste is one of the easiest way to bring a drawing into Word. However, the image quality is poor. Linestyles appear altered. Sometimes text is not exported. Images imported using this method are not typically good enough for reports. This procedure is not documented in this manual.

Print screen is another easy way to bring a drawing into Word. This method usually requires considerable cropping once imported into Word. The background color usually needs to be changed to white. Image quality is OK. This procedure is not documented in this manual.

The MicroStation Image Capture tool can be used to export images to a wide variety of image file formats. This tool allows for cropping during the export process. The background color usually needs to be changed to white. Image quality is OK. This tool can be found in the Drawing (workflow) > Utilities (tab) > Image (panel). No further documentation on this procedure is given in this manual.

Using MicroStation printing tools to export a drawing to an image file is typically the best method to use for most NDDOT reports in the Word document format. Good image quality can usually be maintained. There are numerous variations with this process. The active background color used during the export process is less of a concern.

CADD Standards

Printing a Drawing to an Image File

There are several variations of this process. This manual will discuss how to export an “tiff” file from MicroStation. This format is recommended for word documents because file sizes are small and image integrity is good.

The same techniques used to print a drawing to paper, using MicroStation print tools, are used to print a drawing to an image file. The main difference is that different plot drivers are used.

Several plot drivers have been modified for NDDOT use. They are located at:

S:\STANDARD\CE*\Organization\plotdrv. From the MicroStation “Print” dialog box, select “File>Select Bentley Driver”. The “Select Bentley Driver File” dialog box should open. In order to create an tiff file select

S:\STANDARD\CE(xx)\plotdrv\Manually_Pick_Printer\NDDOT-tiff.plt. When you print the drawing, you will be prompted for a file name and a location to save the file.

Once the image file has been created, it can be imported into Microsoft Word. In Word, select “Insert>Picture>From File”.

CADD Standards

8.2 Bentley View

Oct 2008

If you don't have MicroStation and you just want to view and print CADD drawings, this might be the tool for you. This tool is easy to use, and it is free. People like district engineers and administrative assistants could use this tool to view and print MicroStation drawings.

Exporting drawings to PDF takes little time. However, some reviews benefit from eliminating even the smallest step. If all reviewers have CADD viewers, drawing preparation effort is minimized. Bentley View does not "push" the information to the end user as much as PDF, but it is more flexible in terms of not needing to process drawings into another format. Bentley View reads directly from raw CADD - dgn files.

Some people don't have MicroStation installed on their computer. It is not practical for them to become proficient nor is it cost efficient to install a full version of MicroStation on their computer. But occasionally they may need to review a drawing, (example a drawing was sent to them by email). If this person had Bentley View, they would not have to ask the sender to convert the drawing to another format or ask someone with MicroStation to help them view the drawing. They could view and or print the drawing themselves.

Note, privileges to certain servers for certain uses may need to be adjusted. Some people may benefit if they had access to the CADD Server.

CADD Standards

8.3 Roadway Inventory Management System (RIMS)

Mar 2011

The Roadway Inventory Management System (RIMS) tool can export information to a PDF. This manual does not intend to explain how to use RIMS. This manual only highlights some of the options while print to a PDF.

RIMS files exported to PDF are named after your RIMS User ID, Year, Month, day and Time (example, JONCOL1.080917085600.PDF). RIMS documents exported to PDF are created in the directory: **O:\000 Reports**.

Print Sequence Numbers are used to control the print format. Some print formats don't work with some reports. Data may be clipped from the print or hard to read. The table below can be used to help select the correct print format.

| RIMS Printer ID | Print Sequence Number | Characters per Inch (CPI) | Lines per Inch (LPI) | Orientation | Size | Typical Use |
|-----------------|-----------------------|---------------------------|----------------------|-------------|--------|-------------------------------------|
| PDF | 1 | 12 | 6 | Portrait | 8.5x11 | |
| PDF | 2 | 12 | 8 | Portrait | 8.5x11 | |
| PDF | 3 | | | Landscape | 11x8.5 | |
| PDF | 4 | 18 | | Landscape | 11x8.5 | |
| PDF | 5 | 18 | 10 | Portrait | 8.5x11 | Most Milestone Reports |
| PDF | 6 | 18 | 10 | Landscape | 11x17 | Quantity Sheets with Border |
| PDF | 7 | 18 | 10 | Landscape | 11x17 | Quantity Sheets without Border |
| PDF | 8 | | 8.5 | Portrait | 8.5x11 | Milestone Reports with less margins |

Additional Notes

- PDF's of the Quantity sheets and other should be stored in the project Directory.
- Please review, print, or store this report, then delete it from the site in order to keep this folder manageable. The folder will be purged each month.