M E M O

TO: CADD Users

FROM: CADD Committee; Ron Henke (chairperson), Jon Collado, Diane Gunsch, Nancy Horner, Diane Laub, DeLane Meier, Brian Raschke and Joyce Schmidt (secretary)

DATE: July 26, 2007

SUBJECT: CADD Standards Implementation

The North Dakota Department of Transportation (NDDOT) wants to stress the importance of following the CADD Standards. These standards increase the readability and consistency of design plans. When the format is consistent, readers can find information quicker and a standard level of professionalism is met and maintained.

CADD Standards are also needed for automation. CADD Standards allow applications such as MicroStation and GEOPAK to work together. CADD tools and settings can be adjusted for one particular way of drawing and designing. These tools can be set up once and used on multiple projects. In order to make the most of these tools, the CADD Standards need to be used. The NDDOT is expecting full implementation of the standards. **The CADD Standards must be followed.**

If you are having difficulties applying the CADD Standards to a particular task, please contact the CADD Specialist or a CADD Standards Representative.

20/jdc

CADD Standards

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CADD Standards

Support

1.1 Manuals and Tutorials

June 2012

Internet Resources

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

The **Procedures for Calculating Final Earthwork Quantities** manual is available on the NDDOT intranet site: www.dot.nd.gov/manuals/design/caddmanual/nddot-procedures-for-calculating-final-earthwork-quantities.pdf.

NDDOT Server Network Resources

Axiom manuals are located under their respective folders under M:\APPS\Production\Design\AxiomV8.

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

May 2016

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:

GEOPAK - Survey / DTM:
Troy Zornjak

GEOPAK - Alignments / COGO:
Ranka Samardzic, Garrett Hartl

GEOPAK - Earthwork:
Ranka Samardzic, Garrett Hartl

Corridor Modeling:
Darell Arne

MicroStation:
Travis Cork, Kris Altepeter, Chad Frisinger

Information Technology:
Diane Gunsch, Kai Christensen

Adobe Acrobat:
Travis Cork, Garrett Hartl

GuidSign:
Travis Cork

CADD Standards

1.3 Standards Committee

Feb 2015

Members: Jon Collado (chairperson), Brian Raschke, Troy Zornjak, Sarah BaeHurst, Diane Gunsch and Travis Cork

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 fill out the MicroStation / GEOPAK Standards Request form, SFN 51169.

CADD Standards

Project Administration

2.1 Project Directories

Dec 2010

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.

Users should contact the "Help Desk" within the Information Technology Division if they need to set up a new project directory. Users should contact the "Help Desk" by email (-grp-dot Help Desk). The email request should include the project number. The Help Desk will setup the standard root directories on the central CADD server. NDDOT project numbers consist of a funding code, district, highway, agreement number, and mile point. A typical number may be: NH-8-013(031)389. The directory created for this project would be as follows: r:\project\80013389.031.

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\80013389.031 directory would consist of the following subdirectories:

As-built	(Assigned District or Construction Division)
Bridge	(Bridge Division)
Design	(Roadway Design Sections)
District	(Any of the 8 District offices)
Consultant	(Hired Consultant Firm)
Material	(Materials & Research Division)
ROW	(Right of Way Section)
Survey	(Surveys and Photogrammetry Section)
Traffic	(Traffic Section)
Utilities	(Technical Support Section, Utility Coordination Plans)
ePlans	(Electronic Plans)

Computer Services 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.

Under each of these root directories, there are unique folders that describe the specialized operations of these users. For example, the users in Surveys and Photogrammetry would use the following directory when they are working on electronic field book data: r:\project\80013389.031\survey\EFB.

CADD Standards

The following are recommended subdirectories:

As-built
- Sheets

Bridge
- (Subdirectories for each structure, name based on structure Number)

Consultant
- As-built
- Bridge
- Design
- Material
- ROW
- Survey
- Traffic

Design
- Environmental
- Blue_Tops
- Photos
- Sheets

District
- Sheets

Material

ROW
- Sheets

Survey
- Compilation
- Consultant
- EFB
- Photos_Scans

Traffic
- Sheets
- Photos

Utilities

ePlans
- Addendum
- Asbuilt
- Final
- Plan_Rev
- Preliminary
- PS_E

CADD Standards

The ePlan directory is used for managing Adobe PDF files. Under the ePlan directory, subfolders are used to organize pdf files created at particular phases of project development.

Project Development Phase	Directory Name
Preliminary Project Reviews Conducted before the PS&E	Preliminary
Comprehensive Review of Plans Specifications Estimates done approximately one month before the plan completion deadline.	PS_E
Original version of plans first posted on the internet	Final
After final plan completion and before the bid opening	Addendum
After the bid opening, often used with change orders	Plan_Rev

The Consultant directory is not automatically created. If consultants are involved on a project, The Technical Support person should contact the help desk to have the consultant folder added. Technical Support will have write access to all subfolders. Surveys and Photogrammetry will a write access to the "consultant\survey" subfolder.

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.

CADD Standards

Districts

Most users, including users in the NDDOT Districts, should be directly connected to the Central Office server. If you are a NDDOT District CADD user who's computer doesn't automatically connect to the Central Office server (map the r:\ drive), contact the Help Desk (328-4357).

Sometimes the speed of access across networks is not acceptable. If you are a District User that is experiencing network performance problems, do your work on a local server (usually the g:\ drive) and move your work to the Central Office server (r:\ drive) after it is completed. After the project information has been moved to the r drive it should be removed from the g drive. Be sure to set up and use a project directory structure that is similar to the Central Offices. Except for the drive letter designation, the directory and file path should be the same as the Central Offices (example: g:\project\80013389.031\district\).

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 a CD or DVD.
4. If an entire project has been completed for the NDDOT (including design details), the files should be sent to your respective Technical Support Contact within the Design Division.
5. If only the survey work is to be done by a consultant, the files should be sent to Surveys and Photogrammetry Section Leader.
6. Dependent on steps 4 and 5, the Technical Support Contact or the Survey and Photogrammetry Section Leader will import the project information to the r:\ drive and re-path reference files with Axiom Reference Manager.

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.

2.2 File Naming Conventions

Sept 2015

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 2.9*

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".

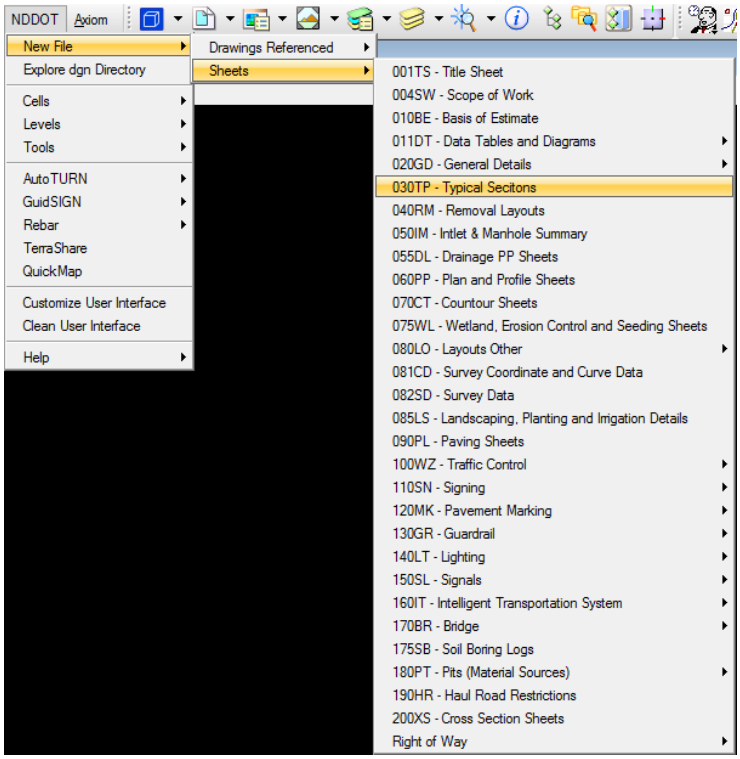
The "prefix" is used to divide and organize plot sets into sections. The prefix is required for all drawings that are going to be **directly** incorporated into a plot set for plan production. These plots are used to directly print a sheet in the plans. The prefix should not be used for a referenced 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 the main NDDOT pull down menu in MicroStation. It is named "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.



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 actually uses a file copy and open command in the background. The file metadata is not rest 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, 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 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

2.3 AAREADME File and Directory Cleaning

July 2007

The AAREADME file should be an ASCI text file that helps users find data within a project folder. Each folder within a project directory should have an AAREADME file in it. 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. Brief Project Description
5. Drawings that do not use the standard naming convention should be listed in the AAREADME file. This list should also be submitted to a CADD Standards representative in order to correct any deficiency with the Standard Naming Convention.
6. List files that should not be archived. List or group files to be deleted after plan completion, like conceptual drawings.
7. If a project was abandoned or shelved, a history of what was designed should be detailed.

AAREADME files for the Survey folder should also contain:

8. County Name
9. File Index
   a. File Name
   b. Progress
   c. Description
10. 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.

AAREADME files for Design, Traffic and District folders used for design work should also contain:

11. Name of designers who worked on the files within the directory
12. Multiple gpk explanation (If multiple GPK files were used within one directory explain why.)
13. Provide a key for correlating alignments (chains and profiles) This key should describe what chains were used with what profiles
14. Explanation of Sub (children) directories.

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

2dBdy.dgn
Complete EFB data and user information
Aareadme.txt
Complete this document
bdy91001.ind
Complete GPK input file for Hwy2
Efb-Top2
TEMP DEL Work file additional Topo data
Efb-Top3
TEMP DEL Work file additional Topo data
Efb-Bdy.dgn
In Progress EFB Bndry data; EFB data from January 2nd needs to be added.
Efb-Top.dgn
Complete EFB Topog data; includes side road extension at station 154+65 Left.
Job001.gpk
N/A Contains current alignment. EFB data from January 2nd will need to be added.

18 March ’04 [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 ’04 [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

CADD Standards

Example for the Design, Traffic or District folders used for design

R:\project\30002269.065\D_URBAN

CMU-3-002(065)269

PCN 12345

Hwy 2 through the City of Devils Lake – Reconstruction

Files that should not be archived

All of the files in the "design\temp" folder should be deleted after final plans have been submitted.

Designers
John Doe
Mary Jane

GPK – 001 was used by Design in the Central Office. GPK -002 was used by a consultant for the tied city project (9th Street)

ALIGNMENTS KEY

HORIZ	EXIST-V	PROP-V	ROADWAY
BASE01			N-S SECTION LINE (NEW STA - S TO N)
BASE64			N-S SECTION LINE (OLD STA - N TO S)
PROP01	EXSR01	VER01	WEST SR 34TH AVE END PROJECT 119+00
PROP02	EXML02	VER02	WEST MAINLINE ROADWAY
PROP03	EXML03	VER03	EAST MAINLINE ROADWAY
PROP04	EXSR04	VER04	EAST SR 36TH AVE TO 32ND AVE
PROP05	EXSR05	VER05	EAST SR 32ND AVE TO END PROJECT 119+00

Sub (children) directories

The "sheet" directory was used for plan cut sheets. The "details" directory was used for plan details.

CADD Standards

Directory Cleaning

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.

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

After the construction records have been completed (at the time the project is moved near-line) some supporting project files may be deleted from the project by the Information Technology Division. The following list of files that will be deleted at this time.

***.x, *.rx**	**GEOPAK Criteria Files**
*.inp	Input files used mostly for GEOPAK
*.jou	GEOPAK journals
*.bak	Backup files
Projdbs Directory	GEOPAK Project Manager directory
*.ind	User input files used for GEOPAK
.lis,.btb *.rtb	Files used for blue top books – slope stakes
*.ond	User cogo output files used for GEOPAK
*.log	Log files
*.cel	Project cell libraries

2.4 Standards Directory

Jan 2017

Here is a summary of the "NDDOT Standards Directory". Files stored in this directory are used to configure many of the operations performed in MicroStation, and GEOPAK. More extensive descriptions of their functions are contained in the *Section 2.5*.

Description	Directory
Bentley View Setting Files	S:\STANDARD\ **BENTLEYVIEW**
Axiom Support Files	S:\STANDARD\ V8I \ **AXIOM**
Geographic Coordinate Systems	S:\STANDARD\ V8I\ **BENTLEY_MAP**
Cell Libraries	S:\STANDARD\ V8I\ **CELL**
Configuration Files	S:\STANDARD\ V8I \ **CFG**
Spell checker Dictionaries, Border Sheet Tags, and Scale definition	S:\STANDARD\ V8I \ **DATA**
OpenRoads Data	S:\STANDARD\ V8I \DATA\ **Civil**
DGN Libraries	S:\STANDARD\ V8I \ **DGNLIB**
Set Up Configuration, Preference Files	S:\STANDARD\ V8I \ **INSTALL**
Interface Files	S:\STANDARD\ V8I \ **INTERFACE**
MDL Applications	S:\STANDARD\ V8I \ **MDLAPPS**
MicroStation Macros	S:\STANDARD\ V8I \ **MACROS**
Central Office Plot Divers	S:\STANDARD\ V8I \ **PLOTDRV**
Seed Files	S:\STANDARD\ V8I \ **SEED**
line styles, fonts, color table	S:\STANDARD\ V8I \ **SYMB**
Visual Basic	S:\STANDARD\ V8I \ **VBA**
GEOPAK Criteria Files	S:\STANDARD\ V8I \GEOPAK\ **CRITERIA**
GEOPAK D&C Manager	S:\STANDARD\ V8I \GEOPAK\ **DCMAN**
Roadway Designer Files (SS2)	S:\STANDARD\ V8I \GEOPAK\ **Roadway_Designer**
GEOPAK Sheet Files	S:\STANDARD\ V8I \GEOPAK\ **SHEETS**
GEOPAK Super Elevation Files	S:\STANDARD\ V8I \GEOPAK\ **SUPERELEVATION**
GEOPAK Survey Support Files	S:\STANDARD\ V8I \GEOPAK\ **SURVEY**

CADD Standards

2.5 Configuration Settings, Preference Settings, and User Interface

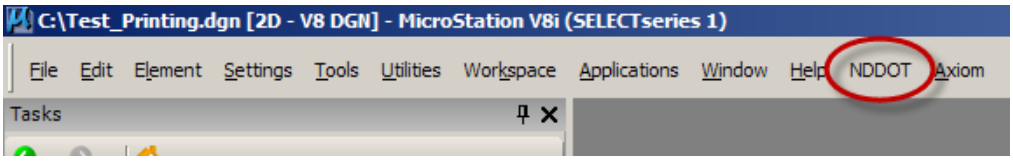
Jan 2017

Having the correct settings is required to use the NDDOT standards properly. Details of some of these settings will be discussed shortly. But for many users, the following summary will suffice.

For most NDDOT users, the standard configuration, preference and setting files should be correctly set up by support staff. Most of the CADD standard files are linked to the s:\ drive. Typically if one standard setting is set up correctly, they all will be correctly set.

Most users can typically tell if their computer is set up correctly by doing the following:

1. Open MicroStation



2. The main menu should have a "NDDOT" pull down menu. If you can see this, everything is probably installed correctly.

<u>Default Directories</u>

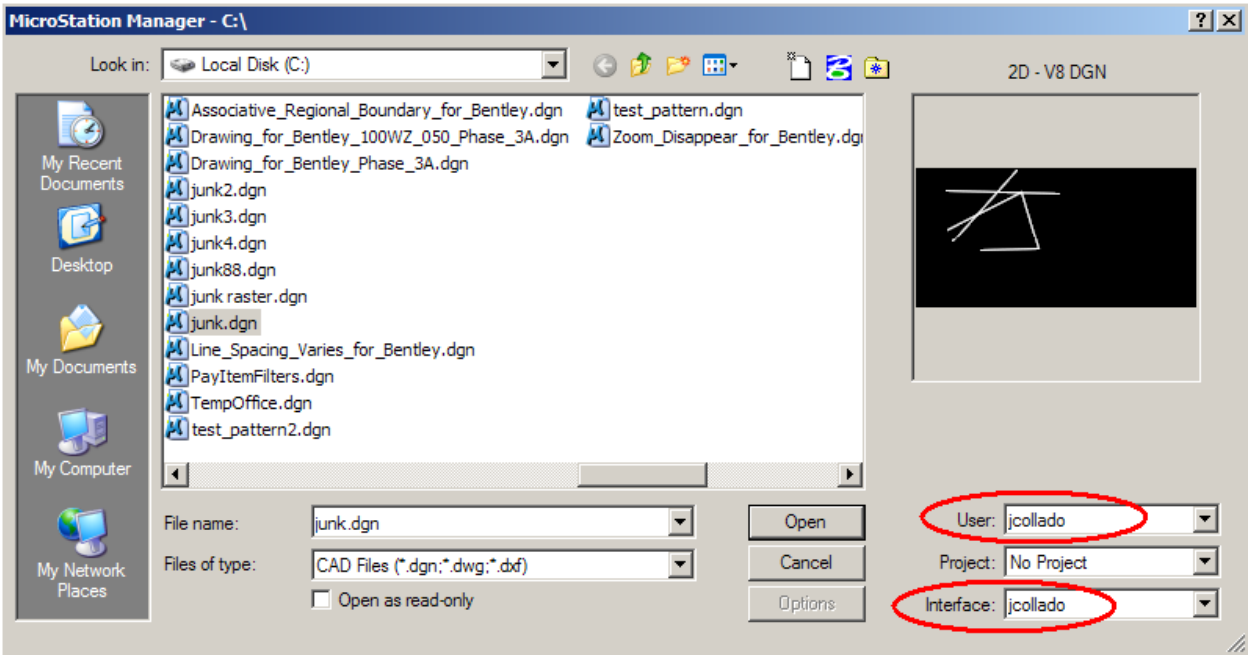
Most user workspace files have been moved to "**C:\NDDOT_CADD\s_drive\Support\users**". A subdirectory named after your user name should have been created under this directory. In this explanation "jcollado" is used. But, everyone will have their own unique name. CADD standards have been created to help 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 easer management. This standard workspace area helps automate many user processes.
2. Files are grouped for easier portability. MicroStation-Geopak, 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.

Your default user name and interface should be setup for you. These settings should be named after your user ID.

CADD Standards



Note, when you log on to your computer (log on to windows) use lower case. The text case isn't important for Windows but it is important for MicroStation (example, "jcollado" is not the same as "Jcollado").

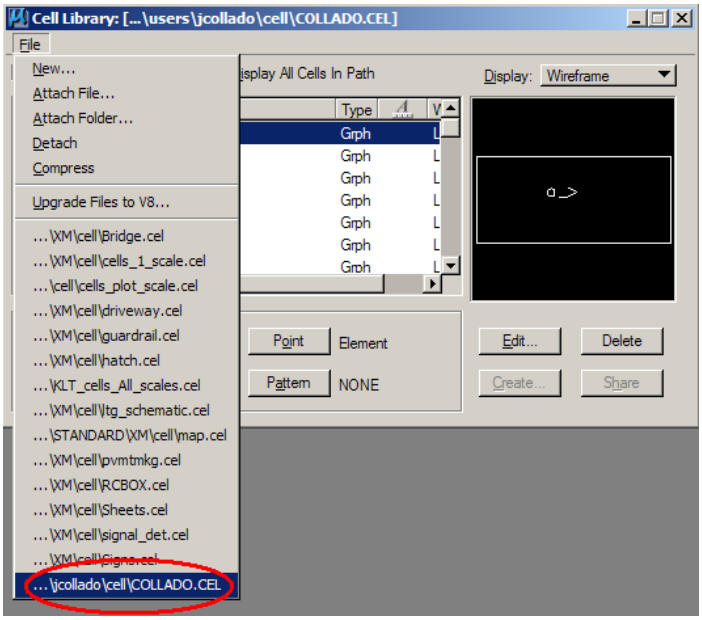
User Configuration Files

Your user configuration file is named after your user id and is stored in the "user" sub directory (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\V8i\Users\jcollado.ucf). Note, a user may have more than one set of user configurations. Example, a user may have another configuration file for the "Image Viewer" Application (C:\NDDOT_CADD\s_drive\Support\users\jcollado\ V8i\Users\iv.ucf).

CADD Standards

Cells

If you put personal cell libraries in the cell directory (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\ V8i\cell), they will automatically be added to your cell list. You should not have to search for your personal cell libraries.



Interfaces (Menus and Tools)

If you create a dgnlib for custom menus and tools for personal use, it should be stored in your interface directory for MicroStation under the appropriate user subdirectory (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\V8i\Interfaces\MicroStation\jcollado\ jcollado.dgnlib). Changes will be appended to the Standards Interface.

Function Keys

If you create custom function keys, you should save your changes to the Fkey subdirectory and name the file after your user ID (Example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\ V8i\Interfaces\Fkeys\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 Fkey subdirectory and name the file after your user ID and the appended "_shortcut.txt" (Example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\V8i\Interfaces\Fkeys\jcollado_shortcut.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\V8i\data\WmsServerList.xml, and pasted it in your user\data directory (Example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\v8i\data\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.

CADD Standards

Macros

MicroStation Basic

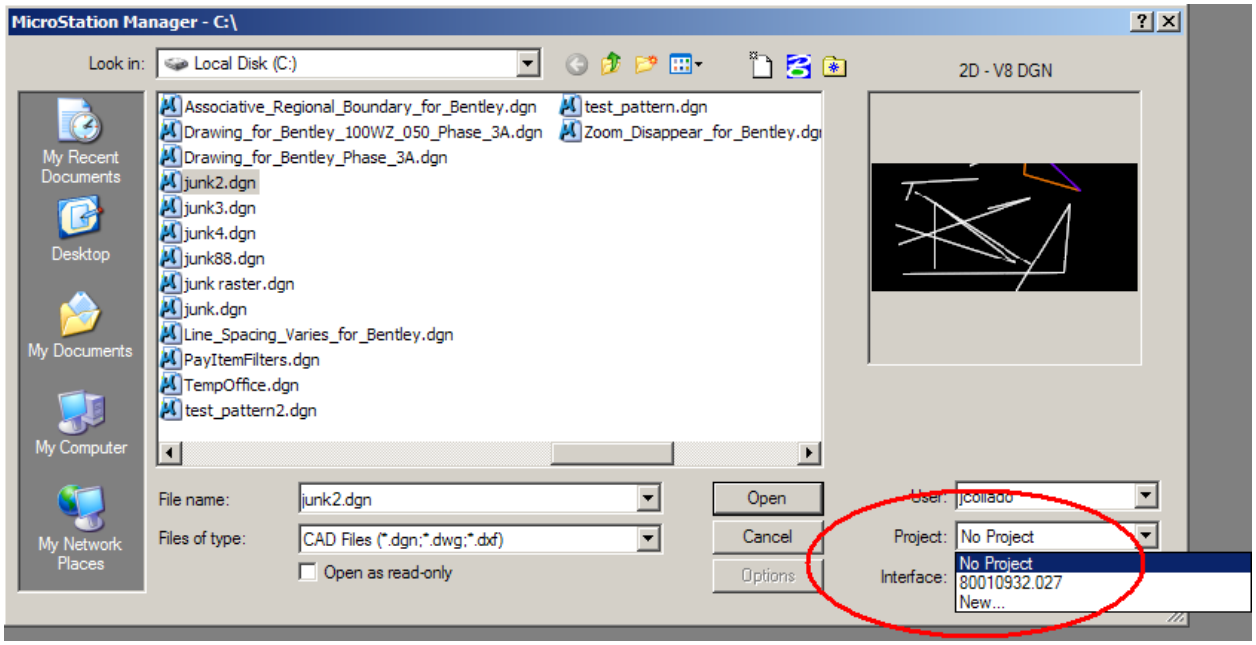
If you create personal Macros, you should save them to the Macro Folder (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\V8i\macros\jdc_test.bas). If the macros are stored in this directory, you will not have to browse for them.

VBA

If you create personal VBA, you should save them to the VBA Folder (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\V8i\macros\jdc_test.mvba). This is the first place MicroStation will look for your macros.

Projects (MicroStation Shortcuts)

Does browsing the R drive for your project annoy you? Do you want to see shortcuts for only your projects? If yes, using a project configuration file may be the answer for you. Simple project configuration files can be copied from S:\STANDARD\PCF\Test. Find the one for your respective project and copy it to your projects subdirectory (example, C:\NDDOT_CADD\s_drive\Support\users\jcollado\V8i\Projects\80010932.027.pcf). If you have a pcf file in this directory, your respective team list will be replaced with your personal list in the MicroStation Manager dialog box. Setting the "Project" in this dialog box will automatically point to your project subdirectory.



If a project configuration file (pcf) has not been set up for your project – file is not in S:\STANDARD\PCF\Test, contact the CADD support specialist.

CADD Standards

Site Configuration Files

Most users don't need to understand how Site Configuration files work. This section is primarily for Consultants and other users that have to set up their own site – office.

The typical installation of Bentley software is used. The application is installed at the default location usually "C:\Program Files (x86)\Bentley\".

The NDDOT uses site configuration files to point to most of the CADD Standard resource files. These files can be opened and reviewed with a simple text editor application such as notepad. During a typical NDDOT computer setup, the configuration settings are redirected to use a different series of configuration files.

The file
"C:\Program Files (x86)\Bentley\MicroStation V8i (SELECT series)\MicroStation\ config\appl\NDDOT_Pointer_1.cfg"
points to the configuration file
"C:\NDDOT_CADD\s_drive\Support\NDDOT_Pointer_2.cfg"
which then points to the configuration file
"S:\STANDARD\V8i\include.cfg"
which intern points to the configuration files under the directory
S:\STANDARD\V8i\cfg.
The second pointer (NDDOT_Pointer_2.cfg) has been added to allow non administrators on Windows 7 the ability to disable the NDDOT CADD Standards.
There are 2 subdirectories under **S:\STANDARD\V8i\cfg.** The **"appl"** directory contains application configuration settings modified for NDDOT work. The **"user_and_groups"** directory contains configuration settings to address NDDOT work groups.

No CADD standards are stored in user configuration files. The NDDOT sets up an empty user configuration files named after the users log on name.

Batch files were created to automate the creation of the standard user workspace. These files are located at "**S:\Standard\V8i\Install\"**

The NDDOT uses a standard interface. For NDDOT users the interface file is accessed directly from the following location;

S:\STANDARD\V8i\Interface\Interface_Date-Version.dgnlib

Appendix S provides a recommendation for NDDOT CADD Standards Installation for Consultants.

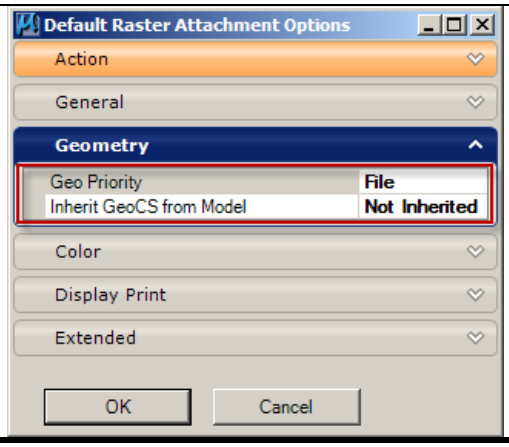
CADD Standards

Preferences

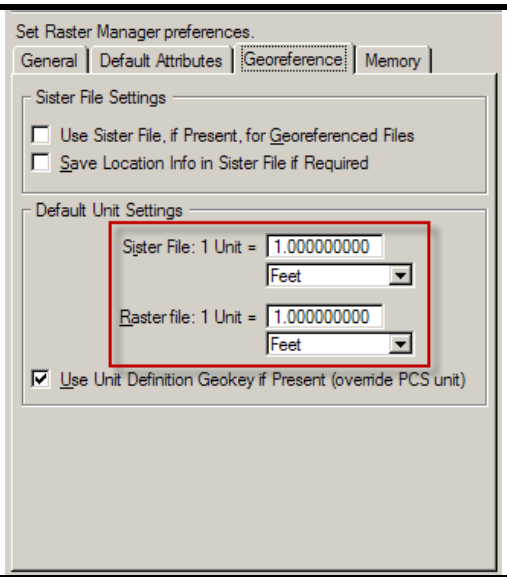
Your user preference files are named after your user id and is stored in the "pref" subdirectory. Most users will have 2 preference files. One for working without Geopak SS4 and one for working with Geopak SS4.

Example,
C:\NDDOT_CADD\s_drive\Support\users\jcollado\V8i\V8i_Home\prefs\jcollado.upf
C:\NDDOT_CADD\s_drive\Support\users\jcollado\v8i\V8i_Home_GeopakSS4\prefs\jcollado.upf

The following table lists some preference settings that are not set with the original MicroStation Installation. These settings are recommended for the general user. Most of the preferences are stored in the user preference file (upf). Make the following changes in your user preferences by selecting "workspace > preferences".

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
Raster Manager > Default Raster Attributes	Set Geographic Coordinate System from Raster	

CADD Standards

Raster Manager > Georeference (tab) > (as shown)	These are some settings needed for working with raster images created by the Photogrammetry Section	
Reference > Set Default Attachment Preferences > Display Raster References	When references are attached, they can also automatically attach the rasters that are attached to the reference.	Disable
Task Navigation > Icon Size	Makes dialog smaller, recommend for verbose task navigation	Small (16 x 16)
View Options >	Element Highlight color Selection Set Color	Yellow Yellow

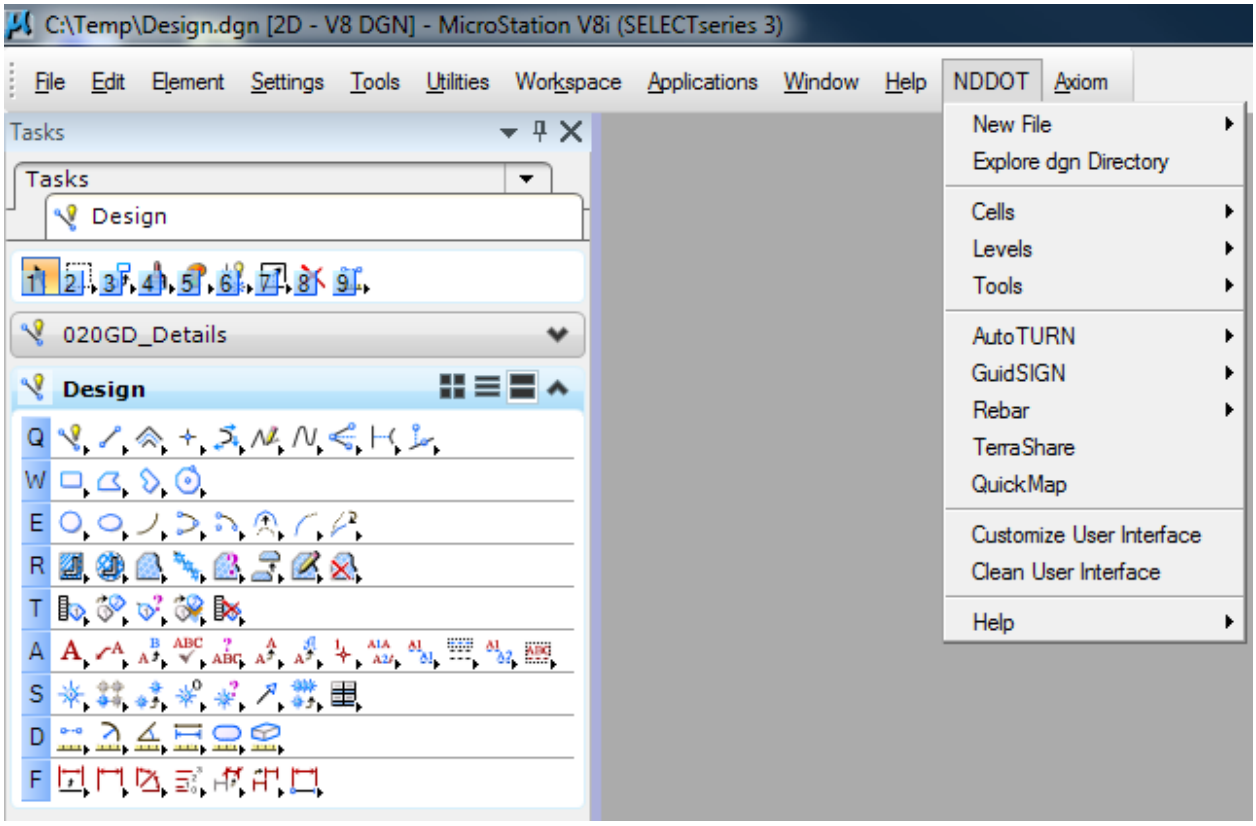
CADD Standards

Some preferences are stored in the preference file (upf) but are not changed through “workspace > preferences”. 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 > Compress > Options	Allow deletion of unused – empty parts of the dgn file	All settings enabled
Settings>Snaps> AccuSnap>Enable For Fence Create	Allows AccuSnap while placing a fence.	enable
Within the Place text command - “Apply changes to all text”	Allows multiple formats within one text element	disabled
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

NDDOT Main Menu



NDDOT changes to the MicroStation menu can be found in one pull down called NDDOT.

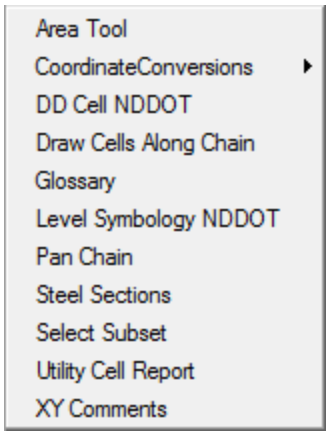
New File
This tool creates a new drawing file as you look up the standard name.

Explore DGN Directory
This tool is used to quickly open your drawing directory with Windows Explorer. It's a quick way to get to resource files related to your drawing.

Cells
Cell shortcuts are quick ways of opening common standards cell libraries.

Attach Levels
These tools will attach additional level libraries.

CADD Standards



Tools (NDDOT)

Additional tools adopted or created by the NDDOT can be quickly accessed from this pull out.

Area Tool

This is an advanced measuring and labeling tool. Not loaded with MicroStation by Default.

Coordinate Conversions

Caution is recommended with these tools. Don't use these tools unless you have received the applicable training.

DD Cell NDDOT

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

Draw Cells Along Chain

This is a great tool to place cells along a roadway alignment, such as placing delineators for work zone traffic control. Some GEOPAK knowledge is required.

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.

Level Symbology NDDOT

This tool is used for some typical level symbology overrides.

Pan Chain

This tool is used to pan (move and rotate) a MicroStation view based on a Geopak Alignment.

Steel Sections

This tool places a steel section shapes.

Select Subset

This tool can refine selection sets by filtering line lengths and angles. It is great for refining Geopak Cross Section Symbology.

Utility Cell Report

This tool runs a special report that is read by NDDOT Geopak utility criteria.

XY Comments

This macro records and relates comments to a specified xy coordinate in MicroStation. Macro centers view on coordinate as comments are reviewed. Macro includes author and priority tags for filtering purposes.

CADD Standards

Other Applications

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

Customize User Interface

Opens user's dgnlib as assigned by the NDDOT standards and opens the customize dialog box.

Clean User Interface

Sometimes users accidently copy level definitions, dimension styles or text styles into their user dgnlib. These definitions can override current NDDOT CADD standards. This tool can purge these definitions and styles.

Help

This pull out contains shortcuts to common help references.

2.6 Metric Support

October 2005

Presently the NDDOT is not using metric measurements for plan preparation work. At this time, NDDOT doesn't have standards created specifically for metric use. However, many of the English Standards could easily be adjusted for metric use. If you need to use metric settings for NDDOT work, contact CADD Support (see *Section 1.2*).

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

Oct 2008

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: GEOPAK V8.11)

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

Example: The file naming standard for alignment drawings changed January 10, 2001. Alignment drawings were previously named align.dgn, but now they are named ds_align.dgn. If an active project already contained an alignment drawing named align.dgn, and this file was referenced in several other drawings, changing the name of the alignment drawing to ds_align.dgn may take several minutes to fully implement. In this case the user may elect to keep the old file name through the completion of the project.

2.8 Taking Electronic Drawings into the Field

Oct 2008

This section discusses using CADD 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 can not 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 icon - shortcut. This shortcut maps the resource files and project files in a manor 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).

Note this procedure does not cover installing MicroStation and GEOPAK or checking out licenses. A Work Management System request is required for installing MicroStation and GEOPAK.

Step 1 can be accomplished by running a batch file or manually. Running the batch file is the preferred method. However, 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\V8I\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 customized desktop icon to temporarily create “S” and or “R” drives on your computer and start MicroStation. Caution, local “S” and or “R” drives can not be created if networked “S” and or “R” drives are already connected. Make sure your computer is disconnected from the network before proceeding with step 3. The icon - batch file runs 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 3 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

2.9 Final Plan Delivery

Sept 2013

The "Final Plan Delivery" includes several products. The requirements below elaborate on some of these products including Production Drawings, Resource Files, Static Electronic Drawings and Paper Printed Drawings. 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 native MicroStation Drawings (dgn). They are typically editable and contain more information than Static Electronic Drawings. Information can by queried from the drawing (example; where are the 96 inch manholes). Functional Electronic Drawings usually have working relationships with other drawings and several display options.

   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 can be used to help build a project. Most are not directly printable. Examples of functional files include: Alignments files (gpk, dc), point files (asc, csv), and surface models (dtm, tin, dc). Several types of Functional Resource Files can be imported directly into survey equipment.

   Resource Files 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.

3. Static Electronic Drawings – These files are usually more user friendly than Production Drawings. They are easy to review, transport, and print. The only approved "static electronic drawing" is a pdf (portable document format). Submittal of other static electronic drawings such as tif, jpg, and pps (portable plan sets) will only be accepted if these formats are pre-approved by the NDDOT.

   Static Electronic Drawings – PDF's are required on all projects.

4. Printed Paper Drawings - This document is the original PE stamped and sealed document. Printed Paper Drawings are always required.

The "Final Plan Delivery" CD or DVD 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 on a separate CD or DVD.

CADD Standards

Production Files Requirements

Production drawings shall follow the NDDOT CADD Standards. They shall be developed with MicroStation V8I.

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. Drawings that are displayed for the public must be reproducible as shown to the public. Note static (pdf) files are the preferred method of displaying information for the public. If static (pdf) files of information displayed for the public are created and saved, the conceptual production (dgn) files do not need to be saved. Production (dgn) drawings can be displayed for the public, but all the drawings including reference files must be protected from further editing including display options. A version of the main drawings displayed for the public and all reference files must be copied and saved to a protected directory as read only. The protected directory should be named so that it is easily identifiable such as "Public Meeting", "Public Input", "Public Hearing" or "Public Informational".

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 2.1* 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 (see *section 3.12* of the NDDOT CADD Standards Manual).

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.

CADD Standards

Resource File Requirements

If shapes were used in the development of cross sections, drawings of GEOPAK super elevation shapes need to be submitted.

If cross sections are required, a working cross section drawing (includes XS origin cells) shall be submitted.

If earth work is calculated from cross sections, the earthwork shapes shall be drawn into the cross sections with stratified colors. The final earthwork shapes shall be kept so that they can be compared with the earthwork log file.

Multiple gpk files for the same phase of project development shall be avoided. Different coordinate geometry elements with the same name shall be avoided during plan development. Different coordinate geometry elements with the same name shall be prohibited when Resource Files are submitted as part of the plan delivery. Minimizing the number of gpk files will minimize the chance of coordinate geometry discrepancies.

CADD Standards

Static Electronic Drawing Requirements

Portable Document Format (pdf) is an accepted static electronic format.

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 plans is a concern. The plans must be easy to download.

1. The plans shall be divided and published in separate volumes.
    a. Every separate volume shall be less than 40 MB. The individual sections, as defined by section numbers, shall not be split between volumes. The volumes may be spilt where the section numbers change. Designers shall use their discretion when deciding where the splits occur.
    b. Cross Sections are always published as a separate volume(s).
    c. The separate volume requirements only apply to the Final Plans used for Electronic Distribution. Separate volumes are not required for other phases of project development, color or the PE version (used only for printing as sealing by a Profession Engineer or Surveyor).
2. The PDF shall be optimized with Adobe Professional 10. The "PDF Optimizer" tool usually reduces the file sizes. The following is an overview of the Optimizer Settings.

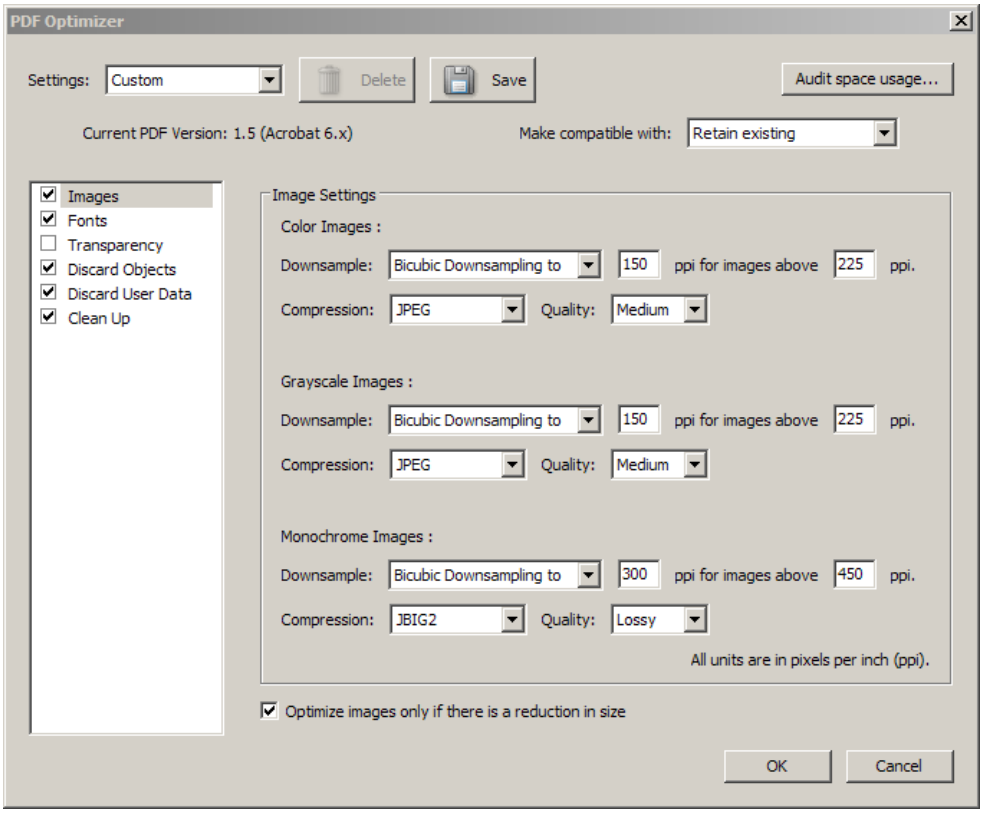
The "PDF Optimizer" tool is found in the Adobe Acrobat Pro menu under "Save As > Optimized PDF". Optimizing a file can take several minutes. Copy the pdf to a local drive before using the "PDF Optimizer" tool in order to improve performance.

CADD Standards

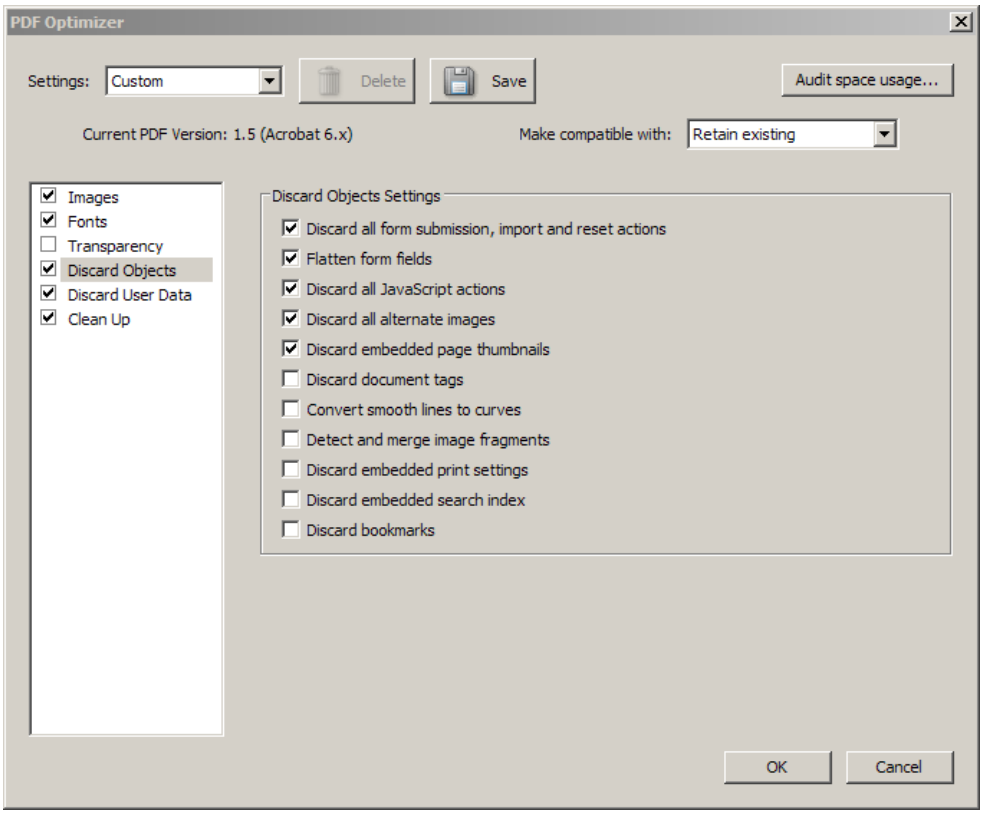
The standard-default "Images" settings should be used.

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

Transparency settings have not been incorporated into the CADD Standards. Optimization settings for "Transparency" aren't enabled.

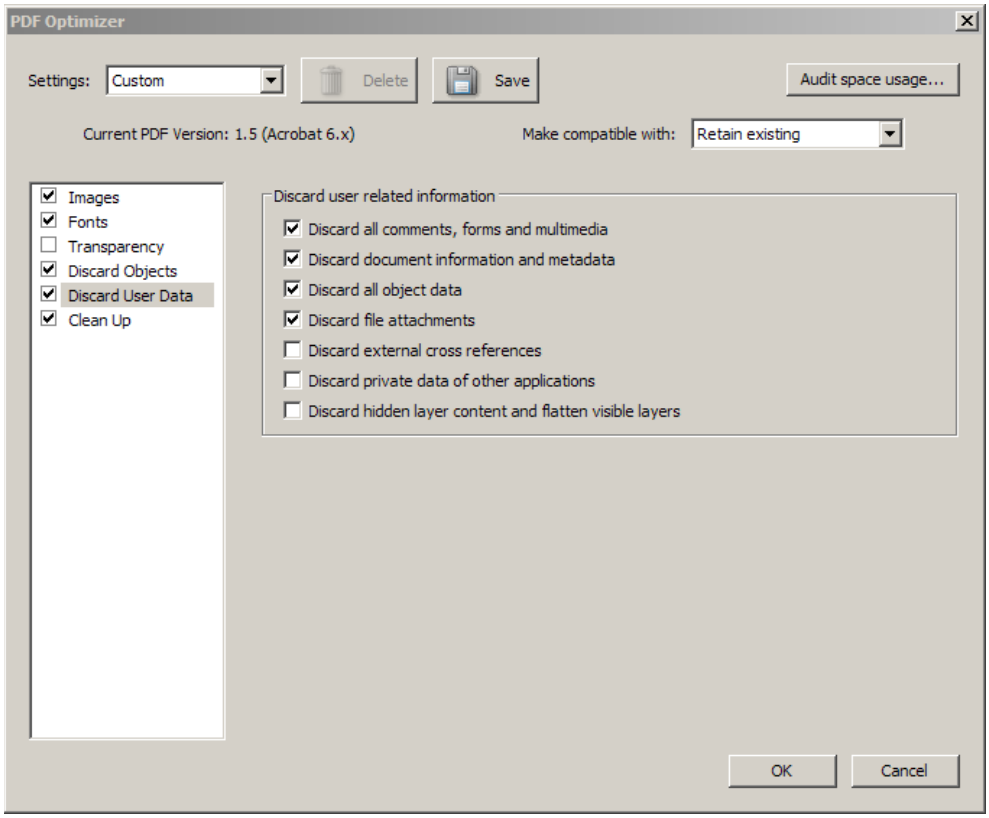


Discard Object Settings are as shown.

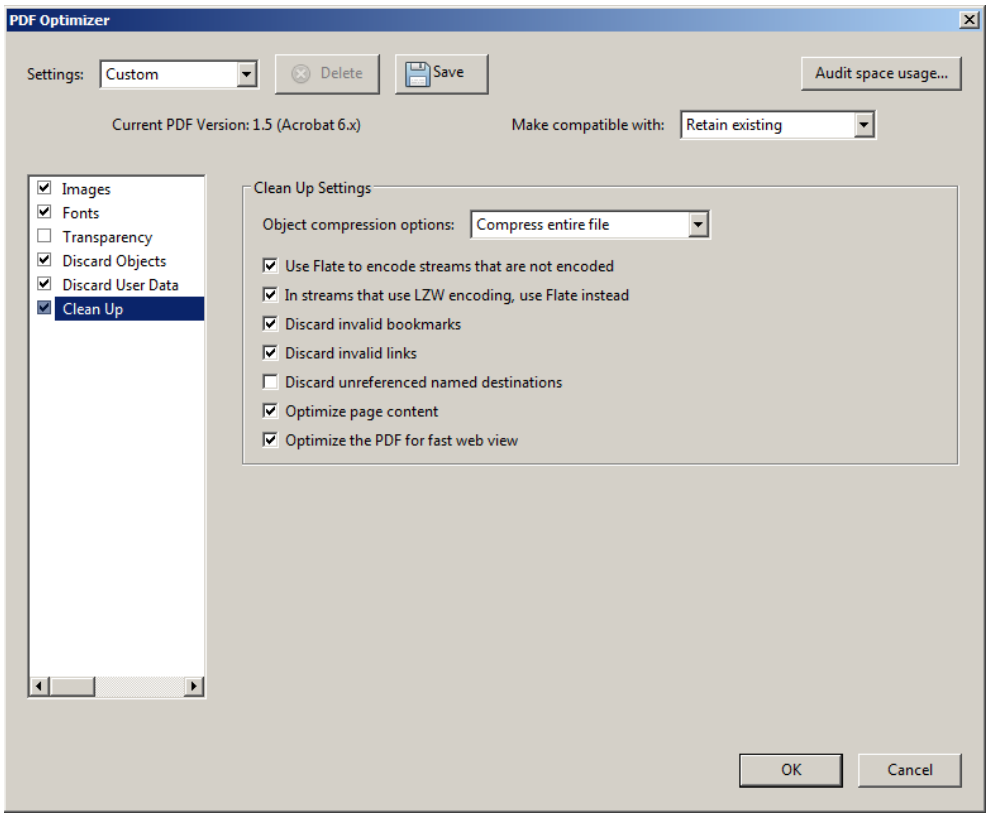


CADD Standards

Discard User Data Settings are as shown.



The standard-default "Clean Up" settings should be used.



CADD Standards

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, ampersand, and another space character (example: "SS-3-001(015)128 & 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"
    c. "Final Plans"
    d. "Addendum1", "Addendum2", … etc
    e. "Plan-Rev1", "Plan-Rev2', … etc
    f. "Asbuilt"
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. The use of separate volumes is optional for other phases of project development.
4. If the project requires cross sections, they must be included as a segregated file. A separate file must be used even if there is only one cross section sheet. 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 "PE" (for Profession Engineer signing and stamping).

CADD Standards

The following is a list of example names.

IM-2-094(070)275 Preliminary
IM-2-094(070)275 Preliminary Color
IM-2-094(070)275 PS&E
IM-2-094(070)275 PS&E Color
IM-2-094(070)275 Final Plans #of# ED
(replace # with actual numbers, example 1of3)
IM-2-094(070)275 Final Plans PE
IM-2-094(070)275 Final Plans Color ED *
IM-2-094(070)275 Final Plans Color PE *
IM-2-094(070)275 Addendum1 ED
IM-2-094(070)275 Addendum1 PE
IM-2-094(070)275 Plan-Rev1 ED
IM-2-094(070)275 Plan-Rev1 PE
IM-2-094(070)275 Plan-Rev2 ED
IM-2-094(070)275 Plan-Rev2 PE
IM-2-094(070)275 Asbuilt
IM-2-094(070)275 Asbuilt Color

IM-2-094(070)275 Preliminary XSEC
IM-2-094(070)275 Preliminary XSEC Color
IM-2-094(070)275 PS&E XSEC
IM-2-094(070)275 PS&E XSEC Color
IM-2-094(070)275 Final Plans #of# XSEC ED
(replace # with actual numbers, example 3of3)
IM-2-094(070)275 Final Plans XSEC Color ED *
IM-2-094(070)275 Addendum1 XSEC ED
IM-2-094(070)275 Plan-Rev1 XSEC ED
IM-2-094(070)275 Plan-Rev2 XSEC ED
IM-2-094(070)275 Asbuilt XSEC
IM-2-094(070)275 Asbuilt XSEC Color

* 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.

After the final plans have been completed, the pdf plan set for preliminary review should be deleted. The pdf plan set used for PS&E review should be kept until the project is constructed (assumed 3 years after bid opening). Versions of PDF plans created for PE stamping should be purged after the paper set of plans has been officially approved and stamped.

Electronic Distribution Statements must be used as noted in the North Dakota Administrative Code, Title 28, “28-02.1-08-03.9”. PDF plan sets without the electronic Distribution Statement will not be accepted for final plans, addendums and plan revisions. The NDDOT cannot use PDF plan sets without the Electronic Distribution Statement for electronic distribution.

CADD Standards

Consultants doing work for the NDDOT shall not submit pdf plan sets with an electronic PE stamp. Plan sets with an electronic PE stamp are not to be distributed electronically.

Optically scanning the original paper plan set in order to create a pdf plan set is discouraged because the image quality is degraded and an electronic distribution statement is needed. PDF plan sets created directly from optically scanning the original paper plan sets must be revised with an electronic distribution statement. The electronic distribution statement is needed whenever the plans are distributed electronically.

Consultants must submit all types of plans in both color, and “black and white”.

CADD Standards

2.10 Plan Distribution

April 2009

Refer to the Design Manual for information on Plan Distribution;

I-10.02 Preliminary Plan Review
I-10.03 Plans Specifications, and Estimates (PS&E)
I-08.03 Final Plans Submittal
I-11.01 Plan Revisions Prior to Bid Opening
I-11.02 Plan Revisions After Bid Opening (Change Orders)

2.11 Current Software

Jan 2017

The NDDOT is presently using the following versions of software;

AutoTurn 10.0
Axiom Toolkit
Axiom Title Block Administrator 8.13c
Bentley View 08.11.09.829
GuidSign 6.2
GEOPAK 8.11.09.878
MicroStation 8.11.09.832

2.12 Current Resource Files

Jan 2017

The current CADD Standard Index File is dated "**1/19/2017 11:20:29 AM**". This index is used with a macro to review your current version of NDDOT CADD Standards. From the MicroStation menu, see "NDDOT > Tools > Index NDDOT Standard Files". The index file (nddotUpdateIndex.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.**

MicroStation Files

Description	File Name (Linked to Recourse)	Updated	Posted
Cell Libraries	Cells.exe	11-16	1-17
Dictionaries, Annotation Scale Definitions, Tag Library, Geographic Coordinate Systems, Line Styles, Fonts and Colors, Seed Files	Data.exe	12-16	1-17
DGN Libraries	dgnlib.exe	10-16	1-17
Macros, MDL	Macros.exe	3-13	09-13
Plotting	Plotting.exe	11-16	1-17
VBA	VBA.exe	1-17	1-17
Workspace Configuration and Setup Files	ConfigurationFiles.exe	12-16	1-17

Geopak Files

Description	File Name (Linked to Recourse)	Updated	Posted
Criteria Files	Criteria.exe	11-13	12-13
Design and Computation Manager, Borehole Tools	DCM.exe	10-14	10-14
Sheet Library	Sheets.exe	11-15	5-16
Super Elevation	GeopakSuperElevation.exe	1-16	5-16
Survey Manager and Legal Library	SMD.exe	1-16	1-17
Roadway Designer	RD.exe	11-13	12-13

Other CADD Files

Description	File Name (Linked to Recourse)	Updated	Posted
GuidSIGN	GuidSIGN.exe	9-15	9-15

CADD Standards

2.13 Software License Agreements

Sept 2010

Most of the time, common sense and a little respect will keep you on the right legal track with software license agreements. The NDDOT Information Technology Division will also promote the legal use of software. So if they tell you not to do something, don't do it. ITD completes most of the License Agreements for NDDOT employees, but all employees need to live up to them. At the end of this section are links to software agreements if you need to get into the details.

There are some agreement rules that might not be widely known. These CADD Standards will highlight a few rules that might deserve more of your attention.

1. The NDDOT has an axiom License for only the Central Office. Employees at Materials and Research, District Offices and Field Offices shouldn't use Axiom products. Central Office employees shouldn't use Axiom products on files located on district servers. ITD will add and remove software as applicable, but sometimes there is a little delay during employee transfers and rotational assignments. Just because you can use Axiom doesn't mean it's OK.
2. 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. See section 7.2.

Axiom (accessible on NDDOT Central Office Network)
S:\STANDARD\V8i\Axiom\Axiom End User Software License Agreement.pdf

Google Earth
www.google.com/accounts/tos/highlights/utos-us-en-h.html
www.google.com/accounts/TOS
www.google.com/enterprise/earthmaps/pro_features.html#faq

MicroStation (Typical location, if installed on your computer)
C:\Program Files\Bentley\MicroStation V8i (SELECTseries)\MicroStation\Eula.pdf

GEOPAK (Typical location, if installed on your computer)
C:\Program Files\Bentley\GEOPAK\V8.11\eula.pdf

CADD Standards

MicroStation

3.1 Seed Files

Dec 2010

Seed files are used to set a number of DGN file parameters. When a new DGN is going to be created, the operator needs to select the correct seed file. The seed file is actually a DGN file itself. Presently the NDDOT is using 3 different seed files;

1. NDDOT_seed.dgn
2. NDDOT_seed_Ft&In.dgn
3. NDDOT_seed_3D.dgn

The following are some of the features adjusted in the NDDOT seed file (NDDOTseed.dgn).

	NDDOT_seed.dgn	**NDDOT_seed_Ft&In.dgn**	**NDDOT_seed_3D.dgn**
Default Font	NDDOT (true type)	NDDOT (true type)	NDDOT (true type)
Default Drawing Scale	1” = 200’	1” = 5”	1” = 200’
Design File > Color	Selection Set: Yellow Highlight Color: Yellow	Selection Set: Yellow Highlight Color: Yellow	Selection Set: Yellow Highlight Color: Yellow
Design File > Working Unit Format	MU	MU:SU	MU
Design File > Working Units > Linear Units > Custom > Master Unit Definition	Unit = Feet Label = ‘	Unit = Feet Label = ‘	Unit = Feet Label = ‘
Design File > Working Units > Linear Units > Custom > Sub Unit Definition	Define Custom Unit: toggled on 1000 th = 12 inches	Unit = Inches Label = “	Define Custom Unit: toggled on 1000 th = 12 inches
Design File > Working Units > Advanced Settings > Edit >Resolution	304800 per Foot Solids 0.62137 miles	304800 per Foot Solids 0.62137 miles	304800 per Foot Solids 0.62137 miles
Design File > Working Units > Angels > Format	DD MM SS	DD MM SS	DD MM SS
Levels - Embedded	Tag DipText Sht Text Sht Stamp Text Sht Lines	Tag DipText Sht Text Sht Stamp Text Sht Lines	Tag DipText Sht Text Sht Stamp Text Sht Lines
View Attributes	ACS Triad: Off Clip Volume: Off Fill: On Grid: Off	ACS Triad: Off Clip Volume: Off Fill: On Grid: Off	ACS Triad: Off Clip Volume: Off Fill: Off Grid: Off
“Place Note” tool	Start at “Terminator”	Start at “Terminator”	Start at “Terminator”
“Scaling” tool	Scale Dimension Values: Off Scale Annotations: On	Scale Dimension Values: Off Scale Annotations: On	Scale Dimension Values: Off Scale Annotations: On
Model Properties > Line Style Scale	Annotation Scale	Annotation Scale	Annotation Scale

3.2 Global Origins and Coordinate Systems

Sept 2010

The present NDDOT CADD standard seed files have a different Global Origin than the previous CADD standard seed files. The new Global Origin is at: x = y = z(3d) = 0

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!**

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.

3.3 MicroStation Templates, Tools and Task Navigation

July 2014

The CADD standards use the term "Task Navigation" to describe the way templates, tools and tasks are used together to manage commands and symbology.

MicroStation "Templates" are the primary way the NDDOT manages element symbology. Tools are the primary way MicroStation commands are issued. Tools often reference the symbology in a template. Tools also offer some additional control of symbology that might not be available in the template. Tasks are used to manage the way tools are delivered – displayed.

A good understanding of Task Navigation will simplify the placement of most drawing elements. This tool is used to change several settings at one time and select a specific tool. 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.

There are numerous Task groups. Some are delivered with MicroStation and GEOPAK. Many other groups have been created by the CADD standards. Several Task groups are organized to draw specific elements in a specific drawing or group of drawings. These task groups promote drawing with the correct standard in the correct drawing. For example, existing power poles are found in the Topog task group and they should be drawn in the file named Topog.dgn. Several task groups are intended for only one particular type of drawing. Some task groups are intended for a group of drawings. *Appendix A* explains which task groups are used with which drawings.

The standard NDDOT interface hides some task groups based on the active drawing name. The standard interface makes it easier to pick the appropriate task group while promoting the use of standard drawing names by limiting the available task groups. 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 task groups uses a function called "**Named Expressions**".

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 following list shows how the 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

NDDOT symbology (templates) rely heavily on Annotation scale (Drawing Scale) settings. In order to use the standards correctly, the drawing scale must be set. Guidelines 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 Task Navigation. 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 Task Navigation, 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. See the next section on “Annotation Scale”.

3.4.1 Levels

Sept 2010

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 in V8 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.

Level Name	Level Number
“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.

3.4.2 “ByLevel” Settings

July 2013

The standard Levels have been set up for “ByLevel” use. However, the linestyle scales have to be manually set by the user and only a few components of the “Tasks - Element Templates” and the D&C Manager use “ByLevel” settings. Presently, “ByLevel” settings are only recommended when they are used by the standard “Tasks - Element Templates” or “D&C Manager” files.

3.4.3 Level Libraries

Sept 2010

The level information is stored in drawing libraries (dgnlib) files. They are located in the directory “S:\Standard\V8I \dgnlib\Levels\”. Most levels are automatically attached with the NDDOT standards. Presently the NDDOT has only one supplemental level library that can be used for additional pay item levels.

3.5 Line Styles

Sept 2010

Users are strongly encouraged to use Task Navigation and Annotation Scale to set the appropriate line style settings (see *Section 3.3*). 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. Task Navigation – Templates automates 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, Task Navigation – Templates automates 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: To easily change the direction of a line style, do the following:
On the menu bar under Tools –> Tool Boxes –> Check the Curves tool box

–> Click OK
Click on the Change Element Direction icon.
Identify the Element needing new direction
Direction of element changed!

3.6 Cells

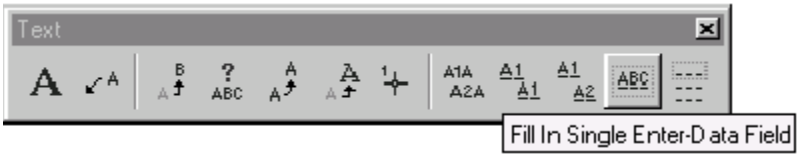
July 2013

NDDOT cell libraries are located at “S:\STANDARD\V8I\cell\”. The following is a list of the active NDDOT cell libraries:

Bridge.cel	Bridge items
Bridge_RCBox.cel	Reinforce concrete box 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.cell	Signal Detail Items
Signals.cel	Signal items
Signs.cel	Signing items

For a comprehensive listing of the available cells (see *Appendix C*).

Some cells in the Signs.cel library contain “Data Fields”. By using data fields there is no need to drop the cell to edit the text in the cell. These cells can be easily identified by looking for the letters DF at the beginning of the cell’s description. For example, the description for the cell named R1 2U, is DF SPEED LIMIT. To use these cells, place the cells and simply select the “Fill in Single Enter-Data Field” tool and click on the data field that needs to be changed.



Then type in the text and press “ENTER”. The data field will fill in with the text that was just entered. Data fields will appear as “ ” within the cells. To ensure that these lines do not show up when the drawing is plotted, access the “View Attributes” through “Settings” and make sure the “Data Fields” box does <u>not</u> have an X in it.

3.7.1 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).
- 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, “D&C Manager” or other NDDOT standard tools. Engineer font is used with some documentation created by GEOPAK in order 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 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 sec 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.

3.7.2 Abbreviations

Sept 2013

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.

Abbreviations are placed without any punctuation (e.g., CI is 23.9' lt of hyd at elev 1800.6').

If additional abbreviations need to be added to the glossary or appendix, contact a Standards Committee representative or use the Standards Request Form at the end of this manual.

3.8 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. 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.)

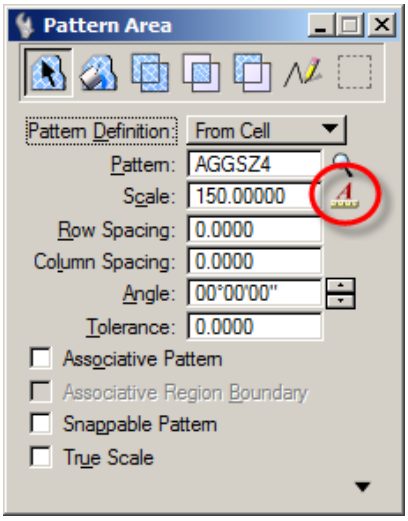
3.9 Patterning and Hatching

Jan 2017

Patterning and hatching is 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 "Tasks" for patterning and hatching because several of the settings are automated. If "Tasks" 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 S:\Standard\V8I\Cell\Hatch.cel. To establish the correct values for the "Pattern Area" box, multiply the values given in *Appendix G* (for scale, row spacing and column spacing) by the final plot scale. For example, if the final plot scale is 1" = 200', and the pattern cell is "Lignite Coal," the scale will be 0.5 x 200 = 100. Row spacing will be 0.15 x 200 = 30. Column spacing will be 0.15 x 200 = 30. And the angle remains at 45 degrees. Remember if "Tasks" is used, these settings are automated.



MicroStation SS4 has the ability to use annotation scale. MicroStation SS2 doesn't have this capability. The current CADD standards use a macro to read the current drawing scale to adjust hatching and patterning, but they do not use annotation scale directly. Do not use annotation scale for hatching and patterning. The annotation scale toggle button should be off for hatching and patterning.

If an operator is working in a file with a lot of hatching or patterning, they should probably toggle off "Patterns" under "Settings," "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.

3.10 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. *Appendix M* is a catalog of the printers and drivers set up for the NDDOT. 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

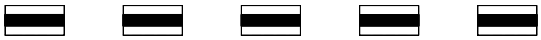
The table on the right is a line weight guide. It is provided as a cross reference for evaluating your printer output. These widths have been used to develop the CADD standards.

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

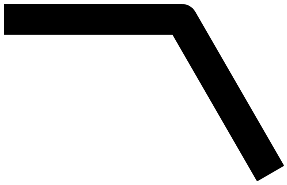
Line Caps and Joins

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



3.11 Print Organizer

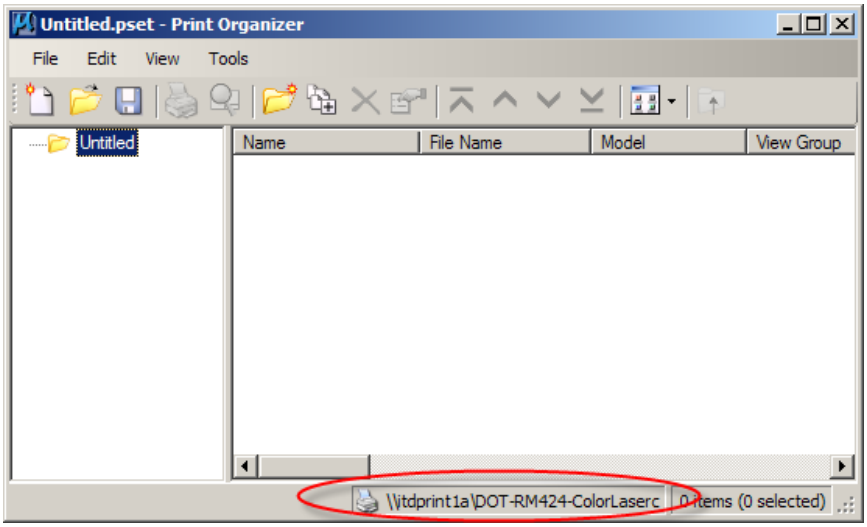
Sept 2010

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.

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. If this is for the final set of plans, add any Standard Drawings that you may need. The Standard Drawings can be found at R:\SUPPORT\DESSTD. Add these files the same way you would add any other MicroStation files.

7. 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.

8. 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.

9. Review the paper size for each document. Paper size should default to 11 x 17. If adjustments are needed; double click the individual paper size you want to edit or highlight all entries that need correction to change them at the same time. Double clicking directly on a paper size will allow you to change all highlighted entries.

a. Check the print area size (X Size and Y Size) as well. It can be adjusted in the same manner. For 11 x 17 sheets, the X Size should be 16.
b. When a print style is applied, one sheet will be printed for each sheet cell found in your files. Print preview will show if this is working. If your drawing does not have a sheet cell, it will default to saved view.

10. 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.

11. 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 - 10 as necessary.

3.12 Referencing Drawings and Attaching Rasters

May 2016

Reference Paths

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. 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). See *section 2.1* of this manual.

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 emphases.

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.

CADD Standards

Live Nesting

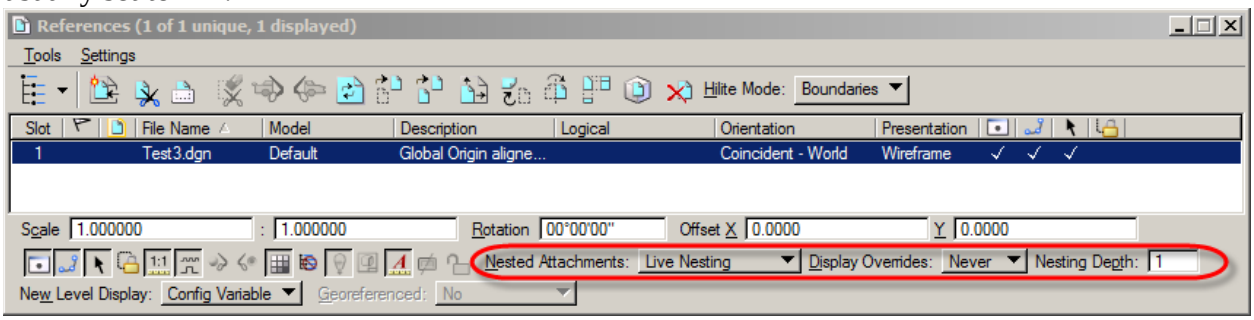
"Pointer Files" are used in an optional work flows. They are not required for plan production, but are encouraged because they can simplify revisions in drawings that use nested referencing. The following is an overview of "Live Nesting" referencing and "Pointer Files".

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.

The Pointer file controls which reference files and level will be displayed in your sheet drawings. The Pointer file can be used to turn on and off levels in multiple drawings. They can also be used to attach or detach reference files in multiple drawings. The Pointer file makes it easier to consistently adjust what is displayed in your plan sheet drawings. Multiple sheet drawings can reference the Pointer files 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 file, Live Nesting is not typically used because the Pointer file 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.

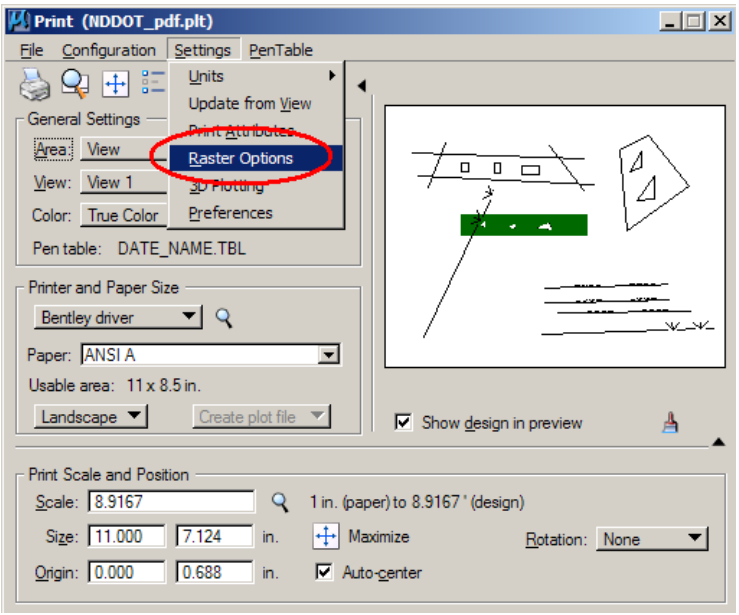
3.13 Printing Rasters (Pictures)

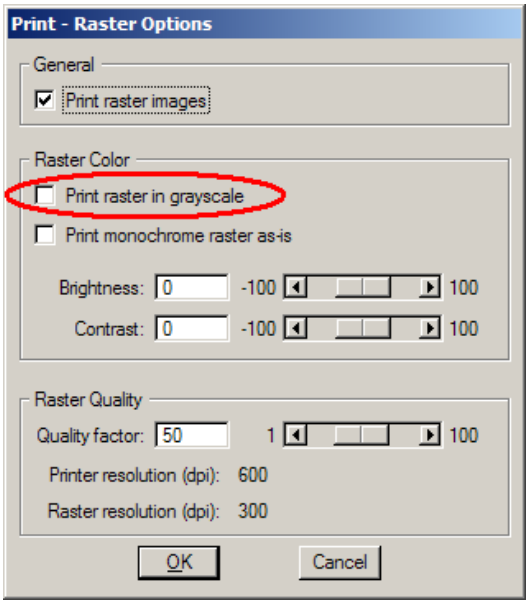
Oct 2008

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 then 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.

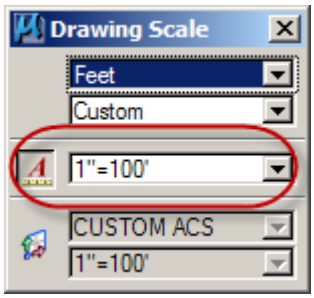




3.14 Annotation Scale

Jan 2017

The NDDOT CADD standards use annotation scale. Annotation scale (for placement) should be on for most elements. Hatching and Patterning is the exception. Annotation scale for hatching and patterning should be off. Annotation scale affects more than just annotation. Annotation scale affects the scale for line styles, cells, text, dimensions, hatching and patterning. The CADD standards presently use annotation scale indirectly, through a macro (VBA), to adjust 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 main MicroStation menu under "Settings>Drawing Scale".

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 drawing. 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.

<u>Annotation Scale for Line Styles</u>

- This is a model property. V8i Standards use "Annotation Scale for Line Styles".
- The V8i 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 is used in V8i.
    - 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).
    - Task Navigation tools will automatically adjust the line style scale factors as needed.

<u>Annotation Scale for Cells</u>

- 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.

CADD Standards

- 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 standard task navigation automates this setting.

Annotation Scale for Text (Text Styles)

Text Styles are used in V8i to help implement annotation scale for text. The actual paper scale values are used for text height and width. You are probably familiar with the values in units of inch. 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. For this standard the text height and width shown in the tool settings will not change. But 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 x 40 = 2.8 ≈ 2.784 = 0.0058 x 12 x 40).

Annotation Scale for Dimension Styles

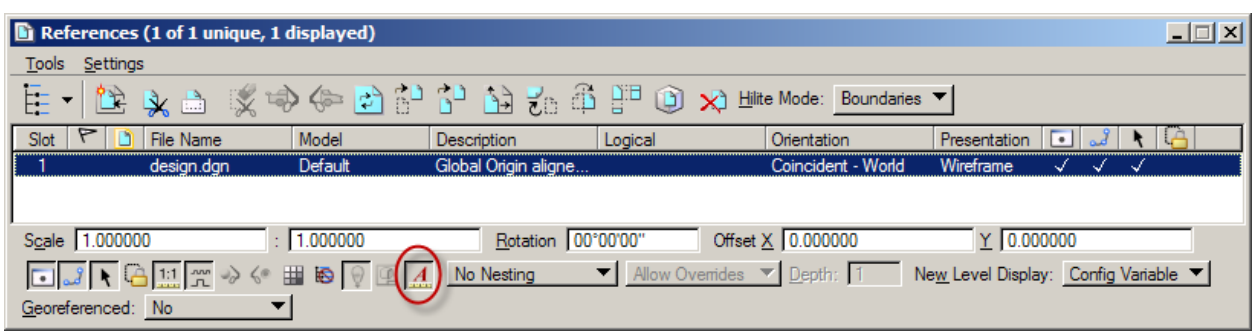
V8i Dimension settings are dependent on text height values. The NDDOT Dimension Styles have been set up using text styles.

Annotation Scale for Hatching and Patterning

Hatching and Patterning do not directly use annotation scale. The NDDOT standard tools read the annotation scale that is presently active and it adjust the Hatching and Patterning settings according to this scale. However subsequent changes to the annotation scale will not change the hatching and patterning settings. If the annotation scale is changed after hatching or patterning is placed, this hatching – patterning will have to manually be edited to the correct scale or replaced.

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.

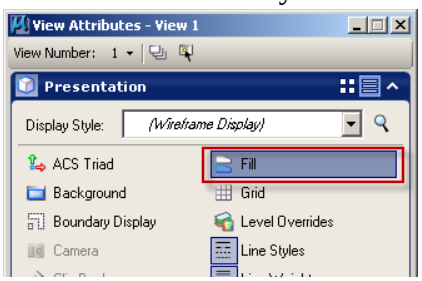


3.15 Priorities and Masking Elements

Jan 2017

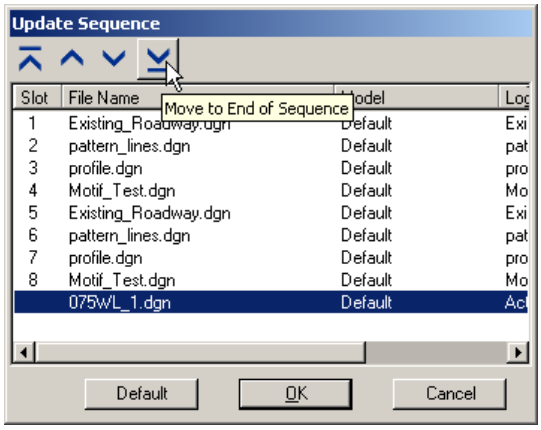
MicroStation shape elements with an opaque color matching the back ground color (number 255) are being used as masking elements within many sheet cells. These masking items are being used to hide referenced elements that might overlap a title block. These elements are being used with MicroStation "priority" 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 turn 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.



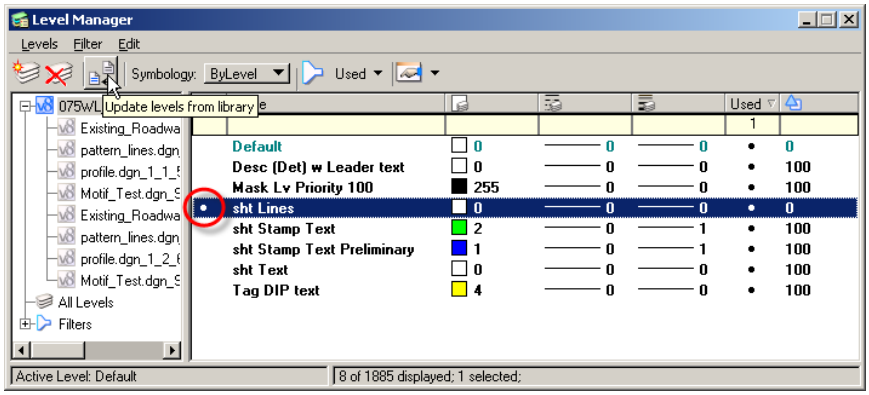
If a 3D drawing is referenced, all of the cut sheets – sheet drawings will need to be edited. With the sheet drawing active, open the reference dialog box and select "Settings > Update Sequence". Move the active sheet drawing to the end of the update sequence list. Be sure to save settings after the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

If a drawing with opaque shapes are being 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

GEOPAK

4.1 GEOPAK User Preference

Oct 2008

The following is a brief discussion on the "working directory" and "job directory" as set in the GEOPAK Users Preferences. The "working directory" is the location of the directory in which the working and support files are located. This directory can be set three different ways.

1. GEOPAK User Preference -Empty Default
2. GEOPAK User Preference -Defined Location
3. Project Manager

All users should be aware that there are three ways to set your working directory.

1. GEOPAK User Preference - Empty Default Method.

   Many GEOPAK functions work properly without setting the "working directory" preference. If this preference is empty, GEOPAK will default to the directory of the first opened drawing. One disadvantage of this method is it can not be used when using GEOPAK to clip sheets that reference drawings in different directories; the working directory must be set to the directory that contains the clipped sheets. See Method 2 or 3.

2. GEOPAK User Preference - Defined Location Method.

   This method is straight forward. Manually set the working directory to the appropriate location. This location is usually the directory in which your .gpk file resides.

3. Project Manager.

   The working directory along with many other settings can be defined within the Project Manager. Once project manager is setup, the settings for the particular project are automatically implemented when project manager is invoked.

   The settings in project manager overwrite the GEOPAK User Preferences. Therefore, using the project manager method to set the working directory, supersedes both methods 1 and 2, as described above. Note, just invoking project manager can set or reset the working directory to the project manager settings.

CADD Standards

The GEOPAK user - Cogo preference “job directory” is similar to the “working directory” preference. The “job directory” preference is used for Cogo files and if not set it will default to your working directory. Most users can leave this preference empty because they keep their Cogo files and drawings in the same directory. If the job directory is set, it also must be reset when switching between projects.

Notes:

- The “project name” field is optional.
- The initials “nd” (North Dakota) should be used for the “operator code” field.
- The “job number” field is required and is usually 001.
- The “subject” field is optional.

4.2.1 GEOPAK Database (GPK file)

October 2005

The gpk file is the main project related GEOPAK file. It is usually stored in the working directory. Individual projects may have multiple .gpk files. Multiple .gpk files are often created and copied to protect the integrity of work. Users should be conscious of all .gpk files used on a project. Users are often required to copy other .gpk files and use the copied .gpk file as a starting point.

When users are first involved in a project they should closely examine what information is presently available in existing .gpk files before creating .gpk files of their own. Users are encouraged to copy .gpk information, in order to save time.

4.2.2 Cogo (Coordinate Geometry)

July 2007

Cogo is an acronym for Coordinate Geometry. GEOPAK's Cogo is an application that allows the operator to define alignments and other elements within a data base (gpk file). This data base is the backbone of a GEOPAK project.

CADD Standards

Elements stored in GEOPAK should follow the numbering convention shown below. The GEOPAK POINT NUMBERING SYSTEM should be followed even if multiple *.gpk files are created for a single project.

GEOPAK NUMBERING SYSTEM			
Numbers	**Information at the Point**		**Typical User**
1-100	Existing	Alignment	Survey - Photo
100-5999	Existing	Primary\Other Control	Survey - Photo
100-5999	Existing	Earth	Survey - Photo
100-5999	Existing	Public Land Survey System (Section Data)	Survey - Photo
100-5999	Existing	Photo Panels	Survey - Photo
100-5999	Existing	Topog	Survey - Photo
100-5999	Existing	Utility	Survey - Photo
6000-7999		Property Lines and Right of Way	ROW
8000-8999	Proposed	Alignment - Office Location	Design
9000-9999	Proposed	Topog Info (curb returns, sidewalk control points, etc)	Design
10000-10999	Proposed	Utilities-Drainage	Design
11000-11999		Bridge	Bridge
12000-13999		Testing and Sample Locations	Materials and Research
14000-14999		Construction - Change Order - As-builts	District
15000-19999		Reserved for CADD Standards Development	
20000-30000	Existing	Survey Data Overflow	Survey - Photo

Curve names should include a prefix “C” and use the same number as the PI point number. Example; the name for curve with a PI at point number 11, should be “C11”. Spirals should also be named in a similar fashion with an additional suffix. The entry spiral should have a suffix “A” and the exit spiral should have a suffix “B”. Example: a SCS with its combination PI at point number 11 would be made up of a spiral named C11A, a curve named C11, and spiral named C11B.

CADD Standards

Alignments

Alignments stored in GEOPAK should follow the naming convention shown below. All alignments require a standard prefix.

Standard GEOPAK Alignment Prefixes			
Type of Alignment	**Alignment Prefix**		
	Horizontal	**Existing Vertical**	**Proposed Vertical**
Survey Center Line	SCL	EXS	PRS
Existing Alignment – Alignment previously Defined in another set of plans – older plans	EX	EXE	PRE
Proposed Alignment – New Alignment Defined	PR	EXP	PRP

The prefix is based on the type of chain – alignment being stored. The rest of the name (body of the name) should be based on the street-roadway name and/or location. The body of the name should consistently be used in the horizontal alignment, existing vertical alignment, and proposed vertical alignment.

The following is a list of example Names:

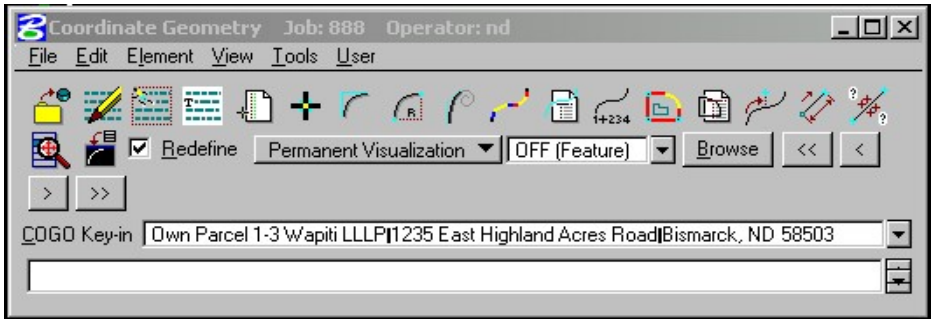
Example Names for Alignments			
Type of Alignment	**Alignment Name**		
	Horizontal	**Existing Vertical**	**Proposed Vertical**
Survey Center Line for US Highway 85	SCL85	EXS85	PRS85
Existing Alignment for US Highway 85	EX85	EXE85	PRE85
Proposed Alignment for US Highway 85	PR85	EXP85	PRP85
Existing Alignment for the North West Loop Ramp for 10th Street	EX10NWL	EXE10NWL	EXP10NWL
Proposed Alignment for the North West Loop Ramp for 10th Street	PR10NWL	EXP10NWL	PRP10NWL
Existing Alignment for Interstate 94 Westbound	EX94WB	EXE94WB	PRE94WB
Proposed Alignment for Interstate 94 Westbound	PR94WB	EXP94WB	PRP94WB

Note, some of the alignments/profiles in the above examples might not be applicable or typical. You probably would not need to design a profile for EXP10NWL if you were going to have a profile for PRP10NWL. The combinations of example names were listed to show the naming pattern.

Cogo input files, journals, and output files have not been standardized, but users are strongly encouraged to develop and save these files in a manner which can easily be reviewed.

Parcels

A parcel is stored in GEOPAK using points, curves, spiral curves, or chains that were previously stored. Points can be stored from electronic field book data, graphical data from intersecting lines or traverse courses drawn into MicroStation. An owner's name and address can be stored with each parcel by invoking Coordinate Geometry and by keying in "Own Parcel" followed by the parcel name and the owner's name and address.



The Design and Computation Manager can read the information of the parcels and prints it into a dgn file along with the parcel boundary.

4.3 Project Manager

October 2005

Project Manager is a coordination tool, organizing both GEOPAK functions and project information. Project Manager incorporates most GEOPAK road functions. Some road tools are only found in Project Manager (example: “Port Viewer” is only found in Project Manager). Project Manager can be used to set and store many project settings. It also provides dialog boxes that help create input files.

Notes:

- Projects should be created and maintained within each separate project’s working directory. Example, The Survey and Photogrammetry section should set up one Project Manager and the Design section should set another Project Manager, separate Project Managers for the same project.

- The use of Project Manager will create sub-directories and files under the working directory.

- Project Manager Users Names should not be shared. Problems may occur if users try to share the same user name at the same time. Users should use their own name (email name) when working in project manager, but they should share the same "Operator Code". The initials "nd" (North Dakota) should be used for the "operator code" field. The "Name" field should be your email name (example: jcollado). The "Full Name" field should simply be your full name.

4.4 Design and Computation Manager

October 2008

GEOPAK's Design and Computation Manager (D&C Manager) is used to draw features into a MicroStation design file using preset attributes and a designated GPK file. The D&C Manager is similar to the MicroStation Settings Manager, in that it can be used to draw a feature into a drawing and it will set the attributes of that specific feature to the current NDDOT Drafting Standards.

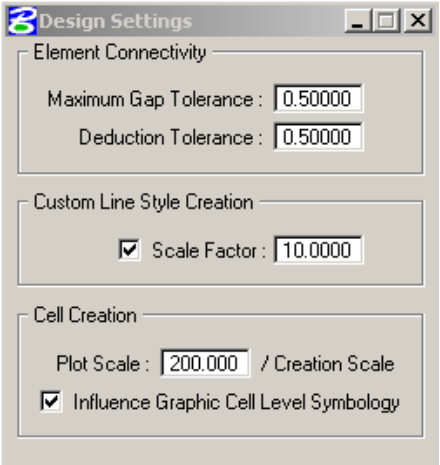
There are 2 standard Design and Computation Manager databases; NDDOT.ddb and NDDOT PayItems.ddb. The default database for the D&C Manager should be NDDOT.ddb. If it isn't your default, see *Section 2.5* of this manual. The following outlines describe the general hierarchies of the database.

1. NDDOT.ddb
    a. Drafting Standards
        i. Alignments
            1. Horizontal
            2. Profiles
        ii. Cross Sections and Typicals Sections
        iii. Pavement Details
        iv. Right of Way and Easements
    b. Applications - 3 Port Criteria – Special GEOPAK programs-scripts

2. NDDOT PayItems.ddb - Features that can be used in calculations of costs
    a. SECTION - Section Number Divisions by hundreds
        i. SPEC – Specification Number
            1. UNIT – Pay Unit Measurement

The DC Manager has several advantages over the MicroStation Settings Manager; The DC Manager draws Cogo features quickly, performs many quantity calculations and has advanced highlighting capabilities. The disadvantage is that the DC Manager does not contain all the standard features.

Note the scale factors in the DC Manager "Design Settings" needs to be adjusted for some cells and custom line styles to be drawn correctly. The line style scale factor is equal to the plot scale / 20.



Note, hatching and patterning symbology used in D&C Manager pay items don't automatically adjust for scale. Settings such as hatch spacing will need to be adjusted manually.

CADD Standards

The majority of the NDDOT pay items are in the D&C Manager (over 4000 items included). Some pay items units are difficult to visualize in a drawing like “Lump Sum” and “Hours”. These types of pay items are not included in the D&C manager. Most of the pay items don’t have unique symbology.

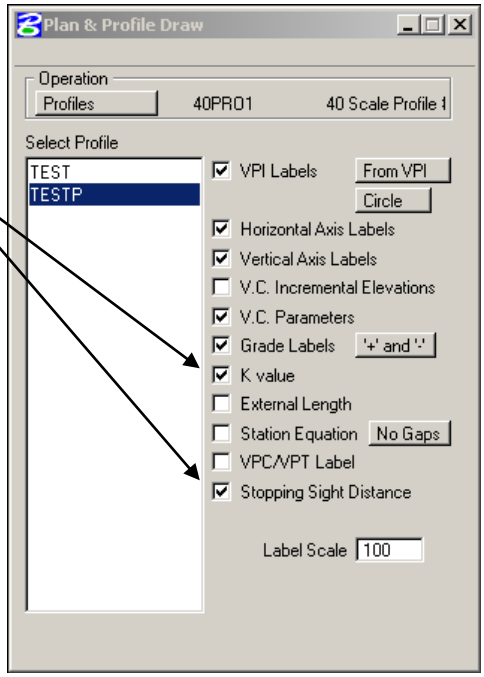
Notes for Drawing Profiles

The NDDOT D&C Manager’s Profiles were created with specific exaggerations (ratios of the horizontal scale to the vertical scale). If you don’t use these scales your curve table data may need to be manually adjusted.

Horizontal Scale	Vertical Scale	Exaggeration	Strip Grades
40	5	8	20’
60	10	6	20’
80	10	8	50’
100	10	10	50’
200	20	10	100’

The vertical curve tables have been set up to display the VPI station, elevation, stopping sight distance (SSD), k, and Length. Most of this information will display by default. However, user will need to manually turn on SSD and K. See the diagram below.

Turn on these settings



Don’t forget to set the correct “label scale” based on the final drawing scale. Examples; 40 scale profiles can only be draw when the label scale is set to 40, and 200 scale profiles can only be draw when the label scale is set to 200.

Notes for Drawing Horizontal Alignments

The horizontal alignment items have been setup for specific label scales. “Small – 80 scale and less” D&C manager alignments can be used for 40, 60 and 80 scale drawings. “Large – 100 scale and greater” D&C manager alignments can be used 100, 200 and 400 scale drawings.

4.5 Digital Terrain Model (DTM)

June 2012

The Triangulated Irregular Network (TIN) files are the basis for creating cross-sections and vertical profiles. TINs are normally created in GEOPAK, using the "Applications", "GEOPAK Road", "DTM tools" box. From here a user extracts graphical information from a dgn file.

The type of graphical data extracted determines the name of the TIN file. The primary sources for graphical data are: Field Surveys, Aerial Stereo Compilation and Aerial Automatic Elevation data. The title "DTM" refers to data collected using field survey and aerial stereo compilation methods. The title of "ISAE" refers to data collected using automatic elevation extraction using aerial imagery. Beyond just the source of the data, files can also be named based on whether or not bridge data within the graphical data was extracted or not. These files will also include a description of "Bridge_In" or "Bridge_Out".

ISAE surface data

Photogrammetry uses a suite of ImageStation programs created and distributed by Intergraph. ImageStation Automatic Elevations (ISAE) is a program designed to use stereo aerial image pairs to automatically create a grid of points in a variety of configurations. The grid size can be constant or variable. The default grid size is based on the Height Above Ground (HAG). Generally speaking a low level flight at 1500' HAG will have a default grid size of 4'. A variable grid of 1, 2, 4, 8 and 16' may also be used within the same surface. The less the elevations change from point to point, the larger the grid space becomes. This tends to minimize the size of the file while providing a more accurate representation of the ground.

ISAE generates elevation points from the stereo imagery. The program does not necessarily differentiate between a gravel pile and a house. The program will create elevation points on top of both features. This is also true for large trees and thick vegetation. That being said, ISAE does have several options available to choose from when creating surface data. For example, if the area being generated is extremely flat and uniform, with very few quick elevation changes then the software can be set to minimize collecting data on top of features and stays on the ground more consistently.

ISAE surfaces can be generated from Controlled and Non Controlled aerial surveys. The major difference between the two is the basic plane that is extracted. Controlled project have points that anchor it to the ground. This creates a surface that is based off of the ground. Non Controlled surveys do not have any points tying them to the ground this makes it possible for the surface to be based off of a plane that may be 20' different than the actual ground elevation. The non-controlled data may have an absolute shift to it but in general the relative accuracy is similar to a controlled survey.

CADD Standards

The most basic format of an ISAE generated surface is a MicroStation DGN file. A DGN file will be created for every pair of stereo photos (models) that are included. These individual DGNs for each model are reference together to create the entire surface. Within the DGNs are points (MicroStation Zero-length line elements) created by ISAE. ISAE will have 3 types of points. These points can be defined as points with: High confidence\redundancy, Medium confidence\redundancy and Low confidence\redundancy. These points are placed on levels "ISAE Confidence High Point Exst" color 6, "ISAE Confidence Medium Point Exst" color 7 and "ISAE Confidence Low Point Exst" color 10 respectively.

The confidence level of ISAE is based on the initial settings used by the operator. The most basic of the ISAE settings are Flat\Hilly\Mountainous and a high smoothing weight. If you take a patch of thick brush as an example with a setting of Flat and High smoothing, the area would either be completely flattened or possibly the surface would go over the top of the brush. In either case the ground surrounding the brush would be on "Level 06" with high confidence\redundancy. The area immediately surrounding the brush and the brush area itself would be on levels 7 and 10 with medium and low confidence. Using the same example with the setting of Mountainous and a low smoothing weight then more likely than not, ISAE would go right over the top of the brush with High to medium confidence. In other words just because a point is on a lower confidence level does not mean it is accurate or inaccurate. The interpolation of the ISAE surface by the end user requires the use of the accompanying aerial mosaic that will be available for every surface made.

ISAE DTM surface data

ISAE_DTM files contain a hybrid of manually digitized stereo compilation data and ISAE surface points. There are many variations of this hybrid data but generally it is used to extend the limited coverage of the stereo compilation data with quickly generated ISAE data. A few examples of these ISAE_DTM files are:

- DTM data from R\W line to R\W line and a 500' ISAE surface outside the R\W
- DTM data covering only the road surfaces with ISAE data for everything else out to the R\W.
- Typical DTM data for the entire project corridor with a 1000' ISAE surface at the beginning of the project.

The ISAE data included in the ISAE_DTM files can have different levels of editing completed. Some of the edits to the ISAE data that may be completed are:

- Limiting the extents of the included ISAE data (generally completed to conserve space)
- Removal of major anomalies (trees, buildings, trucks, etc.)
- Removal of minor anomalies (brush, vegetation, random object, processing ambiguities, etc.)

The user should consult the AAreadme file for the project (or the project editor) to determine the level of editing completed for the ISAE portion of the data in the ISAE_DTM files.

4.6 Survey Manager Database (SMD)

Dec 2010

The SMD file is used in the translation of data from survey data collectors to MicroStation Design files using GEOPAK Survey.

To begin the translation of data, the operator invokes the “Preferences” from Applications>GEOPAK SURVEY>Project>Preferences. Within the Preferences dialog box navigate to the Visualization tab. The SMD Feature File path should be set to s:\STANDARD\V8I\GEOPAK\SURVEY\NDDOT.SMD. The “Apply Feature Best Match” toggle should be turned on and the “Plot Scale” should be set to "1" for all projects. The scale of graphical data will be determined by the Annotation Scale set in the DGN.

Once the data is visualized the key-in "ANNOTATATIONSCALE ADD" must be issued for the graphic to assume the scale set for the DGN.

The .SMD files are protected files and cannot be edited. If any operators have a need for additional items to be added into the .SMD they should contact a support person.
The feature codes, used by field personnel to enter data into their data collectors, are listed in *Appendix I*.

Linking Codes

The linking codes need to be set in the Preferences dialog box. They can be found under the Dataset tab in the Linking Codes item. They should be set as follows:

Begin Line:	=	+
End Line:	=	-
Close Figure:	=	!
Beg/End Curve:	=	/
PC Curve:	=	XPC
PT Curve:	=	XPT
Curve Fit:	=	XCF
PCC Curve:	=	XCC
Continuation:	=	XCN
Left Right:	=	XLR
Front Back:	=	XFB
Up Down:	=	XUD
Duplicate Prefix:	=	XDU
Comment Char:	=	*

The linking codes that are prefixed with an “X” are not intended to be used, however they do need to be set to eliminate conflicts with the EFB codes. Note: The Continuation linking code may be grayed out. You will have to set the definition of this code once you create a dataset in the XYZ to Coordinates dialog box.

4.7 Cross Sections and Earthwork

Dec 2013

Corridor modeling (roadway designer) is the preferred tool for generating surface models. Corridor modeling should be used because the proposed surfaces created from roadway designer are better suited for Automatic Machine Guidance (AMG) projects. Specific surface tolerances can be prescribed and a 3d review of the model and surface can easily be done.

Corridor modeling shall be used for proposed cross sections and surface modeling unless one of these conditions is met.

- Projects that were substantially completed with Geopak criteria by July 22, 2013, do not need to be converted to corridor modeling. Consultants that have started a project with Geopak criteria files, but are not substantially complete, should discuss how to proceed with their NDDOT technical support contact.
- Projects that do not have an existing surface file (dtm, tin, xml) available through typical survey practices can be completed with Geopak criteria. Roadway Designer tools require a DTM. Geopak criteria files only require cross sections. Some NDDOT surveys only provide cross sections directly from raw data. With these surveys, a surface is not created. If cross sections were directly surveyed as linear – transverse shots or cross sections were developed from old plans, an existing surface file might not be created. Sliver grading projects are examples of earthwork projects that usually don't use surface files. Creating cross sections from criteria may be easier in these circumstances and will be allowed.

Request for additional exceptions to use criteria will be considered. This new standard is not intended to increase project development costs or time. This standard is intended to provide opportunities to use AMG on future projects. Consultants can request exceptions through their NDDOT technical support contact to the NDDOT CADD Support Specialist (Jon Collado). Internal (NDDOT) staff can request exceptions through Jon Collado. Request should indicate specific projects, present status of proposed cross section modeling, and reasons why Geopak criteria is desired for project.

Note a combination of Roadway Designer and Geopak Criteria can be used in some circumstances. Geopak Criteria can supplement the cross sections, but should not be used in any part of the proposed surface modeling.

- Criteria for labeling is allowed.
- Criteria for utilities is allowed.
- Criteria for existing surfaces and As-builts is allowed.

Note.
The NDDOT spec book discusses benching for embankment (see 203.02.F). This construction benching requirement shall not be shown on cross sections and the earthwork involved with the embankment benching shall be incidental to excavation and borrow.

4.7.1 Cross Sections Interval (Pattern Line Spacing)

July 2013

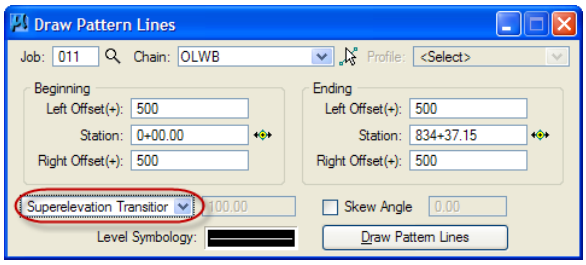
Cross sections should accurately represent a roadway. Cross Sections that are closer together (shorter interval) may represent the roadway better than cross sections at a longer interval because important details between the cross sections are more likely to be missed with a longer interval.

The following standards are for plan preparation. These standards are not necessarily a construction field staking requirement.

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.

Note, the Draw Pattern Lines tool has an option to draw at "Super-elevation Transitions". Pattern lines need to be drawn in the shape drawing in order to use this option.



Other additional "Optional" cross sections have been considered in the CADD standards. The base intervals prescribed above are close together and address these "Optional" cross sections to a degree. These "optional" cross sections are used at the designer's discretion.

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.

These optional cross sections could help produce better surfaces for Automated Machine Guidance.

Limited Cross Sections

Cross sections are sometimes created without a DTM. They are created from non-triangulated survey data or old plans. In these cases, meeting the required cross section interval may be difficult. In these cases, designers use cross section data that is available. Caution shall be used when interpolating data over long distances.

4.7.2 Roadway Designer (Geopak SS2)

Nov 2011

This manual will not discuss Roadway Designer and "Corridor Modeling" in detail. It will only discuss how the standards pertain to these tools.

Roadway Designer File Overview

Two files (NDDOT.itl and NDDOT.xin) are delivered with the CADD standards. The" itl" file is an Inroads Template Library. Templates are cross sections or pieces of cross sections. The 'xin" file contains drafting standards and some of the roadway designer preferences. The NDDOT.itl file should be copied to your project folder. This file will be edited for your project. The NDDOT.xin file usually doesn't need to be copied to your project folder. This file is usually only referenced.

As a Roadway Designer project is developed, the following files should be created: (project).ird, rd_*.dgn, and rd_Plan_Graphics_*.dgn.

The "ird" is the main roadway designer file. This will contain project specific model information.

The drawing rd_*.dgn is a 3d project model. Roadway designer features, components and surfaces should be drawn into a 3d drawing with a "rd_" prefix. Multiple "rd_" files may be desired. Descriptive suffixes for these files are strongly encouraged.

Plan view graphics are usually required to develop a roadway Designer Model. The Corridor Modeling tool imports plan view information from only one drawing. The drawing "rd_Plan_Graphics_*.dgn" is used to perform this import. Needed graphics are referenced and copied into this drawing.

CADD Standards

Template Library

The NDDOT template library contains the following main folders”

1. Components (No End Conditions)
2. End Conditions
3. Labeling
4. Project Specific
5. Templates
6. 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 the Geopak 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. Thickness are typically negative values because parent because they are referenced in a downward direction.

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)

If there are multiple base (alternate surfaces) then use B2 (Top of Base 2), B3 (Top of Base 3), etc.

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 style.)

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 Slough Pavement)
EOSB (Edge of Slough 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).

Repetitive affixes that are automatically assigned, should be renumbered (example: xx_L, xx1_L, xx2_L should be renumbered xx_1_L, xx_2_L, xx_3_L).

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.

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.

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 supper 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 slough pavement.

CADD Standards

Tips

Make regular backup copies of your itl and ird as your project progress.

The template interval must be reviewed and adjusted throughout project development. The interval must account for the cross sections cut with Geopak. The template interval must account for short components. 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 with GEOPAK. Example; if there is only one template (drop) for a driveway, it may appear in Roadway Designer but it won't appear in the cross sections cut with Geopak.

Limits of construction lines must be drawn as line and not line segments. Geopak Earthwork may not recognize a 2 point (smart) line segment.

Template priority conflicts can occur without warnings if the same priority is nested in a different end conduction of the same branch.

4.7.3 Criteria Files and Related Input Files.

July 2007

Criteria files are tools used for creating cross sections, calculating earthwork and generating reports. This is a major function of GEOPAK. This manual will not discuss criteria or earthwork in detail. It will only discuss how the standards pertain to criteria files.

All criteria files shall be included with the projects so that cross sections could be re-run. Hand editing should be avoided whenever feasible. Copy the standard criteria directory into the project directory every time a new project is started or use the typical generator. Certain criteria files may have to be edited. Also, the standard criteria files are edited from time to time. Creating - copying project criteria files will avoid multiple user complications. See *Section 2.4* for the location of earthwork related files.

Revisions to criteria and the typical generator can be requested through the Standards Committee. If a user has a new criteria idea, they should discuss or submit the criteria file to the Standards Committee. New criteria ideas might be used to improve the standard criteria library. Following is the standard criteria requirements.

1. Standard criteria files should have a unique purpose. Redundancy is discouraged.

2. All standard criteria shall be documented. A labeled drawing shall be included in the standards. Standard criteria shall include a header. The criteria header shall include the following information; criteria name, author, revision date, description, inclusion sequence information, and list of variables. Criteria points and variables shall be cataloged in a spreadsheet. *Appendix J* contains a data base of criteria points and variables.

3. Criteria points and variable names shall be approved by the Standards Committee. Criteria points and variable names shall follow the following format. Criteria points shall be labeled for report generation. Points should have two labels; point number (level = "**Xsec Point Number Labels Text**") and another label that would be useful in a segregated report (level ="**Xsec Point Description Labels Text**"). Example; a segregated report for just "Topsoil Bottom" points might be desired, so all topsoil bottom points should have a unique label like "TSB". Note all labels need to be in capital letters in order to be recognized by GEOPAK. Test points do not need to be labeled. Generic text should be on level "Xsec General Text".

The following information contains recommendations and notes for using criteria. Some of this information is not contained in the GEOPAK Manuals.

When using super elevation shapes to create cross sections, first process the proposed cross sections without using criteria files - no side slope conditions. This should only draw the roadway super elevation surfaces into the cross sections. Then check and correct any shape and input errors. Reprocess until there is a run without errors. After processing an error free run, reprocess with the criteria. Separating the proposed cross

section process into smaller incremental steps should help users identify problems.

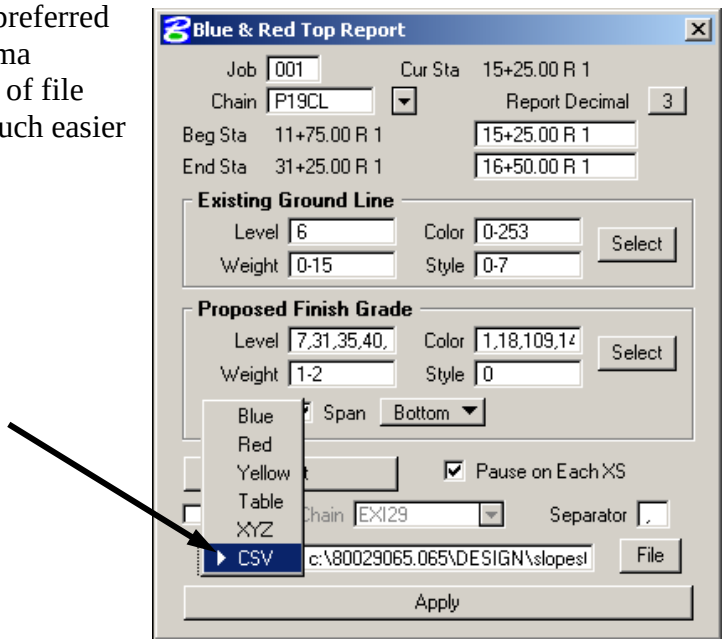
The **standard.x** criteria file defines how all GEOPAK cross section elements are located and then drawn. All standard criteria symbology should be located in this file. The standard.x criteria file may look for elements that do not exist in your drawings. This should not be a problem as long as the drawing file, in which the criteria is to search, exists. The log file will comment “element not found” and continue.

4.7.4 Slope Stake Reports

July 2007

All cross sections should have important points labeled in a manner such that blue top- slope staking reports can be generated.

Designers are responsible for creating a working cross section file in which a GEOPAK Blue top-slope stake report can be generated. At a minimum, a slope staking report showing the break points and tie points to the top of the topsoil shall be developed and provided to the field engineer. See Design Memo No. 01-2005. Reports for the bottom of topsoil and the bottom of base (top of dirt grade) should also be provided. However, the cross sections should be drawn so other base layer surfaces can be reported if the District or Design chooses to generate these reports at a later date. Presently the preferred file format for these reports is "Comma Separated Values" (CSV). This type of file can be opened with Excel and it is much easier to edit.



4.7.5 Earthwork (Geopak SS2)

April 2013

Earthwork shapes must be saved with the cross sections. The earthwork shapes can be used to check earthwork calculations.

Earthwork end areas should be written to 3 decimals if a Mass Diagram is used. The Mass Diagram uses these end areas to recalculate mass ordinates (MO). The MO in the mass diagram may be slightly different than the MO in the earth log.

A Mass Diagram shall be included in the plans for all rural grading and widening projects.

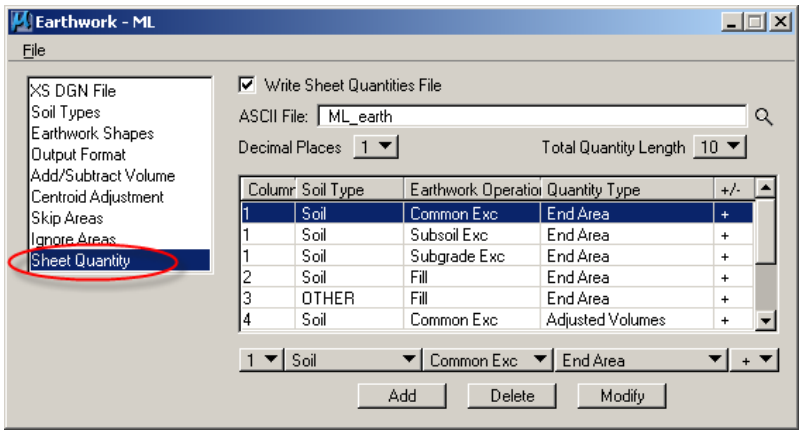
Detailed earthwork summaries (include station by station volumes) shall be include in the plans whenever Geopak earthwork calculations from cross section are used. This summary shall be under section number 11 in the plans (typically after the mass diagram).

The detailed earthwork summary shall include the following fields – columns:

1. Station
2. Excavation End Area
3. Fill End Area
4. Other End Areas that Affect the Mass Ordinate *
5. Excavation Volume
6. Fill Volume
7. Other Volumes that Affect the Mass Ordinate *
8. Mass Ordinate

* There may be materials other than suitable grading – soil on the project that affect the mass ordinate and should be listed in separate columns. For example, a grading project may contain a grade raise with a different volume adjustment factor for embankment placed in the water than embankment place outside the water. Most undercut materials such as aggregate base and paving shall be excluded from the mass ordinate.

Use the earthwork "Sheet Quantity" options to create this summary. This tool will make an ASCI file which can be reformatted and included in the plans. Only end area and volumes used for pay items should be included. "Informational only quantities" such as for pavement and base should not be included in this table.

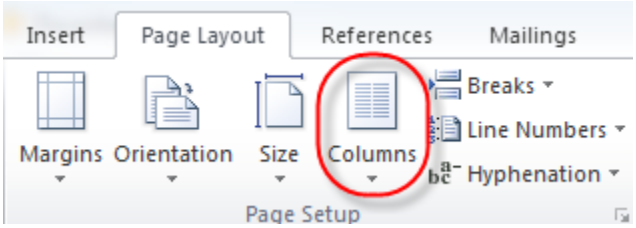


CADD Standards

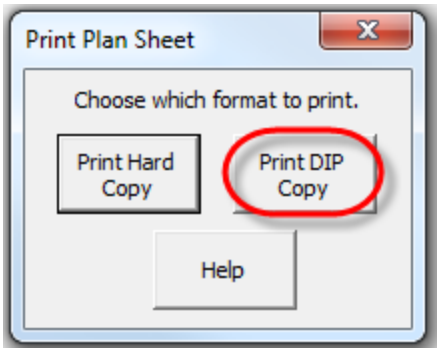
There are many different ways to reformat the "Sheet Quantity" text file. Ultimately, the data must be stored in a pdf, formatted for NDDOT sheet boarders – title blocks, and it must remain extractable for use by contractors. The table shall not be stored as images within the pdf. The numbers from table cannot be extracted as values if they are stored as an image. The ability to electronically cut data from the table and pasted it into other programs as "values" must be maintained.

The following is an example workflow for processing the "Sheet Quantity" text file.

1. Import the "Sheet Quantity" text file into Excel.
2. Use the "Text Import Wizard" or "Text to Columns Tool" to parse your data into columns.
3. Provide Headings and additional formatting as necessary such as cell borders and bolding.
4. The next step is formatting the data with a sheet border. The sheet border format is presently stored in 2 formats; a MicroStation cell and Microsoft Word document. This example is going to use Microsoft Word because this application automates column rapping past the PE Stamp and onto additional pages. Create a new word document using the "Blank Template for Plan Sheets" found in the Plan Preparation Guide. See http://www.ugpti.org/dotsc/prepguide/plansheets/templates.php.
5. Select and copy the formatted data from Excel and paste it into your Word document.
6. Within Word, set "Page Layout > Columns". Using multiple columns helps minimize the number of sheets needed and uses the paper space more efficiently.



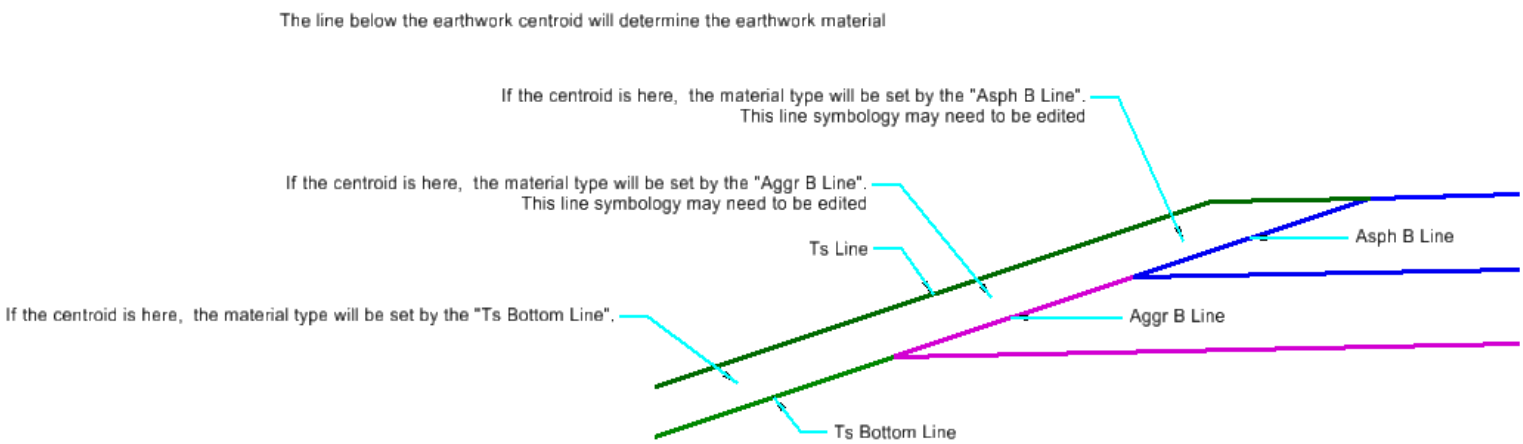
7. Use the macro built into the document to print to a PDF.



CADD Standards

Tips

Look for material layer complications. These may have to be manually corrected.



4.7.6 DTMs (Digital Terrain Models) for AMG (Automated Machine Guidance)

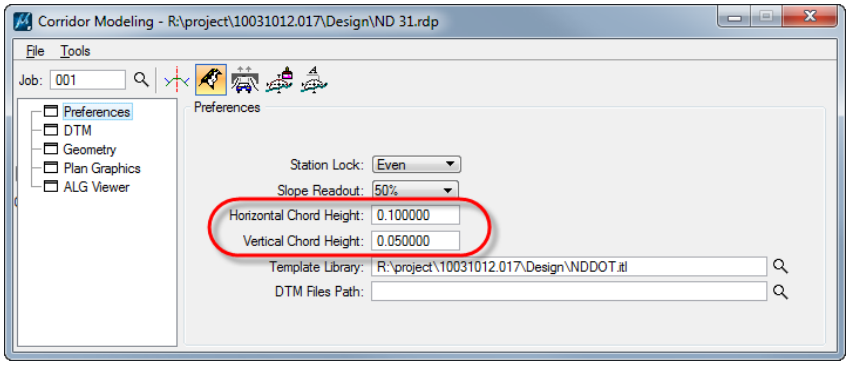
March 2014

DTMs 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). Projects designed with Roadway Designer (Corridor Modeling) shall provide surfaces with the following chord height tolerances.

	Minor Rehabilitation *, Structural Improvement	Major Rehabilitation, New/Reconstruction
Horizontal Chord Height Tolerance	0.1 ft	0.1 ft
Vertical Chord Height Tolerance	0.1 ft	0.05 ft

* AMG surfaces for sliver grading projects are not required.

All curves that are modeled within a DTM are actually a series of chords drawn along the curve. Curve geometry is better represented with shorter and more chords. Chord height is the distance between a cord and the arc it subtends (middle ordinated). Chords with smaller chord heights are closer to the arc by definition. Tolerance for horizontal and vertical chord heights can be set with in the Corridor Modeling Tools.



4.7.7 AMG (Automated Machine Guidance) Deliverables

Jan 2017

The following is an example list of file to provide for AMG.

*Exst.tin
*Exst.dtm
*Exst.xml
*T.tin
*T.dtm
*T.xml
*B1.tin
*B1.dtm
*B1.xml
*DG.tin inc
*DG.dtm
*DG.xml
AAReadMe.docx

job001.gpk
cmjob001.alg
Alignment.xml
Control.dgn
Design.dgn
DS_Align.dgn
Profile.dgn
RW_Bndry.dgn
Topog.dgn
Terrain.dgn
XSEC.dgn
RDM.dgn

*T = top of all finished surface
*B1 = top of base 1 surface
*DG = top of dirt grade surface including fore slopes, ditch and back slopes

Within the AMG workflow, designers are responsible for more than just DTM surfaces. Additional Deliverables are required;

1. Supplemental Design Data Notification
2. Alignment information
3. AMG AAreadme file for contractor
4. Drawings

Earthwork log files are not posted with the supplemental design data. Earthwork tables should be incorporated into the plan – contract documents.

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.

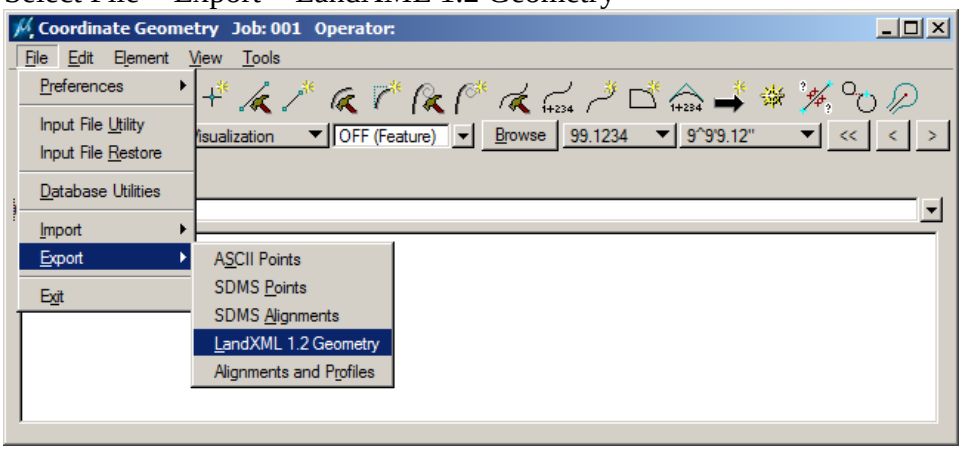
CADD Standards

Alignment Information

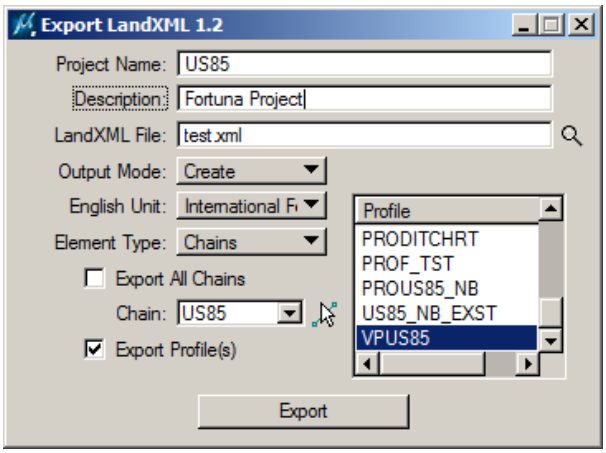
Projects created with Geopak and Corridor Modeling typically store alignment information in both gpk and alg formats. Both of these files should be included with the supplemental design data.

Procedure for Creating Alignment file in XML

1. Open Geopak Coordinate Geometry
2. Select File > Export > LandXML 1.2 Geometry



3. The Export LandXML 1.2 dialog should open. Make the appropriate dialog selections.



a. Most of the settings are intuitive. However there is one setting that is not commonly understood. **The English Unit must be set to "International Foot".** The NDDOT always uses "International Feet".
b. Project Name and Description fields can be provided as desired. These fields are optional.
c. The Output Mode > Create or Append lets your create a file from scratch or append an existing file

d. The Element Type options let you pick the type of cogo element to export; points or chains.

4. Select Export and the xml file should be written to your working directory.

AMG AAreadme file for Contractor.

An informational text file shall be provided to the contractor. An Alignment Index (informational key – general description) shall be included. 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."

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. Profile
5. RW_Bndry
6. Terrain
7. Topog
8. XSEC
9. RDM
    a. Corridor Modeling Style Features (break lines representing template points) shall be drawn in 3d.
    b. Corridor Modeling Components (surfaces and meshes) shall be drawn in 3d.

4.8 Cross Section Sheet Library

Dec 2010

The NDDOT standard cross section sheet library (XSSL) is “NDDOT.xssl”. For NDDOT users, GEOPAK should default to this library when the “Cross Section Sheet Composition” tool is invoked. This tool can be found in the “Cross Sections” tool tray or from the pull down menu (Application>GEOPAK Road>Cross Section> Cross Section Sheet Composition). If the NDDOT.xssl is not your default XSSL, see *Section 2.5*.

Users may need to save minor layout changes to the XSSL, such as the display of earthwork quantities on the cross section sheets. The XSSL in the standards directory is “write” protected. If changes to the XSSL are required, the file (NDDOT.xssl) should be copied to the project directory so that changes can be saved. Then the XSSL in the project directory should be used for creating cross section layout sheets.

There are several sub-dialog boxes within the “Cross Section Sheet Composition” dialog box. Most users only need to edit information in the “XS DGN File”, “Sheet DGN File” and the “Earthwork Quantity Labels” sub-dialog boxes. See the GEOPAK Manual if additional help is needed.

Most users will use the “Active Cross Section Sheet” layout of “XS 20 scale or Less” with a 1 to 1 grid. However, other layouts are available from the pull down field.

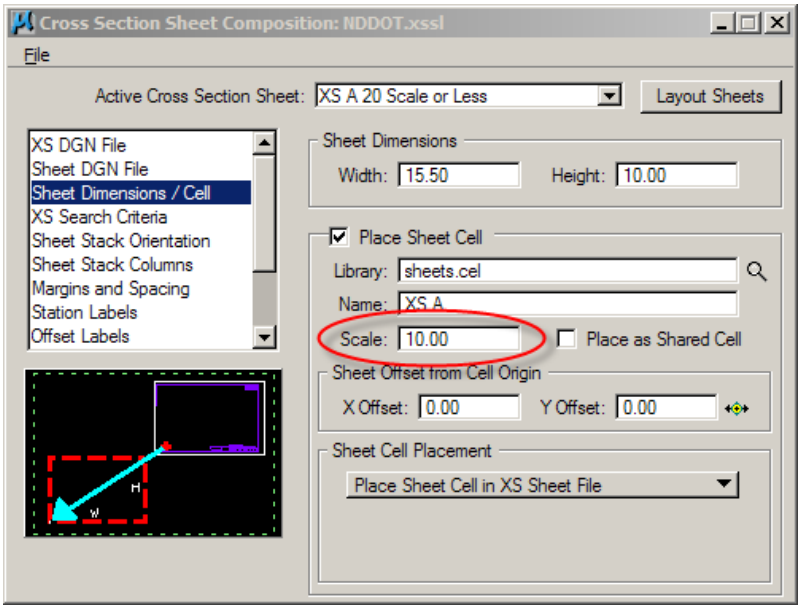
The XSSL is used in conjunction with the cross section sheet cells found in the NDDOT sheets library (sheets.cel). The library uses a scalable cross section sheet and references the working cross sections into your cross section sheet layout drawing.

The drawing scale of your cross sections layout drawing needs to be set to “Full Size 1=1” and settings need to be saved before you cut cross sections.

The final plot scale for the cell needs to be set in GEOPAK. In this example it is set to 10 (1”=10’).

After your sheets are cut, set your drawing scale to the correct scale. In this example 1”=10’.

If you don’t incorporate these steps your sheet cell might be the wrong scale and your tags may be placed in the wrong spot.



CADD Standards

On large projects, hundreds of cross sections may be referenced into one drawing. Users may find it is easier to manage these drawings if they draw only one sheet per drawing model. This option is found in the “Sheet DGN File” sub-dialog box.

4.9 Plan Sheet Library

Jan 2017

The GEOPAK Plan and Profile sheet layout tool is used to automate the creation of plan and profile sheets. In this process, many new drawings are created that can contain a number of referenced drawings. These newly created drawings are formatted to present information in traditional, manageable sized sheets.

The table below lists the sheet layouts that are presently available. If additional types of layouts are needed, please contact a Standards Committee Representative.

SHEET NAME	CELL NAME
Double Plan Sheet 1	Plan-Plan1
Double Plan Sheet 2	Plan-Plan2
Plan and Profile Sheets1	PP10
Plan and Profile Sheets2	PP10S60
Plan and Profile Sheets3	PP10S80
Plan and Profile Sheets4	PP12
PLAN A (Margins; Lt.=0 Rt.=0.0 Top=0.5 Bottom=1.5)	PLAN
PLAN B (Margins; Lt.=0 Rt.=0.0 Top=0.5 Bottom=2.5)	PLAN
PLAN C (Margins; Lt.=0 Rt.=4.5 Top=0.0 Bottom=0.0)	PLAN
PLAN D (Margins; Lt.=0 Rt.=4.5 Top=0.0 Bottom=1.5)	PLAN
PLAN E (Margins; Lt.=0 Rt.=4.5 Top=0.0 Bottom=2.5)	PLAN
PLAN F (Margins; Lt.=0 Rt.=4.5 Top=0.5 Bottom=2.5)	PLAN
PLAN T (Margins; Lt.=1 Rt.=1.0 Top=0.5 Bottom=1.5)	PLAN
PLAN MAX (No Margins)	PLAN
ROWPLAT	RWPLAT

All the different sheet layouts, such as cross section sheets, right of way plats and plan and profile sheets, are designed to be placed as cells. Some sheet cells can be plotted at different scales, others are designed to be plotted at only one scale.

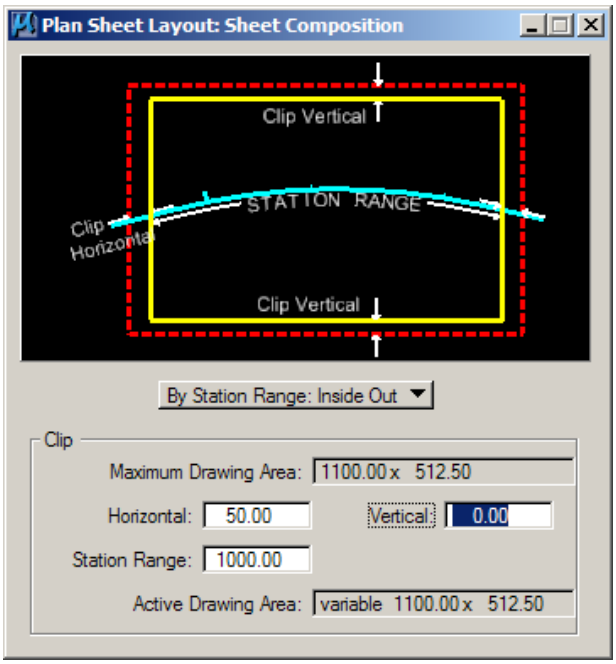
Sheet cell origins are located in the lower left corner, at the intersection of the bottom and left borders. A list of available sheets is included in *Appendix H*.

Most sheets laid out with the NDDOT standards are designed with an overlap. The total overlap is the sum of the beginning and ending overlap. Two different sheet compositions are used within the CADD Standard Plan Sheet Library. The CADD Standards only use 2 out of the 4 “sheet composition” methods.

CADD Standards

For Plan and Profiles Sheets, you should use the sheet composition method of **"By Station Range: Inside Out"**. For all other sheets, you should use the sheet composition method of **"By BeginStation\Overlap"**.

"By Station Range: Inside Out" Example:
A user wants to layout plan and profile sheets at a horizontal scale of 100. The user would select "Plan & Profile Sheets1" from the "NDDOTSheet.psl" and set the scale to 100. The primary coverage (Station Range) is set to 1000 ft. However, this does not include the overlap. The actual plan drawing area will be noted in the Sheet Composition dialog box, in this case, 1100' x 512.5' (see dialog box shown). The primary horizontal coverage is 1000' and the actual coverage is 1100'. In this case the horizontal clip is actually an additional clip outward of 50' on both sides (50+1000+50=1100). Users are expected to realize from these numbers that the overlap is 100' (1100'-1000'=100'). This overlap is split equally between the beginning overlap and ending overlap, in this case 50' and 50' respectively. See diagram below. The user must start the sheet layout process at an even station if they want their sheets to line up with the grid lines.



The following table summarizes composition settings for plan and profile sheets. These sheets use the **"By Station Range: Inside Out"** method.

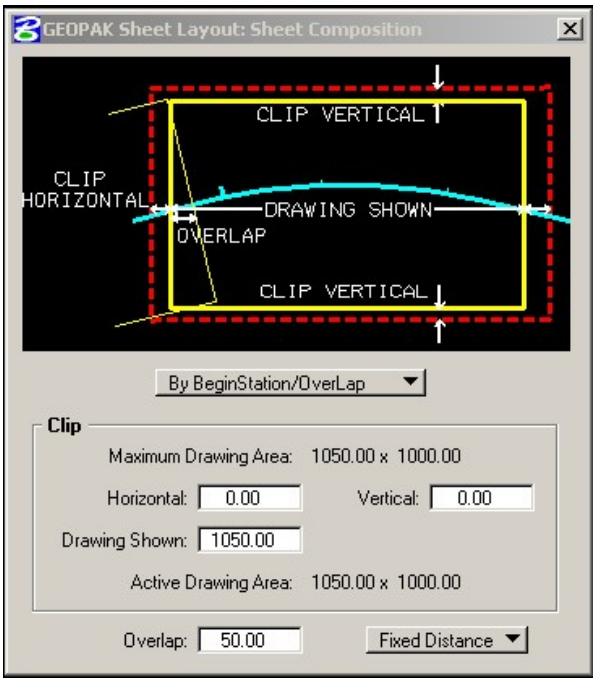
Scale	Clip Horizontal	Clip Vertical	Drawing shown
40	20	0	400
60	30	0	600
80	40	0	800
100	50	0	1000
200	100	0	2000

CADD Standards

"By BeginStation\Overlap" Example:
A user wants to layout plan sheets at a horizontal scale of 100 with 1000 feet of coverage, starting at station 10+00. In this case, the user would select Plan C from the plan sheet library. Note that Plan C settings will provide no margins between the clip area and the sheet border cell for the top, bottom and left edges. However, a 4.5 inch margin will be provided between the clip area and the sheet border for the right edge. This 4.5 inch margin area is often used for quantities.

As discussed earlier, most of the sheets are designed for an overlap. In this example, the actual length of plan view is 1050' long. The actual plan drawing area will be noted in the "Active Drawing Area" (1050.00 x 1000.00). Users are expected to realize from this number that there is 50' overlap. The primary horizontal coverage is 1000' (1050' actual coverage – 50' overlap = 1000' primary coverage).

The overlap is split equally between the beginning overlap and ending overlap, in this case 25' on the left and 25' on the right. The user must start the sheet layout process, half the total overlap distance, before the desired station. In this case, the starting station would be 9+75.



Additional Notes

Adjustments for Priorities and Masking Elements may be needed. See section 3.15.

Make sure to set the drawing scale to the desired sheet scale before cutting sheets.

When using a Double Plan sheet, the length of the "Drawing Shown" in the Sheet Composition is only for the top view (port). The actual coverage on the sheet is greater (+ 11 x plotting scale) than what is listed in this dialog because there are to views.

The "Double Plan Sheet 2" (Plan-Plan2) and "Plan and Profile Sheets4" (PP12) sheets are not intended to be used in situations where quantities need to be summarized on the sheets.

When sheets are clipped, you are given an option to "Rotate Reference" or "Rotate View". Users should always "Rotate View". If you "Rotate Reference", your coordinate system will not be aligned with your drawing and the profile elevation axis within plan and profile sheets will not be aligned.

CADD Standards

The use of a “Motif” files provide several benefits. Motif files can provide a consistent template of reference files including level display. The Motif file can control what is referenced and what is displayed. If you are using motif files and creating similar cut sheets several times during plan preparation, you don’t have to be concerned with what files are referenced to your main drawings, what is displayed and when settings are changed. These settings are independently controlled by the motif file. The motif file can also eliminate unnecessary references. Example, in a plan and profile sheet, references of design.dgn are seldom needed in the profile and tabular data views. Separate motif files, using different sets of reference files, can be used for each view.

“Motif Files” are often used with “Pointer Files” in order to simplify future referencing adjustments. See previous section 3.12 for “Pointer File”. The Motif File should reference the Pointer file with “Live Nesting” and the Display Override set to “Never”.

Having cross sections referenced to drawings used to clip plan or plan and profile sheets may slow down the sheet creation process. Detach unnecessary reference files before clipping sheets.

4.10 Super Elevation

July 2012

The NDDOT uses a table based on table 3-9 of "A Policy on Geometric Design of Highways and Streets", 2011 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 "desired relative gradient". The "desired relative gradient" is 83.3% of the "maximum relative gradient" as shown on table 3-15 of "A Policy on Geometric Design of Highways and Streets", 2011. This "desired relative gradient" results in runoff and runout lengths that are 120 % of the minimum lengths (120 % = 1 / 83.3%)

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.

Geopak Super Elevation Settings

Default NDDOT GEOPAK preferences have been set up for NDDOT users. The standard configuration file (standard.cfg) uses the NDDOT Super Elevation Preferences (NDDOT.sep). See *Section 2.5* (Configuration Settings, Preference Settings, and User Interface).

The NDDOT uses "Adjustment Factors" for increasing the runoff and runout length when multiple lanes are rotated (as shown on table 3-16 of "A Policy on Geometric Design of Highways and Streets", 2011). Note, the "Adjustment Factors" are disabled (set to 1) in the default NDDOT.sep. The "Adjustment Factors" are disabled in order to simplify the modeling – shaping of shoulders. The majority of NDDOT roadways are modeled with 4 shapes within a shape cluster (shoulder shape + driving lane shape + driving lane shape + shoulder shape). The Shoulder widths should not affect the runoff and runout lengths. If a multiple lane facility is being designed, the NDDOT.sep should be edited with correct "Adjustment Factors" for rotating multiple lanes.

Note. If designers need to edit the super elevation preference file (NDDOT.sep), it should be copied, renamed and stored in the project directory.

CADD Standards

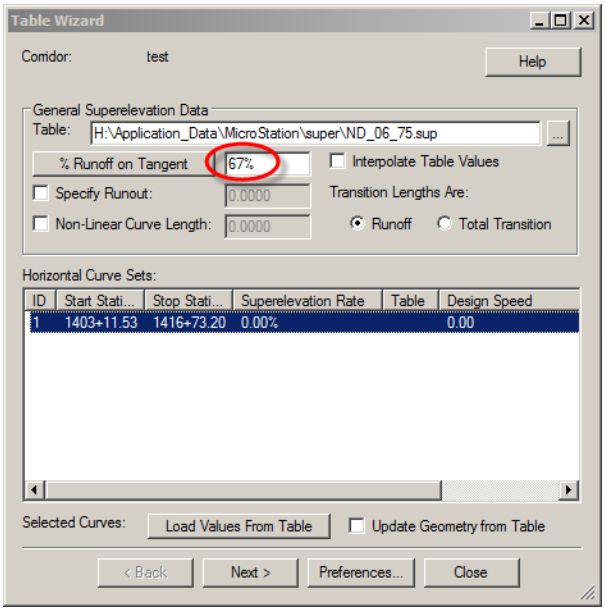
Roadway Designer Super Elevation Settings

Custom NDDOT tables for the Roadway Designer Super Elevation Wizard have been created. They can be found in the following directory:

S:\STANDARD\V8i\GEOPAK\SUPERELEVATION\NDDOT_Super_Tables

These tables are based on tables 3-9 and 3-17of "A Policy on Geometric Design of Highways and Streets", 2011. The NDDOT has modified these tables. Super elevations have been interpolated for every tenth of a percent. Runoff values have been adjusted using the NDDOT Desired Relative Gradient discussed previously.

The "% Runoff on Tangent" field doesn't display decimals in the percentage. However decimals are stored and used by the program. The value "2/3" will work in this field.



The "Runoff Length Multiplication Factor" should be set to 1 for the two lane or four lane options. The runoff lengths have already been adjusted in the NDDOT tables. However there aren't preset options for a 3 or 5 lane roadway where the crown is in the middle of the lane (rotating 1.5 or 2.5 lanes respectively). When rotating 1.5, 2.5, 3 or 3.5 lanes, the "Runoff Length Multiplication Factor" should be set according to table 3-16 of "A Policy on Geometric Design of Highways and Streets", 2011 and the "Number of Lanes" option should be set to "Two".

The tables have been modified to account for rounding and interpolating. The "Interpolate Table Values" option should not affect NDDOT calculations. It won't make a difference if it is enabled or disabled. The NDDOT tables have been designed to use super elevations values to the tenth of a percent.

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 %)

Maximum Relative Gradient (MRG) = 0.38 %
Desired Relative Gradient (DRG) = MRG * 83.3 % = 0.317 %

Runoff on high side (Inroads) = 144.0’ from table ND_06_75.sup
Runoff on high side (Geopak) = e * width of traffic lane / DRG
Runoff on high side = 3.8 % * 12’ / 0.317 % = 143.84’ => 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 - normal crown) / e * 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 = normal crown / e * Runoff on high side
Runout = 2.1 % /3.8 % * 144.0’ = 79.58’

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

Begin e on left side (low side) = Begin full e - (Runoff on low side) = sta 1402+95.12
End e on left side (low side) = End full e + (Runoff on low side) = sta 1416+89.62

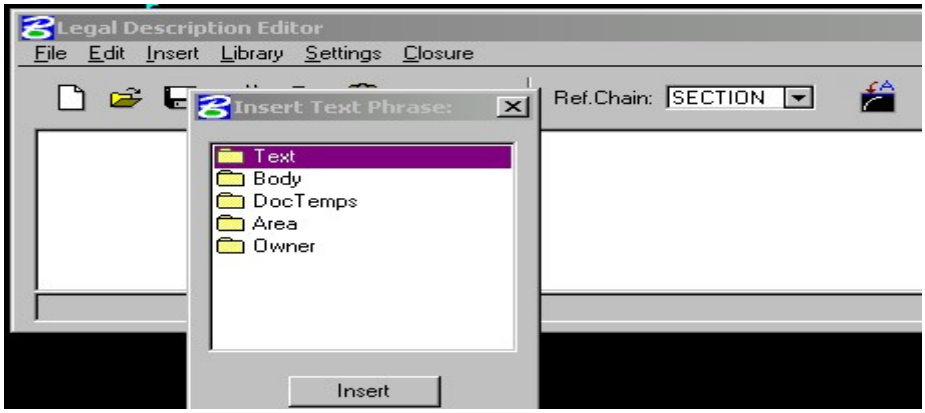
4.11 Legal Description Editor (Right of Way Plats)

Oct 2008

The “Legal Description Editor” is a GEOPAK tool used to create right of way legal descriptions. The Legal Description Library (NDDOT.ldb) is customized to conform to the standard NDDOT legal description format (Chapter 20 Right Of Way Plats; Procedures For Creating Right Of Way Plats). The general statements that are common to all descriptions are stored in the GEOPAK library. The Editor receives information unique to certain parcels from the GPK file, key-in, or lists provided in dialog boxes. Legal descriptions and parcel data are typed one time and stored in GEOPAK.

The Legal Description Editor can be used once the parcel is stored. Points, curves, and parcels must be stored in GEOPAK before using the Legal Description Editor. The Legal Description Editor is found in GEOPAK Road or GEOPAK Site under “\Geometry\Legal Description”. When selected, a dialog box with a menu will appear. The menu bar allows the user to choose a File, Edit the current file, Insert items into a legal description, select the desired Library, define Global Settings, or obtain a closure report on the parcel description.

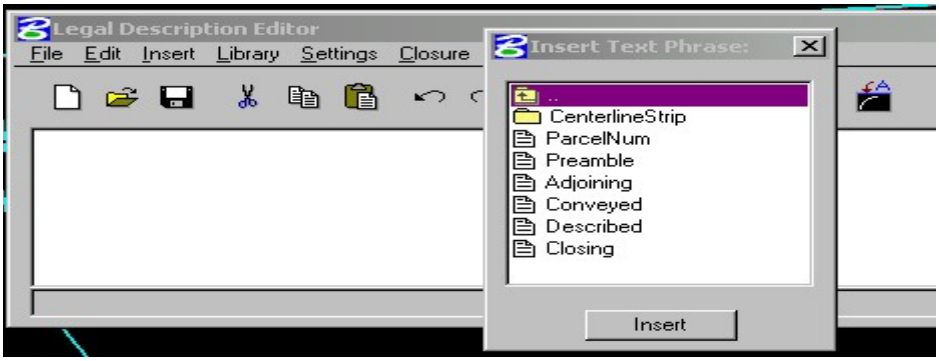
Go into Library to select the NDDOT.ldb library and hit OK. Select “Insert” on the menu bar then select “Text Phrase” from the pull down menu and the dialog box shown below appears.



CADD Standards

Text Folder

Following are steps and explanations concerning the items in the text folder. Select “Insert”, then “Text Phrase” folder. A dialog box appears with a list of Text Phrases to insert. Double click on “Text”. This folder contains phrases for parts of the description dealing with text statements only.



Parcel Number

The first item required to create the NDDOT legal description, is the parcel number. In the text folder, select “ParcelNum” and hit the “Insert” button on the bottom of the dialog box. The “library editor” will automatically print the phrase “Parcel Number,” centered over the description on the first line. A dialog box then appears. At the top of the box is a statement identifying the information needed to complete the first line of the description. In this case, it is the parcel number. Place the cursor in the top window and type in the name of the parcel or open the pull down. Keyed in information is stored in the temporary memory, while creating a legal description. This information will appear in the pull down. Choose information from the pull down, hit the “Add” button, and then hit OK. This will automatically add the parcel number to the text editor.

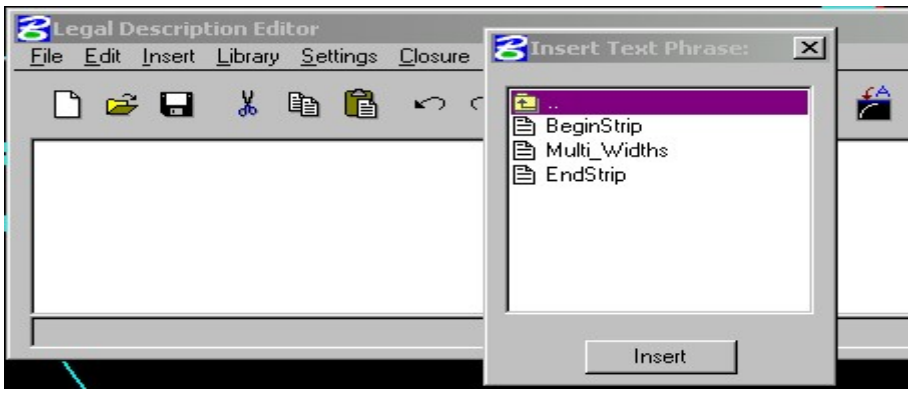
Preamble or Caption

The next required entry is the “Preamble or Caption,” from the Text Phrase dialog box, select “Preamble” and hit insert. The “library editor” will automatically print “A portion of” and a dialog box appears with “Aliquot part” on the top of the box. This is asking the user to type in the part of the section or subdivision that the parcel is located in. The library editor will fill in the general statements in a description and for any data unique to a description, a dialog box will appear to key-in or select data from a list.

CADD Standards

Centerline Strip folder

The centerline description of a strip of land that is parallel or referenced to a survey centerline follows the preamble. Below are explanations concerning the items in the "CenterlineStrip" folder, which is found in "Insert\Text Phrase\CenterlineStrip".



BeginStrip

The editor prints "A strip of land" automatically, and then a dialog box appears for input of the strip width in feet. The next dialog box has a list of cardinal directions (northerly, westerly, easterly…) to describe which lines of the parcel are parallel.

Multi Widths

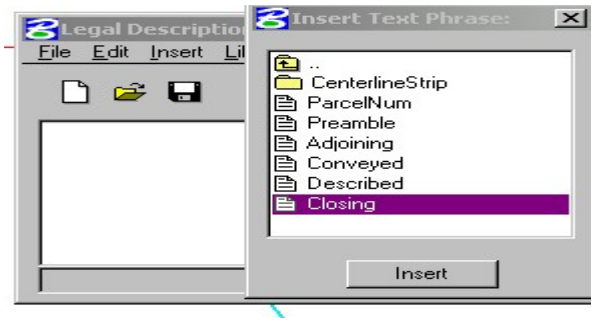
The editor prints "And a strip of land" automatically, and then a dialog box appears for input of the strip width. The next dialog box has a list of cardinal directions to describe which lines of the parcel are parallel.

EndStrip

A dialog box appears with a list of cardinal directions to select the description of the line on the strip that is being described. Another dialog box is available with a list to select strip or strips (if multiple widths strip). The next dialog box contains a key-in to input the offset distance from the centerline, to the closest described line. The last dialog box has a list with cardinal directions to indicate the direction the closest line lies from the survey centerline. The Library Editor will then automatically complete the caption for the centerline description.

Closing

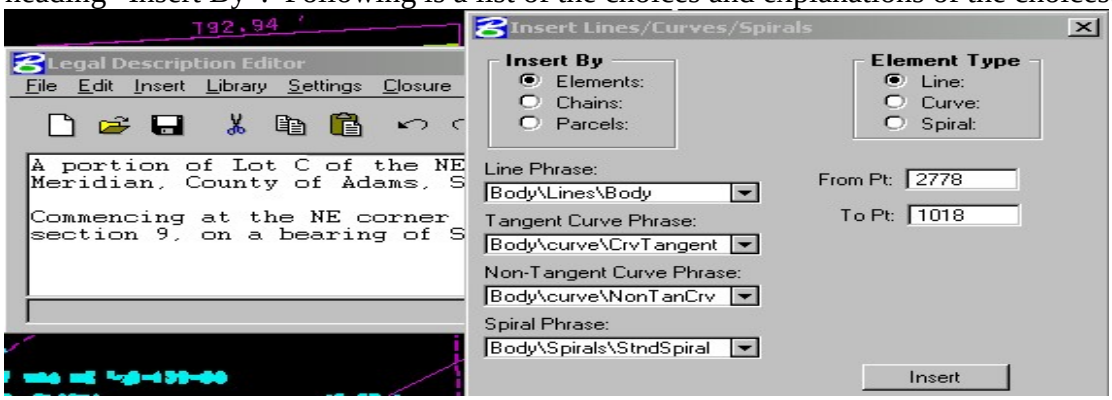
This statement is required at the end of the legal description. Select "Closing" then hit "Insert", the editor will type in "The legal description was prepared by". A dialog box will appear and on the top bar are the words "Insert name" this refers to the name of the person writing the legal description.



CADD Standards

Body Folder

Following are steps and explanations concerning the items in the Center Line folder. This is obtained by clicking on the ”Line\Curve\Spiral Phrase” from the Insert pull down, a dialog box with a variety of choices pops up for these items. The first selection is outlined by a box with the heading “Insert By”. Following is a list of the choices and explanations of the choices:



Elements

To create the “body of the description” based on existing “Elements,” select,

Line: The user may enter points that were stored in the GPK file to identify a line; for example enter a stored point number in the “From Pt:” field and the end point of the course in the “To Pt:” field.

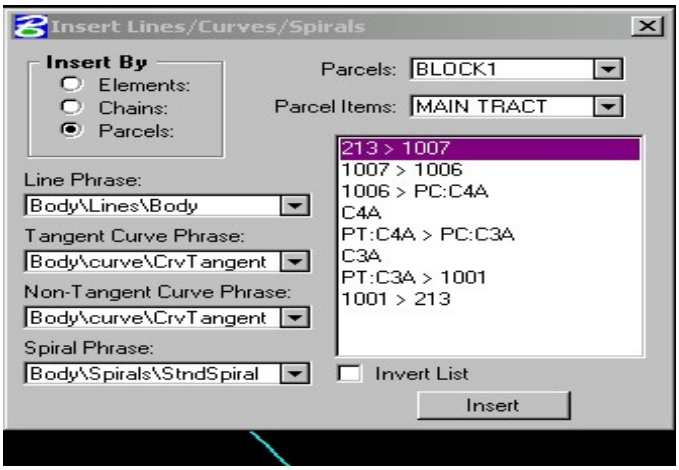
Curve or Spiral: the user may choose from a list of previously stored curves or spirals in the GPK file.

Chains

The user may choose from a list of stored chains in the GPK file from the pull down.

CADD Standards

Parcels



A pull down is available for the Parcels stored in the GPK file. The window to the lower right of the dialog box has a list of the parcel courses. The library will show each course as a "point-to-point chain" or a "point-to-curve" chain. If the points, chains, and/or curves of the parcel are not in a clockwise direction, check the box under the window to invert the courses. It will invert the parcel features but not the curves themselves. Select the parcel from the pull down in the upper right corner, highlight a course, and select the desired "Line Phrase:" statement. Hit "Insert" and the library editor will read the selected course from the GPK file in GEOPAK to print the correct data into the description.

Under the "Insert By" box are Line Phrase, Tangent Curve Phrase, Non-Tangent Curve Phrase, or Spiral Phrase pull down choices. <u>Explanations for "Phrase" statements follow</u>:

Line Phrases

This pull down contains different statements or line styles, which are listed below with an example. The bearings and distances are read from the data stored in GEOPAK:

Body\Lines\Body
"Commencing at the SE corner of section 26, thence northerly along the east line of section 26, on a bearing of N 01 deg. 11 min. 24 sec. E and a distance of 424.46 feet."
This should be the first line used in the body. "Insert By" "Elements" or "Chains" can be used and the first point should be a Section Corner, Quarter Corner, or some known point.

Body\Lines\ToPOBLine
"Thence on a bearing of N 90 deg. 00 min. 00 sec. W and a distance of 422.01 feet to the point of beginning."

Body\Lines\StdLine
"Thence N 90 deg. 00 min. 00 sec. W a distance of 422.01 feet."

Body\Lines\BegCrv Line
"Thence N 90 deg. 00 min. 00 sec. W a distance of 422.01 feet"
This sentence is the same as "Body\Lines\StdLine" but does not have a period at the end; the purpose is to lead into a curve statement. The editor reads the line data for the course before the curve in this part of the statement. The remainder of the statement will require data from a previously stored curve. If the curve is non-tangent, data for the direction of the radius (Body\Lines\ToNonTanCrv) on the curve is required. Insert this before the curve data.

CADD Standards

Body\Lines\ToNonTanCrv
"to a point on a non-tangent curve concave (right), northwesterly, the radius point of which bears N 90 deg. 00 min. 00 sec. W."
The statement for the non-tangent curve is in three different line statements. Insert the "Body\Line\BegCrv Line" statement first, this statement reads the non-tangent course data before the curve. Next insert the "Body\Line\ToNonTanCrv" (the present statement), the data required for this will read the direction of the radius. A data point must be stored at the curve center or radius point, then go back to the "Insert By" box and click on "Elements:" Enter the point number of the PC on the parcel in the "From pt" field and the point number of the curve center in the "To pt" field. From here click on the "Parcels" in the "Insert By" box and continue with the curve data in the parcel. The explanation for the third part of the statement, "Body\curve\NonTanCrv," is in the curve section.

Body\Lines\ComAtForStrip
"Commencing at the NE corner of section 33, thence westerly along the north line of section 33, which is also the survey centerline of ND 6, on a bearing of N 90 deg. 00 min. 00 sec. W and a distance of 422.01 feet to the beginning of a 37 foot strip."
This statement begins the body of a centerline description for a strip of land parallel with the centerline of a highway. The first dialog box contains a list to select the corner of the section or quarter section where the description begins. The next dialog box is a key-in for the section number. Then a dialog box with a list to select the direction traveled. The fourth dialog box contains a list to select the side of the section traveled on. The next dialog box is a key-in for the section number. Another is a key-in for highway name. The last is a key-in for the width of the strip.

Body\Lines\CL Multi Widths
"This point is also the beginning of a 37 foot strip."
This statement describes a change in widths of a continuous strip.

Body\Lines\End of Strip
"Thence N 90 deg. 00 min. 00 sec. W a distance of 422.01 feet to the end of the 37 foot strip."

Body\Lines\Alongline
"Thence on a bearing of N 90 deg. 00 min. 00 sec. W along <u>section line</u> a distance of 422.01 feet."
A dialog box appears with a request to "Insert Reference Line" (a section line, Senior property line, Riparian boundary, or right-of-way line) that the course is to proceed along.

CADD Standards

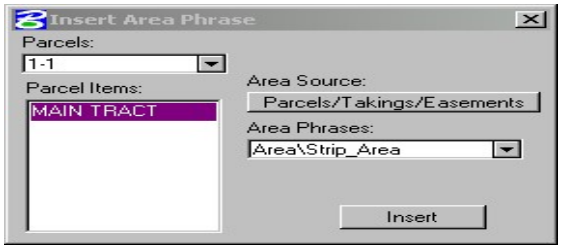
Curve Phrases

Body\curve\CrvTangent
"to the beginning of a tangent curve, concave (right) northwesterly having a radius of 899.50 feet. Thence northeasterly along said curve 113.23 feet through a central angle of 07 deg. 12 min. 45 sec. to the end of the curve."
Insert the "Body\Line\BegCrv Line" before this statement. A dialog box that contains a list to select the direction of the concavity of the curve will appear. Next a dialog box with a list to select the direction of travel along the curve will appear. The library editor reads the arc distance and delta angle of the curve data stored in GEOPAK.

Body\curve\NonTanCrv
"a distance of 1095.07 feet. Thence northwesterly along said curve 1990.55 feet through a central angle of 104 deg. 08 min. 57 sec."
Insert the "Body\Lines\BegCrv" Line (reads the data from the non-tangent course, before the curve) and "Body\Lines\ToNonTanCrv" (reads the data concerning the bearing of the radius) before this curve statement.
The complete statement for the non-tangent curve should read as follows:
"Thence N 90 deg. 00 min. 00 sec. W a distance of 422.01 feet to a point on a non-tangent curve concave (right), northerly, the radius point of which bears N 90 deg. 00 min. 00 sec. W. a distance of 1095.07 feet. Thence northwesterly along said curve 1990.55 feet through a central angle of 104 deg. 08 min. 57 sec."

Area Phrase

Select Insert\ Area Phrase.



A dialog box appears with a pull down list of all the parcels stored in GEOPAK. A pull down is also available for the "Area Source:" this is the fractional areas of a parcel. The parcels must be stored previously with fractional parts. The next pull down on the same dialog box is "Area Phrases:" The choices in here are "Area\Strip Area" and "Area\Parcel". The editor will end this application with "End of description." on a separate line.

Area\Strip Area
The Editor will print out "Said strip is shown on the plat as parcel." a dialog box will appear to type in the parcel name, hit OK and the Editor reads the GEOPAK area data for this particular parcel and finishes the area portion of the description.

CADD Standards

Area\Parcel
This selection will print out the phrase “Said parcel” rather than “Said strip”.

Temp Easement
This statement is used if the parcel is temporary construction easement.
“It is a condition of this easement that it shall not be filed for record and that all rights conveyed to the state of North Dakota and North Dakota Department of Transportation by this instrument shall terminate upon completion of construction of said project, or in five years from the date of conveyance, whichever comes first.”

Closing Phrase
This statement is required at the end of the legal description. Select “Closing” then hit “Insert”, the editor will type in “The legal description was prepared by”. A dialog box will appear and on the top bar are the words “Insert name” this refers to the name of the person writing the legal description.

Select “Insert\Text Phrase\Text\Closing” the Editor will print out the following statement automatically, “The legal description was prepared by”. At this point a dialog box appears to key-in the name of the person creating the legal description. Hit OK, the Editor will complete the closing portion of the legal description.

Parcel Owner’s Name Phrase

To create a list of owners’ names and addresses on a project select “Parcel Owner’s Name Phrase” folder, found in the “Insert” pull down. A dialog box appears, the phrase at the top of the box says “Insert Owner’s Name Phrase”. A pull down is available to select a parcel. The owner’s name and address, of the selected parcel, will in the window under “Owner’s Names”. Hit insert and the phrase “Parcel No.” is printed, then a dialog box appears, with a key-in, to insert the parcel number. After hitting the “OK” button, the Name and address of the owner will print out.

4.12 Survey Alignment Data Sheets

Feb 2009

Survey Alignment Data Sheets (081LO ### SDL.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 are created that can be imported into survey equipment and corresponding paper documents are created. Surveyors should not have to key in this information. This process involves:

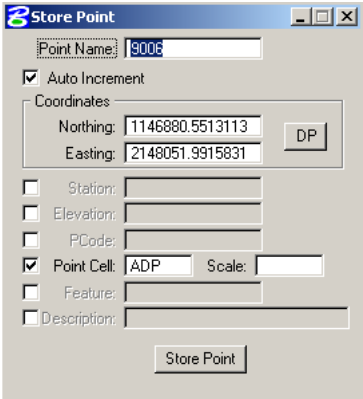
1. Storing the alignments and points into cogo.
2. Drawing and labeling the alignments and points.
3. Creating and placing a coordinate table.
4. Exporting the alignments and points.

This section of the manual will give an overview of the process and highlight a few steps. This section will not provide comprehensive instructions. For additional comprehensive instructions for tasks such as storing an alignment see the GEOPAK help files.

1. Storing the alignments and points into cogo.
   a. Be careful not to redefine important points. If "Redefinition of Elements" is on, you will be able to rewrite existing points. If it is off, you will only be able to create new points. Within Coordinate Geometry, use Navigator to find point ranges not used. Alignments created by design should use points within the range 8000-8999. Design topographical points should stay within the range 9000-9999. See *Section 4.2.2*.

   b. Temporary Cogo Visualization is recommended. Use the D&C Manager for the final symbology displayed in the plans.

   c. Design topographical points should be stored with the cell "ADP". You can leave the cell scale blank. You can set the scale later when it is drawn by the D&C Manager. If the "Auto Increment" option is turned on, the "Point Name" will be incremented after a point is stored into cogo.

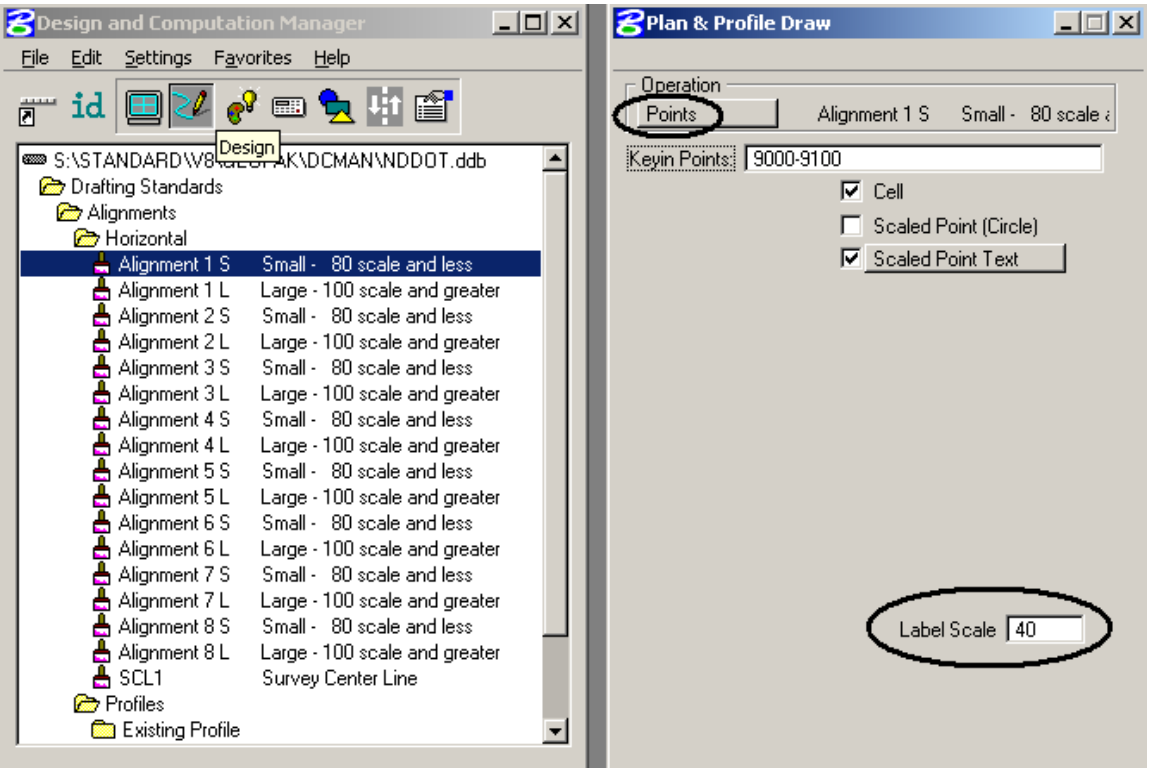


   d. A system of point ranges should be developed for each cut sheet. Try to create points in a logical sequence and leave extra numbers between point ranges in case revisions or additions are needed. Example: sheet 1 uses points 9000-9043, sheet 2 uses points 9100-9153, sheet 3 uses points 9200-9241, the point range 9044-9099 is not used unless revisions to sheet 1 are required and the point range 9154-9199 is not used unless revisions to sheet 2 are required.

CADD Standards

2. Drawing and labeling the alignments and points
   a. Alignment Data Points (used for design topographical features) should be drawn in DS Align.dgn and referenced into the 080LO ### SDL.dgn sheets.

   b. Alignment Data Points are drawn from the Horizontal Alignment items in the NDDOT Standard D&C Manager (S:\STANDARD\V8I\GEOPAK\DCMAN\NDDOT.ddb). There are 8 alignment symbologies. Each alignment can be used for a different point level and point annotation level.



   c. Set the "Label Scale" before you type in the point range that you want to draw. The options to draw "Cell" and "Scale Point Text" should be on by default.

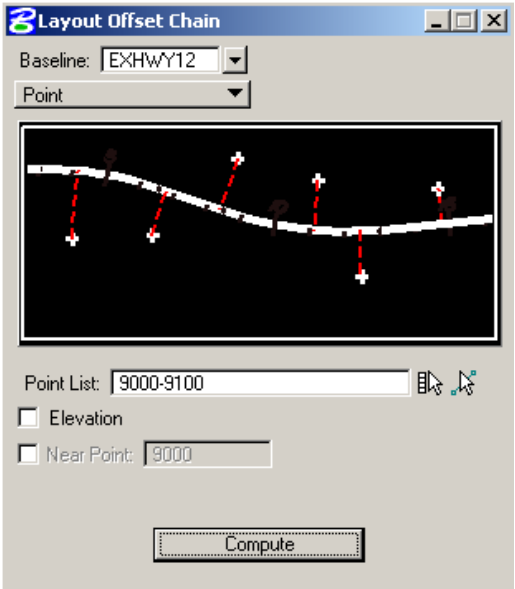
3. Creating and Placing a Coordinate Table
   a. There are two main ways of Creating and Placing a Coordinate Table

      i. Cogo and a text editor can be used to create the Coordinate Table

      ii. Cogo and the "Place Coordinate Table" tool can be used to create the Coordinate Table. This is the recommended method.

b. To create a Coordinate Table using Cogo and a text editor:

i. Open Cogo. From Cogo's main pull down menu select "Element>Chain>Layout offsets".



ii. Select the "Baseline" for the stationing and offsets

iii. Set the option to "Point"

iv. Provide a "Point List"

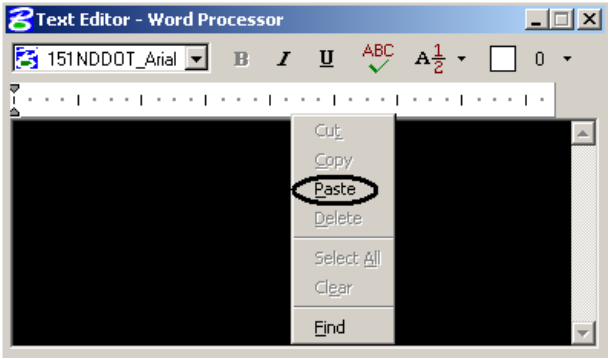
v. Turn off the "Elevation" option if elevations are not stored with points. Turn off "Near Point" if projections are not needed.

vi. Select the Compute button. Cogo will calculate coordinate information.

vii. Create a cogo output file by selecting "File>File Utility" from cogo's pull down menu. Set the option to "Output" and provide an "Output File" name. Note the GPK number will be appended to the name and the extension will be ".ond" if ND was used as the operator code. Example if "yyy" was specified as the "Output file" and the GPK number was 001 then the output file would be named "yyy001.ond".

viii. Use a text editor to edit and copy the desired information.

ix. Coordinate Data can be placed into sheet drawings using the "Cut Sheets Design.stg", "Annotations" group and the "Note (07)" component. Using the MicroStation "Place Text" tool, right click in the "Text Editor" text entry area. A popup menu should appear. Select "Paste".



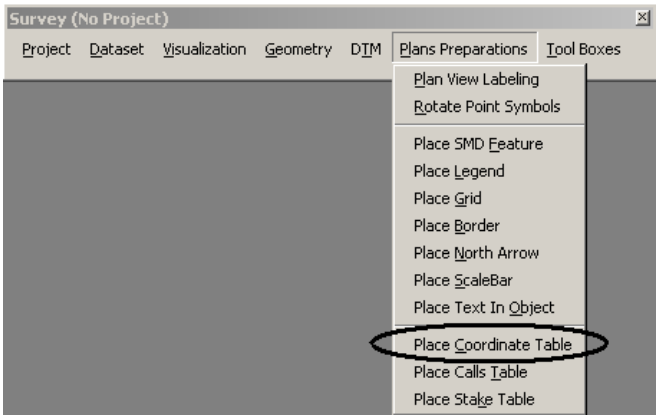
x. Format and clean up text as needed and place it into the drawing.

CADD Standards

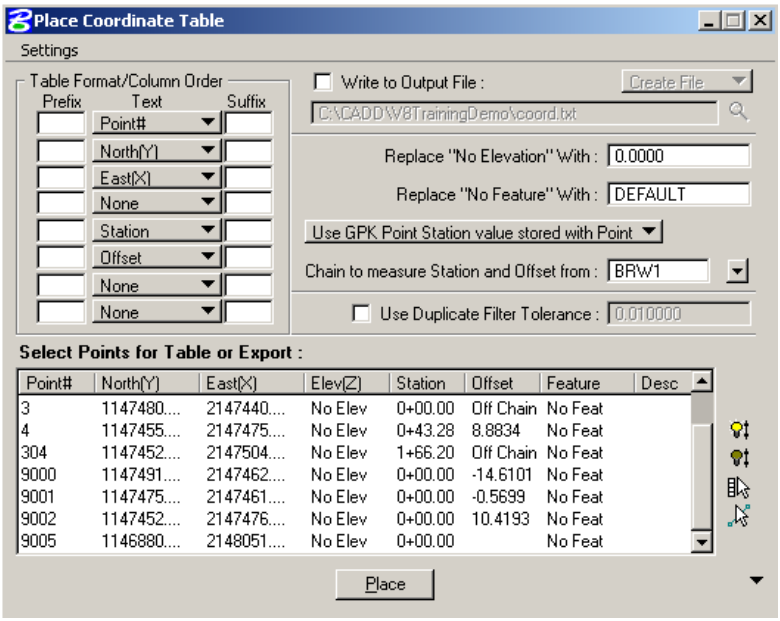
c. To create a Coordinate Table using Cogo and the “Place Coordinate Table” tool.

i. Activate Cogo and Select your GPK – Job Number.

ii. The “Place Coordinate Table” tool is in GEOPAK Survey. Select “Plans Preparations>Place Coordinate Table” to load the “Place Coordinate Table” tool. A survey project does not need to be set up.



iii. The “Place Coordinate Table” should open. Load the NDDOT CADD Standard symbology settings by selecting “Settings>Open” from the “Place Coordinate Table” dialog box.



The settings files are located at C:\Program Files\Bentley\GEOPAK\bin\. Pick the appropriate settings file.

“nddot040.set” is for 40 scale
“nddot060.set” is for 60 scale
“nddot080.set” is for 80 scale
“nddot100.set” is for 100 scale
“nddot200.set” is for 200 scale

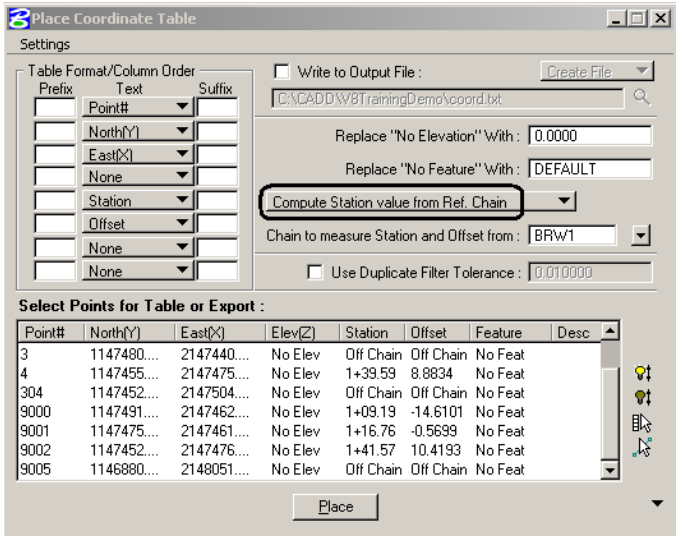
These settings files can be copied from S:\STANDARD\V8I\GEOPAK\bin

Note: the settings files don’t always set the appropriate levels for the coordinate table. This is a know bug with GEOPAK. The levels may have to be corrected manually. The text is intended to be place on level “sht Text 2” and the table lines should be on level “sht Lines 2”

CADD Standards

1. The default table is set up for the fields; Point Number, Northing, Easting, Station, and Offset. If additional fields such as Elevation are needed, use the “Table Format/Colum Order” area of the dialog box to enable additional fields.

2. Set Stationing option to “Compute Station value from Ref. Chain”.



3. Select the desired points.

4. Select the “Place” button and place a data point to define the upper left corner of the table.

4. Exporting the alignments and points

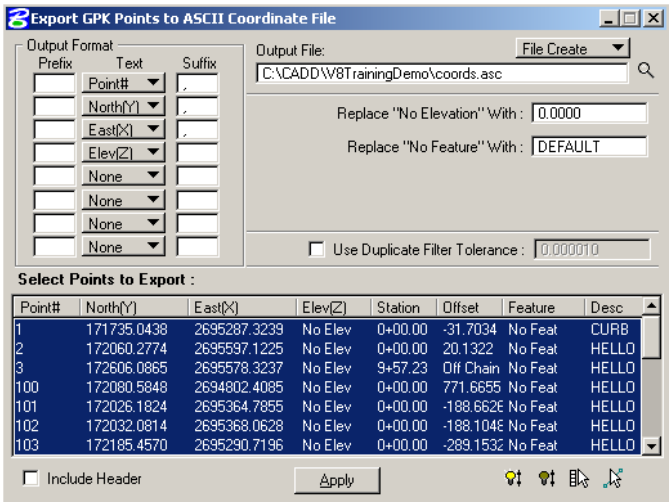
   a. Giving field personnel electronic output files of points and alignments is NOT the correct method of exporting design data into the field. GEOPAK output files (*.ond) can not be directly imported into survey equipments. GEOPAK Points and Alignments should be exported to files that can be directly imported by survey equipment. Points are exported to ASCI files (*.asc). Alignments and Profiles are exported to “Trimble DC” files (*.dc).

   b. To export points from GEOPAK

      i. Open cogo for the applicable gpk – job.

      ii. From the Cogo dialog box, select “File>Export>ASCII Points”

iii. The "Export GPK Points to ASCII Coordinate File" dialog box should open. Clear all prefixes from the "Output Format". A comma (,) should be used as a suffix for all fields except the last one. Example, if elevation is your last field, it should not have a suffix.



iv. Point#, North(Y), East(X) and Elev (Z) are the main fields imported into survey equipment. The Station and Offset Fields are not usually used in files to be imported into survey equipment. Station and Offset Fields are used in coordinate tables that printed in the plans.

v. The "Include Header" option should be turned off.

vi. Select the points to export to the survey file and select the "Apply button" to create the file.

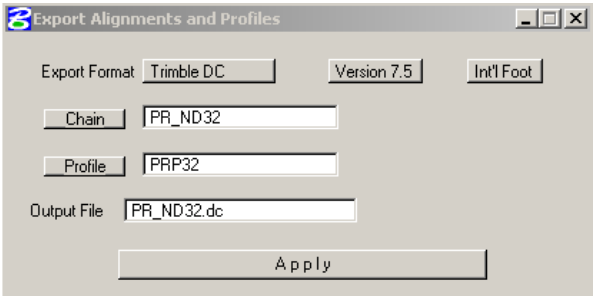
vii. The survey ASCII file can be reviewed with a text editor to insure it was created correctly.

c. To export alignments and profiles from GEOPAK:

i. Open cogo for the applicable gpk – job.

ii. From the Cogo dialog box, select "File>Export>Alignments and Profiles".

iii. The "Export Alignments and Profiles" dialog box should open.



iv. Set the "Export Format" to Trimble DC. Set the Version to 7.5. Set the Foot to international ("Int'l Foot"). Do not use "US Foot".

v. Select the appropriate Chain and Profile. You will have to create a separate “dc” file for each alignment.

vi. The “Output File” should have a “dc” extension. It will be written to your working directory. Select the “Apply” button to create the file.

vii. The “dc” file could be viewed with a text editor. However the format is complex and it will probably not be practical to review without additional Trimble software.

CADD Standards

OpenRoads

4.13 Settings

Jan 2017

The current CADD Standards address both Geopak SS2 and OpenRoads (Geopak SS4). The Standards configuration files look at what version of Geopak is active and makes adjustments when needed. However, there are a few things you need to do that are not automated.

The itl and xin files for OpenRoads are different than the files used for Geopak SS2. On OpenRoads (Corridor Modeling) projects the files located in the following directory should be copied to your project working directory.

"S:\STANDARD\V8i\data\Civil\SS4 Files To Copy To Working Directory"

The xin file for Geopak SS2 included Feature Definitions. OpenRoads doesn't get the feature definitions from this file. A xin file is still required in OpenRoads, but not for feature definitions. The OpenRoads xin is used for cross section sheets and earthwork.

The itl files for Geopak SS2 and OpenRoads are different. The template design for both version are similar, but the Geopak SS2 version avoids closed shapes and the OpenRoads version uses them. The Geopak SS2 version is intended to be used with Geopak SS2 earthwork where closed shapes can cause tolerance issues. The OpenRoads version is intended for OpenRoads Earthwork where closed shapes are needed for multiple material types.

4.14 OpenRoads Survey

Jan 2017

At this time OpenRoads Survey for SS4 is not mandated. Users are encouraged to use the OpenRoads version, but the older Geopak Survey workflows and deliverables will be allowed.

4.15 OpenRoads Feature Definitions

Jan 2017

The NDDOT Feature Definitions for OpenRoads are stored in multiple dgnlibs (libraries). The organization of feature definitions across different files may not be intuitive because there are links to the old system of features used in the Geopak Design and Computation Manager Database and the Survey Manager Database. There are also new feature definitions created solely for OpenRoads. People familiar with the older feature systems may find this structure useful. New users might not appreciate this organization. Another organization system can be used to access Feature Definitions.

The NDDOT element templates, tools and tasks system has been updated to account for features. Several NDDOT drawing elements are directly related to NDDOT feature definitions. Accessing the NDDOT tasks system for a drawing element will also set a feature definition if applicable. If there is no applicable feature, the feature definition will not change. To use the feature definition, you must switch to a civilized tool after you pick the regular (old – uncivilized) tool.

For example, if you pick “Aggr A” from the NDDOT tasks, The Feature Definition Toggle Bar should open and also switch to “Aggr A”. You could ignore the feature definition and continue to draw a non featurized element or you could switch to a civilized tool such as in Horizontal Geometry and draw with the feature definition. Feature definition are only recognized with civilized (OpenRoads) tools.

If you’re not using civil features and don’t want the Feature Definition Toggle Bar opening, choose the Main Menu item “NDDOT > Feature with Tasks > Off”

4.16 Civil Geometry

Jan 2017

The design file drawing scale must match one of common Design Computation Manager Scales in order to work. Example, the feature definition for “Alignment 1 L” will only auto annotate at drawing scales 100, 200, 300, 400, 500 and 1000. The feature definition for “Alignment 1 S” will only auto annotate at drawing scales 40,60 and 80.

Profiles that use civil geometry must be in the same drawing as the horizontal alignment. Civil geometry profiles can be drawn in other drawings such as “DS_Align.dgn” but the horizontal alignments should not be drawn in the “Profile.dgn”. This means only non-civil geometry profiles should be drawn in the “Profile.dgn”.

4.17 Terrains

Jan 2017

Preliminary Survey Terrains

The existing ground surface may be represented by different types of terrains. Standard drawing and terrain 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.

Drawing Name	Terrain Name	Description
Terrain_Exst	Exst	Continuous Along Primary Road Alignment - Used to create continuous existing profile for primary design road.
Terrain_Exst_Alt	Exst_Alt	Discontinuous Along Primary Road Alignment - May include underpasses, overpasses or exclude primary alignment structures. Used for alternate profiles and earthwork calculations.
Terrain_Exst_No_Voids	Exst_No_Voids	Similar to "Exst" terrain except voids are modeled as break lines and obscured data may be considered
Terrain_Exst_Alt_No_Voids	Exst_Alt_No_Voids	Similar to "Exst_Alt" terrain except voids are modeled as break lines and obscured data may be considered
Terrain_Exst_Drape	Exst_Drape	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 incorporated 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.

Intermediate Design Terrains

SS4 project will require an additional terrain compared to SS2 projects. OpenRoads Earthwork doesn’t handle varied thickness and types of unsuitable grading materials. In SS4 the unsuitable grading materials like topsoil and pavement removal should be calculated from plan view. A suitable grading terrain needs to be created for actual earthwork calculations.

The suitable grading terrain can be created by offsetting selected elements used to create the existing ground terrain. The suitable grading terrain is usually an estimate of where the suitable grading surface begins and is based on old typical sections or old cross sections or both. The following is a recommended procedure to create a suitable grading terrain.

1. Locate the drawing used to create the existing ground terrain. This drawing usually contains only elements used for the terrain creation.

2. Use the “Copy/Move Fence Contents to File” command to create a new drawing named DTM_Sutitable_Grading. Use the copy option. This command will do two important things. You will get a separate file to make changes independent of existing ground, and SS4 features used for existing ground creation will be dropped down to regular (non featurized) elements.

3. In the newly created drawing, delete all elements that were not used for the exiting terrain. The remaining elements will be vertically offset to represent the suitable grading terrain. Typically there is only a handful of different offset values.

4. Color code the drawing to simplify and track the offsets. Many of the elements should be offset the thickness of topsoil. Change all of these elements to one color. Use a different color to represent each depth of pavement removal. Remember this drawing is being used for earthwork so if the elements are outside of the limits of construction, don’t get too concerned about a perfect suitable grading representation in these areas.

CADD Standards

5. Once the entire drawing is color coded, use the select by color commands to move the element down the desired amount (adjust elevations as needed).

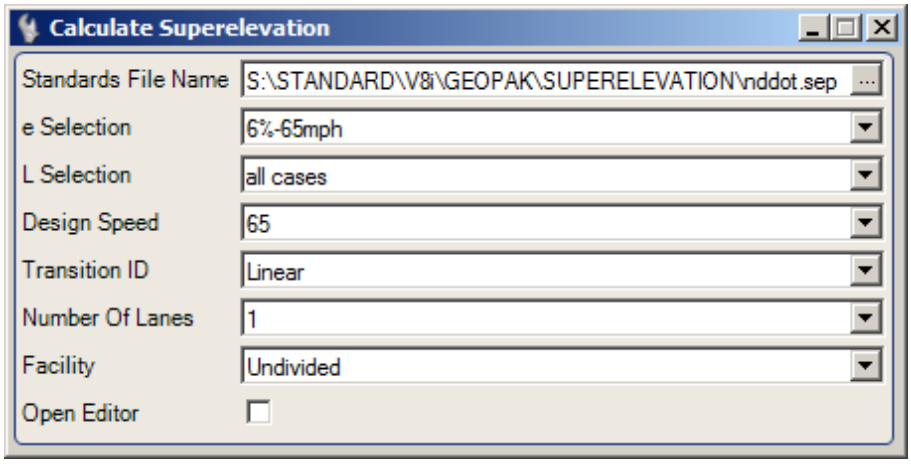
6. Use the offset elements to create the suitable grading terrain. Store the terrain in a separate drawing named “Terrain_Suitable_Grading” and name the terrain “Suitable_Grading”.

7. It is good practice to keep DTM_Suitable_Grading drawing. The suitable grading terrain may require addition edits in the future. Access to the elements that were used to create the terrain may simplify future edits.

4.18 Super Elevation

Jan 2017

OpenRoads super elevation should use the same preference file as used for Geopak SS2. When prompted for a Standards File Name, pick the nddot.sep file.



4.19 Cross Sections

Jan 2017

As discussed in section 4.13, the xin file should be copied to the project working directory. This file may need to be edited for cross section settings. The OpenRoad xin file includes options for the stacked (old working cross section file format) but this is not the desired format. OpenRoads Cross Section Sheet models should be used.

If your preferences options aren't showing the options shown to the right then the standard xin file may not be in the correct directory. See section 4.13

Do not manually draw on the cross section sheets. Realize that when modifications are needed, the typical workflow entails recreating the sheet model from scratch. This includes cross section annotation.

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 some features in cross sections.

Additional drawing versions are usually required for OpenRoads Cross Sections. These drawing versions contain civil features element that can be referenced into the cross sections. The civil features have Plan (2D), 3D, Profile and Cross Section components. These drawings should have a default drawing scale that is same as the cross section file. The most common drawings needed may include; RW_Bndry.dgn, Togog.dgn, Wetland_Impacts.dgn and DS_Util.dgn.

The suffix "Features" is recommend as part of the drawing name suffix (RW_Bndry_Features.dgn, Togog_Features.dgn, Wetland_Impacts_Features.dgn and DS_Util_Features.dgn).

Some CADD workflows like the ones in Right of Way and Environmental aren't inherently incorporated into OpenRoads. Additional processing is required.

CADD Standards

The following workflow will describe creating RW_Bndry_Features.dgn. This workflow assumes a regular – non featurized RW_Bndry drawing is available.

1. Create a new drawing named RW_Bndry_Features from a 2D seed drawing. It is usually easier to let the civil geometry tools create the 3D model from the 2D model.

2. Reference and copy in only the MicroStation elements that you want to change to OpenRoads features and display into cross sections. For Example you may want to only copy the RW and Easement lines. You probably don't need elements like text and dimensions.

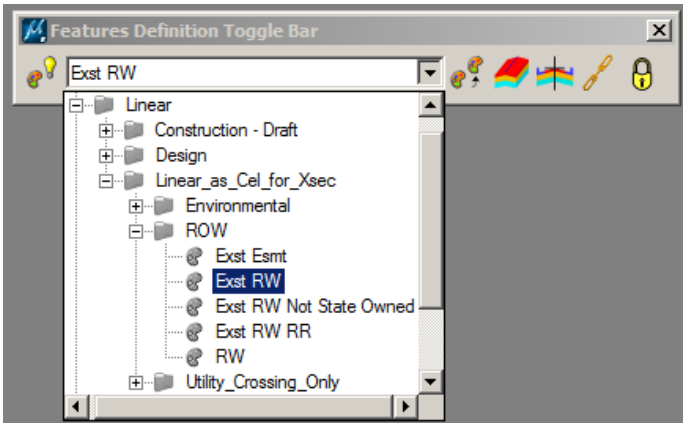
3. Most RW and easement lines are drawn as MicroStation lines or lines string elements. These element types will work in this conversion process. However MicroStation elements like shapes will not. Most wetlands are originally drawn as shapes. The shape surface will displace in the cross section view 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.**

4. 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 2D model version of the terrain and then make this terrain your active terrain model. A Default-3D model should have automatically been created by setting your active terrain.

   Most features should be draped to the existing ground terrain. If they are not draped, they will be at elevation 0 which will be hard to view in a cross section. The next steps will create feature and drape them to the surface.

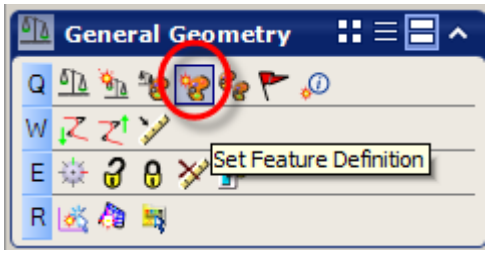
5. Select all drawing elements that you want to convert to a specific type of feature. Each feature type will be processed separately, one at a time. Example, New RW will be processed separately from Existing RW lines.

6. Select the appropriate Feature Definition. NDDOT Tasks can be used to access feature definitions. Also note that many needed feature definitions are under the "Linear_as_Cel_for_Xsec" folder.

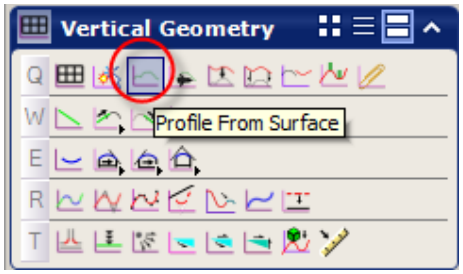


CADD Standards

7. Set the feature definition.



8. Use the "Profile from Surface" tool to create both a profile element and 3D Linear Element. **Note the "Quick Profile from Surface" tool doesn't create the needed 3D Linear Element.**

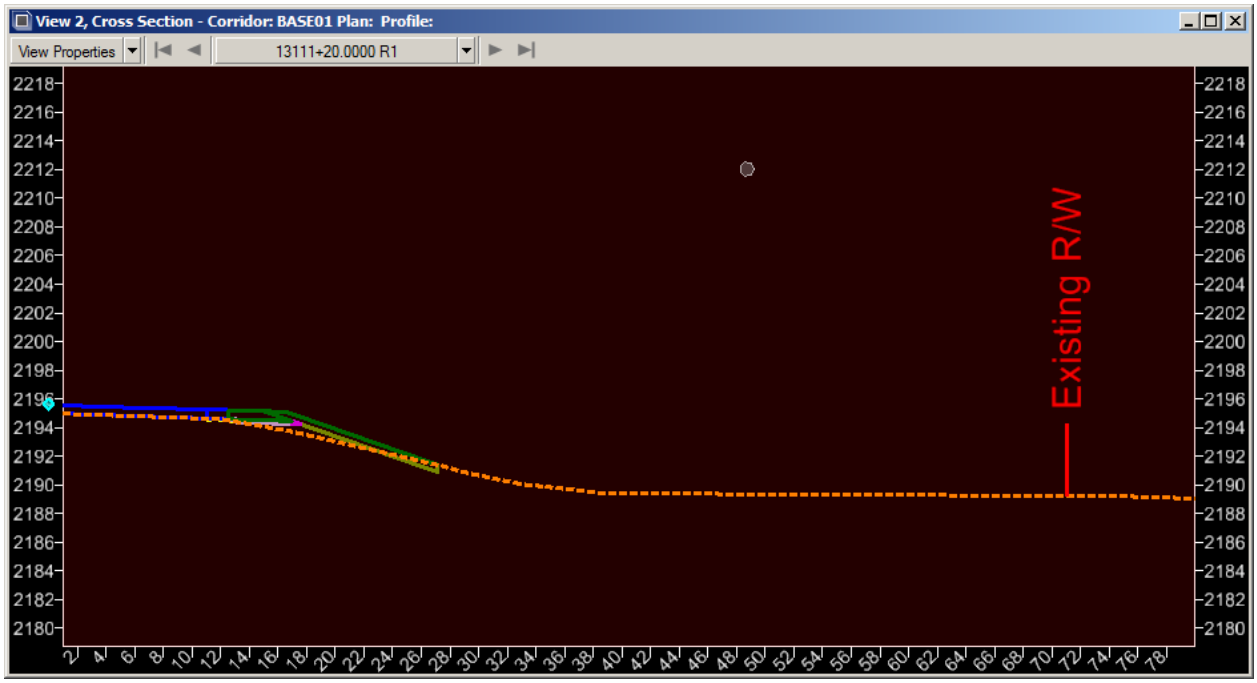


9. Switch to the Default-3D model. You should see the 3D Linear elements.

10. Set the drawing scale of the Default-3D model to match the drawing scale of your proposed cross sections and save drawing settings. The scale of the cross section feature cells will be based on this drawing scale setting.

11. This drawing is now ready to be referenced to your cross section model. Reference the 2D model into the parent 2D file and 3D models should automatically attach.

12. When either Dynamic or Sheet Model cross sections are viewed, the features should appear with the NDDOT CADD standards as a feature cell (example, Existing R/W).



Note, step 7 should include vertical offsets for several existing utilities.

- If underground elevations for water and sanitary sewer lines are not available, a -7.5 foot offset should be used for these features.
- If underground elevations for electrical, communication, gas and other petroleum products is not available, a -3.0 foot offset should be used.

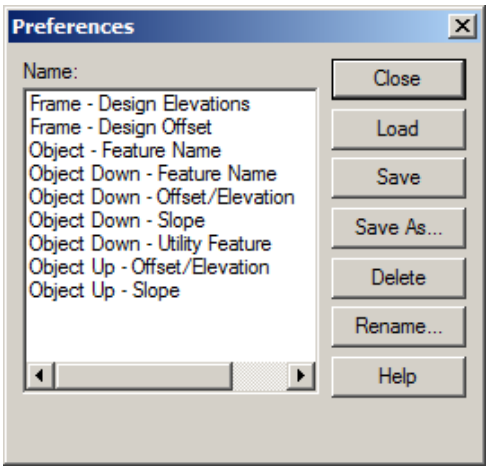
Utilities, such as storm sewer, may have valid underground elevations. These elements can be reference directly to the default-3D model and set as a feature.

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 SS4 version of the drawing DS_Util.dgn should contain a 3D represenation of drainage pipe and structures. (See also Appendix Q – Drawing Production Guidance – DS_Util)

4.20 Cross Section Annotation

Jan 2017



Cross sections sheets should be labeled. Several preferences have been set up for labeling. These options are also delivered in the OpenRoads xin file. See section 4.13.

The NDDOT standard "Annotate Cross Section > Preferences" should include the following as shown to the right.

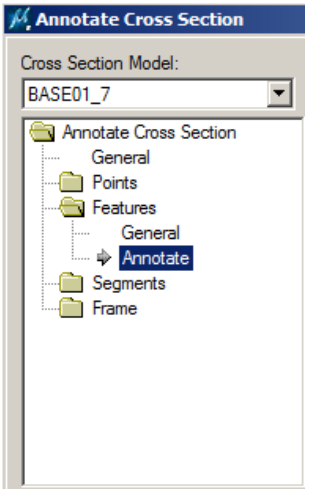
The following are included in the xin for development purposes only;

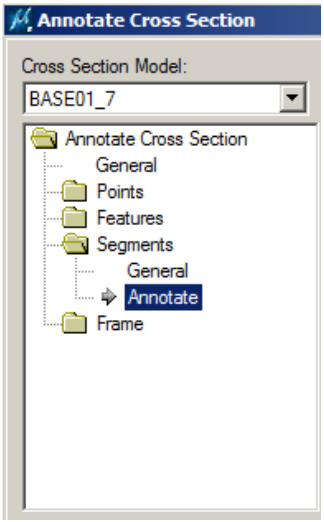
- Frame – Design Elevations
- Frame – Design Offset
- Object – Feature Name

Important break points should be labeled. The "Object Down" prefix is intended to be used for dirt grade points. The "Object Up" prefix 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.

Remember

- Points (offset/Elevation) should be selected by **Features** > Annotate.





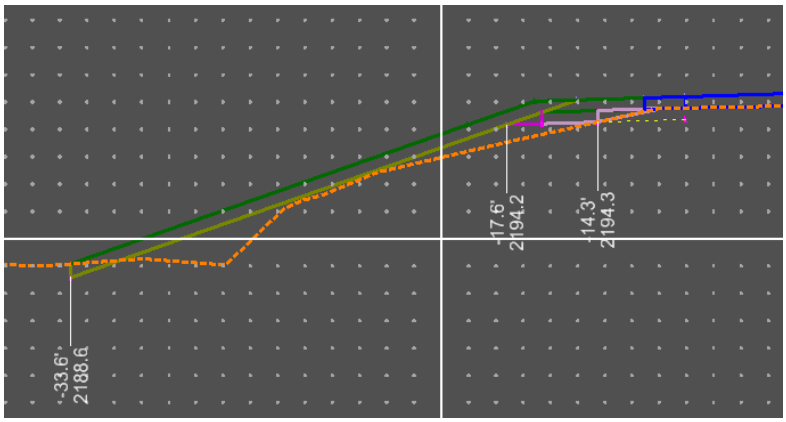
- Slopes should be selected by **Segment** > Annotate.

CADD Standards

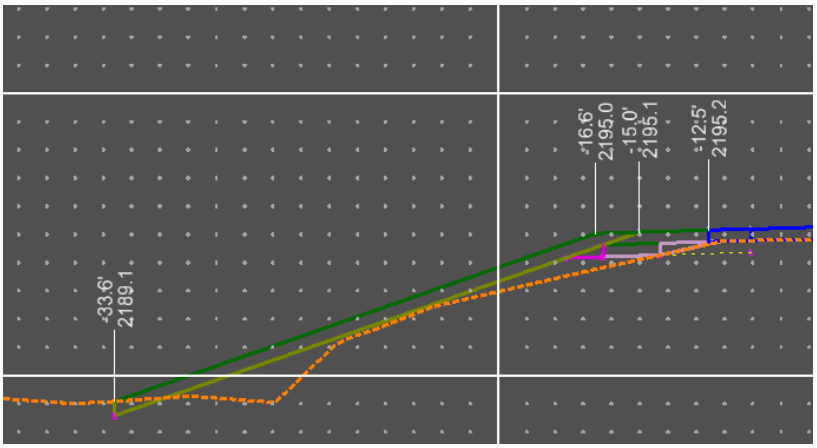
The main annotations used are

- Object Down – Offset/Elevation
- Object Up – Offset/Elevation
- Object Up – Slope

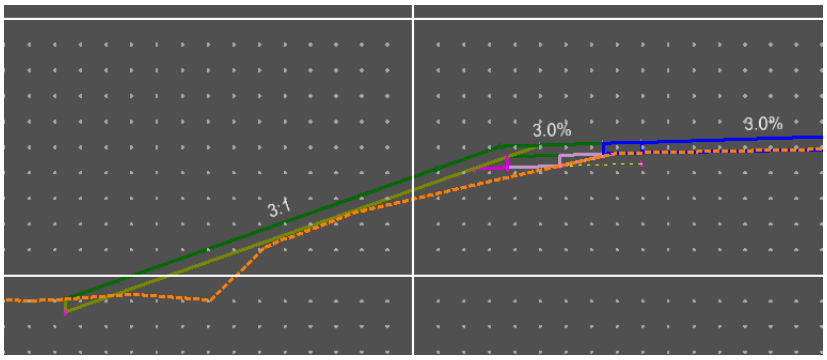
The “Object Down – Offset/Elevation” labels should be used for all important dirt grade points.



The “Object Up – Offset/Elevation” labels should be used for all important top surface points.



The “Object Up – Slope” labels should be used for all important slopes. Note that sometimes it is easier to label groups of continuous segments in separate processes in order to avoid labeling undesired segments. For example the segment from the top of curb to the flow line is seldom labeled because is very steep and short.

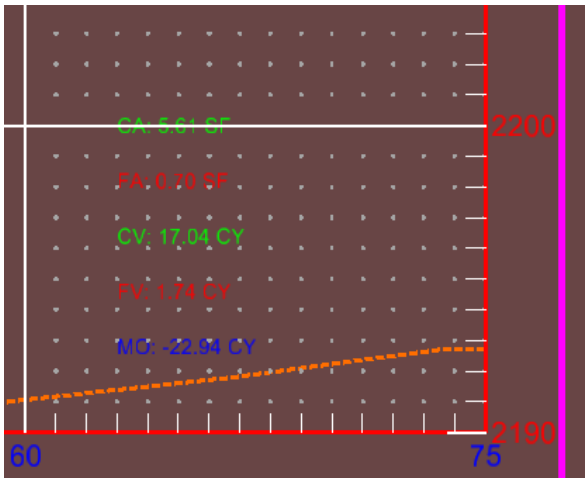


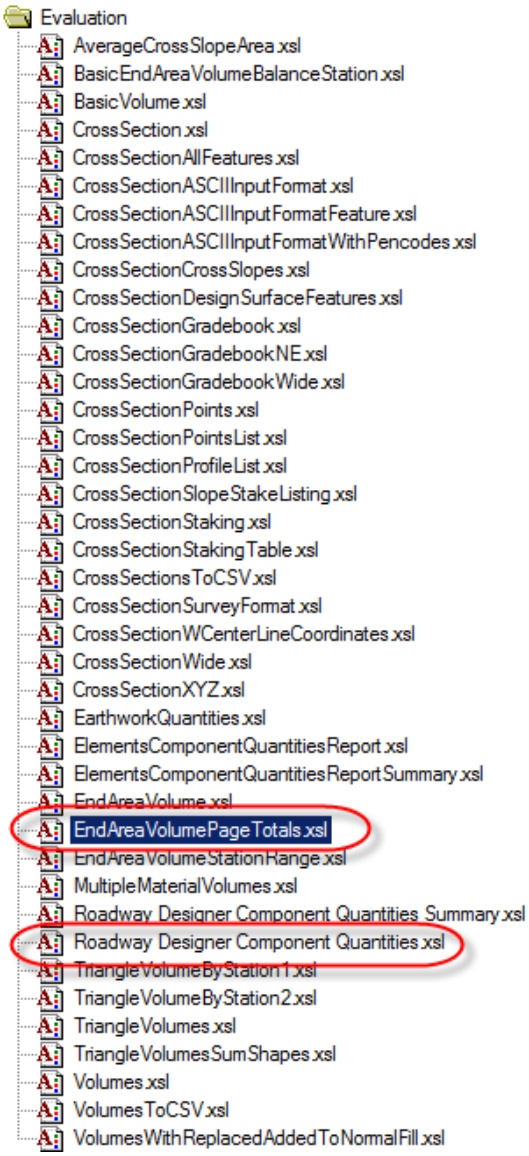
4.21 Earthwork

Jan 2017

Earthwork should be calculated from the suitable grading terrain. See section 4.17. The "Unsuitable Materials by Station" option is not recommended.

OpenRoads Cross Sections should have quantity summaries for each section; cut area, fill area, cut volume, fill volume and mass ordinate. The NDDOT standards have these preferences on. These labels are automated with the earthwork calculations.



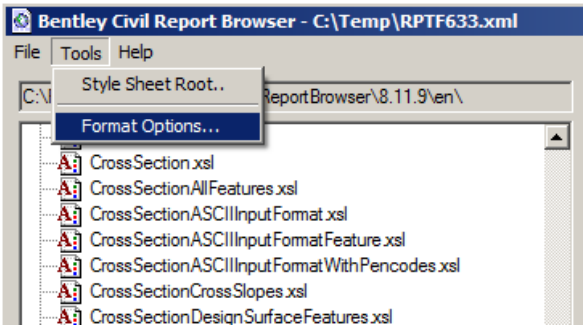


As discussed in section 4.22, the NDDOT doesn't have an automated custom earthwork report. The Bentley reports should be used. Note the earthwork reports for "Component Quantities (undercut materials)" such as pavement, base and topsoil are in a separate report from excavation and fill. The reports shown are recommended.

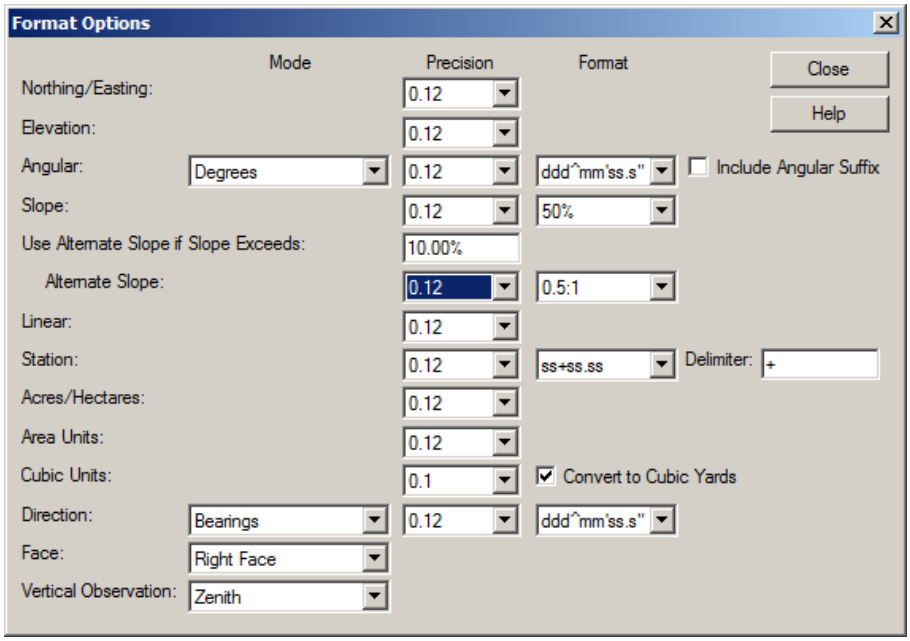
4.22 Bentley Civil Report Browser

Jan 2017

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 NDDOT doesn't have any custom forms. Users may need to cut data from the default Bentley reports and reformat data for plan production.

CADD Standards

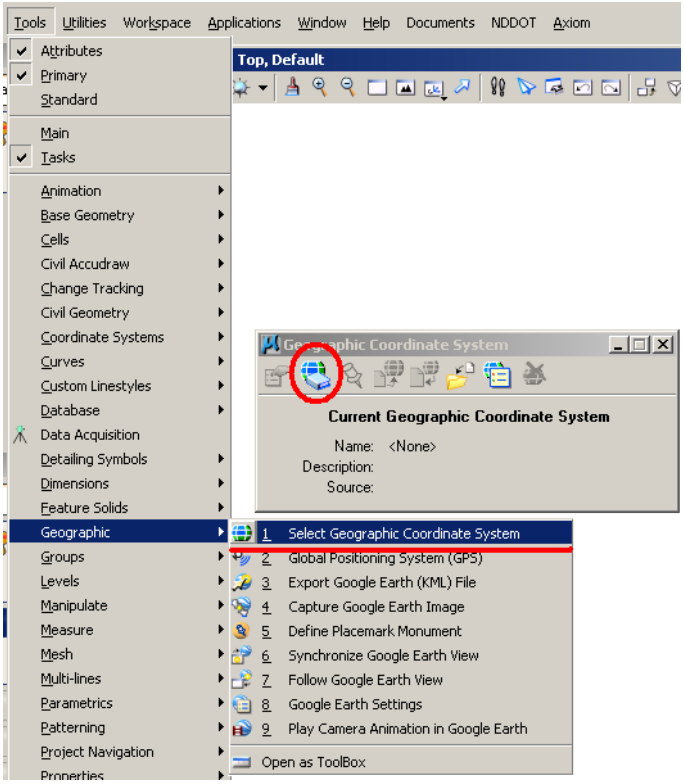
Bentley Map

5.1 Geographic Coordinate Systems (GCS)

Dec 2010

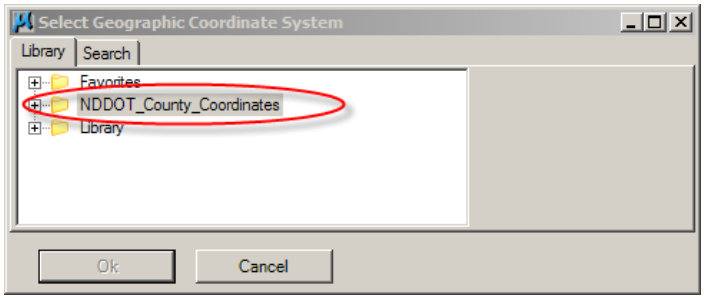
The NDDOT has assigned a special coordinate system to each county. Most NDDOT projects use one of these county coordinate systems. A library of these coordinate systems (NDDOT_County_Coordinates.dty) is included in the CADD Standards.

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



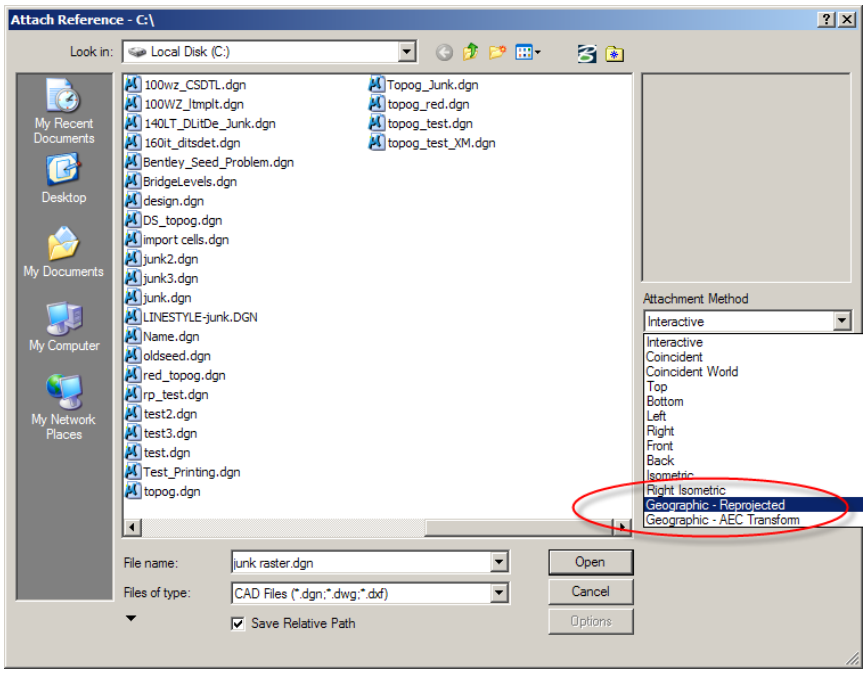
The GCS's are not set with the default NDDOT seed files. They need to be set up on an individual drawing basis. Set the coordinate system by going to Tools>Geographic>Select Geographic Coordinate System. This will bring up the "Geographic Coordinate System Dialog. Select the second button "From Library".

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_Coordinates" systems. After selecting the appropriate Coordinate System, click OK.



CADD Standards

Hint: When working with different GCS's, look for and use options to re-project data such as in referencing.



5.2 Rasters and Geographic Coordinate Systems

Dec 2010

This section discusses how to assign GCS's to rasters in order to enable the re-projection capabilities. Most of the aerial photos – rasters that are created by the Surveys and Photogrammetry Section are created using one of the following projection systems.

- State Plane North Zone – NAD83/ North Dakota North (Feet)
- State Plane South Zone – NAD83/ North Dakota South (Feet)

These rasters will reference into drawings that use the county ground GCS's at a location that may be close to the appropriate location, but not at the correct location. These rasters need to be re-projected. Users need to tell MicroStation which GCS was used in each raster and MicroStation will re-project the raster in the correct location.

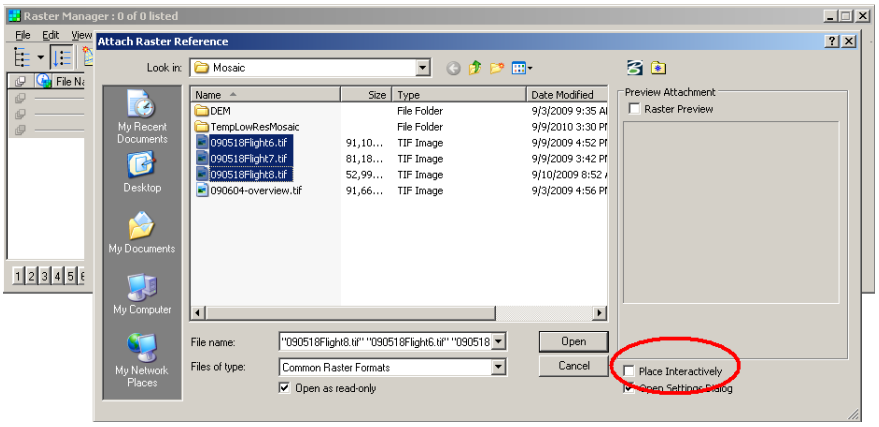
First, the data in the drawing must match a defined coordinate system. Most of the drawings that are delivered by the Surveys and Photogrammetry Sections or other drawings that use Surveys and Photogrammetry's drawings as a direct reference have a matching defined coordinate system.

Second, your user preferences for Raster Manager – Georeference must be set up correctly. See *Section 2.5*.

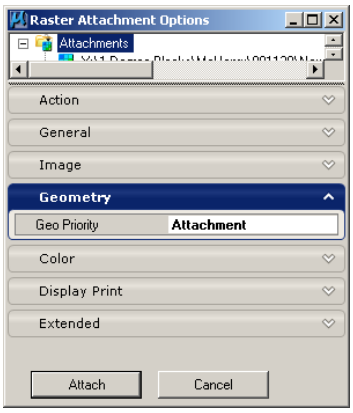
Thirdly, the appropriate GCS needs to be assigned to your drawing. See *Section 5.1*.

Now the rasters can be attached and GCS assigned.

Use Raster Manager to Attach the desired image(s). Make sure that "Place Interactively" is toggled OFF. Click Open



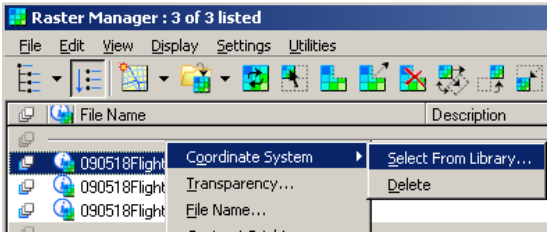
CADD Standards



The Raster Attachment Options Dialog will open. On the Geometry ribbon make sure that the Geo Priority is set to Attachment.

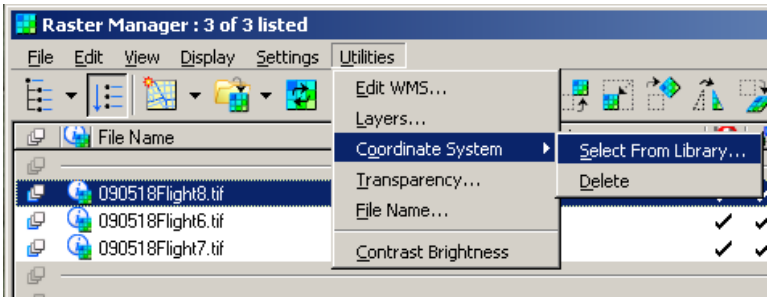
The final step is to set the coordinate system for the Raster Image. You can access the selection Dialog in one of several ways.

1. Select a single raster in the Raster Manger Dialog Box. Right Click on the selected Raster and select Coordinate System>Select From Library.



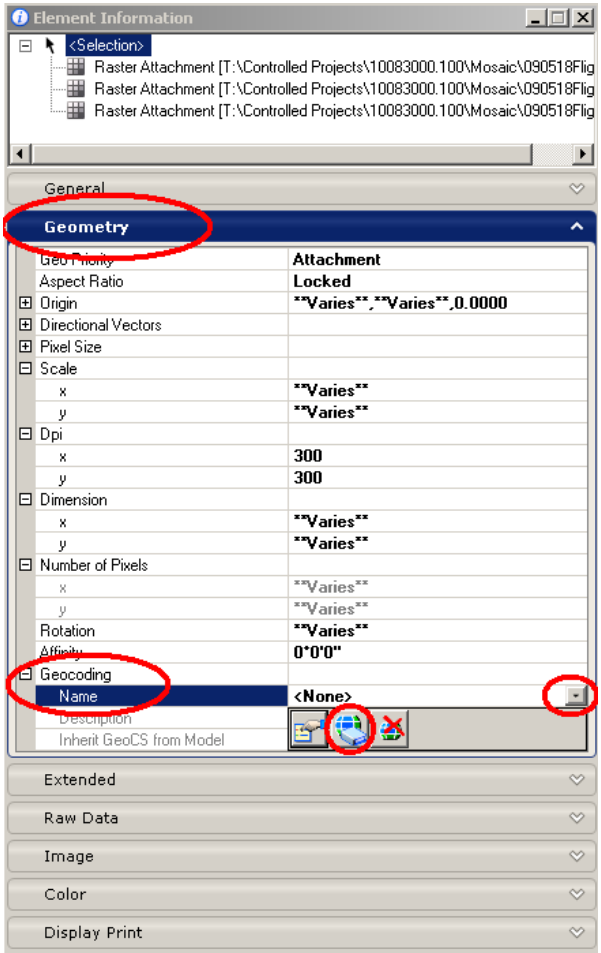
OR

2. Select a single raster in the Raster Manger Dialog Box. In the Raster Manger Dialog box access the Utilities Menu and select Coordinate System>Select From Library.

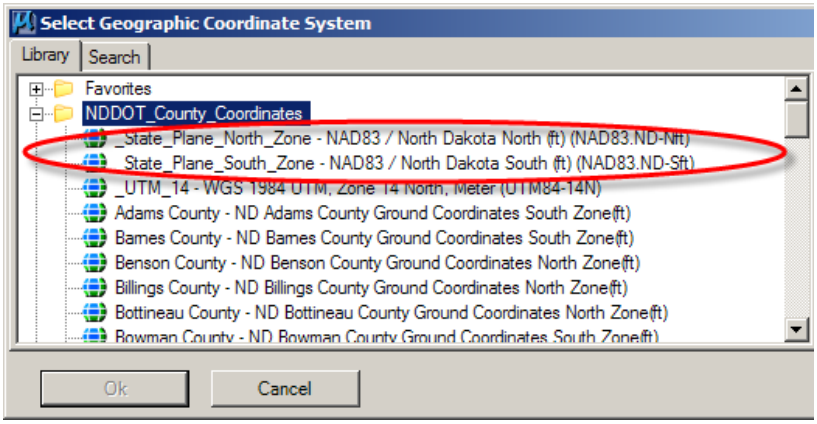


OR

3. This final option will allow you to set the coordinate system for one or many images at the same time. Double Click on One of the images in the Raster manager which will bring up the Element Information Dialog Box. If desired, Select all of the images in the Raster Manager Dialog box that you wish to set to a single coordinate system. All of the selected images should be shown in the Element Information Dialog box. To set the Coordinate system you will need to access the Geometry section of the Element Information Dialog box. Expand the Geocoding item under the Geometry section by click the Plus sign next to if necessary to access the Name field. Click the in the Name Settings field, which may be set to <None> at this point and click the Drop down arrow to access the Coordinate System operations buttons. Click the "Select Geographic Coordinate System From Library" button.



Each of the 3 options listed above will bring up the Select Geographic Coordinate System Dialog. Select the Coordinate system appropriate for the Raster(s) selected. In most cases this will be one of the 2 North Dakota State Plane systems, either North or South. These GCS have been copied to the NDDOT_County_Coordinates Folder for easier access.



Click OK

The Raster Images will be re-projected from the coordinate system you selected for them into the Coordinate System selected for the DGN file.

5.3 Web Map Services (WMS) and Raster Manager

July 2015

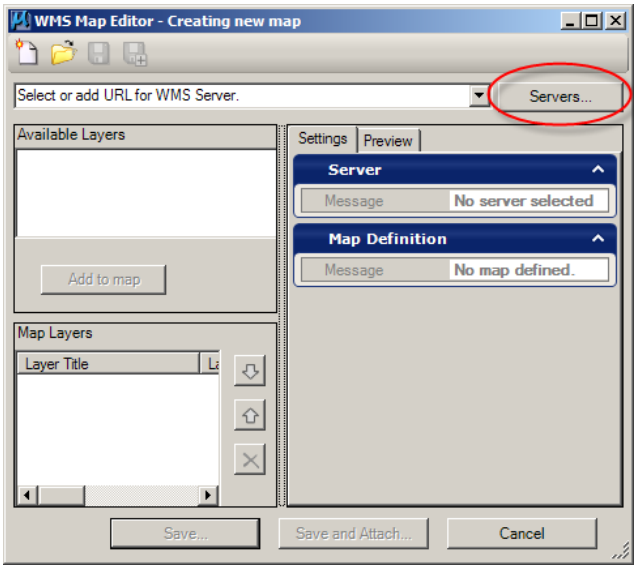
A Web Map Service can be used with MicroStation Raster Manager to reference existing data. Two different data source are discussed in this section; OnRamp and NAIP imagery. These data sources are used by many NDDOT ArcMap users. Now this data can be accessed directly from MicroStation.

The following are instructions to reference a WMS.

1. Attach a Geographic Coordinate System to your drawing. See the previous *section 5.1* (GCS).

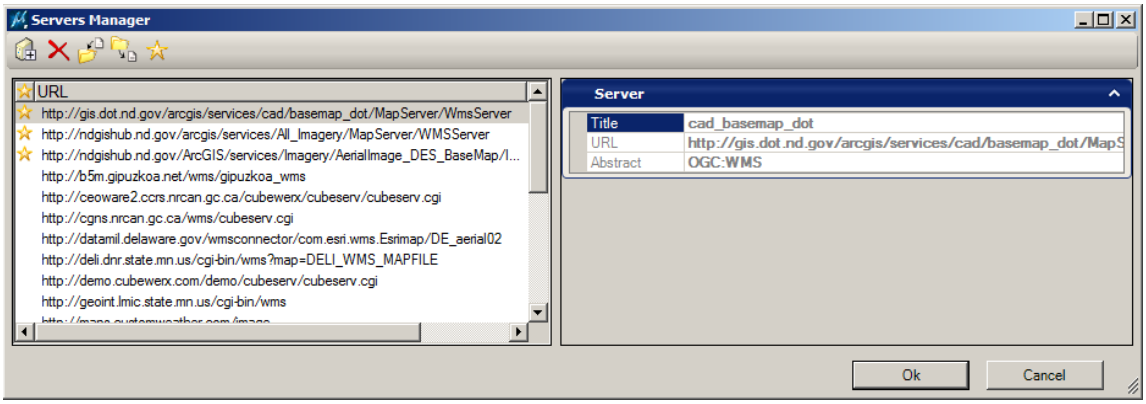
2. Open Raster Manager and select File>New>WMS from the Raster Manager Dialog. The WMS Map Editor dialog box should open.

3. Click on the "Servers" button. The Servers Manager dialog box should open. Several URL address should be shown in the left panel. Two of these addresses should be marked with a star as favorites by default.



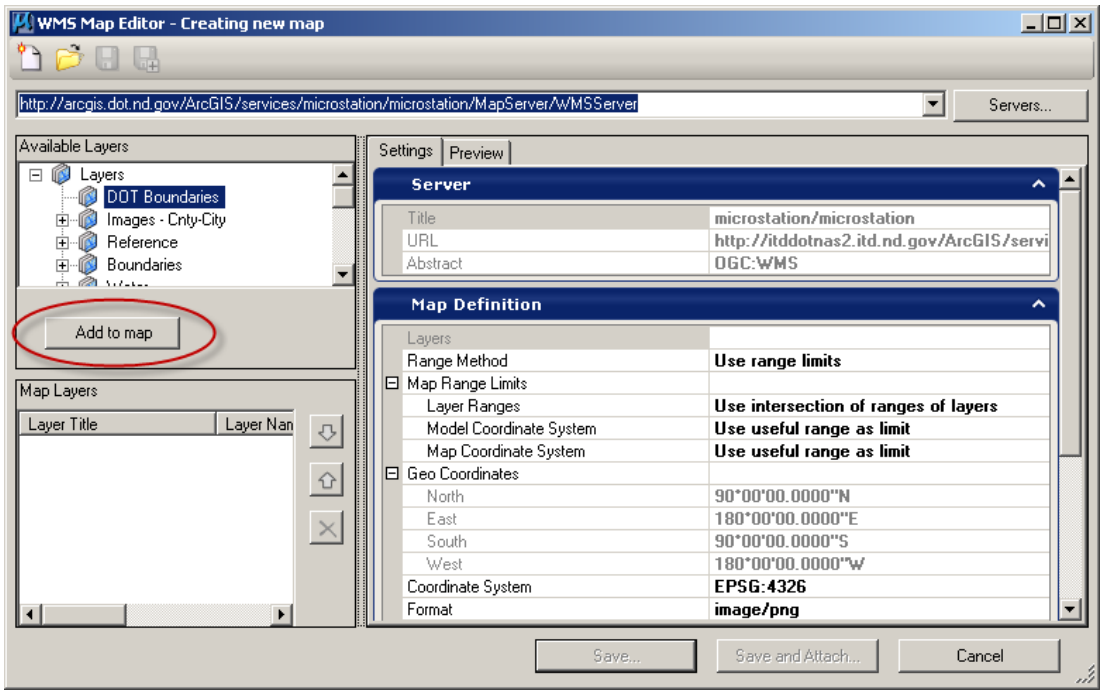
OnRamp data from the NDDOT GIS server
http://gis.dot.nd.gov/arcgis/services/cad/basemap_dot/MapServer/WmsServer

NAIP imagery
http://ndgishub.nd.gov/arcgis/services/All_Imagery/MapServer/WMSServer



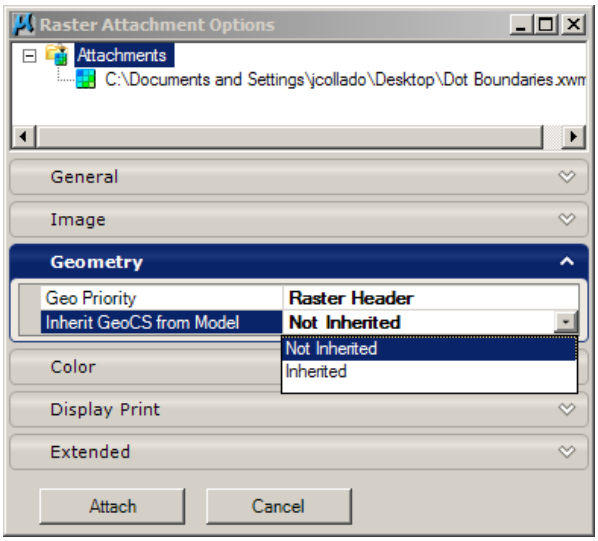
4. Select one of these addresses and click the Ok button. The Servers Manager dialog box will close and the address will be entered into the WMS Map Editor dialog box. Near the upper left corner of this dialog box there will be a panel that shows a layer tree.

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

Axiom

6.1 Axiom Title Block Manager

Oct 2008

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). A preformatted spreadsheet was previously used in early TBM test and demonstrations. However, a couple complications with using a preformatted spread sheet were discovered. Presently, using a preformatted spreadsheet is not recommended.
   c. The standard sheet cells published after April 2005 need to be used. These cells have tags attached. The old standard sheet cells published before April 2005 don't have tags for title blocks.
   d. 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.
   e. This section doesn't discuss TBM in detail. For more information on TBM see Axiom's User Guides; **m:\apps\production\design\axiomV8\tbadmin\tbaminv8.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.

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.

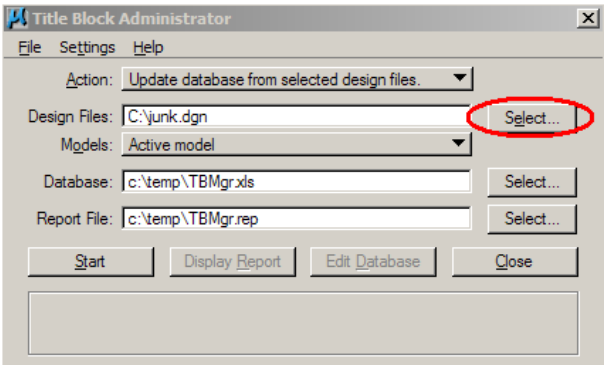
6.2 Axiom FileRename and FileResequence (Custom Macros)

Oct 2008

The FileRename macro will add the section number and sequence (page) number to the front of your file name. You can only do one section at a time and the files must be sequential, but the files do not have to be MicroStation files. You can use this macro for all types of files.

In order to use the FileRaname and FileResequence macros, a list of files names that you want to rename must be stored in an ASCII file with a "lis" extension. Axiom "Title Block Administrator" can be used to create this list.

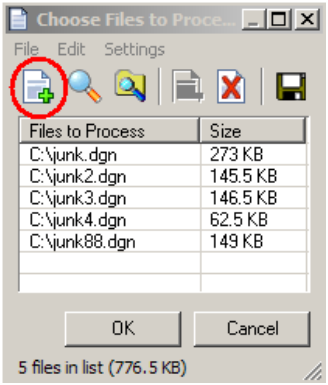
Creating an ASCII list File



1. Open a MicroStation drawing file that is **not** going to be added to the list.

2. Click on "Axiom > Title Block Administrator" on the menu bar.

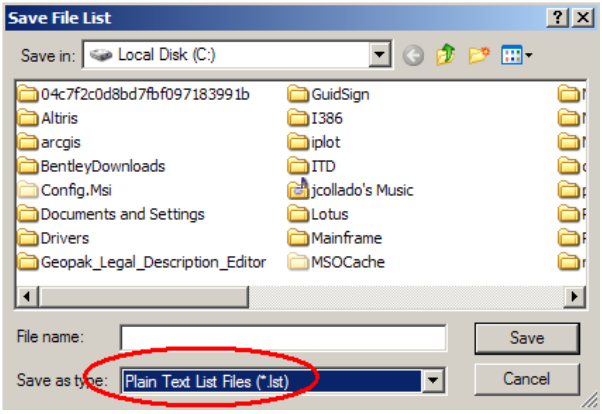
3. Click on the "Select" button.



4. Click the "Browse for files and add to list" button. Select the file that you want to be first in the sequence. Multiple files can be selected by holding down the control key while the files are selected. The order that files are selected is important because this influences the order drawings will be renamed. Select "Open" to add the files to the list.

5. When your list is complete, click the save button or select "File > Save File List" on the menu bar.

6. A "Save File List" dialog box should open. The "Save as type option" needs to be set to "Plain Text List Files (*.lst).



7. Type in a name for the file and save the file in your project directory.

8. Click OK to close the "Choose Files to Process" dialog box.

9. Close the Title Block Administrator dialog box.

CADD Standards

Running the FileRename Macro

1. An ASCII list file is needed before running this macro (See creating and ASCII list file). The files in the list should not be open because the macro will not be able to rename them while they are open.

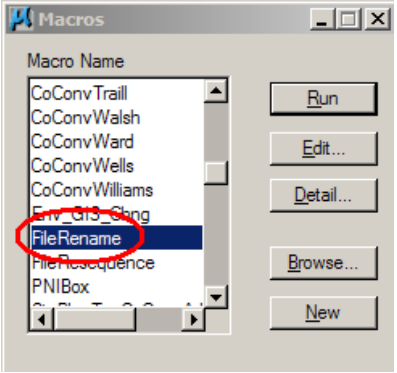
2. Click “Utilities > Macro > MicroStation Basic” on the menu bar.

3. In the Macros dialog box scroll down to the FileRename macro. Click the Run button.

4. Choose the section number from the list and click OK.

5. Enter the starting sequence (page) number and click OK.

6. Locate the ASCII list file you previously saved (Creating an ASCII list file, step 7).



7. Click the OK button on the Information dialog box to finish the process.

If you have to add a file in the middle of a section, you can quickly renumber the files following the inserted file by using the FileResequence macro. The FileResequence macro will change the sequence (page) number of existing files. You can only do one section at a time and the files must be sequential, but the files do not have to be MicroStation files. You can use this macro for all types of files.

Running the FileResequence Macro

1. An ASCII list file is needed before running this macro (See creating and ASCII list file). You will only have to add the files that come after the file you added. The files in the list should not be open because the macro will not be able to rename them while they are open.

2. Click “Utilities > Macro > MicroStation Basic” on the menu bar.

3. In the Macros dialog box scroll down to the FileResequence macro.

4. Click the Run button.

5. Enter the sequence (page) number that comes after the file you inserted and click OK.

6. Locate the ASCII list file and click OK.

7. Click the OK button on the Information dialog box to finish the process.

CADD Standards

Other Standards and Procedures

7.1 As-built Plans (Record Drawings)

May 2016

The "Construction Records Manual" (*Section 7*) discusses what is to be included in As Built Plans. As-Builts can be hand drawn or created electronically. The following instructions for creating as-built drawings are recommendations. This section of the CADD Standards Manual elaborates on "how and where" to specifically include this information in the CADD files.

All as built information that is different than the information from Design will be kept in the As-built Folder located in the project directory (see *Section 2.1*). As-built plans will be assembled in the same manner that the Design Plans were assembled. If design details were documented in one drawing then referenced in cut sheets, then the as-built details should be documented in one drawing then referenced in cut sheets.

Example: A driveway was not built at the location shown in the 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\pp geelan1.dgn.
The person creating the as-built drawings should create new drawings named "design AB.dgn" and "pp geelan1AB.dgn". Note that the file name uses a suffix modifier "AB". *Section 2.2* discusses file naming requirements. 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".

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. The as-built driveway would be drawn within R:\project\80046083.017**Asbuilt**\design AB.dgn and then referenced and clipped into R:\project\80046083.017**Asbuilt**\Sheets\pp geelan1AB.dgn. The pp geelan1AB.dgn should reference the original drawing pp geelan1.dgn. Remember to use a reference nest depth of "1" in order to reference the original sheet and all of its references.

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. However there are exceptions to referencing for as-builts.

Some as-built files need to be copied from the original design file and then edited in order work with GEOPAK. The GPK file and Cross Section files should be copied from the original design folder.

As-built drawings with extensive changes are another exception to referencing. Drawings that have many revisions can be copied an edited for simplicity. For example a detailed drawing of a Lift station may have many revisions. This drawing could be copied from the design folder into the as-built folder. Then the revisions could be made to the typical drawing without referencing.

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Remember to rename these copied drawings with the as-built “AB” suffix modifier.
The element symbology for as-built drawings should be the same as the symbology used for the design plans. Unique element symbology is desired in as-builts for the same reasons it is desirable in design plans. We want to be able to quickly identify features both in as-built and design plans. However all as-built drawings need to use “level symbology”. Traditional as-builts are black and white with the exception of 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.

Creating as-built’s from drawings that were created with Pointer files requires additional adjustments. See previous section 3.12 for a discussion on Live Nesting and Pointer files. If a Pointer file is used in the original plan sheet, the as-built sheet should be created by referencing the as-designed sheet with a nesting level of 2.

As-built plans shall be assembled in the same manner that the Design Plans are assembled except that the words “As-Built”, shall be placed directly under the project number in the upper right title block.

7.2 Design Division's Quick Maps

July 2015

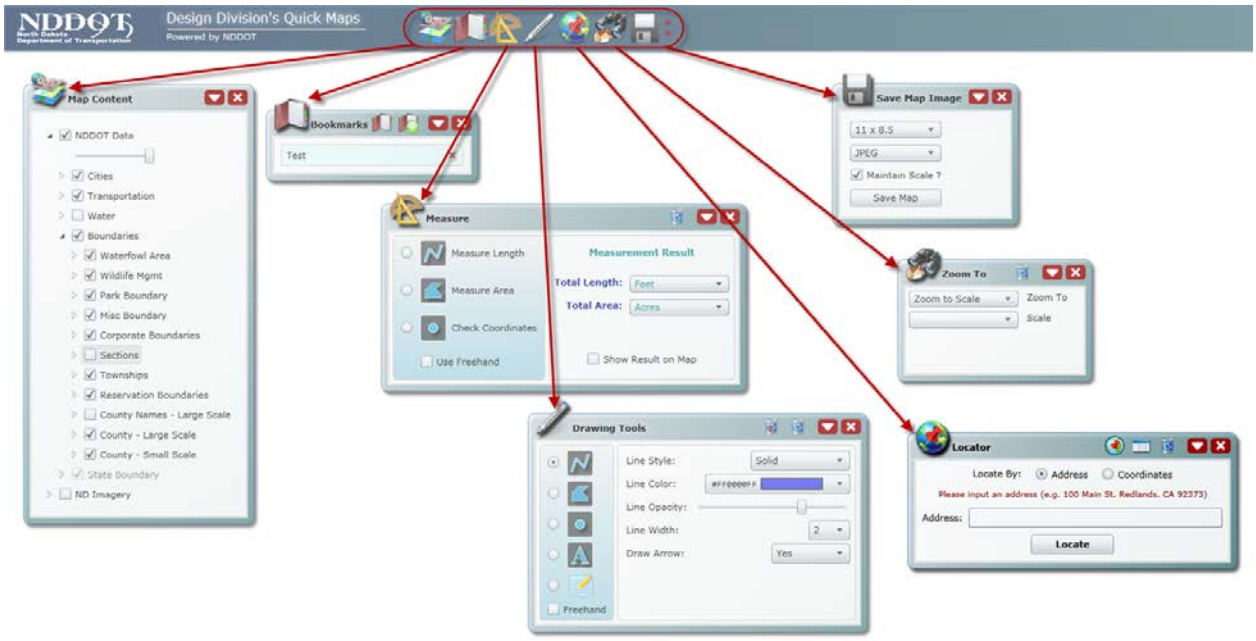
This tool is used to create maps for "Design Plan Title Sheets" and "Construction Haul Road Restriction Maps". It can also be used for other Design Plan Sheets and Project Concept Report maps.

If you just want a simple county map, don't use this service. County maps as pdf's can be retrieved from www.dot.nd.gov/road-map/county-base/index.htm .

The following steps explain how a plan title sheet image can be created. There could be several variations to this process.

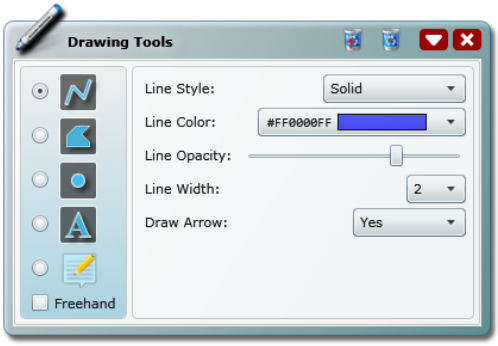
1. The Design Division's Quick Maps are accessed through the web; http://gis.dot.nd.gov/external/ge_html/?viewer=quickmap.

2. The tools for Quick Maps are relatively self-explanatory. Hover your cursor over these tools to learn what each tool does. A text description of the tool should appear.

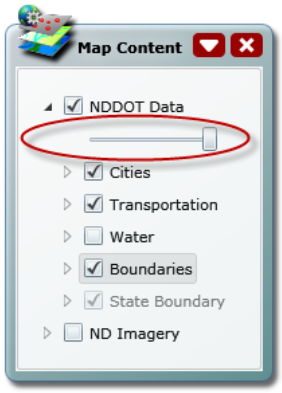


CADD Standards

3. There are several new features with this version of Quick Maps.
   a. Drawing Tools are available within quick maps.



   b. There are "Opacity" (Transparency) tools for layer control.



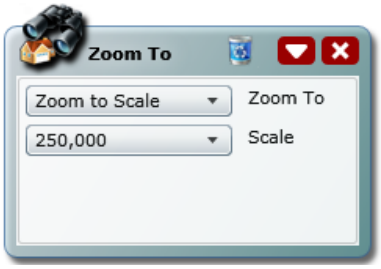
   c. Locations can be bookmarked.
   d. "Locator" (Geo-coding) tools are available.
   e. The new "Overview Map" helps you keep your perspective when you are zoomed in. This tool accessed from the lower right corner of the screen.

4. There are a few changes with the new version of quick maps that may side track people who have used the old version of quick maps.
   a. You may have to click on a view control tool that you don't want to use to see and use other options (Example, if you want to zoom in, you may have to click on the "zoom out" tool in order to get to the "zoom in" tool.

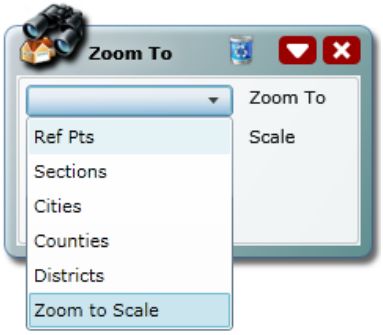
   b. There is no built in tool to save an image as a pdf. The available options are jpeg, png and tiff.

c. All of the layers can't be turned off. The background layers are always on. However they can be overlap or hidden by adding other layers.
d. There is no option to create a legend.
e. There are no querying options.
f. There is no zoom to fence option.

5. Use the zoom and view control commands to generate and view a map similar to what you want to use for your design plan sheet. If you're using "Zoom to Scale" options; 126720 scale works good for title sheets, 250000 scale works good for haul road restriction maps.



6. Quick Maps has tools that can help you navigate to a specific location in the state by selecting either a;
   a. Highway and Reference Point
   b. City
   c. County
   d. Section, Township and Range
   e. District



7. The Map Content dialog box shows features - layers that can be turned on and off similar to ArcMap and MicroStation Levels. Set the layers "on" or "off" as needed. Note that certain levels are only available at certain scales. More levels are available as you zoom in.
   a. Pay special attention to the layer NDDOT Data>Boundaries>County-Large Scale. Turn on or off this layer to hide or display the background layers.
   b. The layer "NDDOT Data>Transportation>Restricted Construction Haul Roads" is used for "Construction Haul Road Restriction Maps".

8. Once you have created a view that you will want to use for your map. Click the "Save Map Image" icon. Note your view of the image and the actual map that will be generated will be slightly different. The 15x9.5 aspect ratio – size works well for plan sheets. Save your image to your project folder.

9. Additional notes for working in MicroStation:
   a. The "Raster Manager>Edit>Clip" tools can be used to further process the image within the drawing.
   b. The PE stamp is not required for the Haul Road Maps. Use the Plan sheet (Plan3) without title blocks.

CADD Standards

7.3 Tags, Professional Stamping and Signing

Sept 2010

Most Consultants and NDDOT Districts don't have Axiom Title block Manager. However, these people still need to use the same sheet library (sheets.cel) and still have to address the professional engineer stamping requirements. The following notes discuss how these users can operate.

1. The sheets library has been modified. Most of the title blocks for the sheet cells have been filled with "tags". Tags are special MicroStation elements that look like "text" elements.
   a. These tags have been added so that the sheet cells can be used with Axiom Title Block Manager. However, you don't need TBM to edit these tags. The tags can be edited with just the MicroStation "Edit Tags" tool.
   b. Title block tags can be deleted without dropping the cell. So if you don't want to use them, they can be deleted and you could fill out the title blocks with normal text. However, the Standard Committee recommends using the "Edit Tags" tool. The preformatted tags are setup with the standard symbology.

2. Several of the standard sheets have a title block for a profession engineer's or registered surveyor's stamp. A special note is included in these title blocks. The note must be included when the drawing is transmitted electronically. Do not fill in the PE stamp tags until the plan sheet has been sealed by a PE. By filling in this information, you are stating the sheet has been sealed. In order to avoid having to maintain multiple versions of a drawing (preliminary, one for stamping and one for electronic distribution), special print drivers and pen tables are being used to control when the PE note is printed and when it is not printed. The following pen tables are used;
   a. Preliminary.tbl
   b. PE_Stamping.tbl
   c. Electronic_Distribution.tbl

3. The title sheet has several signature lines. When the design plans are electronically distributed or archived, these signature lines need to be electronically filled out. The signatory name should be spelled out followed by characters "/s/". These lines should only be filled out after the plans have been signed. The text used for the signature line should be on the level named "Sht Stamp Text" so that it is displayed through the pen tables in a manner similar to the standard "Electronic Distribution Statements".

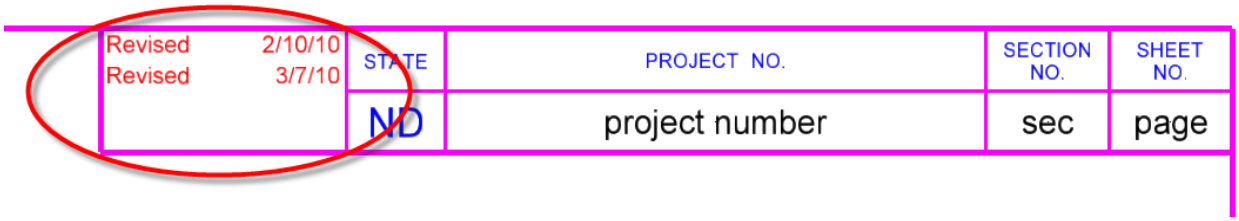
APPROVED DATE 1/6/05 Francis Ziegler /s/ OFFICE OF PROJECT DEVELOPMENT ND DEPARTMENT OF TRANSPORTATION	I hereby certify that the attached plans were prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the state of ND. APPROVED DATE 1/6/05 Roger Weigel /s/ NDDOT DIV-DIST OR CONSULTANT FIRM	This document was originally issued and sealed by Roger Weigel, Registration Number PE- 2930 , on 1/6/05 and the original document is stored at the North Dakota Department of Transportation
APPROVED DATE FEDERAL HIGHWAY ADMINISTRATION U.S. DEPARTMENT OF TRANSPORTATION		

7.4 Addenda and Change Orders

May 2016

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.



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.

A separate pdf shall be created for each Addendum or Change Order. The original posted PDF file shall never be edited. The separate pdf shall only include the sheets that have been revised.

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

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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 (see *Section 2.1*). A separate folder shall be used for each addenda 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. When starting a revision, check the other designer's folders for previous revisions. If someone is already working on a revision, check to see if your sheets can be added to it.

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_004**A**_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.

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.

Some addenda and change order files need to be copied from the original design file and then edited in order work with GEOPAK. The GPK file and Cross Section files should be copied from the original design 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.

Refer to the Design Manual, Section 1-11, Plan Revisions and Change Orders, for additional administrative requirements.

7.5 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.

7.6 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:
   b. 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.
   c. The Traffic Control Devices List has a Print Plan Sheet button located at the top of the Input sheet.

7.7 Scanning Documents into PDF Plan Sets

Oct 2008

1. Assemble the plan sheets and put the section and page numbers in the upper right-hand corner.
2. Scan the plan sheets and save them into the appropriate project directory with the correct file name (see *Section 2.2* and *Appendix A*.)
3. If this is a plan sheet that requires sealing by a PE, you will need two versions of these sheets; one with the electronic distribution statement and one without it. The version without the statement is needed for preliminary and PS&E plans. The version with the statement is needed for final plans, addendums, change orders, and as-builts. Do not put the statement on the plan sheet until it has been sealed by a PE.

CADD Standards

Miscellaneous Help

8.1 Using MicroStation Files in Microsoft Word

Nov 2011

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. Encapsulated Postscript (.eps)
    b. Tagged Image Format (.tif)
    c. Joint Photographic Expert Group (.jpg)
    d. Microsoft Document Imaging
    e. Clear Water

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 main MicroStation pull down menu “Utilities>Image>Capture”. 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 "postscript" (.eps) 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\V8I\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 eps file select S:\STANDARD\V8I \plotdrv\NDDOT-pscript.plt. When you print the drawing, you will be prompted for an eps file name and a location to save the file.

Once the image file (*.eps) has been created, it can be imported into Microsoft Word. In Word, select "Insert>Picture>From File". Then select the eps file.

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 relatively 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.

This tool is free and is relatively easy to use. Addition help using Bentley View can be found in its own help files.

NDDOT personnel should submit a work order request through the Work Management System if they want Bentley View loaded on their computer.

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.