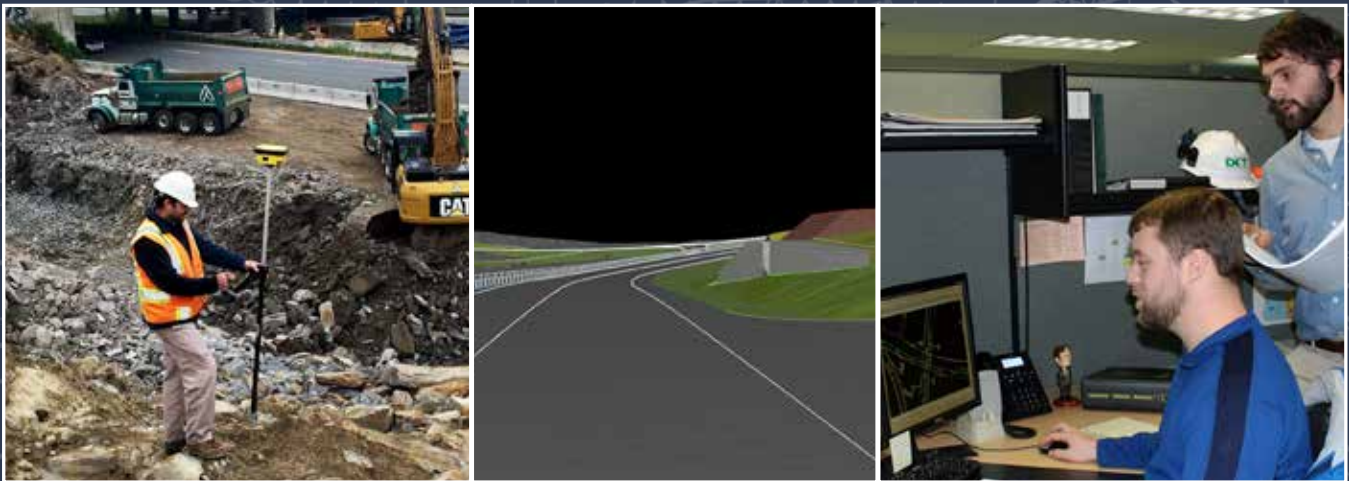


New Hampshire
Department of Transportation

2022 CAD/D Procedures & Requirements



Effective May 1, 2022

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PART 1 - GENERAL INTRODUCTION

1.1 INTRODUCTION

This document, in its entirety, may be freely copied and distributed for the purpose of providing a consistent guide to the Computer Aided Design & Drafting (CAD/D) requirements of the New Hampshire Department of Transportation. Copies of this document along with CAD/D resource files (style libraries, naming conventions, etc.) can be downloaded at <https://www.nh.gov/dot/cadd/downloads/index.htm>.

Any recommendations for improvements to this documentation are welcome. Any errors found should be brought to the attention of the CAD/D Staff so corrections can be made. For additional information or detailed explanations of the standards described within this document, contact:

CAD/D Support and Development
Bureau of Highway Design
New Hampshire Department of Transportation
PO Box 483
Concord, NH 03302-0483

E-mail: DOT-Cadd@dot.nh.gov
Tel: 603-271-2171

NHDOT CAD/D Website: <https://www.nh.gov/dot/cadd/> **[Note that the NHDOT website was planned to undergo a major revision about the time this document was released. The address listed here may no longer be accurate.]**

This document contains the New Hampshire Department of Transportation's (NHDOT) specifications for electronic (computer) data as it relates to engineering design projects. It explains the minimum requirements that must be met for all Computer Aided Design & Drafting (CAD/D) data produced by and for the New Hampshire Department of Transportation. This is to ensure that CAD/D files can be used by the entire project team throughout all phases of project development. While the requirements contained herein provide a basis for uniform CAD/D practice for NHDOT projects, precise rules that would apply to all possible situations that may arise are not possible to describe. Situations may exist where these standards will not apply. If variances from the "CAD/D PROCEDURES AND REQUIREMENTS" are necessary for a project, they must be approved in writing by the NHDOT Project Manager and documented in the Project Journal File as defined herein.

As a minimum, NHDOT Design staff and engineering consultants are expected to adhere to the standards that were in force at the time the contract was initiated. Although not required, following the latest standard is recommended whenever feasible.

This document is published as an update to the "CAD/D PROCEDURES AND REQUIREMENTS" document dated June 2017 and supersedes all CAD/D standards previously published.

1.2 CURRENT NHDOT SOFTWARE VERSIONS

NHDOT desires to stay current with state of the art trends in the market, however, budget constraints, statewide implementation, impact on users, and providing support for the new features must be considered prior to any change.

As NHDOT makes a change that results in modifying electronic procedures, the "CAD/D PROCEDURES AND REQUIREMENTS" will be updated where necessary to reflect the change. A list of the modifications will be found in the revision summary. **As a rule, until documentation is modified, deviation from the current dated requirements must be approved by the Project Manager.**

As of May 1, 2022, all new NHDOT projects are to be prepared with MicroStation Connect and OpenRoads Designer unless there are extenuating circumstances requiring use of the older software. For projects already underway, it will be up to the Project Manager to determine whether it should be completed with v8i or Connect Edition software.

MAJOR SOFTWARE AND CURRENT PRODUCTION VERSIONS AT TIME OF PUBLICATION

1. MicroStation Connect Update 16 (version 10.16.02.034)
2. MicroStation v8i (SS10) (version 08.11.09.916)
3. OpenRoads Designer 2021-R2 (version 10.10.20.078)
4. InRoads v8i (SS10) (version 08.11.09.918)
5. Microsoft Office 365 products

TRADEMARKS

Microsoft and **Windows** are registered trademarks of Microsoft Corporation.

MicroStation, **OpenRoads**, **MDL**, **InRoads**, **GEOPAK**, **MX**, and **MXROAD** are registered trademarks of Bentley Systems, Inc.

1.3 FILE FORMAT

In addition to the traditional hardcopy delivery items, NHDOT requires supplementary electronic data delivery items. This data shall be submitted in the formats specified in Part 6 - Engineering Consultant Deliverable Requirements. In general, 3D design data and Digital Terrain Model (DTM) data is to be provided in the 3D DGN or LandXML formats, and 2D graphical data is to be provided in DGN drawing format. Organizations wishing to perform professional engineering services for NHDOT are required to deliver electronic data as specified by this document. This specification also requires organizations to accept and utilize pertinent electronic input data as provided by NHDOT.

1.4 ACCEPTANCE OF ELECTRONIC DATA SUBMISSIONS

One of NHDOT's guiding principles is to be a productive, lean, efficient, and effective organization. To achieve that mission, it's vitally important for NHDOT processes and workflows to work smoothly and efficiently from project conception through completion of construction. The submission of information that is incomplete or incorrect can cause problems during the preparation of the plan package, delays in the bidding process, or issues during construction.

Ultimately, NHDOT reserves the right to reject any electronic data, or files, that do not meet the requirements outlined in these guidelines. All errors, omissions, or areas that do not conform to the guidelines in this document must be corrected prior to resubmitting the electronic data and files for review.

PART 2 – GENERAL CAD/D INFORMATION

2.1 DIRECTION & GOALS

The CAD/D Section is committed to supporting the Department’s goals of providing 3D design models to contractors to improve the accuracy of proposed designs and to provide data for GPS-guided construction vehicles. The CAD/D Section is also developing methods for adding intelligence to model data for improved asset management.

To accomplish these goals, the Department will be expecting to receive 3D models of design projects. These models are expected to be delivered at the completion of the project design so they can be made available to potential bidders with the project advertisement. The 3D design model should contain, at a minimum, the roadway finished grade between the slope breaks just beyond the edges of pavement. More complete models containing slope impacts are desired whenever feasible.

2.2 DOCUMENTATION

Documentation of NHDOT CAD/D practices and procedures can be found on the Internet at <https://www.nh.gov/dot/cadd/>. [Note that the NHDOT website was planned to undergo a major revision about the time this document was released. The address listed here may no longer be accurate.]

2.3 SURVEY DATUM

For NHDOT projects, the horizontal and vertical coordinate systems can vary from project to project depending on a variety of conditions. New projects will tend to have a vertical datum based on NAVD88 with the horizontal coordinates using NAD83/2011F. Be aware that the survey datum will likely be changing during the period that this document is in effect. The designer should always check with the Survey group to confirm these details so the CAD/D drawings can be set up correctly.

2.4 PROJECT JOURNAL FILES

A Project Journal will be produced for each project. On consultant-designed projects, a copy of the journal file will be delivered with each electronic project plan submission. The purpose for this journal is to provide information to downstream consumers of the CAD/D data so they may utilize existing CAD/D work in their processes. The format of the journal will be an electronic file, either in text format or a format supported by the current version of Microsoft Word. As a minimum, the journal will contain the following information:

- A listing (Index) of the project files, including brief descriptions of each file and where the file is located.
- Documentation about the CAD/D software used, special CAD/D decisions made, exceptions to standards that were made, problems encountered and how they were addressed or other important issues that arose during the course of the CAD/D work. For example, if a custom linestyle needed to be created, the justification, resource file, and files where that linestyle was used would be documented in the Journal. Other documentation would include the design software used (including version number), particular software settings, and other information that would help a downstream user of the data understand how it was created.

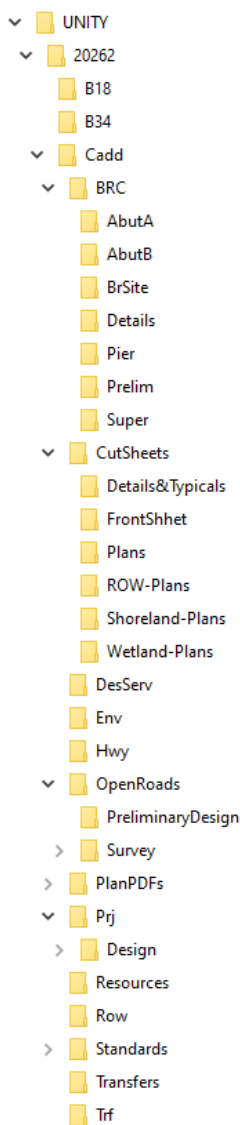
Important information that should also be contained in the Journal includes:

- All information necessary for the regeneration or use of those files by subsequent consumers of the CAD/D data
- Document the design data, controlling alignment and profile names and geometry input/output files, relevant survey information, cross sections and the methodology used to obtain the final geometric controls in the CAD/D product.

NHDOT has not established a specific format for the Journal file. The sample file shown in *APPENDIX A – SAMPLE CAD/D PROJECT JOURNAL* beginning on page 31 should be used as a guideline for the type of information to be included and format that is expected.

The project journal must be kept up to date as the CAD/D design work progresses and be delivered with the project on the preferred media for archival purposes.

2.4 DIRECTORY STRUCTURE



The standard directory structure being used for CAD/D projects within NHDOT is shown below: Directory and file names will only contain alphanumeric characters, dashes ("-") and underscores ("_"). Spaces in file names should be avoided whenever possible. Since every project is unique, file structure will vary. A representative example is shown here.

CAD/D files are stored in directories under the *Cadd* folder.

Files used with MicroStation or by multiple bureaus are stored in the *Prj* folder.

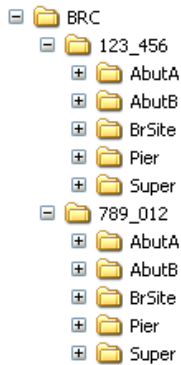
The following folders will contain files that are only pertinent to that bureau:

<i>BRC</i>	Bridge Design
<i>DesServ</i>	Design Services
<i>Env</i>	Environment
<i>Hwy</i>	Highway Design
<i>OpenRoads</i>	Data and drawings associated with OpenRoads.
<i>Row</i>	Right of Way
<i>Trf</i>	Traffic

The BRC folder contains the following subdirectories:

<i>AbutA</i>	Detail plans depicting Abutment A footing, masonry, and reinforcing.
<i>AbutB</i>	Detail plans depicting Abutment B footing, masonry, and reinforcing.
<i>BrSite</i>	General Plan, Site Plan, notes, and boring logs.
<i>Details</i>	Miscellaneous details, for example Bridge and Approach Rail.
<i>Pier</i>	Detail plans depicting Pier footing, masonry, and reinforcing.
<i>Prelim</i>	Preliminary Plans. After preliminary plans are accepted, pdf files of the Genplan & Siteplan drawings are created. Other drawings are copied into this directory and renamed.
<i>Super</i>	Superstructure details.

The *CutSheets* folder contains final contract plan DGN files. There are separate subfolders for the various types of plans. .



Bridge Design contract plan files are stored in the various Bridge directories.

If there are multiple bridges on a project, the BRC directory structure is typically modified so that drawings for each bridge are kept separate. The subdirectories under BRC can be named for the feature being crossed or in cases where the same feature is crossed multiple times, the bridge number as shown here.

2.5 NHDOT RESOURCES AVAILABLE FOR CONSULTANTS

To assist in the production of the required CAD/D files, NHDOT provides OpenRoads Designer and MicroStation support files. Contact the CAD/D staff at the email address in section 1.1 *Introduction* on page 3 for access to the workspace download. This information will eventually be available on the CAD/D website at the address is listed in section 2.2 *Documentation* on page 5.

The download package includes:

- seed files for OpenRoads Designer and MicroStation drawings
- linestyle and cell libraries
- libraries of Element Templates, Feature Symbolologies and Feature Definitions
- libraries containing text and dimension styles
- sample roadway templates
- macros developed by NHDOT
- other files described in Part 3 – Connect Workspace

2.6 STANDARD PLAN DRAWINGS

Standard plan drawings are not maintained by the CAD/D Section. The latest copies can be found on the NHDOT website (www.nh.gov/dot → Doing Business with DOT → Engineers/Consultants → Standard Plans for Road Construction). Symbol sheets can also be found on the NHDOT website (www.nh.gov/dot → Doing Business with DOT → Engineers/Consultants → Detail Sheets – Highway Design)

PART 3 – CONNECT WORKSPACE

The goal of the New Hampshire DOT's CAD/D section is to make the implementation of the Department's CONNECT workspace as simple as possible. Any recommendations for improving this process are welcome.

Bentley's default configuration has Organization and Workspace components. The Organization is fixed for each site and cannot be changed by the end user for different types of projects. Knowing that the consultant community will need to operate with standards from multiple clients, NHDOT has avoided customizing the Organization settings. All customization has been done through the Workspace.

By having all customization at the Workspace level, consultant designers should be able to copy the NHDOT folder from the zip file provided into their Workspace folder and have all folders under it populate with the Department's standards. If successful, there will be a NHDOT option in the Workspace listing the next time MicroStation or OpenRoads Designer (ORD) are opened.

The associated configuration file – NHDOT.cfg – will need to be modified to set variables defining locations to their proper places on the site's network. A word document is included with the workspace files explaining this process in detail.

The files mentioned in this section can be requested through the Project Manager or by emailing the CAD/D staff at the address shown on page 3. NHDOT's website was about to undergo a significant update at the time this document was being prepared. The new web address was not known at press time.

3.1 SEED FILES

MicroStation uses "seed" files to create all design files. These seed files are templates in which standard parameters are set according to what is needed to begin drafting for a specific type of work in accordance with NHDOT standards. Seed files allow the user to begin work in a standard format and maintain uniformity. The seed file defines the working units for the file, coordinate system, view attributes, default color table, text settings, coordinate readout and several other important parameters. NHDOT supplies seed files for both 2D and 3D drawings.

NHDOT design teams are working with both 2D and 3D MicroStation drawings. As a general rule, drawings strictly used for drafting are 2D while those which are also used within OpenRoads (survey and design files) will contain both 2D and 3D managed models.

Working units are expressed as master units and fractional sub-units. The number of positional units per sub-unit is called the working resolution. The working resolution determines the precision to which elements are drawn. The format for the working units in MicroStation is defined as MU:SU (master units, sub-units).

NHDOT seed files have Working Units of U.S. Survey Feet. However, a Notice by the National Institute of Standards and Technology and the National Oceanic and Atmospheric Administration on October 5, 2020 announced "the final decision to deprecate use of the 'U.S. survey foot' on December 31, 2022. Beginning on January 1, 2023, the U.S. survey foot should not be used and will be superseded by the 'international foot' definition (i.e., 1 foot = 0.3048 meter exactly)." It is not yet known how this will impact future CAD/D files.

Since there may be specialized instances where International Foot seed files are needed, they are available and have "-INTF" appended to the file name.

SEED FILES (2D & 3D)

Working Units:

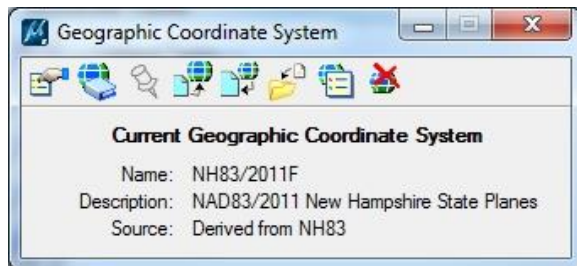
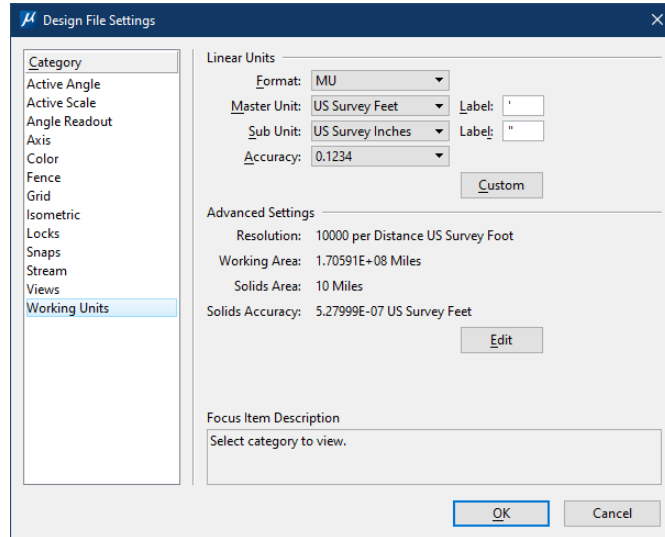
Master Units.....U.S. Survey Feet

Sub-Units U.S. Survey Inches

Resolution..... 10000/U.S. Survey foot

Geographic Coordinate System:

..... NH83/2011F



The Geographic Coordinate System (GCS) has been set to NAD83/2011F New Hampshire State Plane coordinate system. Using these coordinates, the seed files can be used for both drawings based at State Plane Coordinates and drawings, such as cross-sections, profiles, typicals and special details, using a local coordinate base.

Designers should confirm which coordinate system was used during the survey of the project and adjust the Geographic Coordinate System of the drawing files, if necessary, before developing the drawing.

Seed files available at the time of publication include:

NH_Seed2D_Design.dgn	A seed file with only a <i>Default</i> model for typical MicroStation work.
NH_Seed3D_Design.dgn	A seed file with only a <i>Default-3D</i> model for creating 3D drawings such as terrain models.
NH_Seed3D_Design_INTF.dgn	Same as above with International Foot working units.
NH_SeedORD_Design.dgn	Seed file for OpenRoads Designer containing both 2D and 3D models.
NH_Seed_MS.dgn	2D seed file for MicroStation Connect
NH_Survey_Seed_3D.dgn	OpenRoads Designer seed file for processing survey data.

3.2 FILE NAMING

Directory and file names will only contain alphanumeric characters, dashes (“-”) and underscores (“_”). Spaces in file names should be avoided whenever possible. The current list of drawing names can be found on the CAD/D website at the address listed in the Introduction. In general, MicroStation (2D) files are named with the project number followed by an indicator of the drawing type. OpenRoads Designer drawing names have the project number followed by a dash “-” and then the drawing type indicator.

3.3 REFERENCE FILE ATTACHMENTS

MicroStation Connect and OpenRoads Designer can attach a reference file by one of three ways:

1. Name only – the path to the referenced file is resolved by the configuration variable MS_RFDIR.
2. Relative path – the reference file name and its location relative to the master file.
3. URL address – the file is attached in the form of a URL address using relative paths.

To streamline future use of the files for printing purposes without modification, the reference files must be attached in a way that will allow MicroStation Connect and OpenRoads Designer to resolve the reference file attachment paths regardless of the drive or parent directory of the project. Option 1 above is the preferred method for NHDOT projects, since it allows the files to be moved from drive to drive without losing the reference file attachments. However, this option requires that the configuration variable MS_RFDIR is set for all NHDOT projects.

3.4 LEVEL ASSIGNMENTS AND SYMBOLOGY

DGNLIB files containing element templates defining the proper level, color, style and other attributes of drawing features are included in the file download package. These files include the libraries of level names and level attributes. The DGNLIB files also contain the feature definitions for OpenRoads Designer. A list of current feature and element template libraries is in section 4.4 *Feature Definitions*.

Level names were changed during the transition to Connect software with the intent that they become better organized and more descriptive. Some of the prefixes used in level names include:

Prefix	Description
Corr-	Corridor elements
E-Env- (P-Env-)	Existing/Proposed environmental features
E-Road-	Existing roadway features
E-ROW- (P-ROW-)	Existing/Proposed right-of-way features
E-Structure-	Existing bridge features
E-Terrain- (P-Terrain-)	Existing/Proposed terrains
E-Text-	Existing detail annotation
E-Topo-	Existing detail features not covered in other categories
E-Util- (P-Util-)	Existing/Proposed utility features
FSH-	Front sheet elements
HER-	Hearing plan elements
P-Bridge-	Proposed bridge features
P-Design	Proposed design features
P-Note-	Proposed notes
P-Traffic-	Proposed traffic signals, devices and pavement markings
QTY_	Shapes for calculating quantity areas and volumes
Surv_	Features created by processing survey file

3.5 LINSTYLES

Line style is part of the symbology of graphical elements in MicroStation. An element can be set to the standard MicroStation linestyles (numbered 0 - 7) or to a custom one defined in a linestyle resource file. Custom linestyles are user definable resource files for the display of different patterns, for example, a tree line, fence line, guardrail, etc. When an element is drawn in MicroStation with a custom linestyle, the definition of the style is not contained within the design file. The resource file from which it was selected must be packaged with the design file and it must be found by MicroStation's configuration to properly display the line. Therefore, users are strongly discouraged from creating their own custom linestyles. Use the NHDOT supplied custom linestyle resources whenever practical. Graphical depictions of NHDOT CAD/D linestyles are shown in *APPENDIX C - NHDOT CUSTOM LINSTYLES* on page 34.

Most v8i linestyles have been redefined for Connect Edition (CE) products to take advantage of Annotation Scale. Linestyles in v8i were created to be at a scale of 1 when used on 50 scale plans. The Connect Edition linestyles are created at 1:1 to be used with annotation scale. The new linestyle names begin with an asterisk (*) to differentiate them from the v8i versions.

NHDOT CUSTOM LINSTYLE RESOURCE FILES

NH-CE-LineStyles-AnnoScale.rsc	Linestyles which are designed to take advantage of Annotation Scale and resize if the drawing scale is modified.
NH-CE-LineStyles-PhysicalScale.rsc	Linestyles which have a fixed pattern which needs to be maintained regardless of drawing scale.

LINSTYLES AND SCALE

There are several line styles that are created at actual scale such as the guard rail linestyles for post spacing and the railroad line style for the rail spacing. They do not resize if the Drawing Scale is changed.

Styles in this group include:

*E-CurbLt	*GrCblLt	*P-GrBmSteelPostLt
*E-CurbRt	*GrCblMedian	*P-GrBmSteelPostRt
*E-DrainPipe	*GrCblRt	*PaveMark
*E-GrBmSteelPostLt	*GrCblRt	*Railroad
*E-GrBmSteelPostRt	*JerseyBarrier	*SheetPile
*GrBmWoodPostDbI	*P-CurbLt	*TrafBarIs
*GrBmWoodPostLt	*P-CurbRt	
*GrBmWoodPostRt	*P-DrainPipe	

3.6 FONTS

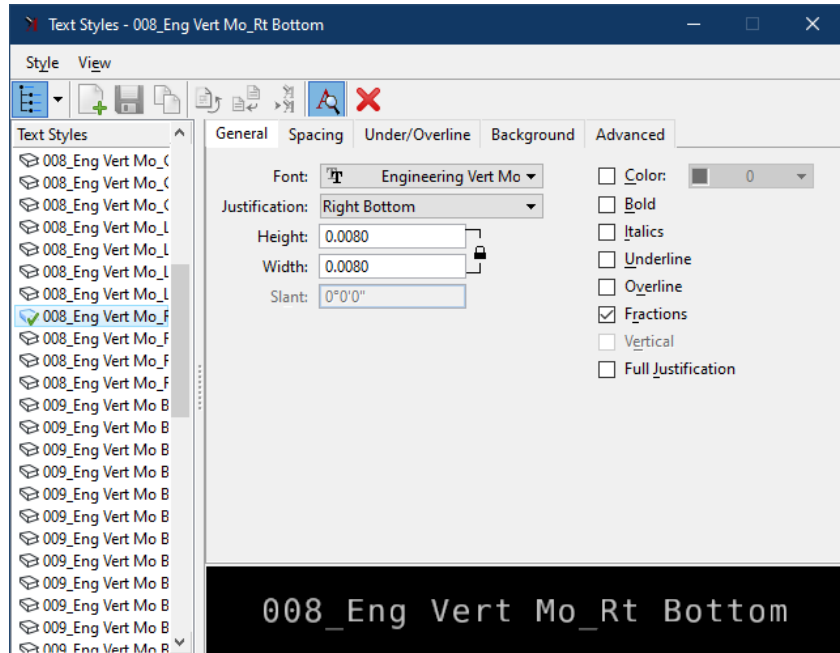
The font primarily used for drawing annotation is *Engineering Vert Mono* which is provided with the software. *Engineering Vert* will also be used in areas where a monospaced font isn't suitable, particularly text using some symbols and fractions. These replace the *nh_engineering* font (#180) used with earlier versions of the software. The NHDOT v8i font resource file - *nh-custom-font.rsc* – is still included in the workspace download for backward compatibility.

3.7 TEXT STYLES & TEXT FAVORITES

Standard text heights and fonts have been defined to ensure uniformity and legibility on all CAD/D drawings. These dimensions have been incorporated into a variety of text styles. Since, the most important issue with text is that it should be legible, font and text height may vary if absolutely necessary. Text line spacing varies between half of the text height and the text height depending on the use.

Text styles are available at various sizes noted by the beginning of the style name. The text styles are located in **NH-TextFavorites_TextStyles_DimensionStyles_Imperial.dgnlib**.

This dgnlib should be included in the MS_DGNLIBLIST variable. While this list is oversimplified, it provides the intent of the various styles. The text below will be followed by the justification to complete the style name. For example, text style **009_Eng Vert Mo Bold_Lt Top** is the **009_Eng Vert Mo Bold** style with top left justification. Linespacing in styles defaults to 1 and intercharacter spacing is 0.08.



008_Eng Vert Mo	Existing detail annotation
009_Eng Vert Mo Bold	Proposed labels and notes
010_Eng Vert Bold	Station text
010_Eng Vert Bold 010_Eng Vert Mo Bold	Titles and larger text
020_Eng Vert Mo Bold	Larger titles
020_Eng Vert Bold	Front sheet large titles

Text Favorites are pre-defined text blocks containing Text Fields representing one or more element properties. When a Text Favorite is placed on the drawing, it is associated with an element to display the desired properties of that element. They are also contained in the same DGNLIB as the Text Styles.

3.8 CELL FILES

Symbols, including standard borders, are contained in NHDOT’s standard cell libraries and are available in Bentley’s .CEL file format. Cells were recreated during the transition to Connect Edition products to accommodate annotation scale. These files have “CE” added to the name of the former cell file.

The consultant, with the approval of the Project Manager, may create symbols that are not covered in the NHDOT Design Manual or contained in NHDOT cell libraries that are needed to complete project plans. Resource files containing any linestyles and/or symbols created by the consultant for use on the project drawings will be provided to NHDOT.

NH-CE-Alignment.cel	Symbols for alignment transfers and MicroStation tasks
NH-CE-archpa.cel	Pattern cells from Bentley’s Archpa cell file with updated names.
NH-CE-Borders.cel	Plan sheet borders (including front sheets, ROW summary, property layout and cross-section borders plus their text cells)
NH-CE-Br_Borders.cel	Miscellaneous bridge borders
NH-CE-Br_Misc.cel	Rip-rap, slope lines, waterstops, sheet piles, section A-A, North arrow, shear connector, & RR section
NH-CE-Br_Pile.cel	HP sections and Pile Key
NH-CE-Br_Precast.cel	New England Bulb Tees (precast concrete beams)
NH-CE-Br_Rail.cel	2 bar, 3 bar aluminum and T2,3,4 steel bridge and approach rails
NH-CE-Br_RailMisc.cel	Existing/superseded, temporary, and Texas 101 bridge and approach rails
NH-CE-Br_Weld.cel	Weld symbols
NH-CE-Cells.cel	Boring and miscellaneous plan and profile Annotation scale cells
NH-CE-Cross Section Labeling.cel	End area volume cells and early _Lbl_Xs cells
NH-CE-Dynamic XS Labels.cel	Barrier and Guardrail cells for Dynamic sections
NH-CE-environ.cel	Environmental detail cells
NH-CE-exist-drainage-features.cel	2D cells for existing plan work as well as 3D cells of TOP and BOTTOM of existing and proposed Drainage features.
NH-CE-exist-in.cel	Existing topography cells
NH-CE-Guardrail.cel	Proposed guardrail detail cells
NH-CE-misc-cells.cel	Pavement marking words and symbols
NH-CE-Plan View Labeling.cel	Bentley delivered Lbl cells for plans
NH-CE-Profile View Labeling.cel	Bentley delivered Lbl cells for profiles
NH-CE-prop-drainage-features.cel	Primarily 2D Plan Proposed Drainage Node cells
NH-CE-row.cel	Proposed right-of-way detail cells

NH-CE-Subsurface Feature Definitions.cel	2D cells for existing plans as well as 3D cells of TOP and BOTTOM of existing and proposed Utility features.
NH-CE-XSect.cel	XS Detail Cells for Cross sections
NH-CE-xsect-scaled.cel	Contains Tick Mark and some Guardrail cells for cross-sections Most have not yet been updated for Annotation Scale.

3.9 COLOR TABLE

A standard color table is necessary to provide visual consistency thus allowing users to easily identify elements in shared files and for consistency in color plotting. NHDOT has its own default color table called *nh-color.tbl*. The table defines 256 colors from which an active color can be selected and applied to an element. NHDOT’s black and white plotters are configured to print all colors except 10-14 in black. Colors 10-14 will plot in the shades of gray displayed in MicroStation.

3.10 PLOTTING

The plotter configuration file (file extension .PLTCFG) is used to set default plotter settings. Black and white plot configuration files have been modified to force all pen colors to black except pens 10-14 which are defined as various shades of gray in the NHDOT color table.

Plotter driver files should be edited for plotter specific adjustments only. Changes intended to affect all plots should be made in the pen tables.

Plot configuration files for creating PDF files are included in the workspace downloads available on the CAD/D website. Information about creating PDF files is in the MicroStation section of the website.

3.11 PLAN SHEETS & PRINT ORGANIZER

The plan drawings will contain a Named Boundary defining the shape of the area to be placed on an individual cut sheet. Some drawings, such as bridge detail sheets, may have multiple Named Boundaries on the drawing. A Sheet Model is then created using the area(s) defined by the Named Boundaries combined with border and level settings to define what is displayed for the particular plan being created. Profile and cross-section drawings generated by OpenRoads Designer will also create Sheet Models which will be used for printing those drawings.

When plotting plan sheets, a rectangular element drawn on level **Border** and in color **84**, style **0**, weight **0** has been placed at the outer edge of NHDOT border cells. A print style, **BorderLevelandColor**, was created for Print Organizer to use this element as a boundary when plotting plan sheets. When developing CAD/D drawings, elements of this color, style and weight should be avoided unless an element defining a batch print limit is being created.

Print Organizer can save the print settings of the plan set so it can be recalled and printed later. These saved plan sets have a .pset file extension. NHDOT has a seed pset file containing a number of folders to help organize the drawings for plotting. Different pset files will be created for the various types of plan submissions.

3.13 PEN TABLES

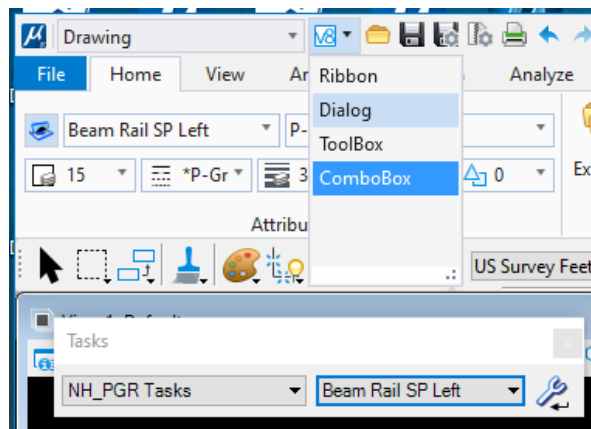
A pen table is used to alter the way a drawing is sent to the plotter. It can be used to control the levels that are plotted, control the order in which they are plotted, make text substitutions, or run macros at plot time. NHDOT uses a pen table called *nhdot-pen.tbl* to make a number of text substitutions in plan borders and front sheets. The variables that are substituted are typically defined in the project configuration file (cfg). Currently defined substitutions include:

Drawing text	Text substitution	Description
\$PROJCLASS\$	\$(PROJCLASS)	Project class
\$STNO\$	\$(STNO)	State project number
\$SCALE\$	\$(NH_SCALE)	Project scale
\$FEDNO\$	\$(FEDNO)	Federal project number
\$NHPROJ\$	\$(NHPROJ)	"N.H. PROJECT NO. 12345"
\$ROUTENO\$	\$(ROUTENO)	Route number or road name
\$ROUTENAME\$	\$(ROUTENAME)	Road name on Right-of-Way registry plan borders
\$CSHTOT\$	\$(CSHTOT)	Total number of construction plan sheets
\$LSHTOT\$	\$(LSHTOT)	Total number of landscaping plan sheets
\$MRSHTOT\$	\$(MRSHTOT)	Total number of Materials & Research plan sheets
\$RSHTOT\$	\$(RSHTOT)	Total number of right-of-way plan sheets
\$SSHTOT\$	\$(SSHTOT)	Total number of shoreland plan sheets
\$WSHTOT\$	\$(WSHTOT)	Total number of wetland plan sheets
\$BT\$	\$(BT)	Total number of bridge sheets
\$PBT\$	\$(PBT)	Total number of preliminary bridge sheets
\$BRNO\$	\$(BRNO)	Bridge inventory number
\$BRDESCR\$	\$(BRDESCR)	Bridge description (road over feature crossed)
\$BRFILNO\$	\$(BRFILNO)	Bridge file number
\$BRDIR\$	\$(lastdirpiece(_DGNFILE))	Bridge directory
\$TIME\$	_TIME_	Current time
\$FILE\$	_FILE_	DGN file name
\$USER\$	\$(_USTN_USERNAME)	User name
\$DATE\$	_DATE_	Current date
\$FILENAME\$	\$(basename(_DGNFILE))	DGN file name without directory path
\$ROWTOWN\$	\$(ROWTOWN)	"TOWN OF -----"
\$COUNTY\$	\$(COUNTY)	County name
\$TOWN\$	\$(TOWN)	Project Name (Town)
\$MODELNAME\$	_MODELNAME_	Model name
\$REVNUM\$	\$(REVNUM)	Right-of-Way plan revision number
\$REVDATE\$	\$(REVDATE)	Right-of-Way plan revision date
\$PROJNAMENUM\$	\$(PROJNAMENUM)	Partial file path to project folder
\$PSETNO\$	<expr?name=Snumber>	Sheet number from Print Organizer file
\$PSETTOT\$	<expr?name=Stotal>	Total number of sheets from Print Organizer file
\$REGDATE\$	\$(REGDATE)	Registry of Deeds plan date

3.14 TASK NAVIGATION

To aid the consultant and in-house staff in developing a set of contract plans that conform to the requirements contained in this document, NHDOT has developed a series of task menus for working on MicroStation drawings. Using the task menus will ensure that elements on the drawings are created according to the established MicroStation standards. Use of the task menus is optional.

The tasks will set the Element Template which, in turn, sets the appropriate element attributes as well as giving a Key-in command to activate the most common tool for the type of element selected. For instance, when selecting Fill Slope, it will activate the Place Line command and for a Clearing Line it will activate the Move/Copy Parallel command.



The task menus can be activated from the user settings: *File > Settings > User > Tasks*

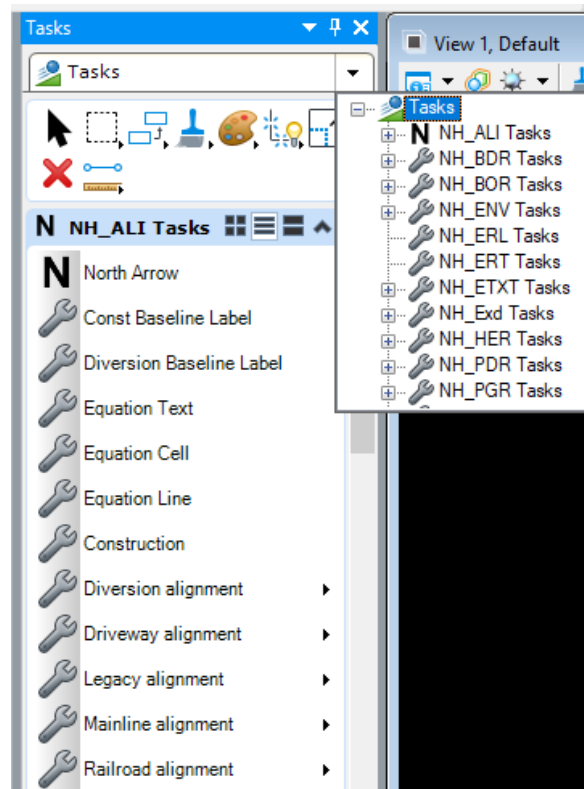
In the upper left corner of the MicroStation window, next to the Workflow dropdown menu, is the dropdown menu to select the Task Menu Mode.

Selecting **Ribbon** will change the workflow to Task Navigation and load the current task list inside the ribbon with the mode button allowing the different task lists to be selected. To change to a different type, the Workflow would need to be changed back to **Drawing** or **General**.

The **Dialog** option brings up the Task list as it appeared in v8i versions of MicroStation.

The list can be changed by selecting the dropdown (black triangle) next to the title of the task list. Change it to match the drawing type being worked on.

The Task list can be docked and pinned closed on the left side of your session. Hover over it to expand it and pin it open if desired.



PART 4 – OPENROADS DESIGNER

4.1 INTRODUCTION

Bentley's decision to replace their three different Civil Design software packages, (MX, InRoads and Geopak), with OpenRoads Designer provides the opportunity for NHDOT staff to exchange Civil Design data with consultants regardless of which package they formerly used. NHDOT previously implemented the OpenRoads tools within MX and InRoads and has now migrated to OpenRoads Designer. Consulting firms should be aware that software updates are likely to occur in between updates to this document. When receiving a new project, one should check with the Project Manager or CAD/D staff to confirm which version of the Civil Software was used for the project's design up to that point.

As noted in section 2.1 *Direction & Goals* on page 5, the Department expects to receive 3D model data which can be provided to the Bureau of Construction to aid in the layout of the project's design.

4.2 OPENROADS DRAWING FILE NAMES

A naming convention for OpenRoads drawings has been established. To reduce the potential for errors and conflicting data, this information is not included in this document. The current naming conventions can be found within the OpenRoads section of the CAD/D web-site at the address listed in section 1.1 *Introduction* on page 3. Like MicroStation drawings, OpenRoads Designer file names should always begin with the project number.

4.3 SEED FILES

OpenRoads Designer seed files vary from those used by MicroStation. The primary difference is the inclusion of a 3D model which is managed with the 2D model for the complete representation of the data. Additional details can be found in the Connect Workspace section 3.1 *Seed Files* on page 9.

There are also seed files for OpenRoads Designer which are used when creating named boundaries and cut sheets for plans, profiles, and sections.

Files available at the time this document was prepared include:

- NH-100_Plan-8x11-Sheet_Def.dgnlib
- NH-10_Profile_Drainage_Sheet_Definition.dgnlib
- NH-20_Plan_Sheet_Definition.dgnlib
- NH-50-Plan-Plan-Sheet-Def.dgnlib
- NH-50-Prof-Prof-Sheet-Def.dgnlib
- NH-50_Plan_n_Profile_Sheet_def.dgnlib
- NH-50_Plan_Sheet_Definition.dgnlib
- NH-50_Profile_Sheet_Definition.dgnlib
- NH-Cross_Section_Sheet_Definition_Landscape.dgnlib
- NH-Cross_Section_Sheet_Definition_Portrait.dgnlib
- NH-Cross_Section_Sheet_Definition_Roll.dgnlib
- NH-Profile Sheet SU Frame Annotation Definitions.dgnlib

4.4 FEATURE DEFINITIONS

ORD Feature Definitions describe the engineering properties of the feature and define how it will display in various contexts (plan, profile, 3D, cross section), by pointing to one or more Feature Symbologies. Feature Symbologies may define Annotation Groups and also point to one or more Element Templates. These Element Templates, in turn, point to a specific Cell or Level, and therefore define how a feature is displayed.

Feature definitions for OpenRoads Designer are stored in DGNLIB files. NHDOT has four primary ones:

NH-Design_Features_ElemTemp_Levels.dgnlib	Proposed Features
NH-DU_Features_Annotations_ElemTemp_Levels.dgnlib	Drainage and Utilities
NH-Survey_Settings_Features_Annotations_ElemTemp_Levels.dgnlib	Survey features for processing ORD survey files.
NH-Topo_Features_ElemTemp_Levels.dgnlib	Design features of existing topo.

4.5 SURVEY DATA

The processing of survey data is transitioning from MX procedures to OpenRoads Designer. Drawings which are intended to contain survey data processed with OpenRoads Designer should be created with the survey seed file as noted in section 3.1 *Seed Files*.

Survey information can also be imported from MX model files by using the Geometry Import/Export tool with a mapping table to correlate MX string labels to OpenRoads Designer feature names. At this time, MX data must be brought into a drawing created from the International Foot seed file and then updated to US Survey Feet.

4.6 TEMPLATE FILES

Templates are used to create corridors. Each template is basically a typical section that contains the features and components that are extruded along a civil geometry. Since each project is unique and will likely need modification to any standard template, a “seed” template file has been created — *ApprovedCE-NHDOT-Templates.itl* — which contains templates developed by the NHDOT. When working in a new project, this file should be copied into the appropriate folder for that project. The file would then be renamed to replace “Approved” with the state project number. The template files obtain their component feature definitions from NH-Design_Features_ItemTypes_ElemTemp_Levels.dgnlib. Although ITL files from earlier versions can be opened by OpenRoads Designer, the components used in earlier versions have been modified and are no longer valid.

When templates from the template library are applied to the assigned horizontal and vertical geometry of a corridor, they are copied, not referenced, from the template library into the design file and are assigned station ranges. It is possible to drop different templates at defined station ranges to achieve changes in the roadway design. The template drop interval is the spacing that final templates will be dropped. Set this at a value appropriate for the project. For automated machine guidance construction, a rule of thumb is 5-ft between points. Data points are also required at key stations, including horizontal and vertical geometry points, superelevation stations, offset geometry points, drainage facilities and guardrail and barrier limits.

4.7 OPENROADS LINSTYLES

In addition to the linestyles described in section 3.5 *Linestyles* on page 12, 3D linestyles which can be used in OpenRoads and for the Subsurface Utility Engineering features are still being developed. These linestyles are used to represent linear features such as guard rails in 3D views. Once they are ready, they will be available for download from the CAD/D website.

The 3D linestyles which are available are contained within *NH-CE-LineStyles-3D.rsc*. Additional linestyles will be available for download as they are developed.

4.8 CIVIL CELLS

Civil Cells for driveways and side roads are available in *NH-CC-Drives.dgnlib* and *NH-CC-SideRoads.dgnlib* which are included in the files available for download. Additional libraries will be added in the future.

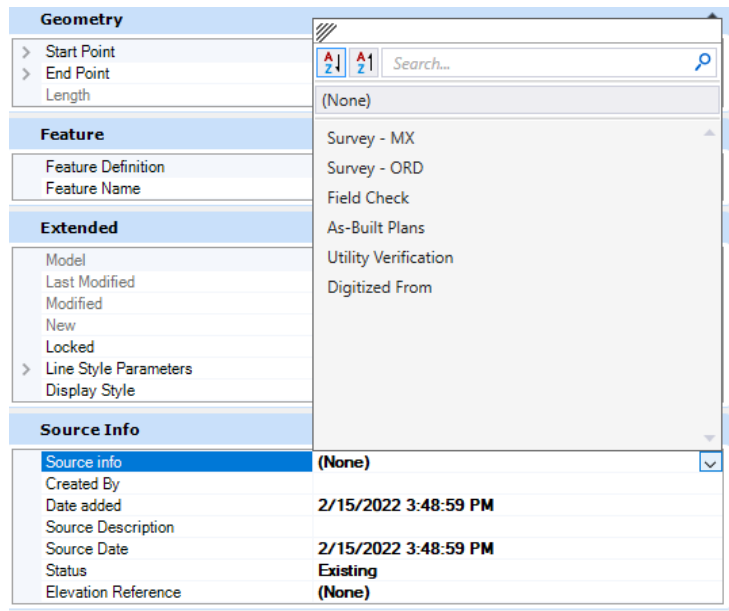
4.9 ITEM TYPES / ASSET MANAGER

Item types are a customizable set of properties used to describe an object or an element. Reports can be generated with this data and it can be used for annotating elements on drawings. Examples of what item types could be used for include:

- Data Source
- Specification number
- Pay item data
- Element’s state
 - Existing to remain
 - To be removed

At NHDOT, item types are used to document the source of existing detail; whether an element was obtained from MX Survey, OpenRoads Designer Survey, Field Check, As-Built Plans, etc.

Item Types can be attached to elements with the Asset Manager. Once this step is completed, the Item Type appears in the Element Properties where it can be set to the appropriate value.



Many feature definitions have pre-assigned Item Types associated to them. However, reports using that data have not yet been developed.

4.10 UTILITY FEATURES

NHDOT is using the Subsurface Utility tools to prepare existing survey detail of underground utilities for proposed drainage design. Drainage Features are extracted from survey detail using Utility Filters and properties assigned to define the specific size and material type of the pipe or structure. Procedures for extracting the drainage and utility features are defined in the CAD/D Documentation.

PART 5 - PROCEDURES

5.1 EXCHANGING RIGHT-OF-WAY DATA

Right-of-way data is routinely updated during the project's lifetime. This information is typically maintained by the NHDOT Bureau of Right-of-Way for both in-house and Consultant-designed projects. Knowing that DOT staff and Consultants both need to work on the existing right-of-way drawings, a process has been developed to ensure that this data is kept current and accurate. Any procedure outlined in the consultant agreement shall take precedence over the process described below.

The existing right-of-way information will be divided between multiple drawings. One contains the line work (ERL) a second will have the text information (ERT). Some projects may also have a third drawing containing digitized right-of-way information (ERD). It is intended that the Department will maintain the master ERL drawing (abstracting) and send the consultant a copy when updates have been made.

The Bureau of Right-of-Way will continue to utilize *Design History* and that record will be maintained throughout the life of the project. The Bureau of Right-of-Way will continue business as usual with the ability to make changes at any time during the design process with the understanding that the NHDOT Consultant Reviewer will be notified when changes have been made.

The process shall be:

- Two drawings are created by the Bureau of Right-of-Way with Design History enabled. The ERT drawing is a 2D drawing containing the property text elements. 12345-E-ROW-Lines.dgn is a civil drawing containing managed 2D and 3D models used to store property lines, right-of-way lines and town boundaries. These linear features are draped over the existing terrain surface to add elevations so they can be displayed on cross sections. Under normal circumstances, only the NHDOT Bureau of Right-of-Way should be making changes to the 12345-E-ROW-Lines.dgn drawing.
- The Consultant receives a copy of the ERT drawing. At their discretion, the Consultant is free to adjust text position or make other cosmetic changes to improve legibility of the drawings.
 - Updates to parcel ownerships made by the NHDOT abstractors are revised on the ERT drawing and a copy of the updated ERT drawing is sent to the Consultant. The Consultant will be responsible for updating their copy of the ERT drawing. Design History can be used to highlight changes and text revisions made to the ERT drawing by NHDOT staff.
- The Consultant also receives a copy of the 12345-E-ROW-Lines.dgn drawing which is referenced into other drawings (Not copied or merged).
 - When the NHDOT Bureau of Right-of-Way staff updates property lines, ROW lines, easement lines etc. on the 12345-E-ROW-Lines drawing an updated copy is sent to the Consultant. The revised 12345-E-ROW-Lines.dgn supersedes all previous versions.
 - Updates to the 12345-E-ROW-Lines.dgn can be reviewed using the Design History to identify changes and impacts to the property line and ROW line locations
- Right-of-way data is submitted in both paper and DGN format to NHDOT Bureau of Right of Way for review and approval prior to the production of recordable plans.

PART 6 - ENGINEERING CONSULTANT DELIVERABLE REQUIREMENTS

6.1 OVERVIEW

The purpose of this section is to establish the minimum acceptable criteria for electronic CAD/D deliverables. Obtaining drawings and ground models in a common format will reduce the amount of time spent becoming familiar with the designs if they are transferred from one designer to another and allows for their reuse in the future.

6.2 FILE FORMAT AND DELIVERY

All electronic data furnished to the NHDOT shall use the appropriate naming convention and format for the type of data to be transmitted. It is very important to clearly communicate what is being transmitted and to describe the format of the transmitted files.

A letter (electronic or printed) is to be attached to **all submissions** stating briefly:

1. File content
2. File Format (zipped, MicroStation, OpenRoads Designer, etc. and the utility used)
3. OpenRoads Designer and/or MicroStation version
4. Number of CDs, DVDs, etc., if any
5. Files must be in the proper format before transmitting to NHDOT. **No translating of information by NHDOT personnel shall be required.**
6. If files are zipped or backed up, a brief explanation of the recommended procedure to extract the files should be included.
7. Versions of software must be current to or fully compatible with that of the NHDOT.
8. NHDOT reserves the right to reject any file transmitted that does not conform to these requirements.

6.3 DEVIATION FROM FORMAT

Any CAD/D file to be submitted that deviates from the DGN format must have prior approval from the Project Manager or Contract Manager. The approval must be in writing with the name of the individual from NHDOT who permitted the varying format.

6.4 INITIATING A DESIGN PROJECT

This section describes the data that is to be provided to a design consultant at the beginning of a project.

NHDOT's Plan Preparation section is responsible for using project survey data to prepare the digital terrain model (DTM) and base drawings that will be used during the design process. They should also be the ones to initiate the Project Journal File described in *PART 2 – GENERAL CAD/D INFORMATION* beginning on page 5. A sample of the Journal File is shown in *Appendix A – Sample CAD/D Project Journal*.

Electronic data to be provided by the NHDOT Plan Preparation Section includes:

- The 2D and 3D DGN files containing survey data with Plan Preparation modifications, enhancements and annotation.
- 3D terrain model
- The Project Journal File containing all pertinent information about the project.

6.5 INTERMEDIATE SUBMISSIONS

The consultant shall be prepared to submit sample plan sheet, profile, typical or detail, and/or cross-section sheets for review of conformity to the NHDOT CAD/D specifications at various stages of the project's development. As a minimum, the final design consultant should be prepared to submit electronic project drawings at the Preliminary Plans, Specifications & Estimate (PPS&E) and PS&E stages of the project. Depending on the project, NHDOT may request electronic submissions at a more or less frequent interval.

Since numerous groups work together during the project's design, it is important that everyone uses the same data. Therefore, when changes are made that would affect the design, updated drawings shall be provided to the NHDOT Consultant Reviewer. These, in turn, will be distributed to all affected parties.

6.6 PART A & B DESIGN PHASES

This section describes the data that is to be exchanged when a project moves from one designer to the next. This could be a transition between Part A and Part B consultant designers or a transition between NHDOT designers and consultants. Data received at this point will be provided to the group continuing the design process.

Electronic deliverables expected to be transferred between designers:

CAD/D Data in MicroStation DGN Format

- MicroStation .DGN files developed for the project
- Include any files from sub-consultants (including Traffic Signals, Retaining Walls, ROW plans, Mitigation sites, Soundwalls, etc.).
- Any cell files and linestyle resource files used on the project that are not included in the NHDOT standards.
- The Project Public Hearing Plan in DGN and PDF format.

Civil Design Data

- 3D terrain model surfaces (existing and design surfaces), triangulation models or dtm surfaces developed with OpenRoads Designer.

- Any templates necessary to recreate the proposed design alternatives.
- Any OpenRoads Designer DGN files developed such as drawings containing alignments, profiles, corridors and subsurface utility features.

Other Data

- The Project Journal File containing all pertinent CAD/D information about the project.

6.7 PROJECT COMPLETION

The following list is a guide to what electronic information is expected to be returned from the design Consultants to NHDOT for final storage at the completion of a design project. These electronic delivery items **DO NOT** replace any **hardcopy** delivery items.

Additional deliverables may be required if 3D design data is to be provided to the construction contractor. In this instance, additional deliverables would be required to comply with Item 670.822 - GNSS Construction Inspection Equipment. Check with the Project Manager for full details.

CAD/D Data in MicroStation DGN Format

- MicroStation .DGN files developed for the project
- Include any files from sub-consultants (including Traffic Signals, Retaining Walls, ROW plans, Mitigation sites, Soundwalls, etc.).
- Plotting references needed to re-produce project cut-sheets including sheet numbering (include final project configuration file, pen-tables, etc.)
- Any cell files and linestyle resource files used on the project that are not included in the NHDOT standards.
- Final embellished presentation plan.

Civil Design Data

- 3D terrain model surfaces (existing and proposed surfaces), triangulation models or dtm surfaces developed by OpenRoads Designer. Limits of the proposed 3D design (such as EP to EP or toe of slope) are to be determined by the Project Manager.
- Any templates necessary to recreate the submitted design.
- Any OpenRoads Designer DGN files used to develop the final contract plan drawings such as drawings containing alignments, profiles, corridors and subsurface utility features.
- Final alignment files (text file format).

Spreadsheet Information

- All project quantity summary sheets in original format (Excel).
- All sign text sheet information in original format (Excel).
- All quantity sheet information in original format (Excel).
- All drainage note information in original format (Excel, Word, or .dgn).
- All pollutant loading and related information in original format (Excel, Word, etc.).
- All design spreadsheets used to complete certain design elements (guardrail design, borings, monitoring wells, storm protection, etc.) in original format (Excel, Word, .dgn, etc.).

- All traffic analysis studies done during the project including any HCM analyses, traffic simulation models (Synchro, SimTraffic, SIDRA, etc.), and presentation graphics.
- Any special quantity studies done during the project that could be useful in the future.

Drainage Information

- All Hydrocad Models in their original format (include index of models in the file).
- All Stormcad, Storm and Sanitary, HY8, Pond Pac, or Hydrain data in their original formats include an index of the numbering sequence of tables).
- All HEC-RAS files.
- All watershed maps in their original format (GIS, .dgn, mapping software, etc.).
- All soil map information that was included in the pollutant loading package.

Project Plan Files

The following plans need to be provided in the formats specified to conform with the Department's internal naming format for archiving.

- Provide PDF files of all project final design plan sheets included in the Proposal Prints, in the following format: 12345POPXXX.pdf where the "12345" is the project number, the XXXX is the sheet number, and POP is the "Plan of Proposed", (i.e. 13933GPOP0001.pdf would be the front sheet number 0001 from the 13933G project plans). This format matches the Department's internal naming format for archiving. This includes the Final Roadway plans, Final Bridge plans, etc.
- Provide PDF files of all project plan sheets included in the Proposal Prints, in the following format: 12345ROWXXX.pdf where the "12345" is the project number, the XXX is the sheet number, and ROW is the "Right-of-Way Plan", (i.e. 13933GROW010.pdf would be sheet number 10 from the 13933G project ROW plans). This includes the Final Roadway plans, Final Bridge plans, etc.
- Provide the Final Erosion Control Plans in PDF files of all project final design erosion control plan sheets in the following format: 12345ECPXXX.pdf where the "12345" is the project number, the XXX is the sheet number, and ECP is the "Erosion Control Plan".
- Provide the Wetland Impact Plans in PDF files of all project final design plan sheets in the following format: 12345WETXXX.pdf where the "12345" is the project number, the XXX is the sheet number, and WET is the "Wetland Impact Plan". Roll plan PDF files may also be required depending on the project (including scale and layout).
- Provide the Shoreland Impact Plans in PDF files of all project final design plan sheets in the following format: 12345SHOXXX.pdf where the "12345" is the project number, the XXX is the sheet number, and SHO is the "Shoreland impact Plan".
- Final embellished presentation roll plan.

Project Photographs

- Provide electronic versions of all photographs taken during design of the project. This should include any photos used in the Wetland Impact and Shoreland Impact application process and design decisions (guardrail, drainage, etc.).

Project Journal File

- Care shall be taken to prepare a complete Project Journal File outlining all files and descriptions used on the project. In addition to the cut-sheet definitions, all plan sheet models need to be included so the sheets can be re-produced.
- Plotting needs to be included to provide any necessary guidance on how the sheets are to be plotted at the correct scale. Include any pen-tables used in the project.
- Complete index of all 3D model surfaces provided and what they are used for.
- Index of all alignments used on the project (with appropriate string names) and descriptions.

Text Files

- COGO and coordinate reports of each alignment similar in format to the ones shown in *Appendix E – Construction Reports* on page 37 for use by the NHDOT Survey Section and the Construction Contractor.
- Station and offset listing of proposed bounds.
- Complete index of all 3D model surfaces provided and what they are used for.
- Any information necessary to properly plot the drawings. Include any pen-tables used in the project.

Additional Data

- Additional deliverables may be required if 3D design data is to be provided to the construction contractor. In this instance, additional deliverables would be required to comply with Item 670.822 - GNSS Construction Inspection Equipment. Check with the Project Manager for full details.

6.8 SPECIALIZED DEVELOPMENT BY DESIGN CONSULTANTS

Any specialized programs, macros, utilities, symbology, etc., developed by the consultant that are necessary to properly display drawings submitted to NHDOT shall be included with other project deliverables.

Submission of copies of other specialized programs, macros, utilities, symbology, etc. developed to improve the CAD/D drafting and design processes is encouraged. It is understood that NHDOT accepts these items without any guarantee of usefulness or expectations of support by the developer. In addition, NHDOT will not distribute these items to any other individual, consultant or State Transportation Department without prior permission of the developer.

PART 7 - APPENDIX

APPENDIX A – SAMPLE CAD/D PROJECT JOURNAL

CAD/D PROJECT JOURNAL

(12345_project_journal.doc)

Last edited 4/12/2022

PROJECT JOURNAL

This file contains information about the project **12345** and the corresponding electronic files contained in the **project directory**. This file should be kept up to date and stored in the project's "cadd" directory. If a project is archived, this file is to be included with the project's electronic files. When filling in the required information, please delete the instructions and examples in order to maintain a concise record.

PROJECT DESCRIPTION

State Project Number:..... 12345
Federal Aid Number: N/A
County: County
Project Manager:..... Project Manager
Project Designer: Project Designer
Project Directory: N:\cadd\pbt\xx\12345\cadd\prj
Project Units:Imperial-USSF
Project Scale:50 20
Survey Field Book #'s:...#,#,#

SCOPE OF WORK

Include as much detail as necessary to define the work done for the project.

SIGNIFICANT EVENTS or DESIGN DECISIONS

List any CAD/D-related significant events or design decisions such as converting the project from v8i to Connect or current design alternative.

PROJECT FILES

List any drawing files that do not fit into the standard naming convention. Include a brief description of the data contained in each one.

MICROSTATION FILE INFORMATION

Seed File(s) Used for this Project: NH_Seed2D_Design.dgn NH_Seed3D_Design.dgn

Non-Standard Drawings

List any drawings that are not on the standard naming convention list with a brief description of each one's contents.

Plot Information

List information about Print Organizer specifications, pen tables, or other features used to generate the plot files.

OPENROADS DESIGNER

ORD Version:

Template File name – 12345NHDOT-IMP.itl

Project Features DGNLIB if used –

Project Civil Cell DGNLIB if Used –

Roadway – "Road Name"

Alignment Information

DGN Name12345-Geometry.dgn

Horiz. Alignment Feature Name ..MCxM Rte 16

Vert. Alignment Feature Name....MCxM Rte 16 Prof

Existing Feature NameMCxM Sect Exist Elev

Reports

Horizontal Review ASCII-.....12345-MCxM-Hor-Review.txt

Horiz. Interval Points XYZ.....12345-MCxM-Hor-XYZ.xls

Vertical Review ASCII12345-MCxM-Vert-Review.txt

LandXML12345-MCxM-Landxml.xml (saved as a Text file named xml)

Corridor Information

DGN Name12345-Corridor

Corridor NameMCxM Rte 16 Cor

SuperElevation XLS file name MCxM-ss4_superelevations_2_4.xlsm

Parametric Constraint txt file for import -

Guardrail Design XLS file name MCxM_guardrail_calcs_office_2010.xlsx

Parametric Constraints txt file for import -

Corridor Exported Parametric Constraints

Corridor Exported Template Drops CSV

Driveway Information

DGN Name

Drive list containing:

Drive Station \ Horizontal Geometry Name \ Vertical Geometry Name \ Civil Cell

Section Information

DGN Name12345-xsections

Custom Settings .XSC12345-MCxM-Sta-Sta.xsc

XS Model Name.....MCxM Sta to Sta




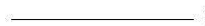
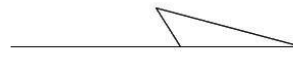
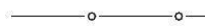

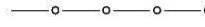




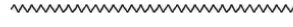

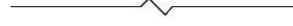

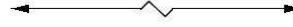


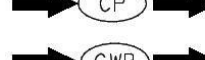





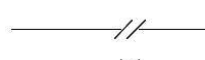














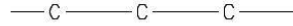














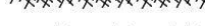
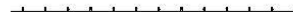


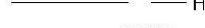
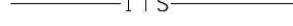








XS Detail dgn name12345-Xs-Detail-MCxM














































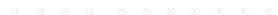













XS Detail Data File

APPENDIX B - LEVEL MAPPING CONVENTION

Note: MicroStation level information was included in previous editions of this document. To reduce the potential for errors and conflicting data, this information has been removed. The latest mapping convention can be found on the NHDOT website under the MicroStation section at the address listed in section 1.1 Introduction on page 3. Previous versions of the level mapping will be maintained on the website.

APPENDIX C - NHDOT CUSTOM LINSTYLES FOR CONNECT

	*Arrow		*E-Light
	*Arrow2		*E-Sewer
	*ArrowBeginOpen		*E-StoneWall
	*ArrowBeginSolid		*E-StoneWall-Short
	*ArrowEndOpen		*E-Stream
	*ArrowEndSolid		*E-Telephone
	*Berm		*E-Water
	*Break		*ErosCtlChannProLt
	*BreakDim		*ErosCtlNatBffPeri
	*CableTV		*ErosCtrlChannProt
	*CDLnOHW		*ErosCtrlCleanWat
	*ConservationLand		*ErosCtrlCleanWatLt
	*County		*ErosCtrlPerimeter
	*CowardinDistinct		*Fence
	*CutLt		*Fence-Barbed
	*CutRt		*Fence-Barbed-Short
	*DevelTidalBuffZone		*Fence-Short
	*Dim		*Fill
	*Ditch		*FloodPlain100
	*E-ConduitLight		*FloodPlain500
	*E-ConduitSignal		*Floodway
	*E-CurbLt		*GrBmWoodPostDbL
	*E-CurbRt		*GrBmWoodPostLt
	*E-DrainPipe		*GrBmWoodPostRt
	*E-Electric		*GrCblLt
	*E-FiberOptic		*GrCblMedian
	*E-Fire		*GrCblRt
	*E-Gas		*Ground
	*E-GrBmSteelPostLt		*Hedge
	*E-GrBmSteelPostRt		*HighObsTidalLine
	*E-IntelTransSys		*InvasiveSpecies
			*JerseyBarrier
			*Leader
			*Ledge
			*MagDetector
			*MeanHighTide
			*MeanHighWater
			*MeanLowWater

 NWB150	*NatWoodIndBuff150	 *StreamLt
 NJDA	*NonJurisDrainArea	 *StreamRt
 NHW	*NormHighWater	 *Tick
 NtnlForest	*NtnlForest	 T B Z
 OHT	*OrdHighTide	 T O B O
 OHW	*OrdHighWater	 T O B
 OW	*Overhead-Wire	 *TownLine
 P-ConduitLight	*P-ConduitLight	 *TrafBarls
 PC	*P-ConduitSignal	 V P
 *P-CurbLt	*P-CurbLt	 WB50
 *P-CurbRt	*P-CurbRt	 DW
 PD P	*P-DrainPipe	 WBF
 P E	*P-Electric	 *WoodsLt
 P F O	*P-FiberOptic	 *WoodsRt
 P F	*P-Fire	 Z
 P G	*P-Gas	
 *P-GrBmSteelPostLt	*P-GrBmSteelPostLt	
 *P-GrBmSteelPostRt	*P-GrBmSteelPostRt	
 P I T S	*P-IntelTransSys	
 P L	*P-Light	
 P S	*P-Sewer	
 *P-StoneWall	*P-StoneWall	
 *P-Stream	*P-Stream	
 P T	*P-Telephone	
 P W	*P-Water	
 *PaveMark	*PaveMark	
 // . //	*PedRail	
 P W E T	*PrimeWetland	
 P W E T 100	*PrimeWetIndBff100	
 P	*PropLine	
 P S 250	*ProtectedShore250	
 *QML	*QML	
 *Railroad	*Railroad	
 *RailroadROW	*RailroadROW	
 *RetWallLt	*RetWallLt	
 *RetWallRt	*RetWallRt	
 *Rockline	*Rockline	
 *RockRt	*RockRt	
 *ROW	*ROW	
 *SheetPile	*SheetPile	
 R E F	*ShoreLandRef	
 S A S	*SpecAquaticSite	
 *StateLine	*StateLine	
 *StoneFill	*StoneFill	

APPENDIX D – CIVIL DATA TRANSFER FORMATS

LANDXML

The use of LandXML is encouraged for transferring design data between different software packages. LandXML was established to exchange design data utilizing a non-proprietary data standard. LandXML is the easiest avenue for transferring alignments between design softwares, including (but not limited to) OpenRoads Designer, MX, InRoads, and Geopak.

Survey data and surface triangulations may also be transferred via LandXML. However, at this time, there are still limitations when transferring large models (surfaces). Therefore, it is strongly recommended to translate only essential data.

Importing LandXML data to OpenRoads Designer and exporting OpenRoads Designer data to LandXML are documented on the Department's web site. Also, learn more about LandXML at www.LandXML.org.

APPENDIX E – CONSTRUCTION REPORTS

HORIZONTAL ALIGNMENT REVIEW REPORT

Report Created: Monday, November 29, 2021

Time: 9:21:05 AM

Project: Default

Description:

File Name: N:\CADD\PBT\UNITY\20262\Cadd\OpenRoads\20262-Geometry.dgn

Last Revised: 11/29/2021 09:20:52

Note: All units in this report are in feet unless specified otherwise.

Alignment Name: Unnamed

Alignment Description:

Alignment Style:

		Station	Northing	Easting
Element: Linear				
START	()	500+00.000	288666.790	800455.238
PC	()	504+32.572	288822.299	800051.585
Tangential Direction:		N68.931°W		
Tangential Length:		432.572		
Element: Circular				
PC	()	504+32.572	288822.299	800051.585
HPI	()	507+33.074	288930.329	799771.173
CC	()		289755.445	800411.084
PT	()	510+16.406	289175.035	799596.759
Radius:		1000.000		
Delta:		33.451°	Right	
Degree of Curvature (Arc):		5.730°		
Length:		583.834		
Tangent:		300.502		
Chord:		575.577		
Middle Ordinate:		42.306		
External:		44.175		
Back Tangent Direction:		N68.931°W		
Back Radial Direction:		N21.069°E		
Chord Direction:		N52.205°W		
Ahead Radial Direction:		N54.521°E		
Ahead Tangent Direction:		N35.479°W		
Element: Linear				
PT	()	510+16.406	289175.035	799596.759

NHDOT CAD/D Procedures and Requirements

PC	()	513+38.809	289437.576	799409.633
Tangential Direction:		N35.479°W		
Tangential Length:		322.403		
Element: Circular				
PC	()	513+38.809	289437.576	799409.633
HPI	()	514+74.620	289548.170	799330.807
CC	()		289582.679	799613.215
PT	()	515+87.630	289674.491	799380.684
Radius:		250.000		
Delta:		57.025°	Right	
Degree of Curvature (Arc):		22.918°		
Length:		248.821		
Tangent:		135.811		
Chord:		238.677		
Middle Ordinate:		30.322		
External:		34.508		
Back Tangent Direction:		N35.479°W		
Back Radial Direction:		N54.521°E		
Chord Direction:		N6.967°W		
Ahead Radial Direction:		S68.454°E		
Ahead Tangent Direction:		N21.546°E		
Element: Linear				
PT	()	515+87.630	289674.491	799380.684
END	()	518+65.024	289932.502	799482.557
Tangential Direction:		N21.546°E		
Tangential Length:		277.394		

SAMPLE OPENROADS ALIGNMENT REPORT (COORDINATES)

Horizontal Elements XYZ Report

Report Created: 4/7/2017 3:20pm

Project:

Unity 20262

Description:

File Name:

\\Unity\20262\OpenRoads\FinalDesign\20262geometry.dgn

Last Revised:

4/7/2017 15:20:37

Note: All units in this report are in feet unless specified otherwise.

Alignment Name:

MC1

Point	Easting (X)	Northing (Y)	Elevation	Station	Direction	Radius
1	1112416.8044	473216.5314	0.00	506+00.000	N 8°15'39.39" E	
10	1112423.9885	473266.0126	0.00	506+50.000	N 8°15'39.39" E	
11	1112431.1725	473315.4938	0.00	507+00.000	N 8°15'39.39" E	
12	1112438.3566	473364.9750	0.00	507+50.000	N 8°15'39.39" E	
13	1112445.5407	473414.4562	0.00	508+00.000	N 8°15'39.39" E	
14	1112452.7248	473463.9374	0.00	508+50.000	N 8°15'39.39" E	
15	1112459.9089	473513.4186	0.00	509+00.000	N 8°15'39.39" E	
16	1112467.0930	473562.8998	0.00	509+50.000	N 8°15'39.39" E	
17	1112474.2770	473612.3810	0.00	510+00.000	N 8°15'39.39" E	
18	1112481.4611	473661.8622	0.00	510+50.000	N 8°15'39.39" E	
19	1112488.6452	473711.3434	0.00	511+00.000	N 8°15'39.39" E	
20	1112495.8293	473760.8246	0.00	511+50.000	N 8°15'39.39" E	
21	1112503.0134	473810.3058	0.00	512+00.000	N 8°15'39.39" E	
22	1112510.1974	473859.7870	0.00	512+50.000	N 8°15'39.39" E	
23	1112517.3815	473909.2682	0.00	513+00.000	N 8°15'39.39" E	
24	1112524.5656	473958.7494	0.00	513+50.000	N 8°15'39.39" E	
25	1112531.7497	474008.2306	0.00	514+00.000	N 8°15'39.39" E	
26	1112538.9338	474057.7118	0.00	514+50.000	N 8°15'39.39" E	
27	1112546.1178	474107.1930	0.00	515+00.000	N 8°15'39.39" E	
28	1112553.3019	474156.6742	0.00	515+50.000	N 8°15'39.39" E	
29	1112560.4860	474206.1554	0.00	516+00.000	N 8°15'39.39" E	
30	1112567.6701	474255.6366	0.00	516+50.000	N 8°15'39.39" E	
31	1112574.8542	474305.1178	0.00	517+00.000	N 8°15'39.39" E	
32	1112582.0383	474354.5990	0.00	517+50.000	N 8°15'39.39" E	
33	1112589.2223	474404.0802	0.00	518+00.000	N 8°15'39.39" E	
34	1112596.4064	474453.5614	0.00	518+50.000	N 8°15'39.39" E	
2	1112603.3988	474501.7220	0.00	518+98.666	N 8°15'39.39" E	
3	1112603.3988	474501.7220	0.00	518+98.666	N 8°38'10.33" E	-1190.0255
35	1112603.5984	474503.0414	0.00	519+00.000	N 8°34'19.03" E	-1190.0255
36	1112610.0103	474552.6249	0.00	519+50.000	N 6°09'52.62" E	-1190.0255
37	1112614.3338	474602.4339	0.00	520+00.000	N 3°45'26.22" E	-1190.0255
38	1112616.5613	474652.3806	0.00	520+50.000	N 1°20'59.82" E	-1190.0255
39	1112616.6890	474702.3768	0.00	521+00.000	N 1°03'26.58" W	-1190.0255
40	1112614.7165	474752.3342	0.00	521+50.000	N 3°27'52.99" W	-1190.0255
41	1112610.6474	474802.1646	0.00	522+00.000	N 5°52'19.39" W	-1190.0255
42	1112604.4888	474851.7802	0.00	522+50.000	N 8°16'45.79" W	-1190.0255
43	1112596.2516	474901.0933	0.00	523+00.000	N 10°41'12.20" W	-1190.0255
44	1112585.9503	474950.0168	0.00	523+50.000	N 13°05'38.60" W	-1190.0255