Ontario

MINISTRY OF TRANSPORTATION

OpenRoads Designer CONNECT Edition User Guide

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1.0 General Introduction

This document provides an introduction to MTO workspace configuration for Bentley OpenRoads Designer CONNECT Edition (ORD). The configuration and customization have been updated to and tested with OpenRoads Designer CONNECT Edition 2021 Release 2 (10.10.21.04).

The MTO customized workspace for ORD is available for MTO and Service Provider staff working on MTO highway projects. MTO ORD workspace files and resources are provided "As Available" without any warranty, and subject to change with future updates and enhancements.

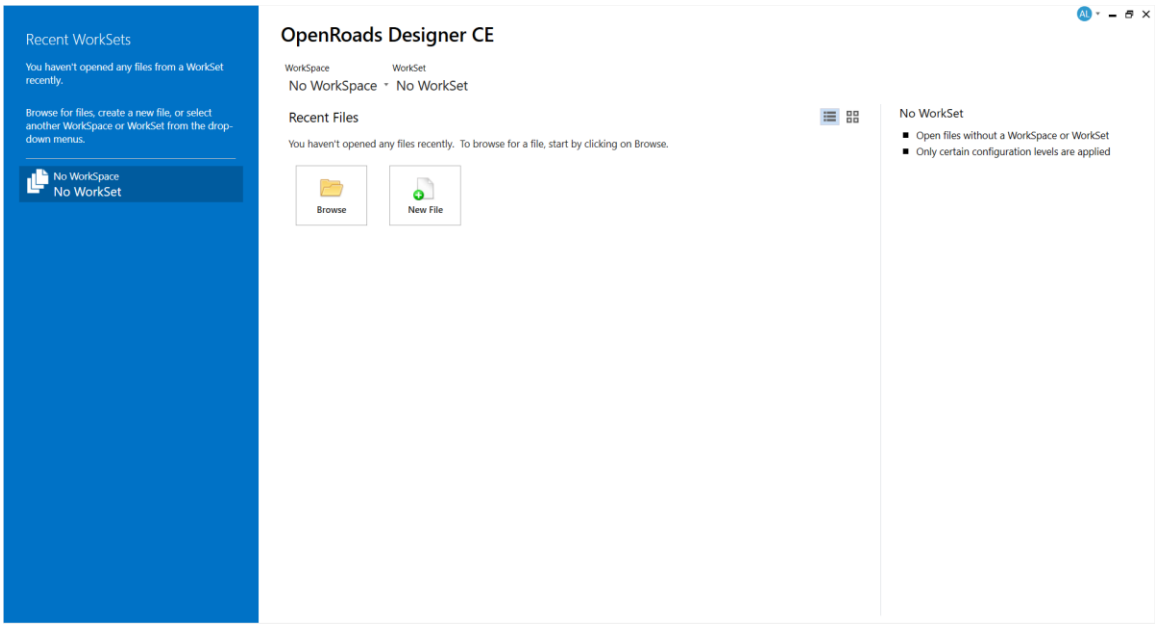
1.1 OpenRoads Designer CONNECT Edition

ORD CONNECT Edition is a new application that replaces the capabilities of all applications in the InRoads, GEOPAK, MX, PowerCivil for Civil, and GeoMacao product lines in a single offering.

Upgrade to OpenRoads Designer was a huge leap. Although most of the basic concepts of the program had been retained, the underlying data structures, the workspace, and the workflow had been dramatically changed. OpenRoads Designer is built on OpenRoads modeling technology and provides significant new design modeling, analytical modeling and project collaboration capabilities.

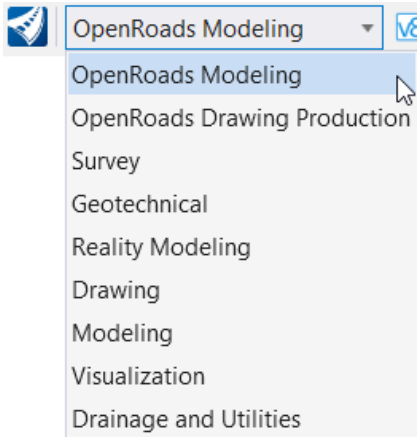
1.2 User Interface

ORD's user interface has been redesigned. It now features ribbons, context menus, heads-up display, graphical and dynamic edits. ORD uses the Startup screen to select or create the WorkSpaces and WorkSets, open existing files, and create new files.



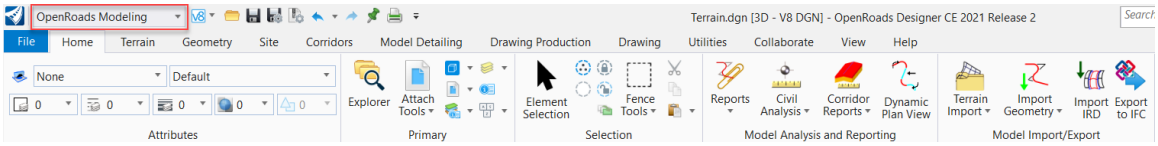
The graphical user interface of ORD is now based on ribbon design. Ribbons are organized by workflow. Each workflow consists of multiple tabs, which are organized by tasks.

The workflows are activated from the Quick Access Toolbar in the upper left corner.



Select a workflow will load a series of tabs containing relevant tools in groups at the top of the ribbon.

The ribbon menu of the OpenRoads Modeling workflow is organized into simliar categores called Ribbon Tabs as the InRoads Explorer menus.



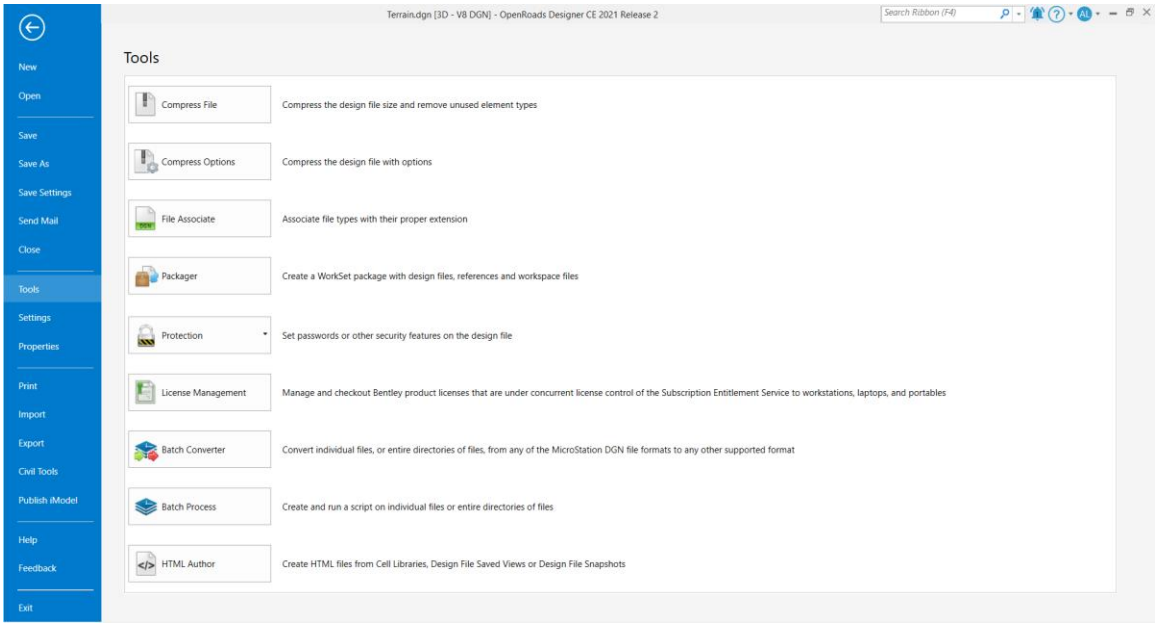
The ribbon tabs included in the OpenRoads Modeling workflow are:

Home	Attributes, primary (commonly used) tools, element selection tools, model analysis and reporting, and import/export tools.
Terrain	Element selection, terrain modeling, editing, and analysis tools.
Geometry	Element selection, horizontal and vertical geometry tools, and general tools (standards, civil accudraw, etc.).
Site	Element selection and site optimization tools.
Corridors	Element selection, template, corridor, and superelevation modeling tools.

Model Detailing	Element selection, civil cells, and 3D tools (linear template, surface templates, etc.).
Drawing Production	Element selection, clip volume, saved views, tables, notes, text, labels, annotations, and named boundaries(plans production) tools.
Drawing	Commonly used MicroStation drawing tools.
Utilities	Geographic, item type tools.
Collaborate	Collaboration, clash detection and markup tools.
View	Commonly used view control tools.

1.3 Backstage Functionality

The File tab opens the backstage view where you can set user preferences and change design file-specific settings, manage documents, import and export files, access help, and so on.



The seed and library files in MTO workspace are set to confirm MTO AutoCAD standards. The configuration files contain MTO workspace and workset configuration variables. Caution must be exercised when change the settings for these files.

1.4 File Types

In ORD, all civil data is stored within the DGN file, minimizing or eliminating the use of external files. Surfaces, geometry, corridors, etc. are all stored in DGN files.

The legacy file types such as .dtm, .alg, .ird, etc. used in InRoads/Power InRoads can be imported into ORD.

The InRoads XIN file which contains feature styles, symbologies, annotations, preferences, and other settings is replaced with the MicroStation dgn library file (.dgnlib).

1.5 WorkSpace Configuration

ORD uses MicroStation as its CAD platform. The WorkSpace has been changed and enhanced. The ORD workspace configuration contains resources, configuration files, configuration variables, Workspaces, and WorkSets. This multi-level configuration file structure provides a flexible way to configure the work environment.

A WorkSpace is a container for grouping WorkSets, standard files and associated configuration files that are used for specific projects or disciplines.

Under WorkSpace, there are WorkSets. A WorkSet is a container for grouping project files, associated data, and project specific resources and standards that will supplement the workspace standards.

1.6 Feature Definition

OpenRoads Designer is a feature based design environment. OpenRoads Designer uses feature in design to represent a real world thing that can be seen or located. Feature definition is used to define options when creating features. Feature definitions take the place of **Styles** in SS2 to control how a feature is to be displayed, annotated, and computed.

There are different types of feature definitions in OpenRoads Designer and each has different properties. Below is a list of feature definition types in the roadway modeling:

- Alignment
- Terrain
- Corridor
- Superelevation
- Linear Template
- Surface Template
- Linear
- Point
- Mesh
- Trace Slope
- Aquaplaning
- Sight Visibility

2.0 OpenRoads Designer Workspace Configuration

MTO workspace for OpenRoads Designer contains WorkSets, resources that are used in designs, standards files, and associated configuration files. It was developed based on MTO AutoCAD standards and Power InRoads V8i (SS2) standards. Most of the SS2 styles are brought into ORD, however, many new feature definitions have been created to use the feature and rule based new design environment.

The workspace can be further customized to fit into organization's workspace or modified to meet specific project requirements.

Download MTO's OpenRoads Designer workspace from the following internet address: https://www.xfer.mto.gov.on.ca/

The default location for the workspace is ***C:\MTO ORD Standards***. Modify the configuration file if you have a different location.

2.1 Configuration Files

OpenRoads Designer uses the configuration files and variables to set up the work environment. Configuration file ***WorkSpaceSetup.cfg*** contains variable to specify the workspace location. It is located in the following folder:

C:\ProgramData\Bentley\OpenRoads Designer CE 10.10\Configuration\

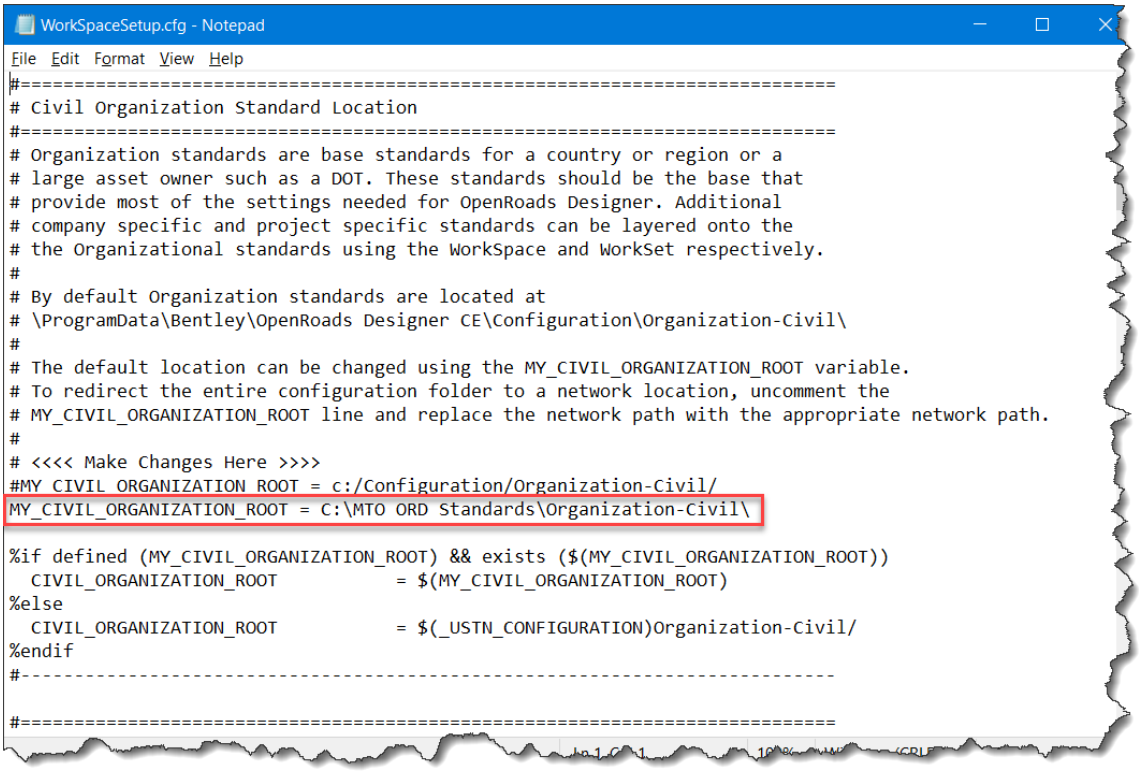
To use MTO ORD configuration from the default location *C:\MTO ORD Standards*, copy the *WorkSpaceSetup.cfg* from the downloaded zip file to above mentioned location.

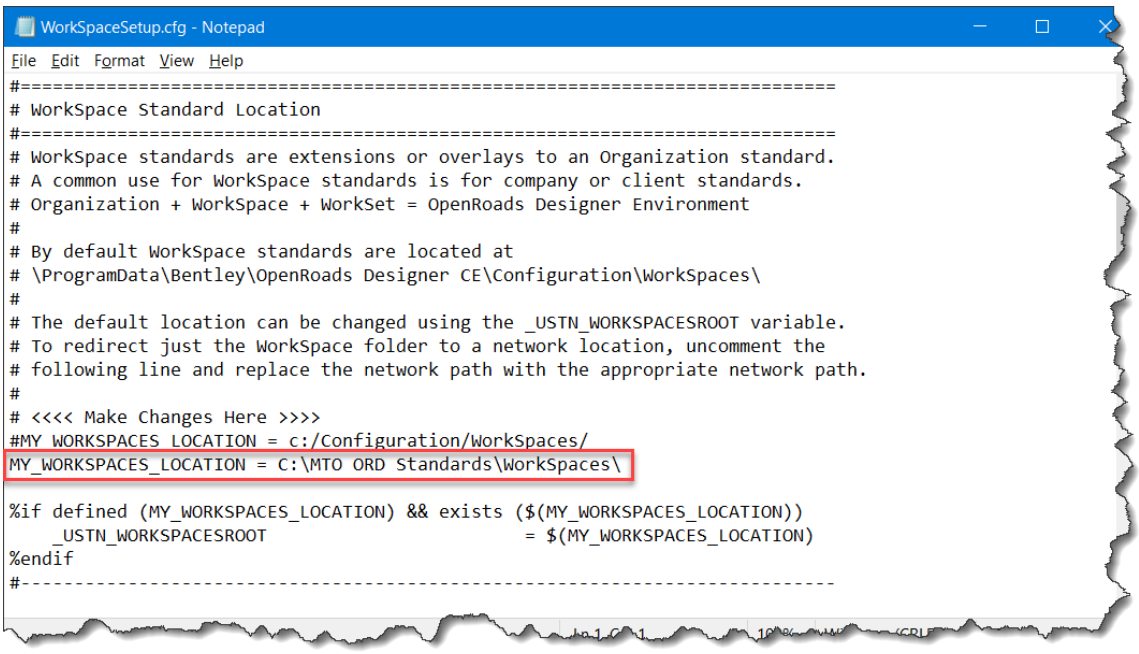
To use the standards from a different location, modify the *WorkSpaceSetup.cfg* file to point to the user selected location.

Open the configuration file with Notepad or other text editor. Modify the following variables with the appropriate path.

MY_CIVIL_ORGANIZATION_ROOT

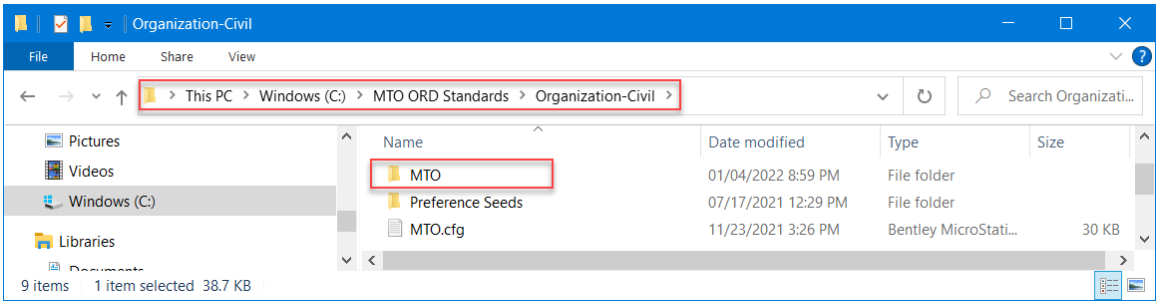
MY_WORKSPACES_LOCATION



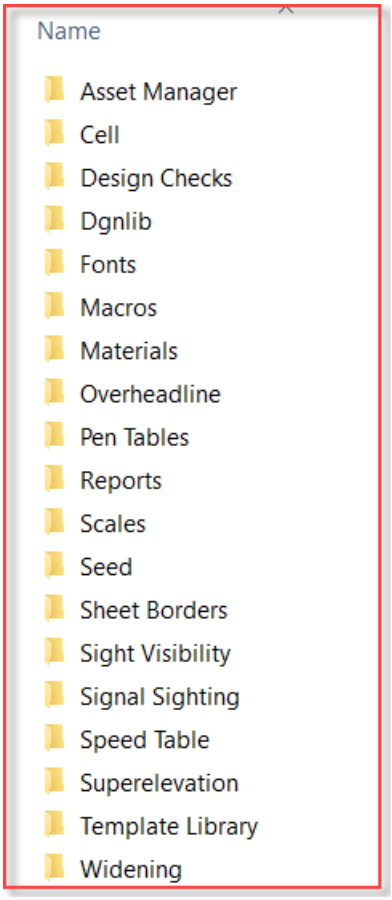


MTO ORD WorkSpace is customized at the organizational level and MTO ORD standard files are located in the following folder:

……\Organization-Civil\MTO\

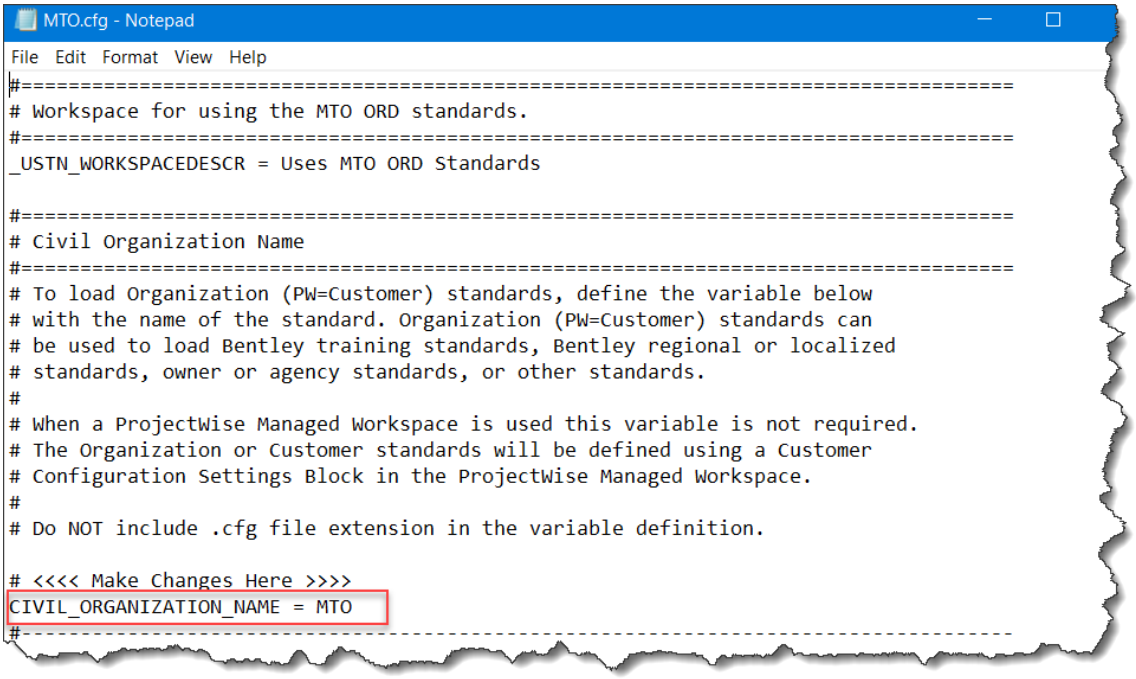


In this folder, there are series folders as shown below. Some of them also contain subfolders.



The default workset loaction for MTO workspace is located at *C:\MTO ORD Standards\WorkSpaces\MTO* (see **WorkSpaceSetup.cfg**).

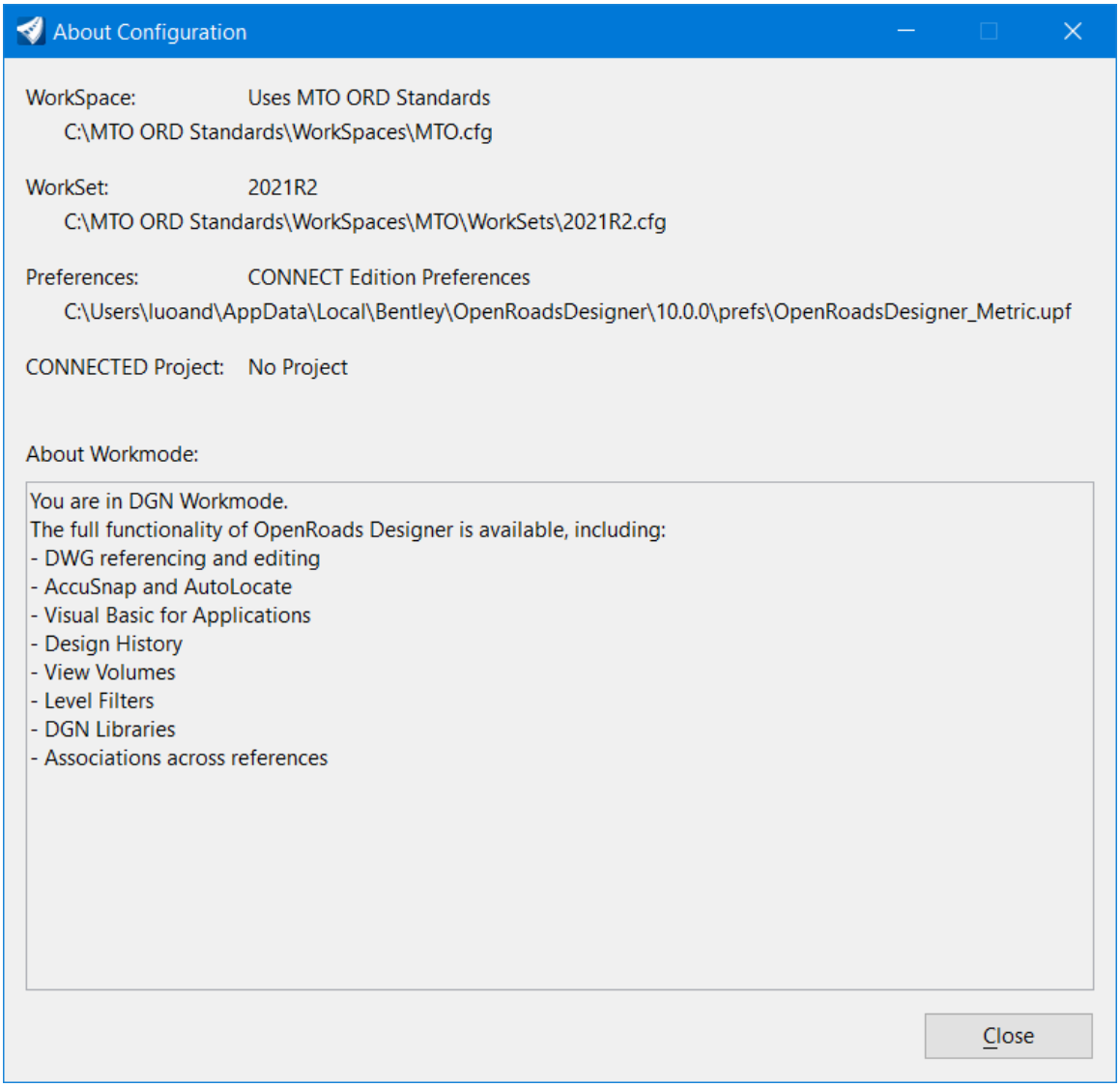
The default workspace configuration file **MTO.cfg** located in the folder *C:\MTO ORD Standards\WorkSpaces* will define which ORD standard (the "*CIVIL_ORGNIZATION_NAME"*) to be loaded for current workspace.



To Find the Location of your Active WorkSpace and WorkSets,

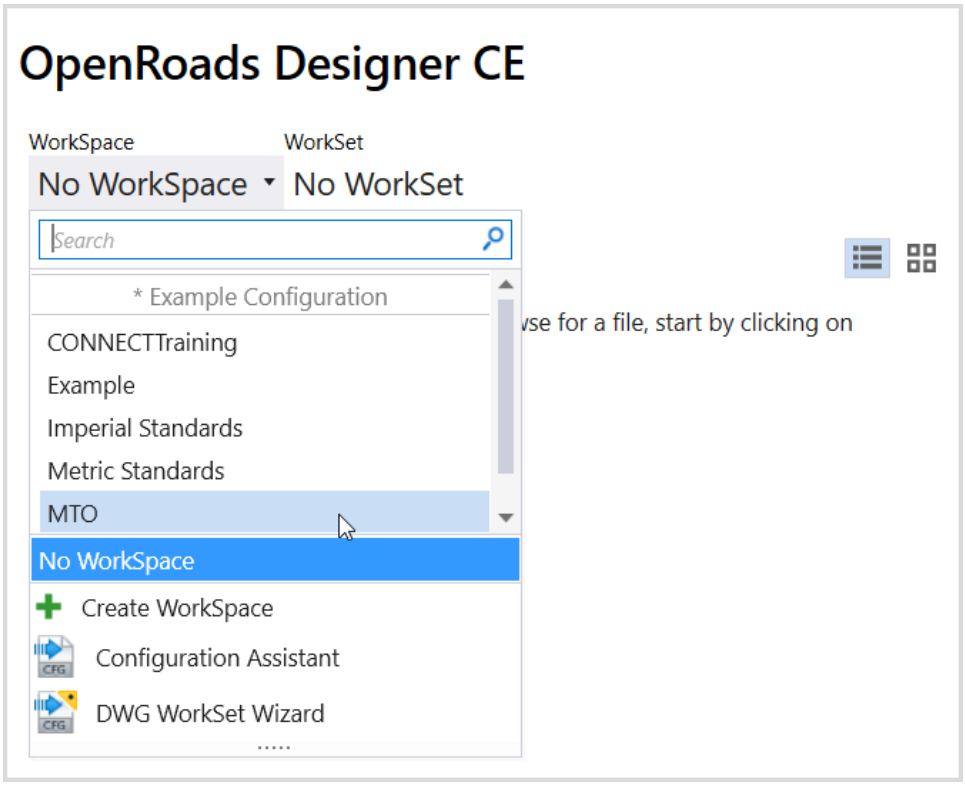
Select **File > Settings > Configuration > About Configuration**.

The ***About Configuration*** window opens, displaying information about the active WorkSpace and its components.

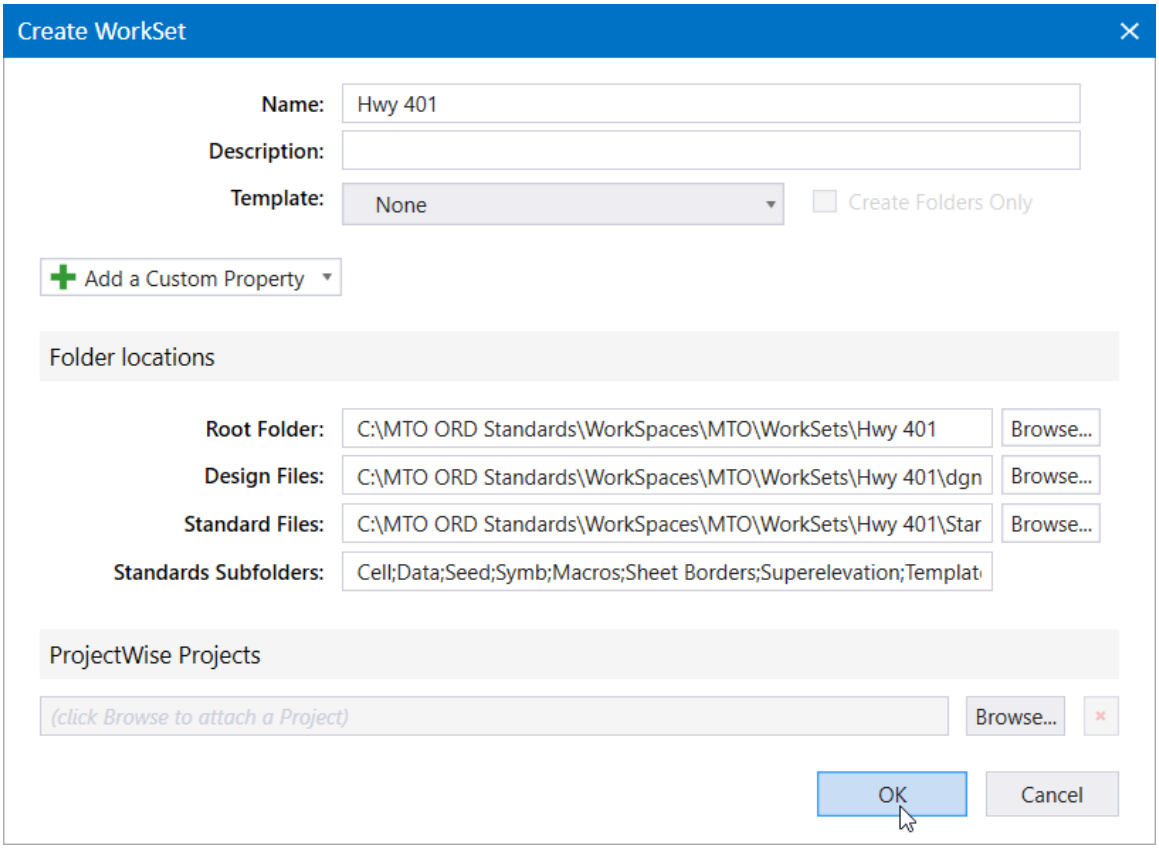


2.2 WorkSpace and WorkSet

The MTO workspace is accessed from the OpenRoads Designer menu as shown below:

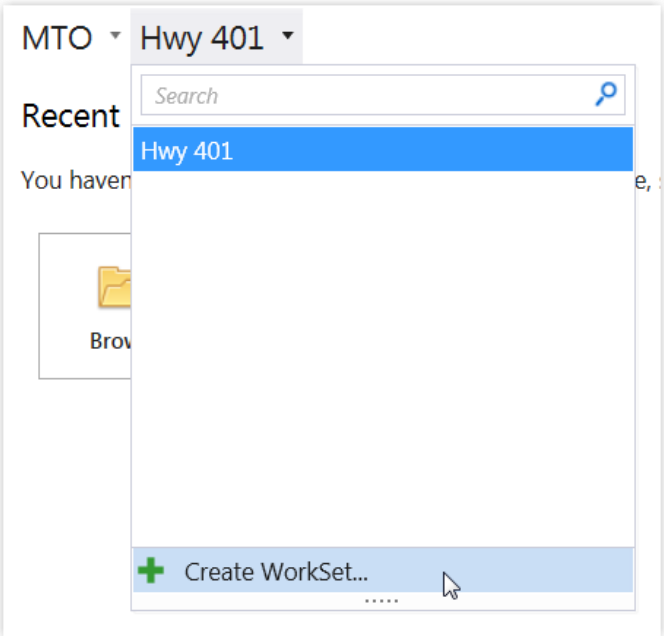


After selecting the WorkSpace, click on the **Create a WorkSet** button to create a new WorkSet.



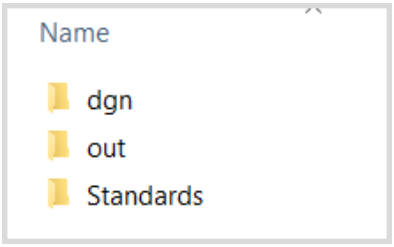
Once the WorkSet has been created, it will appear on the WorkSet list.

If there are worksets in the current workspace, select a Workset from the list or use the **Create WorkSet** command on the bottom of the WorkSet list to create a new Workset.



2.3 Project Folder

By default, the project folder (the workset) has a simple file folder structure, one for design files, one for design outputs, and one for the project specific standards.



Additional folders may be created to organize files in disciplines or categories such as survey, structure, drainage, terrain, geometry, superelevation, corridors, reports, sheets, etc. especially when work on large, complex projects.

2.4 Seed Files

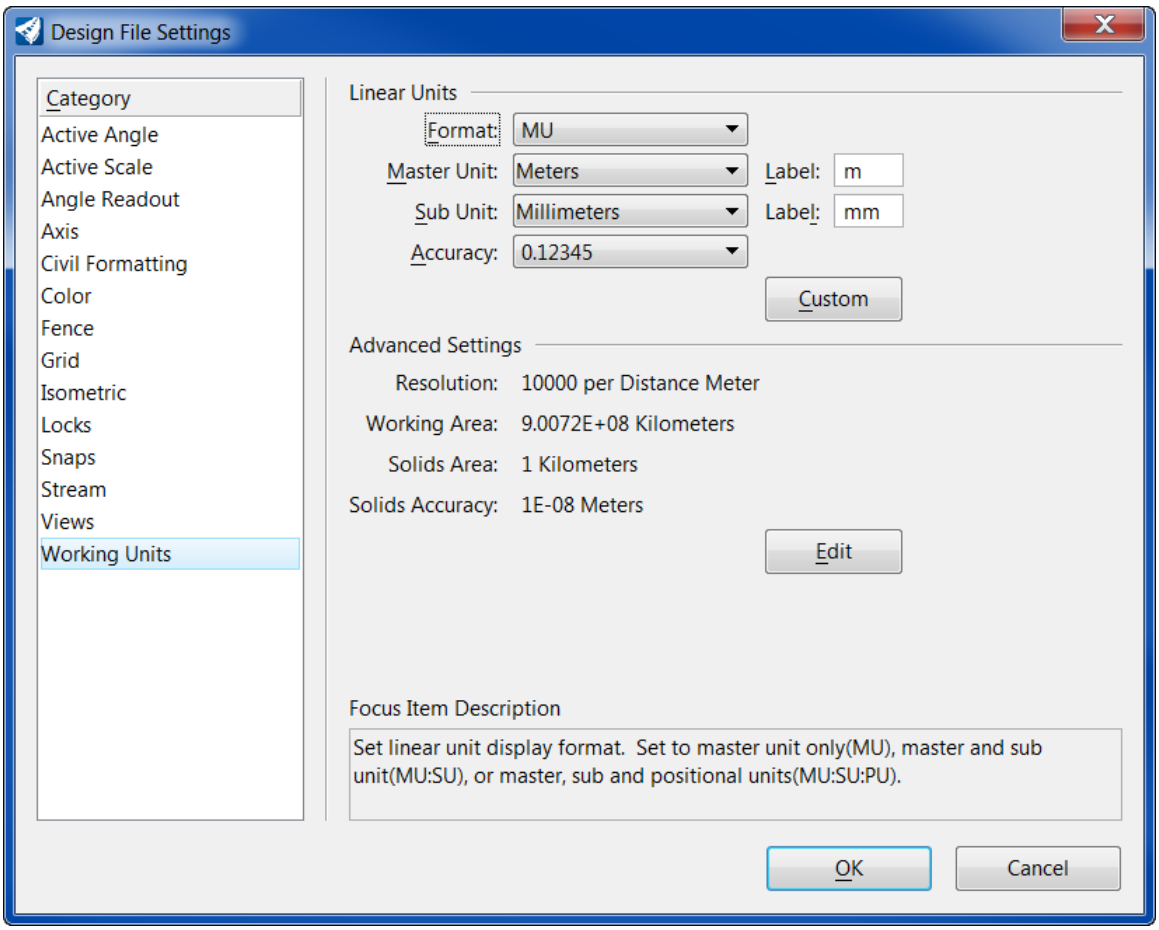
In order to use the full functionality of OpenRoads Designer, DGN design files are required. Seed files are templates used to create DGN files. They contain settings and configurations. According to MTO CAD standards, two seed files ***MTO_Seed2D Design.dgn*** and ***MTO_Seed3D Design.dgn*** are provided in the following folder:

……\Organization-Civil\MTO\Seed\

These seed files are set to use the standard AutoCAD color table. This is in consistence with MTO CAD standards and provides the consistency in graphic display, file sharing and plotting.

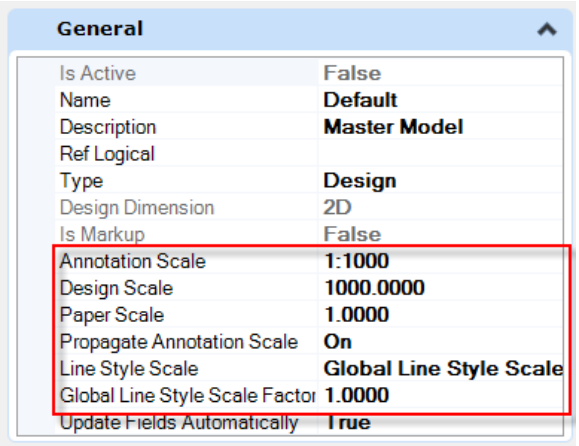
Generally, the 3D seed file is only needed for survey and terrain workflows.

MTO uses metric units for highway design. The working units are defined in the seed files as shown below.



MTO custom line styles are defined from MTO CAD standards (IESCAD). They are created at a scale of 1:1 for drafting at a scale of 1:1000 (1 drawing unit = 1m).

The Line Style Scale settings are shown as below.



2.5 Levels

The following groups of levels based on MTO AutoCAD Standards (IESCAD) are included in ORD library:

*Planning and Design (PD - *)*

*Surveys and Plans (SP - *)*

*Photogrammetry (PH - *)*

*Structural Design (ST - *)*

*Traffic (TR - *)*

Additional levels are defined for element templates, feature symbologies, feature definitions, and ORD specific features or functions.

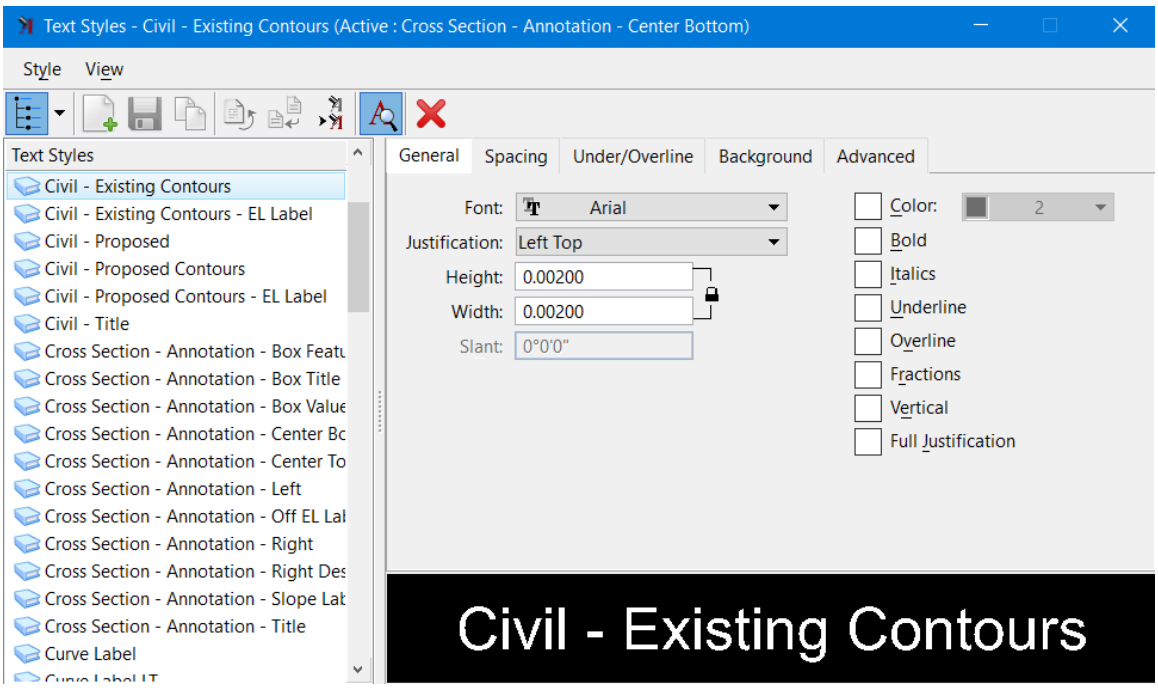
2.6 Fonts & Text Styles

The text styles, text favorites are defined in **MTO_Text Favorites_Text Styles_Dimension Styles.dgnlib** in the folder:

……\Organization-Civil\MTO\Dgnlib\Feature Definitions\

All text styles in MTO workspace use standard true type font **Arial**.

Standard text sizes (heights) have been defined. The following sizes are used: 0.0001, 0.0005, 0.001, 0.002, 0.0025, 0.003, 0.004 & 0.005.



3.0 Feature Definition DGN Library

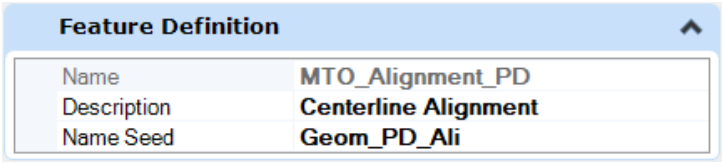
Feature Definitions, Feature Symbologies, Annotation Definitions & Groups, levels and Element Templates are provided in the dgn library **MTO_Features_Annotations_Levels_ElemTemp.dgnlib** in the folder:

……\Organization-Civil\MTO\Dgnlib\Feature Definitions\

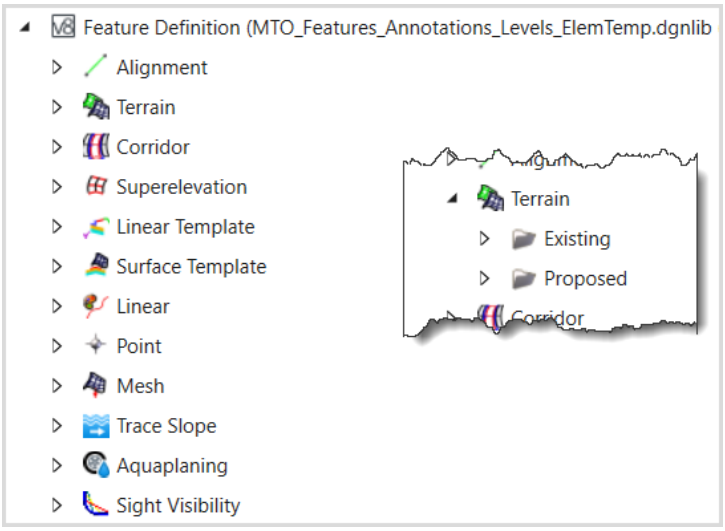
3.1 Feature Definitions

Feature Definitions are used to control symbology, annotation, and various other properties that are applied to the geometric elements. A Feature Definition defines what an item is and links to Feature Symbology to define how the item is displayed.

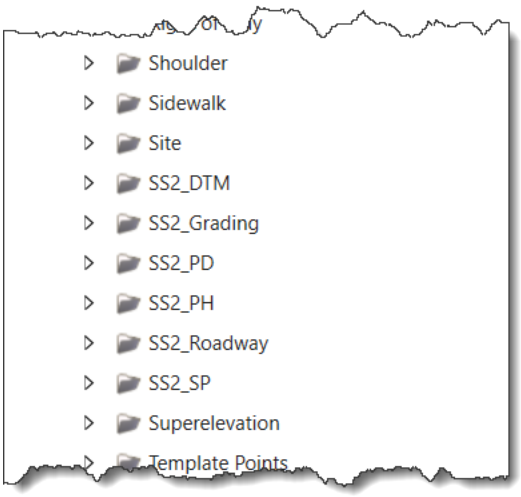
Each feature definition type has different properties but has three in common: **Name**, **Description** and **Name Seed**.



MTO ORD feature definitions are based on MTO AutoCAD Standards Guide and MTO InRoads Preference and Standards (SS2). The feature definitions are defined with specific names and organized into categories according to the element type. Some categories are further grouped into subcategories.

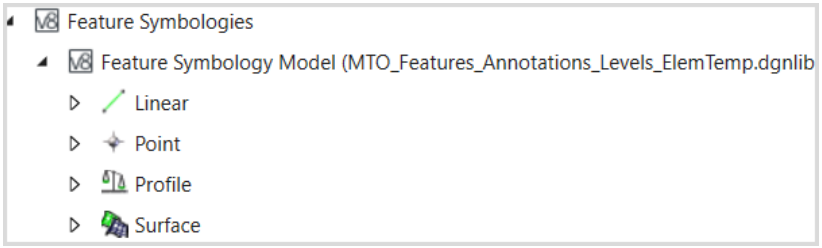


Feature definitions corresponding to the SS2 styles that are named with the IESCAD layer names in Planning and Design, Photogrammetry, Surveys and Plans sections, and SS2 specific styles are defined and organized under subcategories with a prefix SS2 in the category name. These feature definitions can be used to help to import SS2 projects.

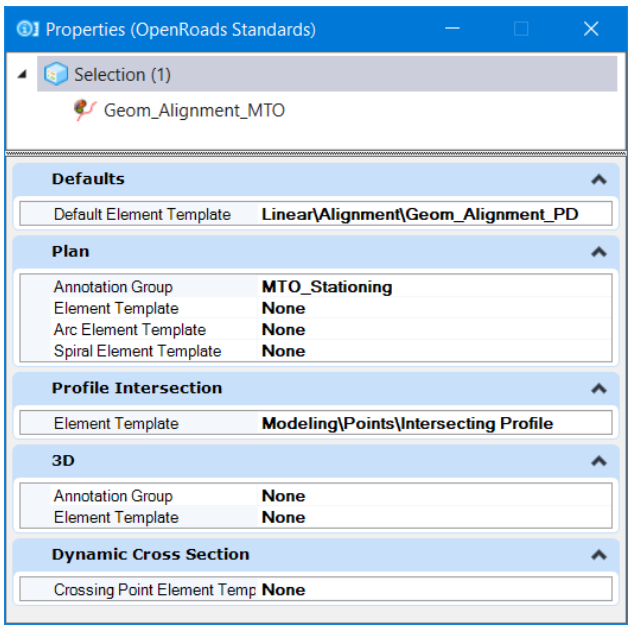


3.2 Feature Symbologies

Feature Symbologies are used to define how the items are displayed. There are four categories are supported including Linear, Point, Profile and Surface with subcategories similar to the Feature Definitions. Each of these categories has different parameters.



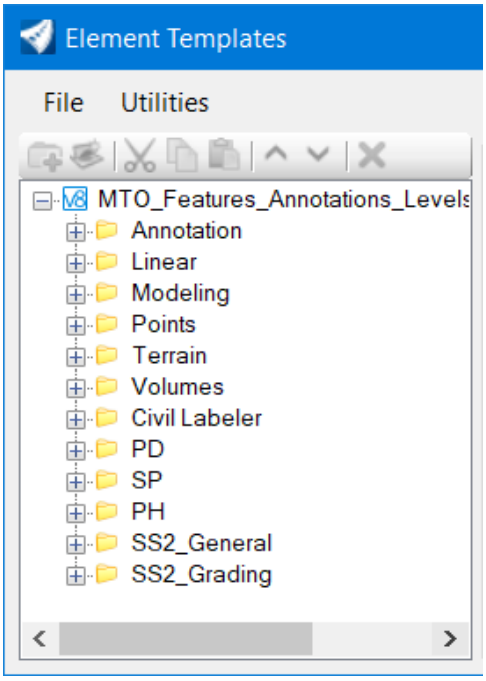
Feature Symbologies refer to Element Templates and Annotation Group when required for detailed display setting.



Both Feature Definitions and Feature Symbologies are accessed through the **OpenRoads Standards** tab on ***Explorer*** dialog.

3.3 Element Templates

Element Templates define properties of elements. An element template has a set of properties (level, color, line style, line weight, text style, material etc.) that can be preconfigured for element placement or applied to existing elements. ORD Element Templates are used to set up the symbologies, define detailed display settings for both MicroStation elements and civil features. The Element Templates can be accessed through **Home > Attributes**:

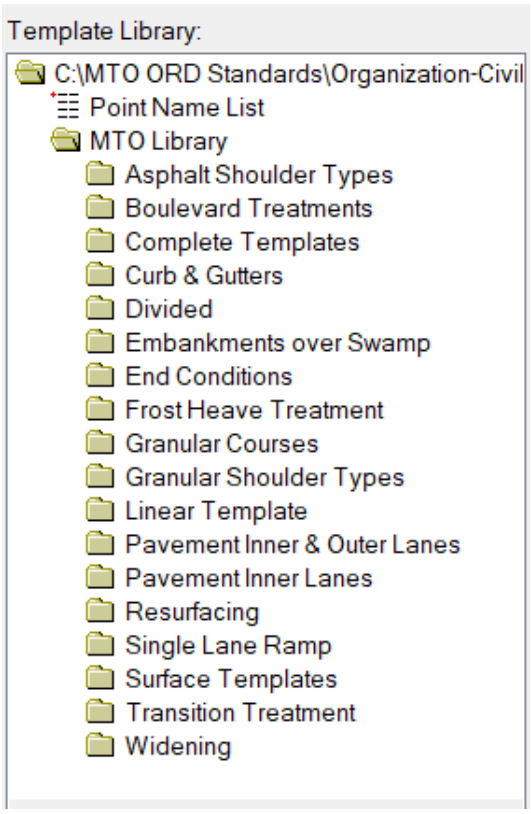


4.0 Template Library

MTO standard template library **MTO_STD_Templates.itl** is located in the following folder:

……\Organization-Civil\MTO\Template Library\

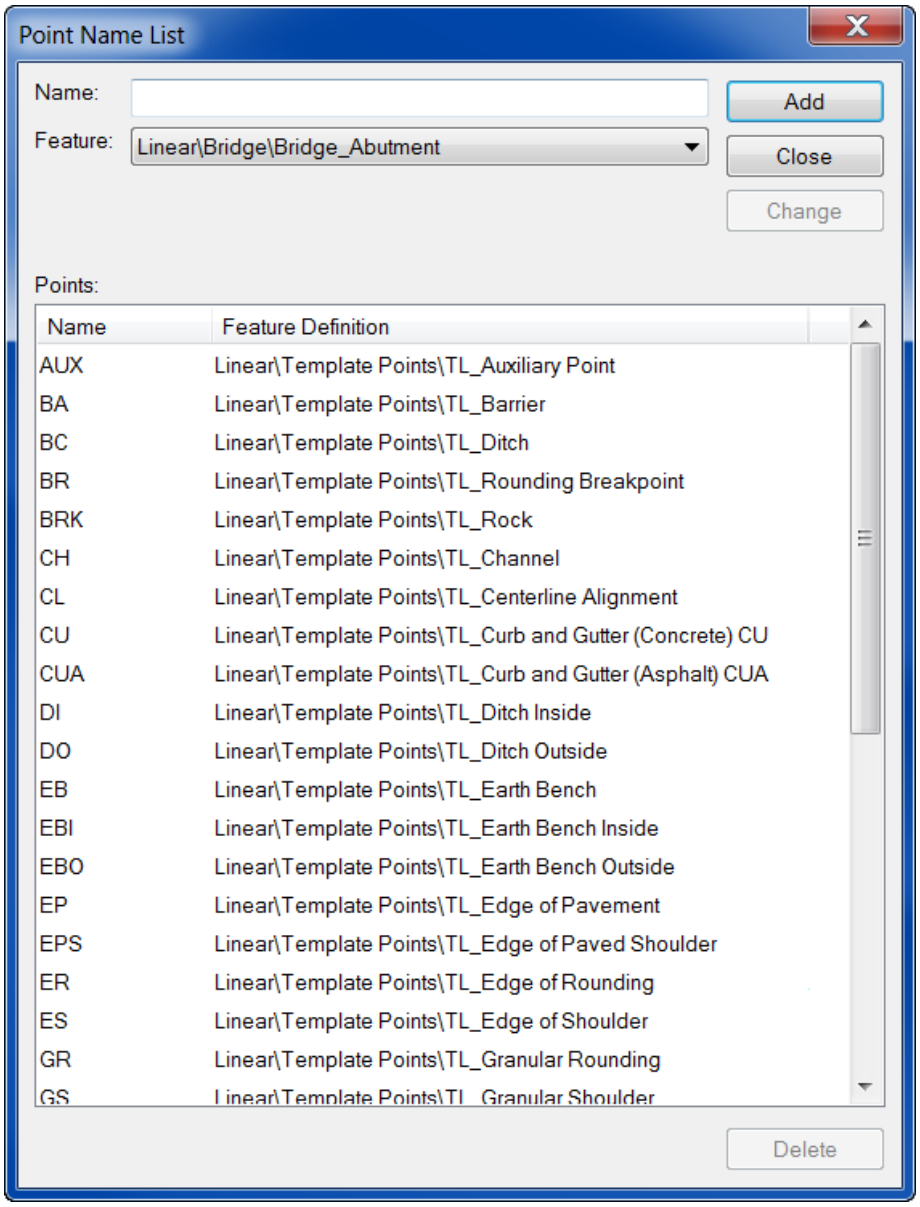
This library contains typical section templates, linear templates, surface templates, components and end conditions with predefined point names that are associated with MTO OpenRoads Designer standard feature definitions. It can be used to facilitate the creation of new components/templates on any project library.



4.1 Point Name List

The standard template library contains a predefined point name list where point names are assigned feature definitions defined in dgn library:

MTO_Features_Annotations_Levels_ElemTemp.dgnlib



Employ the standard **Point Name List** and supplement as needed before creating project templates. Apply prefix, suffix and layer identifier to the point names and keep the points linked to predefined feature styles.

4.2 Point Naming Convention:

1. The first component will identify which side of the centerline which needs to be set up using template options when creating templates.
2. The second component will indicate the layer/surface.
3. The third component will be the point feature name.

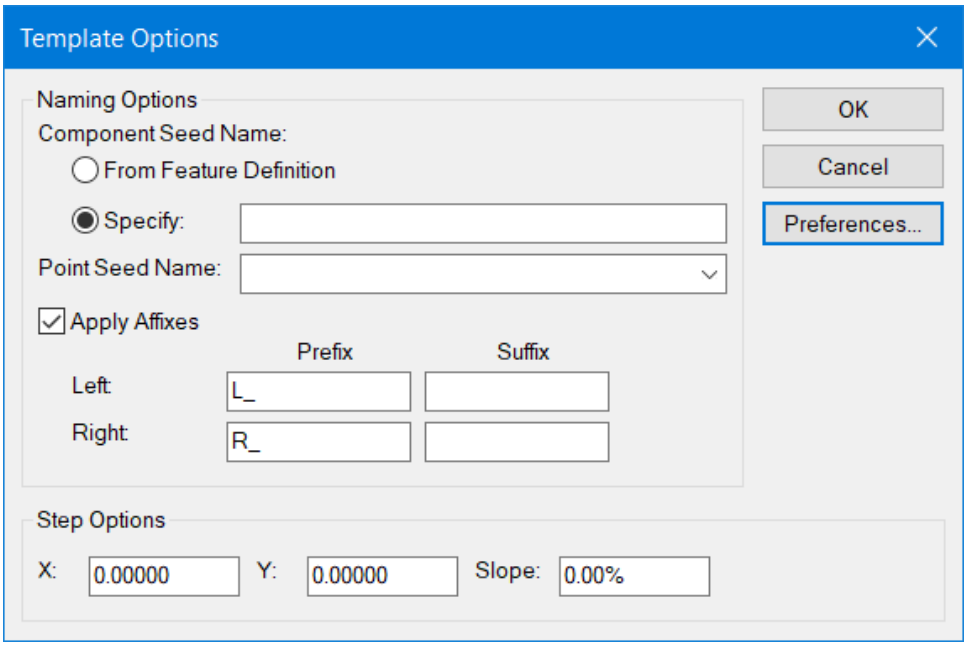
Example: for point edge of pavement, L_TP-EP, L_TA-EP, and L_TB-EP.

Where:

L	identifies left of centerline.
TP, TA or TB	identifies the layer and/or surface.
EP	identifies the point feature name.

4.3 Template Options

The template options have been set to "**Apply Affixes**" for default preference **MTO**. The affixes are prefixes L_ and R_. The affixes will be applied to point and component names when the components are placed or created in the template.



For more complicated templates, suffixes can also be added to the point names.

4.4 Parametric Constraints

Parametric constraints can be used to change one or more labeled constraint values of a template while the template is being processed in the corridor modeling. This allows designers to use only one template to handle a number of different conditions. When use **Parametric Constraints**, designers should consider the constraint types and the design features to assign descriptive names for the labels.

Typical label names are combinations of abbreviations such as:

Constraint Types:

Width	Horizontal Constraint
Depth/Thickness/Height	Vertical Constraint
Slope/Slp	Slope Constraint

Design Features:

Rdwy	Roadway
Shld	Shoulder
SW	Sidewalk
Lane	Travel Lane
Blvd	Boulevard
Pavt	Pavement
Drive	Driveway
Curb	Curb
Ditch	Ditch
Median	Median

Material/Surface Layer

Asph	Asphalt
Conc	Concrete
GranA	Granular A
GranB	Granular B
Sand	Sand
WC	Wearing Course
BC	Binder Course
Base	Base Course
SG	Subgrade

Suffix

Lt	Left
Rt	Right

Some Example Labels:

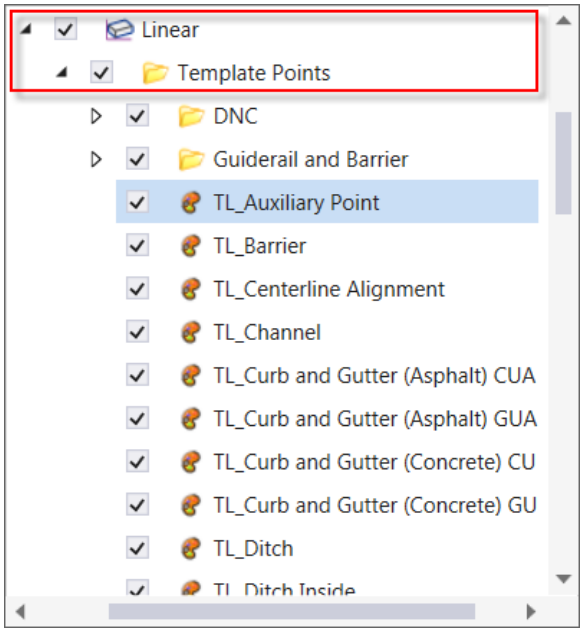
Lt_Shld_Asph_Depth	Left Shoulder Asphalt Depth
Rt_Shld_Slp	Right Shoulder Slope
Rt_Pavt_Width	Right Pavement Width
GranA_Depth	Granular A Depth

4.5 Feature Definitions

Feature definitions defined in ORD Standards dgn library are to be applied to the points, components.

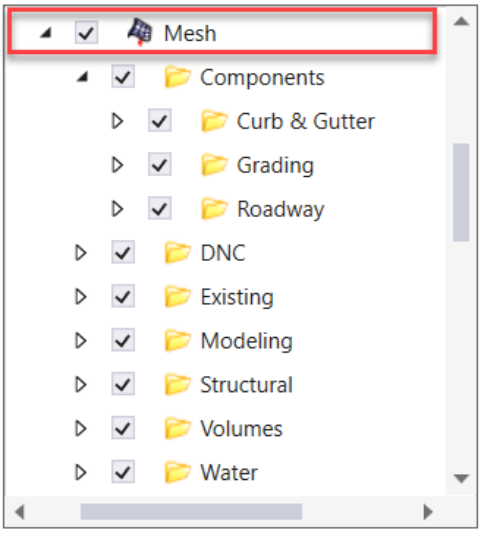
The feature definitions for points can be found under folder:

…… Linear\Template Points\



The feature definitions for components can be found under folder:

…… Mesh\



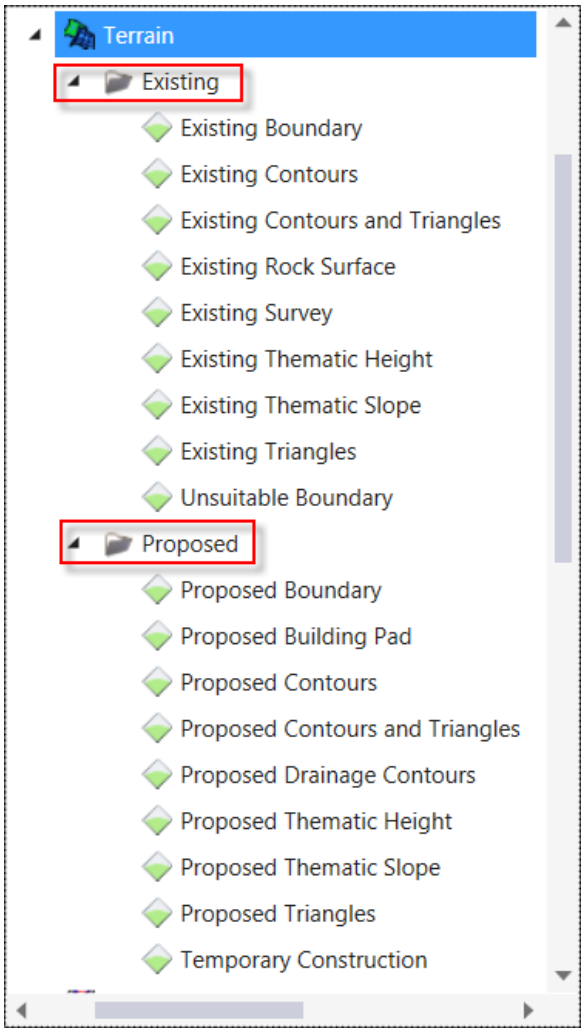
5.0 Terrain

Terrain model (similar to InRoads surface) is a three-dimensional DGN element defined by points, breaklines, voids, holes, contours to model a surface on the earth. Terrain model is stored in 3D design (dgn) file similar to InRoads DTM file.

A boundary is used to constrain the external boundary of the terrain model. No triangles are created outside the boundary.

5.1 Terrain Feature Definitions

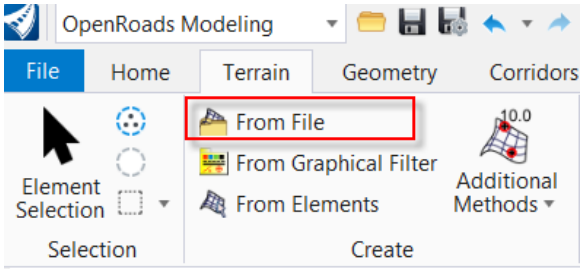
The display of a terrain model is controlled by feature definition and its associated feature symbology and element template. Both Existing and Proposed terrain features definitions are defined in the workspace.



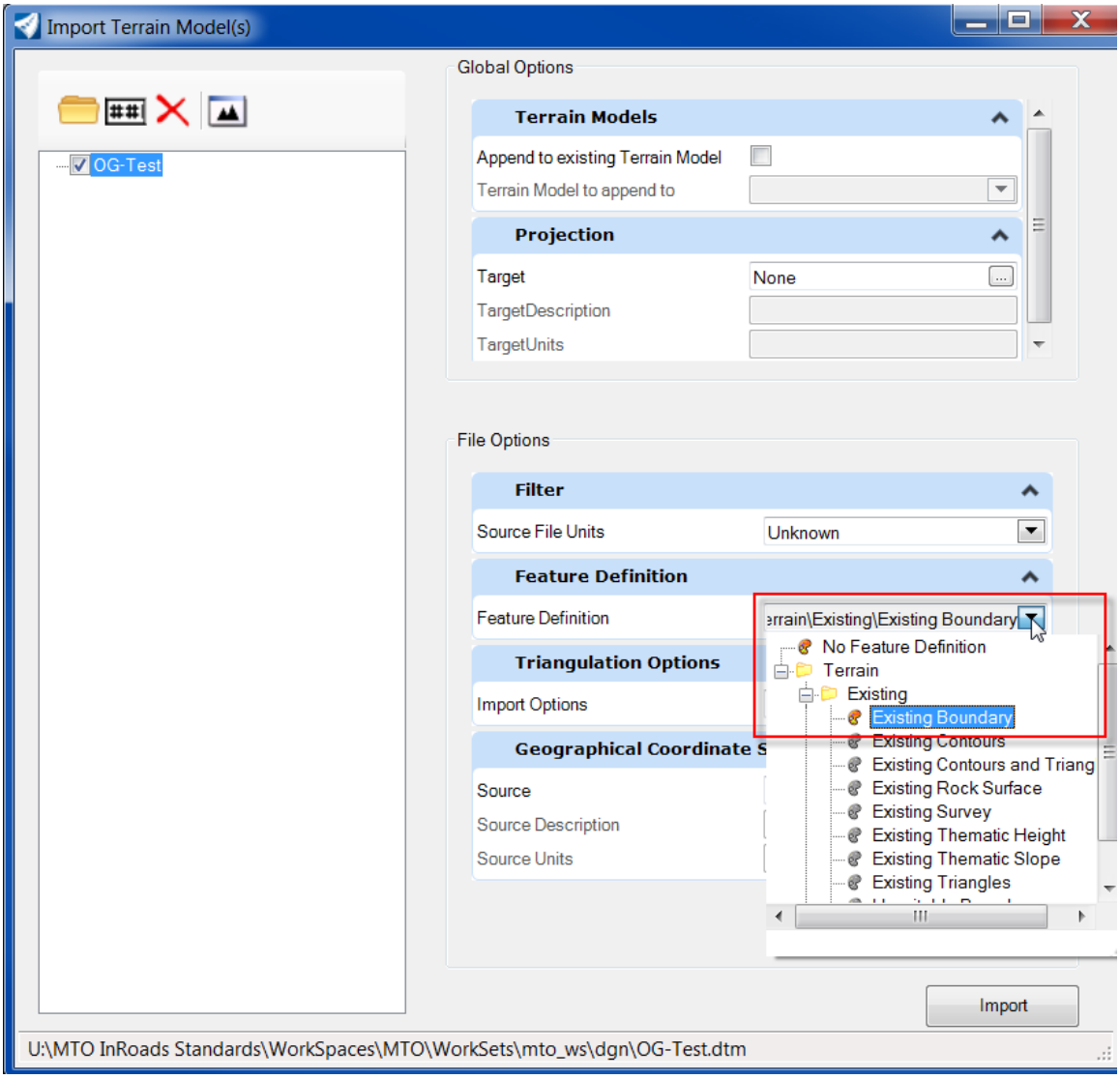
5.2 Import Terrain from DTM Files

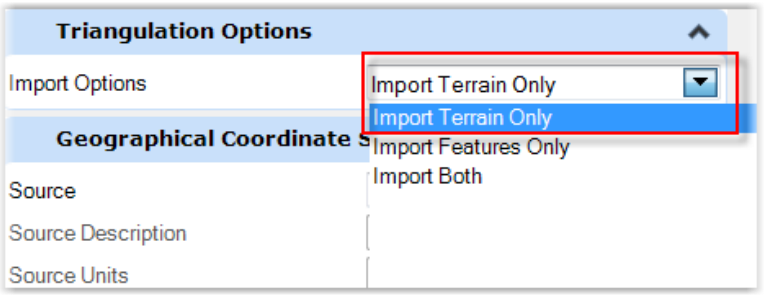
Existing Terrain Model can be created from the digital terrain model (DTM) provided by survey. ORD supports the following file types:

Create a design file with the 3D seed file. Select **From File** command from the ***Terrain*** tab ***Create*** group on the OpenRoads Modeling workflow ribbon.

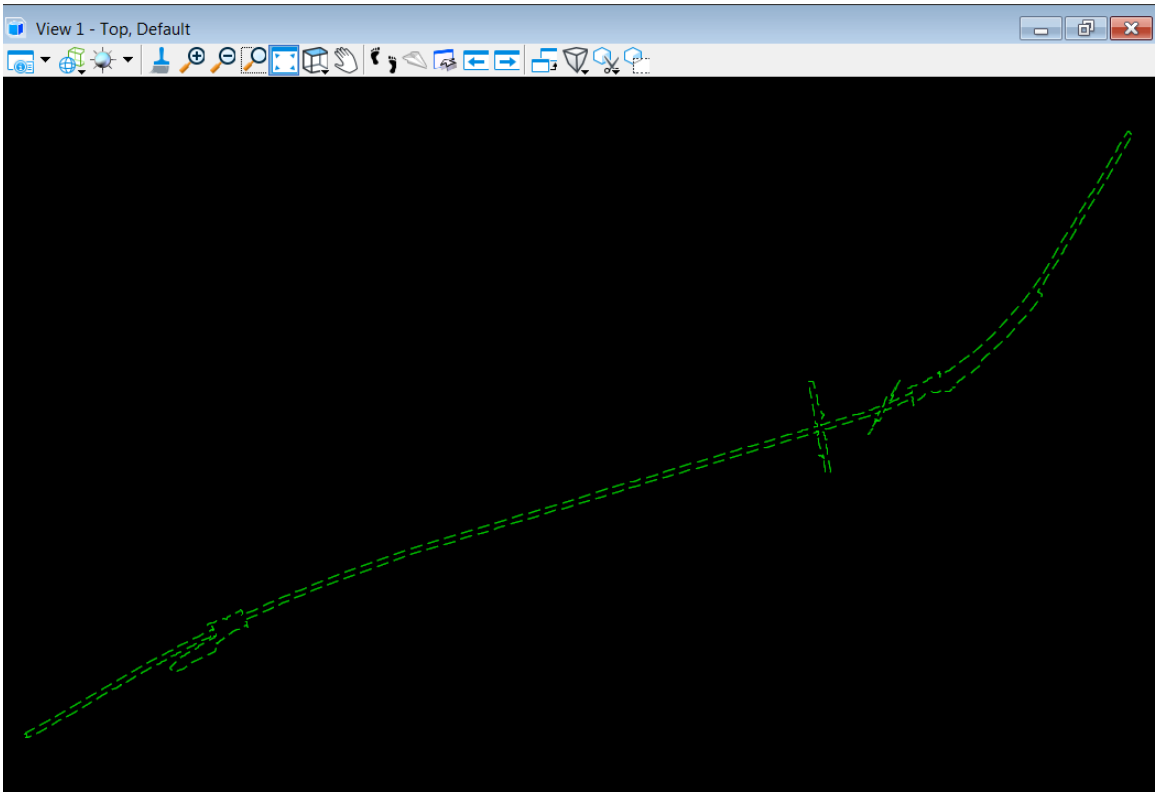


On the ***Select Files To Import*** dialog, browse to the location where the DTM file located. Select the file and confirm. The ***Import Terrain Model(s)*** dialog will appear. Set the ***Feature Definition*** to **Terrain\Existing\Existing Boundary** and set the ***Import Options*** to **Import Terrain Only**.





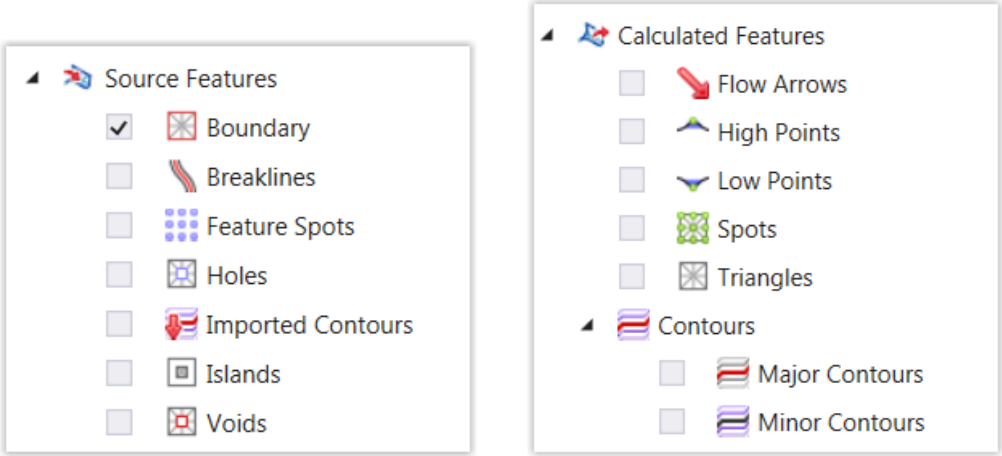
Select **Import** to start the process. Use the **Fit View** tool on the ***Import Terrain Model(s)*** dialog or the active view's quick access toolbar to place the entire terrain model within the active view.



5.3 Display Terrain (Model) Data

Terrain model contains both Source Features and Calculated Features. Source Features include the data used to create the terrain model, such as boundary, points and breaklines. Calculated Features are items that are calculated from the data in the terrain model, such as triangles, contours, and high/low points.

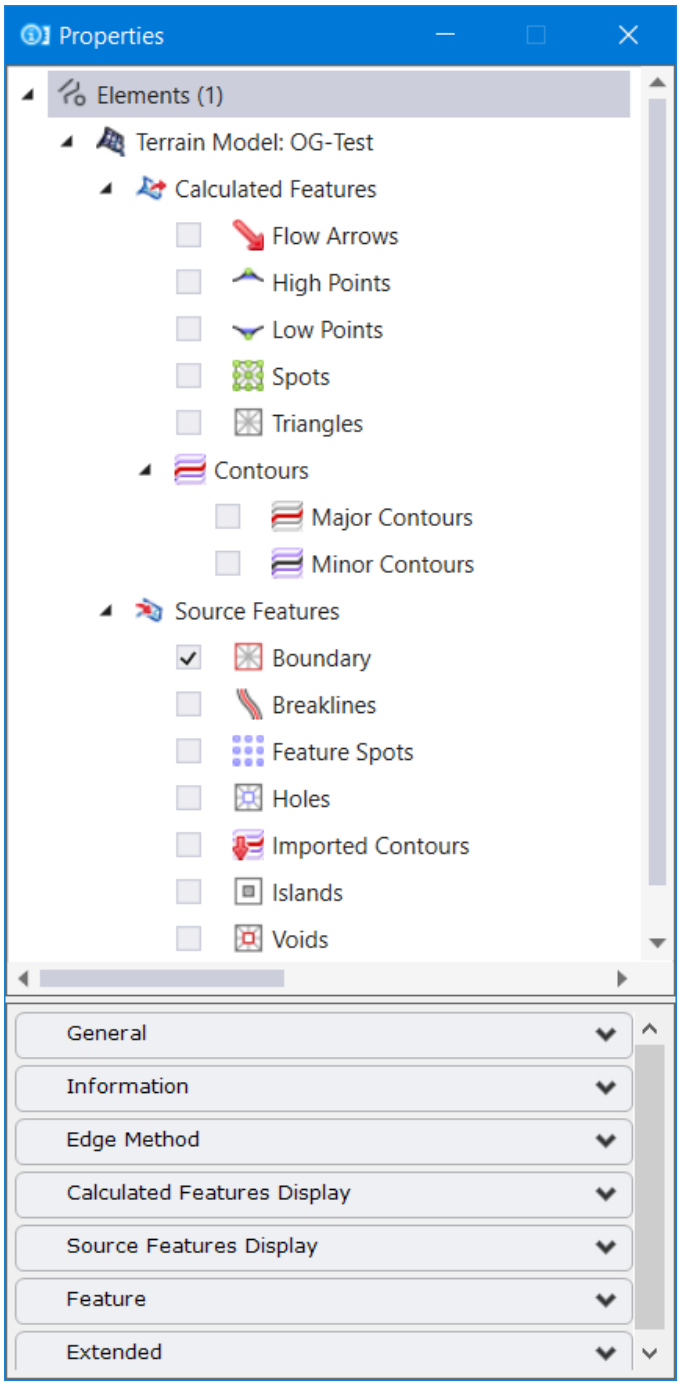
The display of a terrain model can be controlled by using feature definition or individual parameter setting.

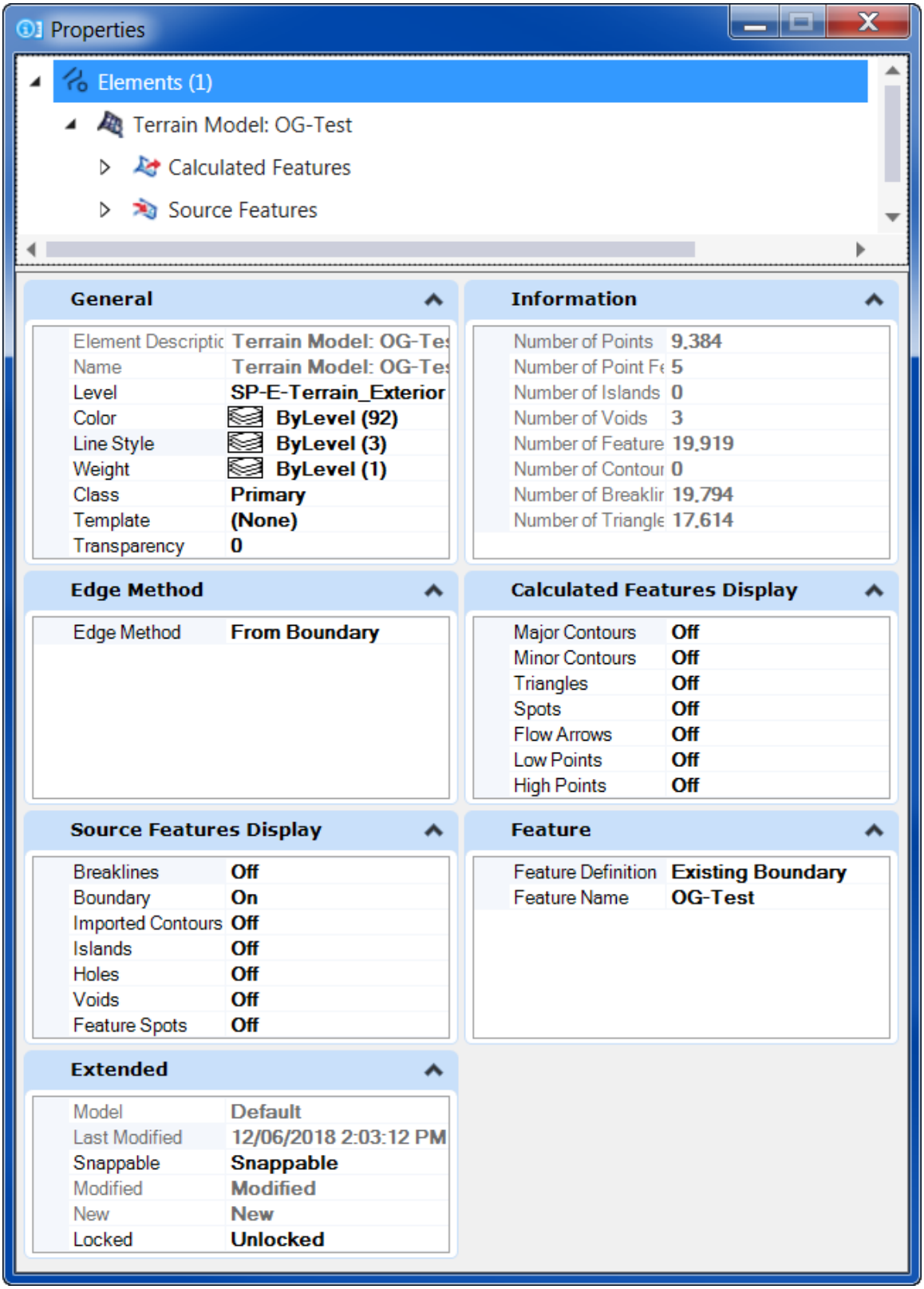


Terrain Properties

Select **Home > Primary** > **Properties** to open the ***Properties*** dialog. Use the Element Selection tool to select the terrain model to display the properties in the dialog.

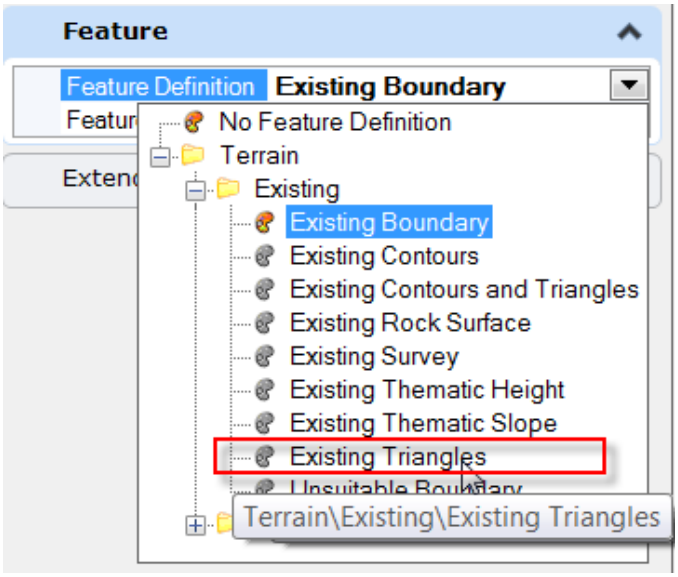
Toggle on and off features or change the parameter values on the dialog will change the terrain display.



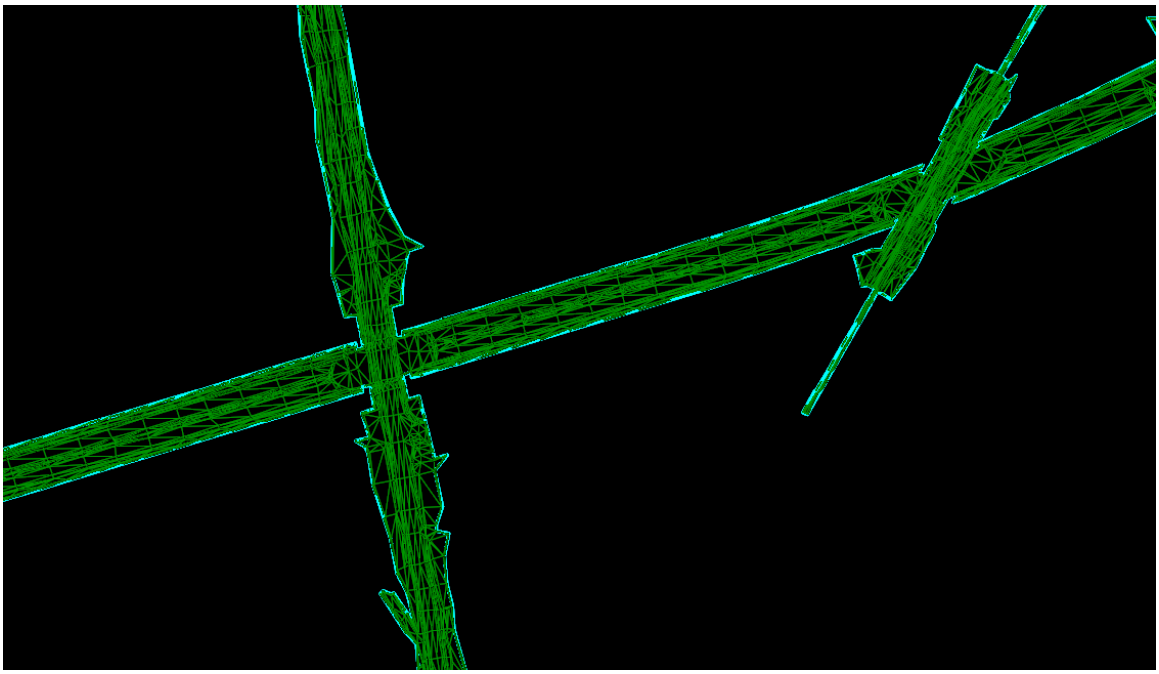


Change Feature Definition

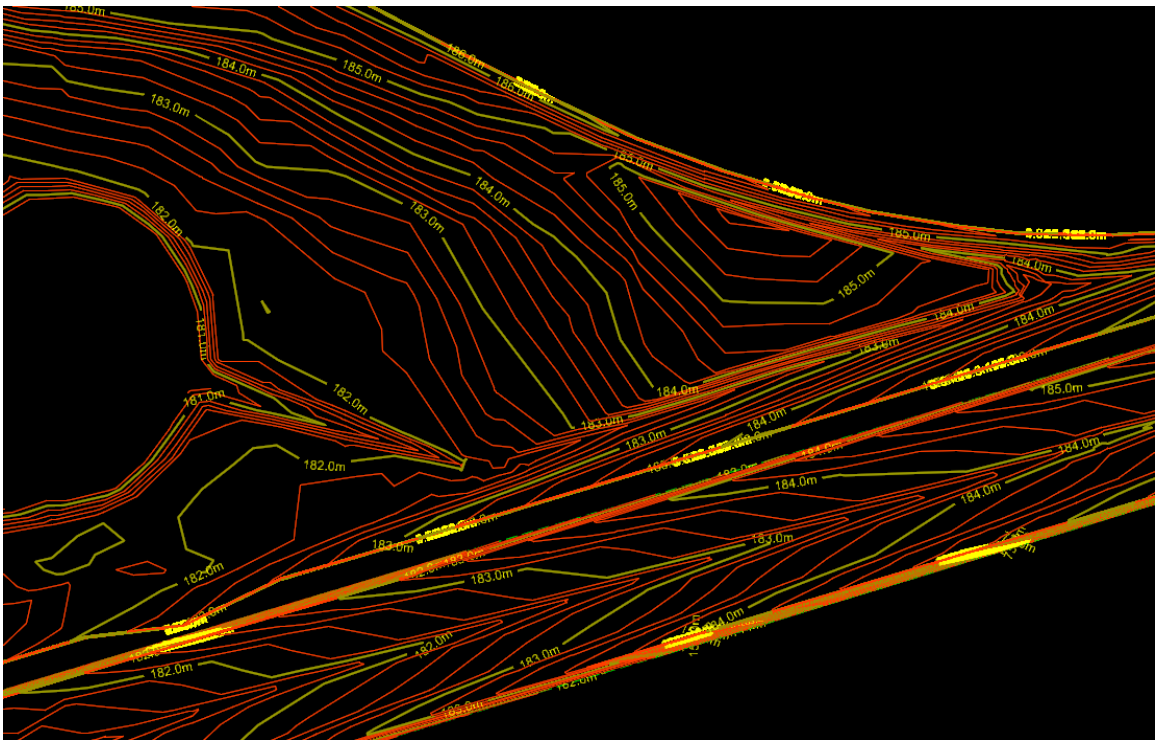
Using the feature definition is a quick way to change the display of a terrain model with a set of predefined parameters.

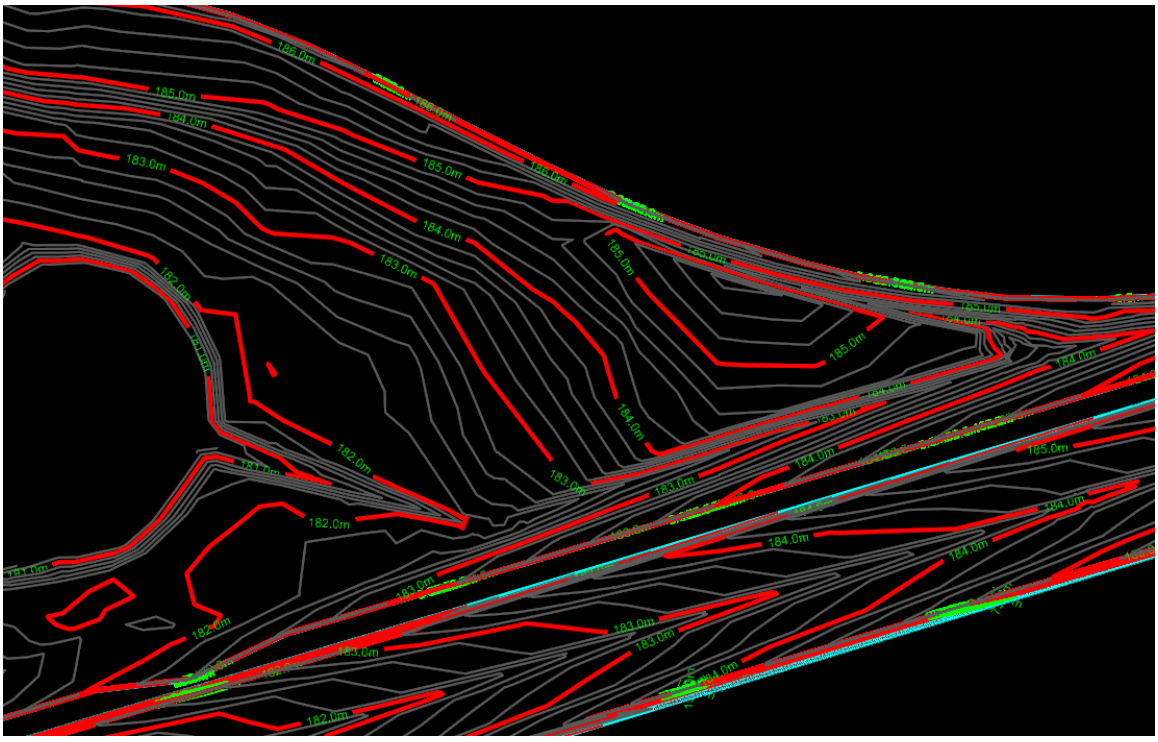


Shown below is terrain displayed with **Existing Triangles**.



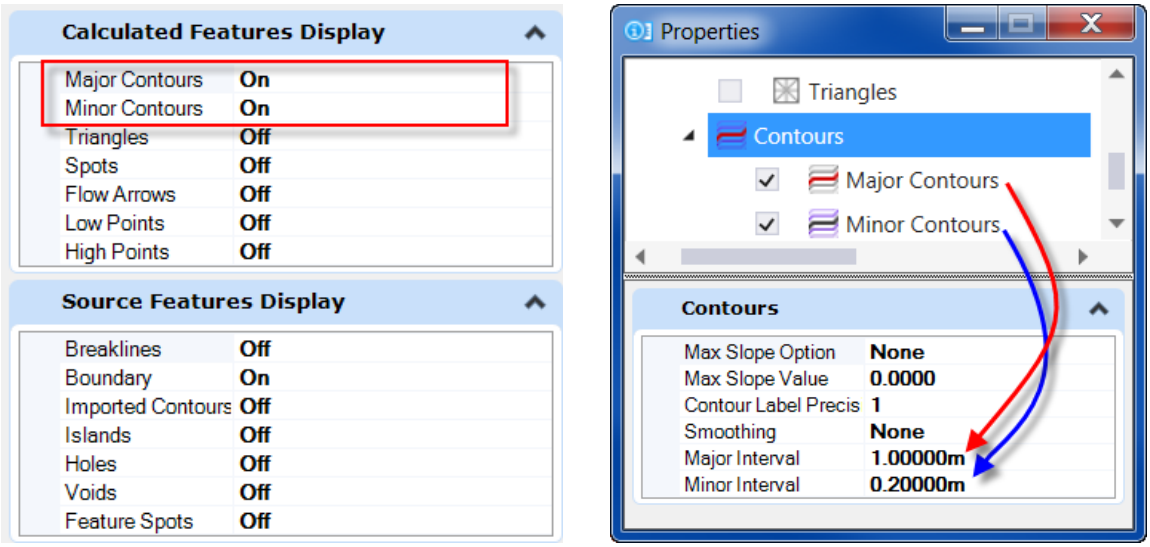
Shown below are terrain displayed with **Existing Contours** and **Proposed Contours**.





Change Individual Setting

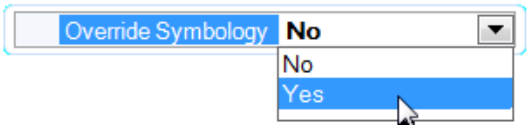
Turn on and off the features or change the parameters to control the terrain display.



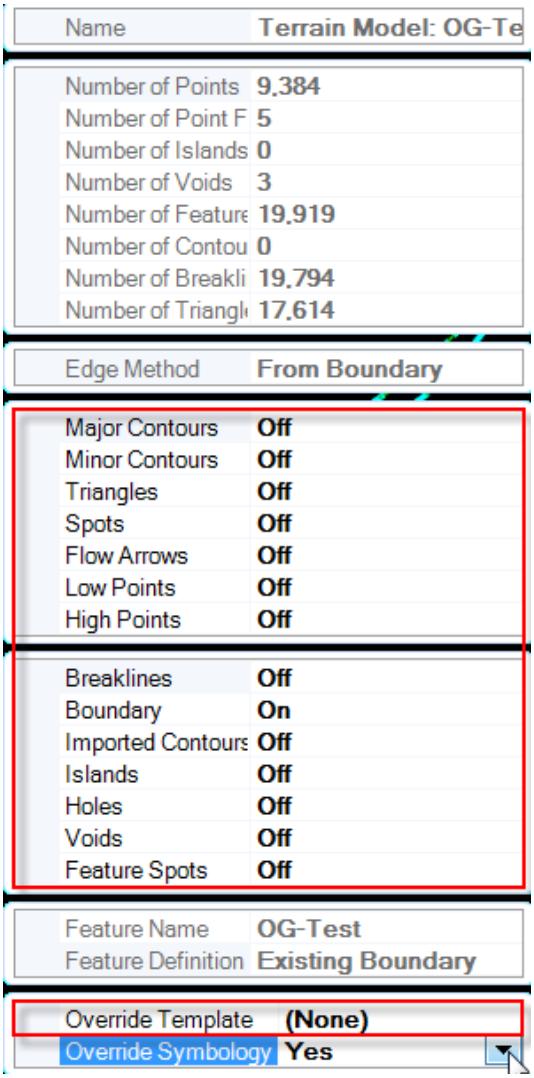
5.4 Modify the Display of Referenced Terrain Model

In OpenRoads Designer common workflow, the terrain models are stored in 3D design files and referenced into the design or project 2D files. The referenced terrain model allows the override of symbology and element templates to change the display of the terrain model without modifying the source file.

Use the **Element Selection** tool to select the referenced terrain model to open the ***Properties*** dialog and display the properties in the dialog. Set the ***Override Symbology*** option to **Yes**.



The ***Calculated Features Display, Source Features Display and the Element Templates*** fields are now accessible, and the display of the terrain model can be changed as in a 3D terrain model file.


Name
Terrain Model: OG-Te
Number of Points
9,384
Number of Point F
5
Number of Islands
0
Number of Voids
3
Number of Feature
19,919
Number of Contou
0
Number of Breakli
19,794
Number of Triangl
17,614
Edge Method
From Boundary
Major Contours
Off
Minor Contours
Off
Triangles
Off
Spots
Off
Flow Arrows
Off
Low Points
Off
High Points
Off
Breaklines
Off
Boundary
On
Imported Contours
Off
Islands
Off
Holes
Off
Voids
Off
Feature Spots
Off
Feature Name
OG-Test
Feature Definition
Existing Boundary
Override Template
(None)
Override Symbology
Yes

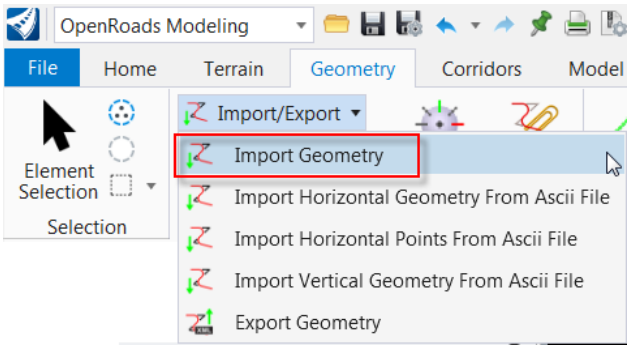
6.0 Geometry

OpenRoads Designer stores all geometric data directly in the dgn file. Civil geometry tools are provided for creating, importing and exporting, manipulating, and modifying the civil geometry. MicroStation Manipulate tools are disabled for civil elements.

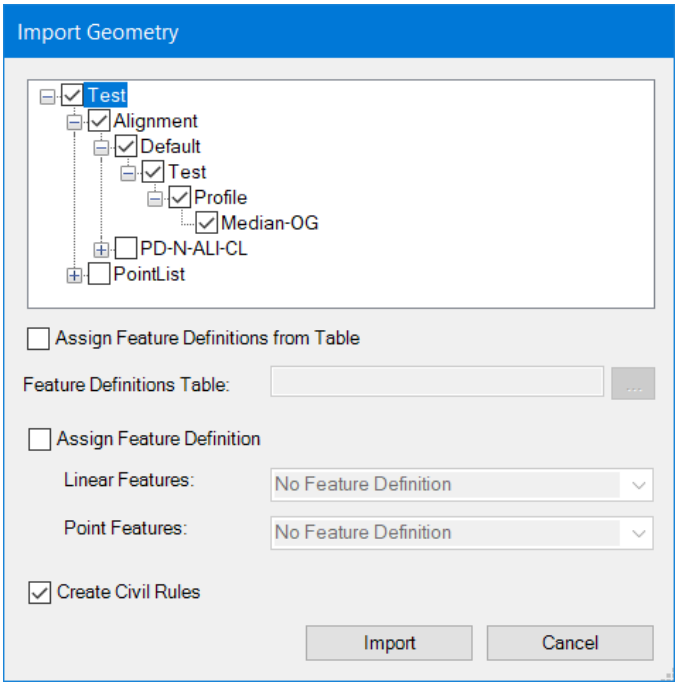
6.1 Import/Export Geometry

OpenRoads Designer provides tools to import geometry from or export to native products (InRoads, GEOPAK and MX). The *Import Geometry* tool is used to import InRoads ALG files.

Create a design file with the 2D seed file. Select **Import Geometry** command from the ***Geometry*** tab ***General Tools*** group on the OpenRoads Modeling workflow ribbon.

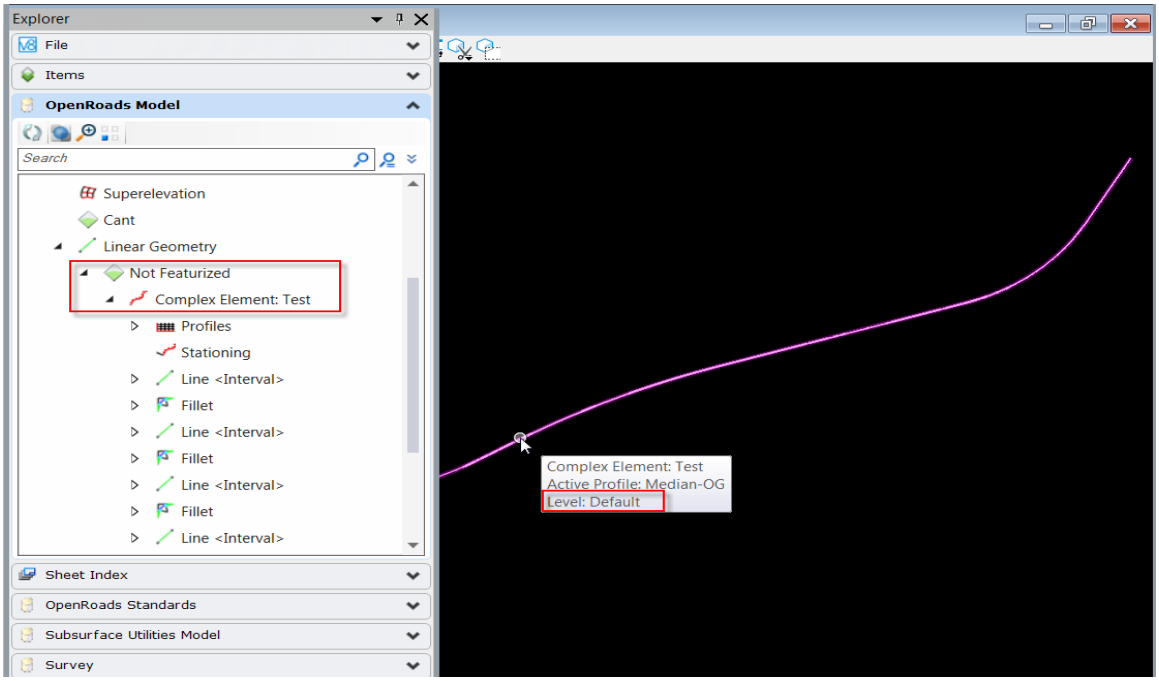


Browse to the location where the ALG file located. Select the file and confirm. On the ***Import Geometry*** dialog, select the horizontal with or without the vertical alignment(s) to import.

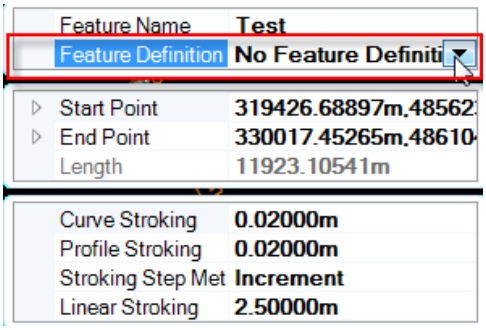


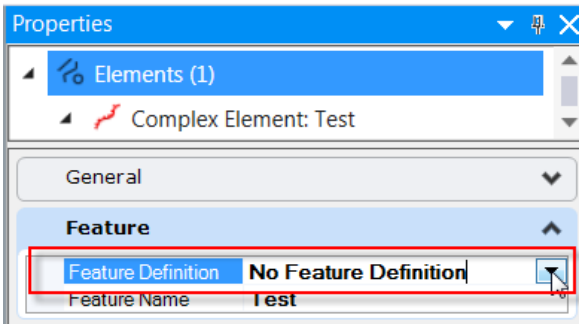
There are two options to assign the Feature Definitions, **Assign Feature Definitions from Table and Assign Feature Definition**. The table used here is an Excel spreadsheet that maps the Style/Symbology values coming from the imported file to feature definitions in ORD. The Assign Feature Definition will assign all selected elements to the same feature definition selected in the combo boxes. When both options are selected, ORD will look for a match in the table first. If no match is found, the combo box selection will be used.

When both options are not used, the alignment(s) will be imported as *Not Featurized* (no Feature Definition assigned) Linear Geometry into level Default. Then the feature definition can be assigned to each of the imported alignments individually.

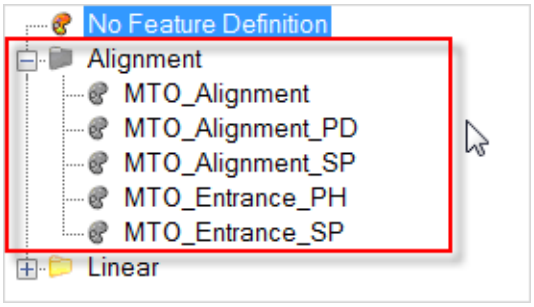


Select each alignment and set the **Feature Definition** on the ***Properties*** dialog.

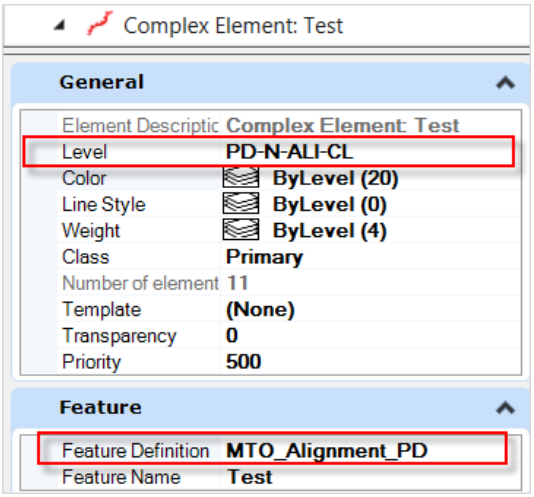


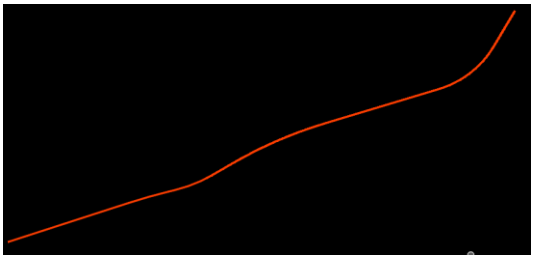


Alignment feature definitions have been setup based on MTO CAD Standard (**IESCAD)** for **Planning and Design, Surveys and Plans** and **Photogrammetry** alignment as shown below.



Select or change the feature definition will change the geometry to the level assigned to the feature definition.

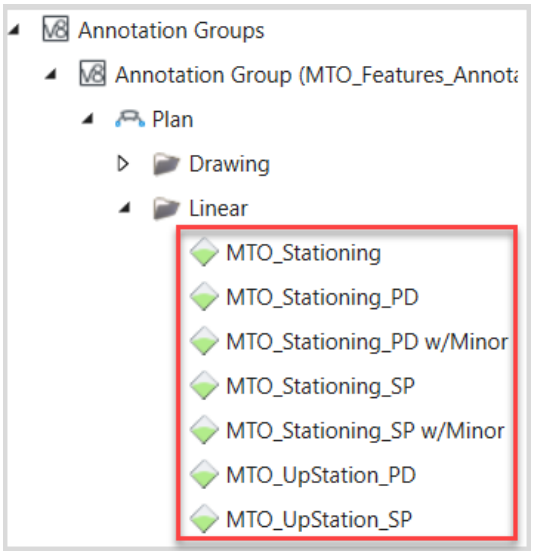




6.2 View Horizontal Alignment Annotation

Horizontal alignment annotation includes both curve set annotation and stationing annotation. They are defined in annotation groups and attached to the alignment feature definitions.

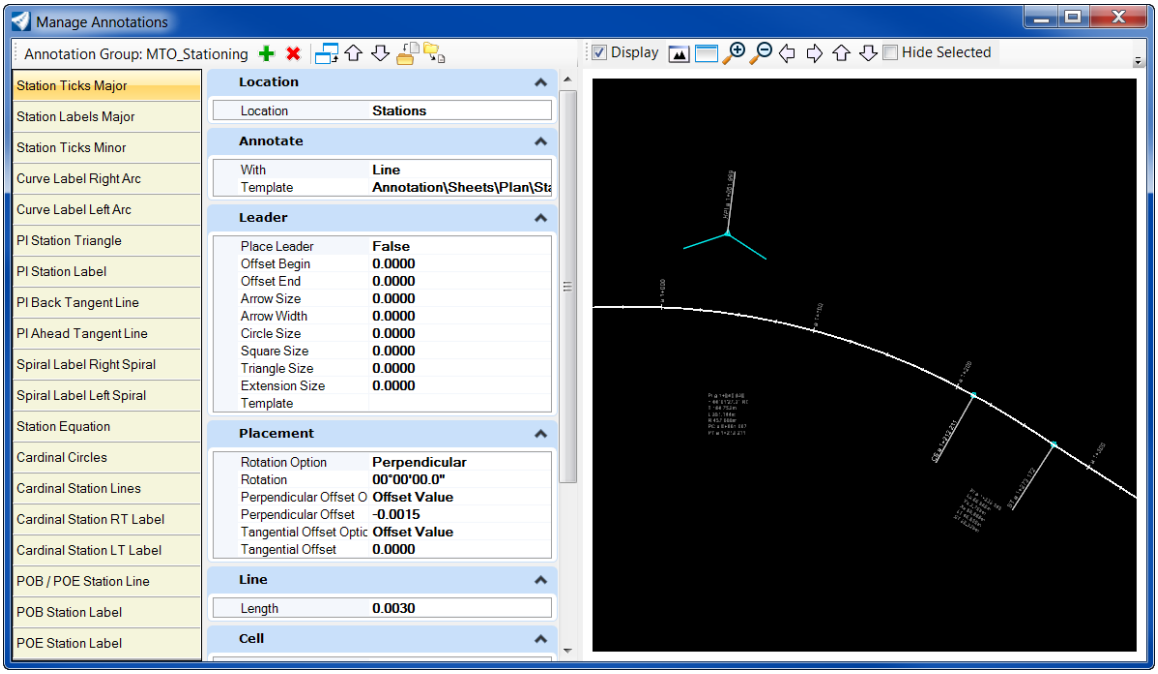
There are different setups for station annotation for new (P&D) and existing (S&P) alignment stationing. The following annotation groups are available:



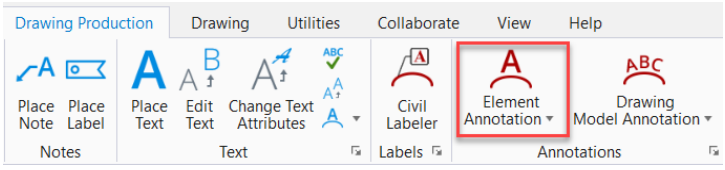
Annotation group **MTO_Stationing** is similar as annotation group **MTO_Stationing_PD** with different offsets from the center line.

Both annotation groups **MTO_Stationing_PD** and **MTO_Stationing_SP** are set up with *Down Station* (looking down the alignment). **MTO_UpStation_PD** and **MTO_UpStation_SP** are options for *Up Station* (looking up the alignment).

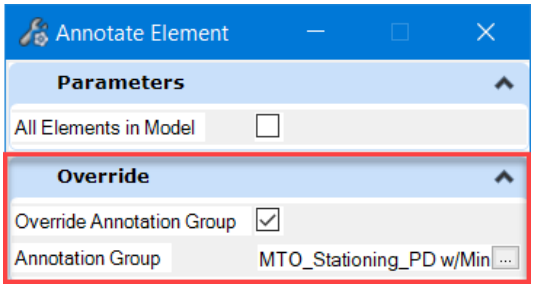
Annotation with both major and minor stations are provided as annotation groups **MTO_Stationing_PD w/Minor** and **MTO_Stationing_SP w/Minor.**



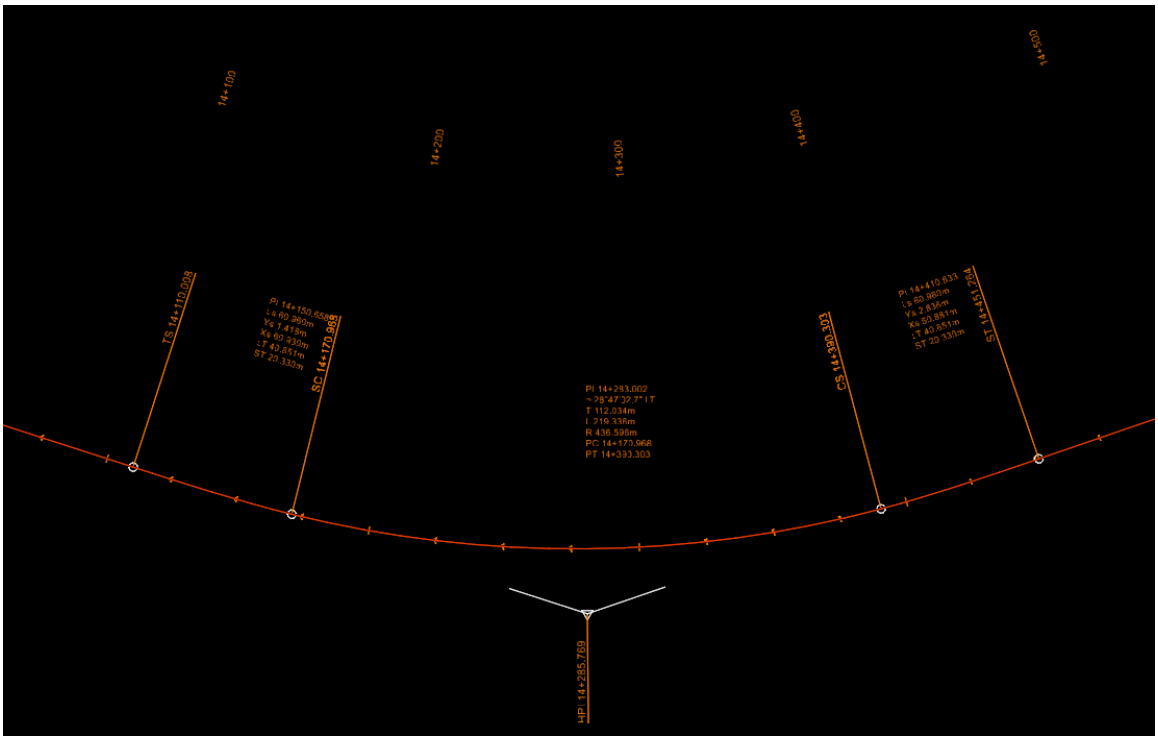
Annotation groups are assigned to the feature definitions for alignment elements through feature symbologies. Select **Annotation Element** command from the ***Drawing Production*** tab ***Annotations*** group on the OpenRoads Modeling workflow ribbon.



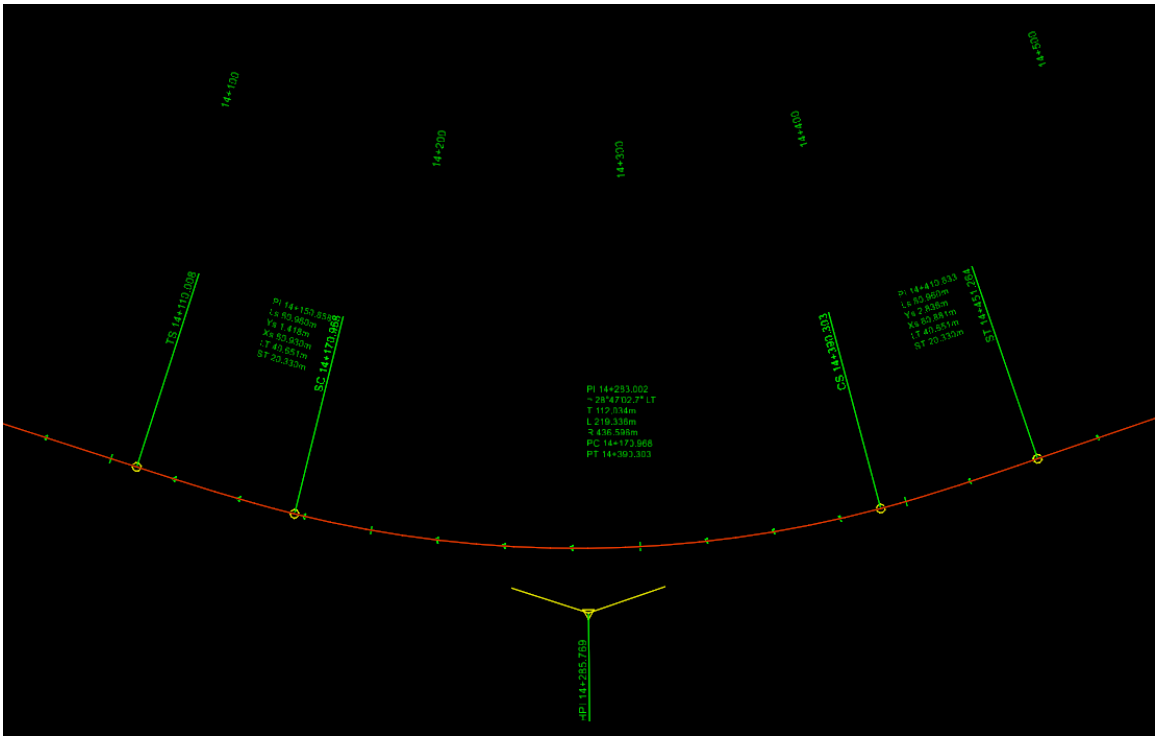
By default, the annotation group associated to the feature symbology that the alignment is assigned to will be used for the annotation. Follow the prompt to select the alignment and reset to complete the command with default annotation group. The curve set information, major stations, major and minor ticks, PI stations and cardinal stations are displayed along the alignment. Use the Annotation Group **Override** option on the ***Annotate Element*** dialog to annotate the alignment with different annotation settings.



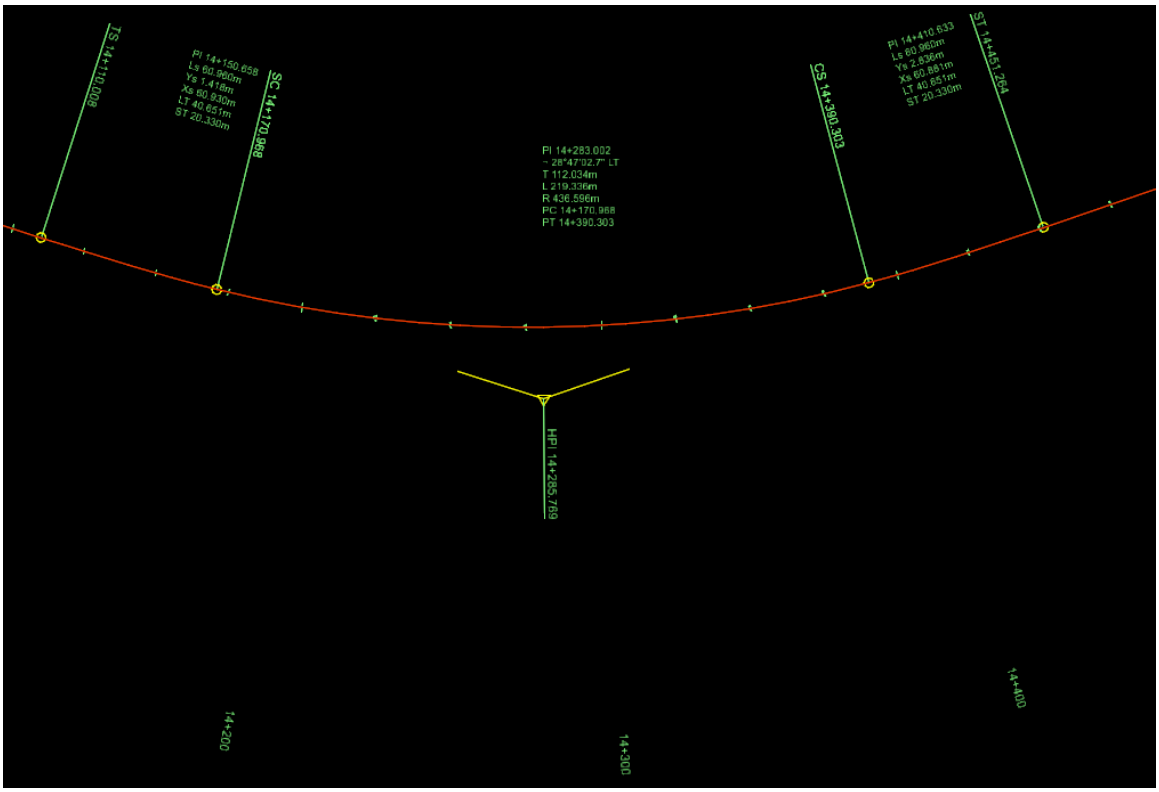
Shown below are alignment with feature definition **MTO_Alignment_PD** and annotation group **MTO_Stationing_PD**.



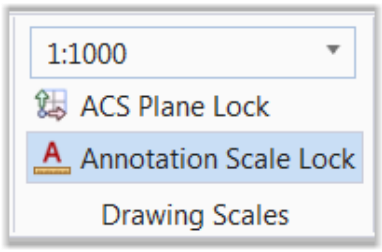
Change the feature definition will automatically change the annotation. Shown below are alignment with feature definition **MTO_Alignment_SP** and annotation group **MTO_Stationing_SP**.



The feature definition **MTO_Alignment_SP** with *Up Station* annotation group **MTO_UpStation_SP** is shown below.



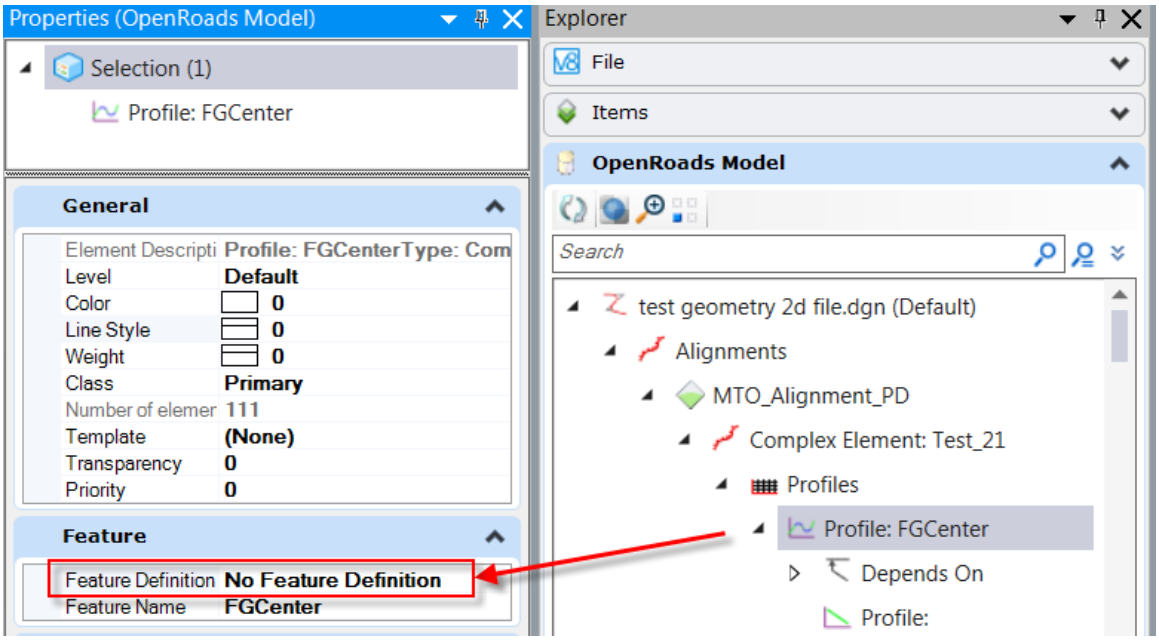
Annotation is placed with the *Annotation Scale Lock* on. Change the scale (Drawing Production > Drawing Scales) will change the annotation automatically.



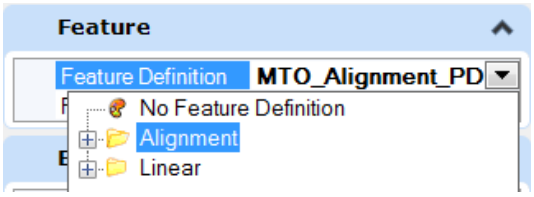
6.3 Import profiles

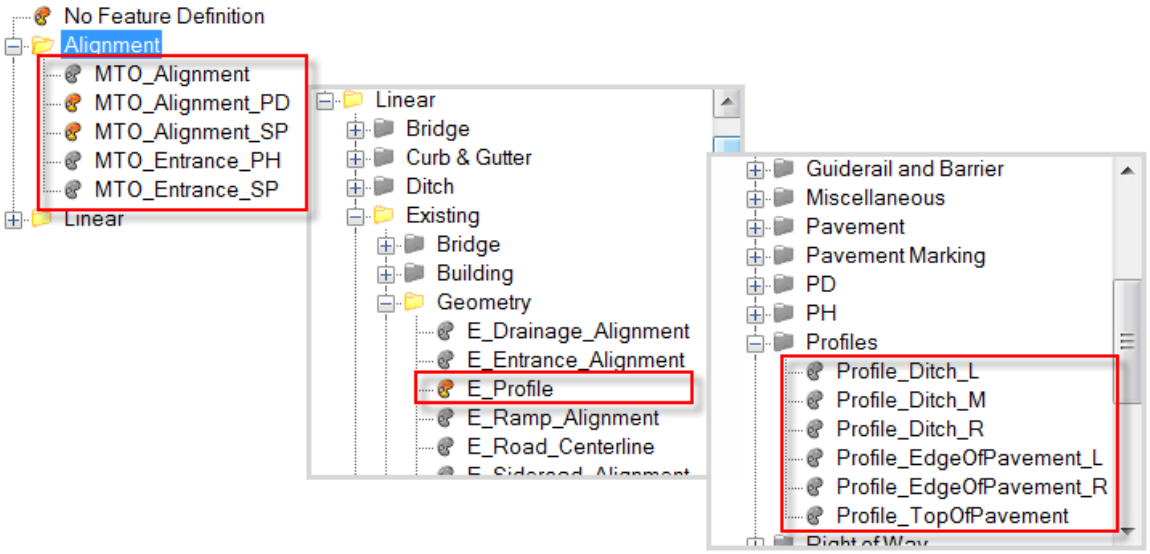
When import profile(s) from native product InRoads ALG files, the horizontal geometry which the profile(s) associated with will be imported at the same time if it is not presented in the current drawing. The Feature Definitions can be assigned during the Import process with one selected feature definition applied to both horizontal and vertical geometry or can be assigned individually after the import.

To assign feature definition to vertical geometry, expand the horizontal geometry the vertical geometry associated with on ***Explorer*** dialog, then select the vertical geometry and set the **Feature Definition** on the ***Properties*** dialog.



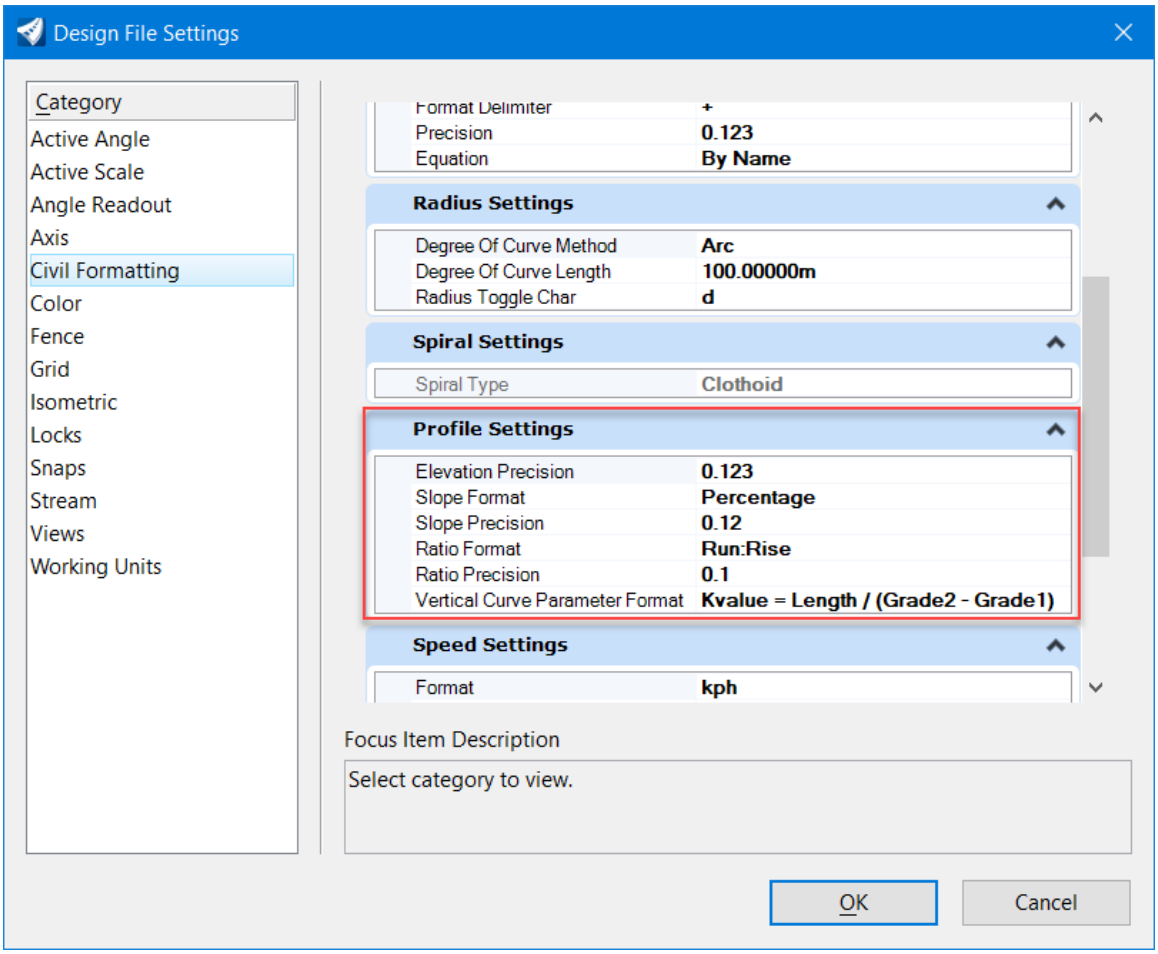
Select the profile and set the **Feature Definition** on the ***Properties*** dialog in Feature section. Feature definitions for profile are available in both Alignment and Linear folders.





6.4 Profile Settings

When working with vertical geometry, the vertical curve parameters need to be set based on the project requirements. Default Profile Settings are shown as below:



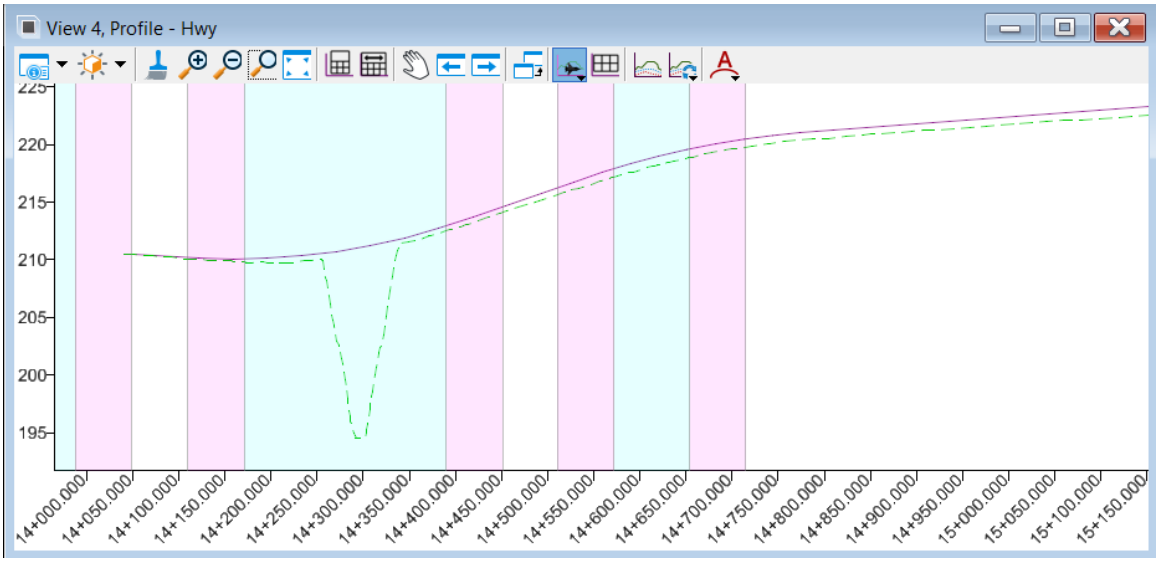
6.5 Profile Model View

To create vertical geometry, a profile model view must be opened with the Open Profile Model tool. The view presents a desired feature in profile thus enabling the vertical geometry tools to interact with the chosen feature.

Access the **Open Profile Model** command from the ***Geometry*** tab ***Vertical*** group on the OpenRoads Modeling workflow ribbon.

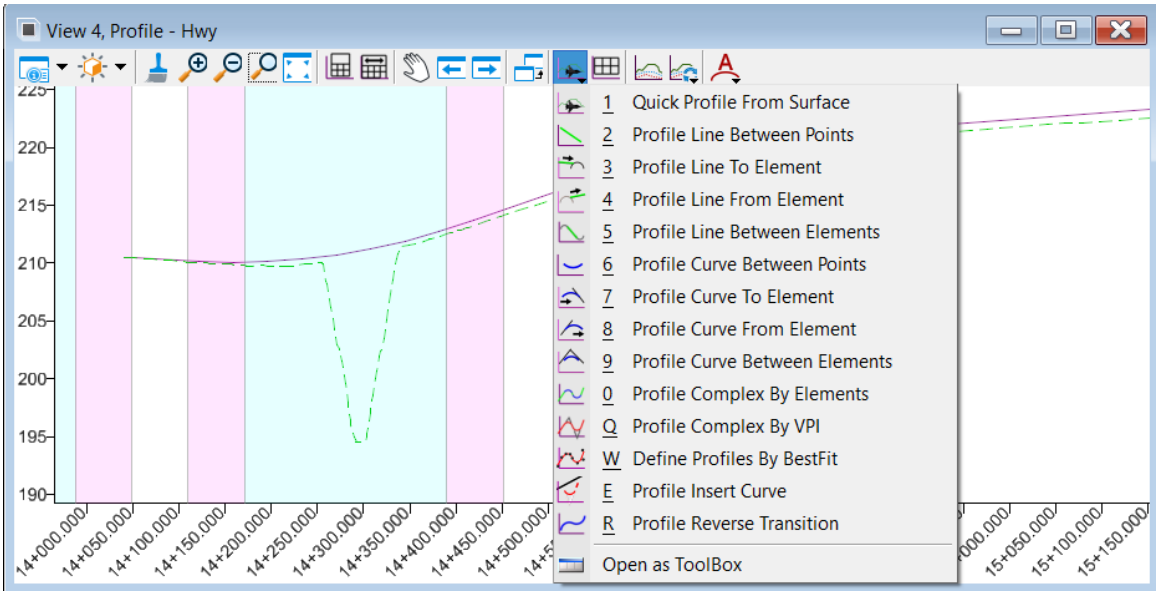
Geometry > Vertical > Open Profile Model

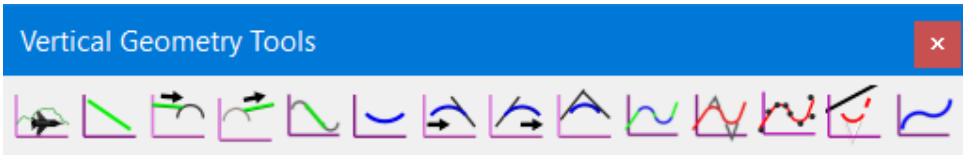
Select the element wish to work in profile then follow the prompt to select or open a view.



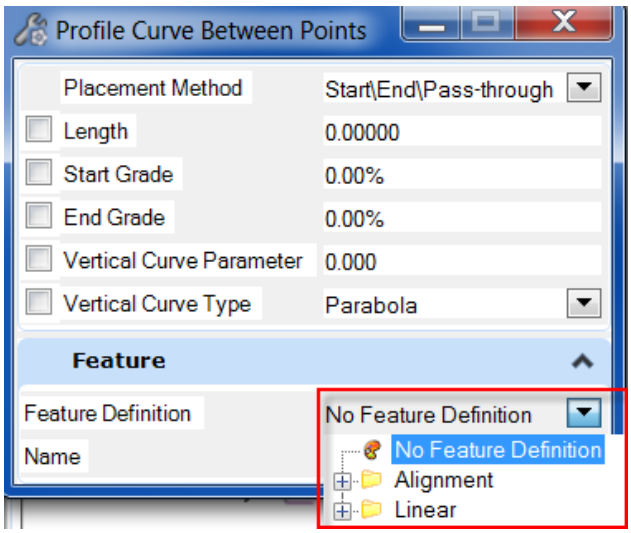
The selected horizontal geometry name is shown in the title bar of the view.

The Profile Model View also provides easy access to the vertical geometry tools. The tools can be docked as a toolbox.

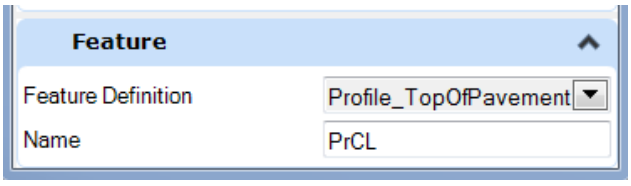




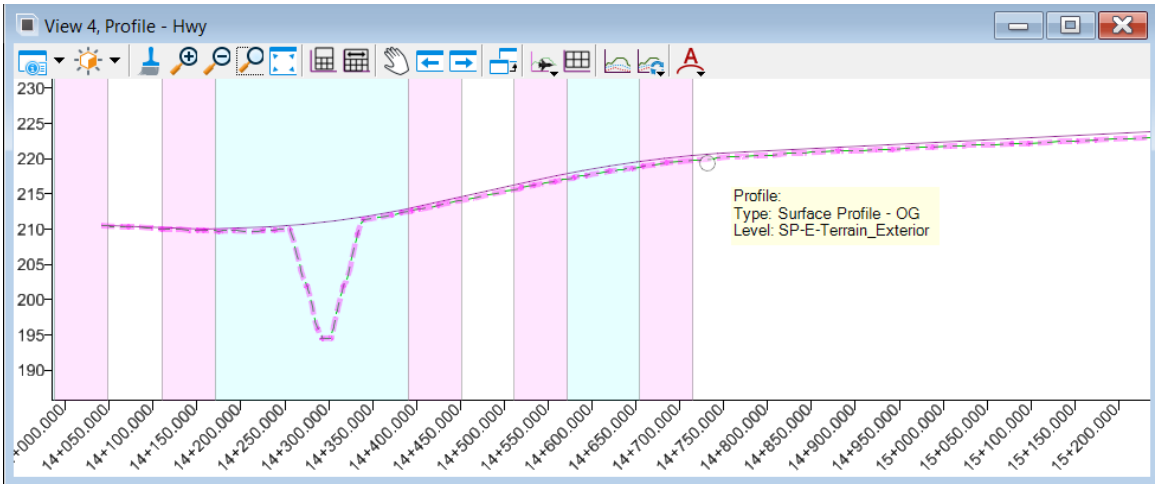
Each of the vertical tools has a **Feature Definition** field on its dialog. Feature definitions for profile are available in both Alignment and Linear folders.



The feature definition has name seed (prefix) assigned. Different name can be assigned on the dialog.

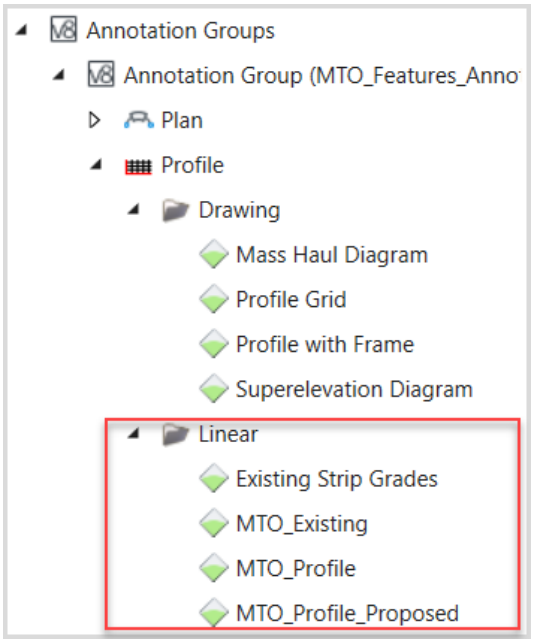


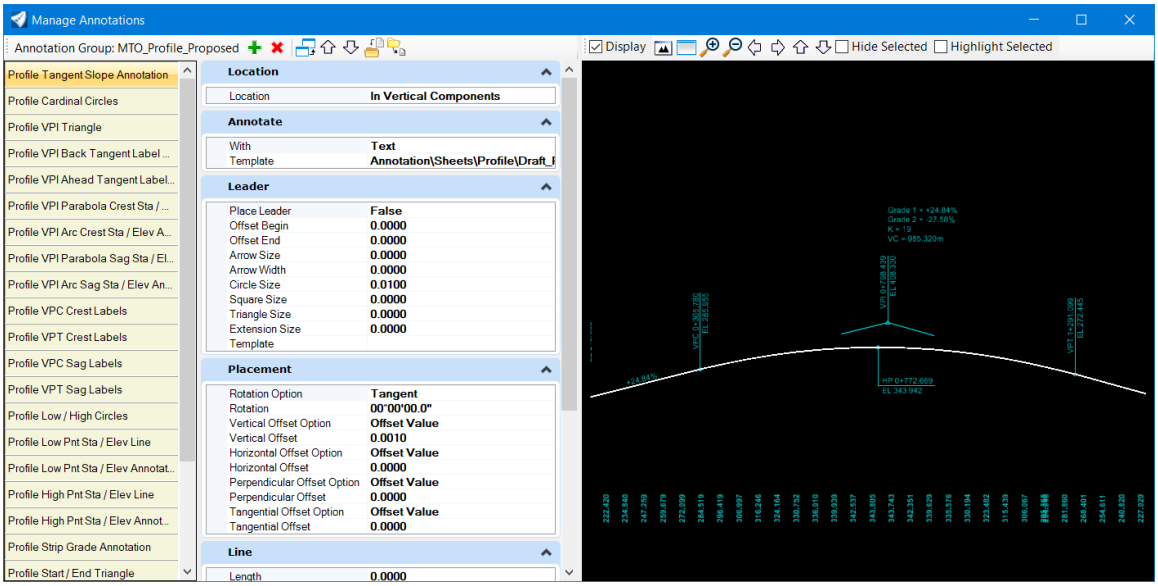
The surface profile (profile from surface) will apply the terrain feature definition. See terrain section for available terrain feature definitions.



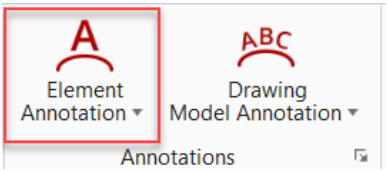
6.6 View Profile Annotation

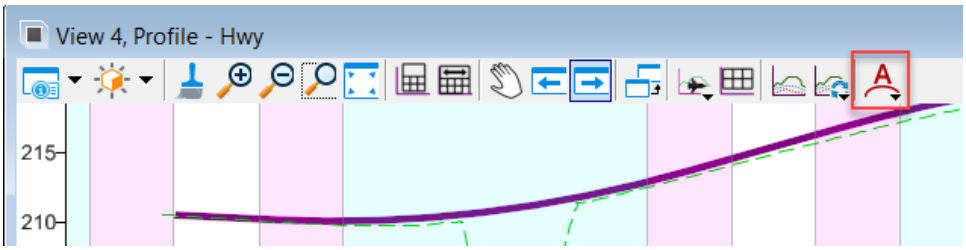
The Annotate Element command can be used to annotate vertical geometry in the Profile Model. Feature Definitions have been set up to annotate profile elements using Feature Symbologies with assigned Annotation Groups. Shown below are available Annotation Groups.



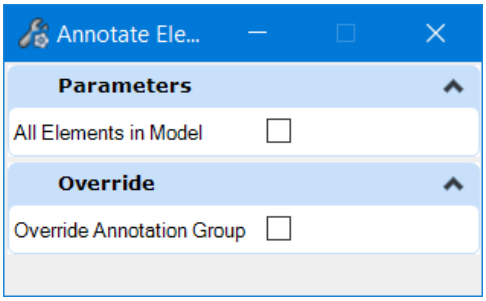


Select Annotation Element command from the ***Drawing Production*** tab ***Annotations*** group on the OpenRoads Modeling workflow ribbon or from the Profile Model View.

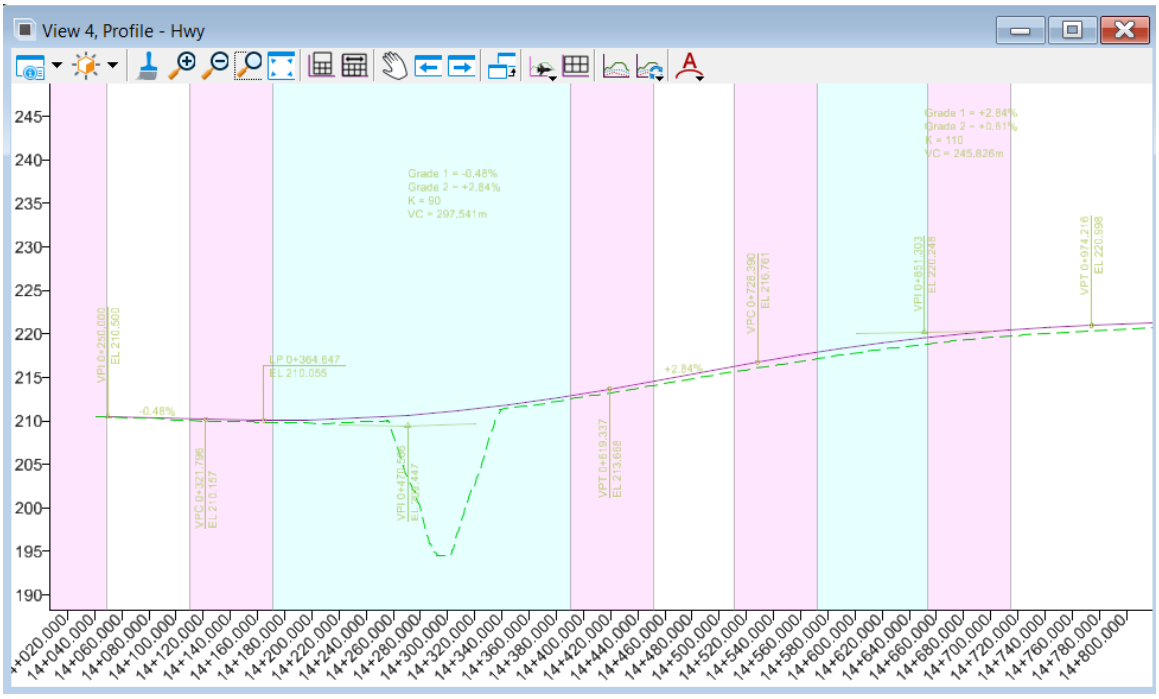




By default, Annotation Group associated to the Feature Symbology that the profile elements are assigned to will be used for the annotation. The Annotation Group **Override** option is provided on the ***Annotate Element*** dialog.



Select the profile elements and reset or check the **All Elements in Model** option to complete. Annotation is placed with the *Annotation Scale Lock* on. Change the scale (Drawing Production > Drawing Scales) will change the annotation automatically.


View 4, Profile - Hwy
Grade 1 = -0.48%
Grade 2 = +2.84%
K = 90
VC = 297.541m
Grade 1 = +2.84%
Grade 2 = +0.61%
K = 110
VC = 245.826m
VPI 0+250.000
EL 210.500
-0.48%
LP 0+364.647
EL 210.055
VPC 0+321.796
EL 210.157
VPI 0+470.595
EL 207.447
VPT 0+619.337
EL 213.668
+2.84%
VPC 0+728.396
EL 216.761
VPI 0+851.303
EL 220.248
VPT 0+974.216
EL 220.998
245
240
235
230
225
220
215
210
205
200
195
190
14+020.000
14+040.000
14+060.000
14+080.000
14+100.000
14+120.000
14+140.000
14+160.000
14+180.000
14+200.000
14+220.000
14+240.000
14+260.000
14+280.000
14+300.000
14+320.000
14+340.000
14+360.000
14+380.000
14+400.000
14+420.000
14+440.000
14+460.000
14+480.000
14+500.000
14+520.000
14+540.000
14+560.000
14+580.000
14+600.000
14+620.000
14+640.000
14+660.000
14+680.000
14+700.000
14+720.000
14+740.000
14+760.000
14+780.000
14+800.000

7.0 Corridor Modeling

OpenRoads Designer uses the Corridor civil object to model roadway. The 3D model is then used to create terrain models, cross sections and generate quantities.

ORD corridors are created directly in the MicroStation views. The corridor information is stored in 2D design (dgn) file. The corridor is started in 2D and the 3D model is automatically generated and attached to the 2D model. A minimum of one horizontal and one vertical civil geometry elements are required to create a corridor.

The corridor modeling toolset includes tools for creating, modifying, managing and reporting corridors. These tools can be accessed from the ***Corridors*** tab on the OpenRoads Modeling workflow ribbon.

7.1 Corridor Modeling Workflow

The general workflow for corridor modeling is listed below:

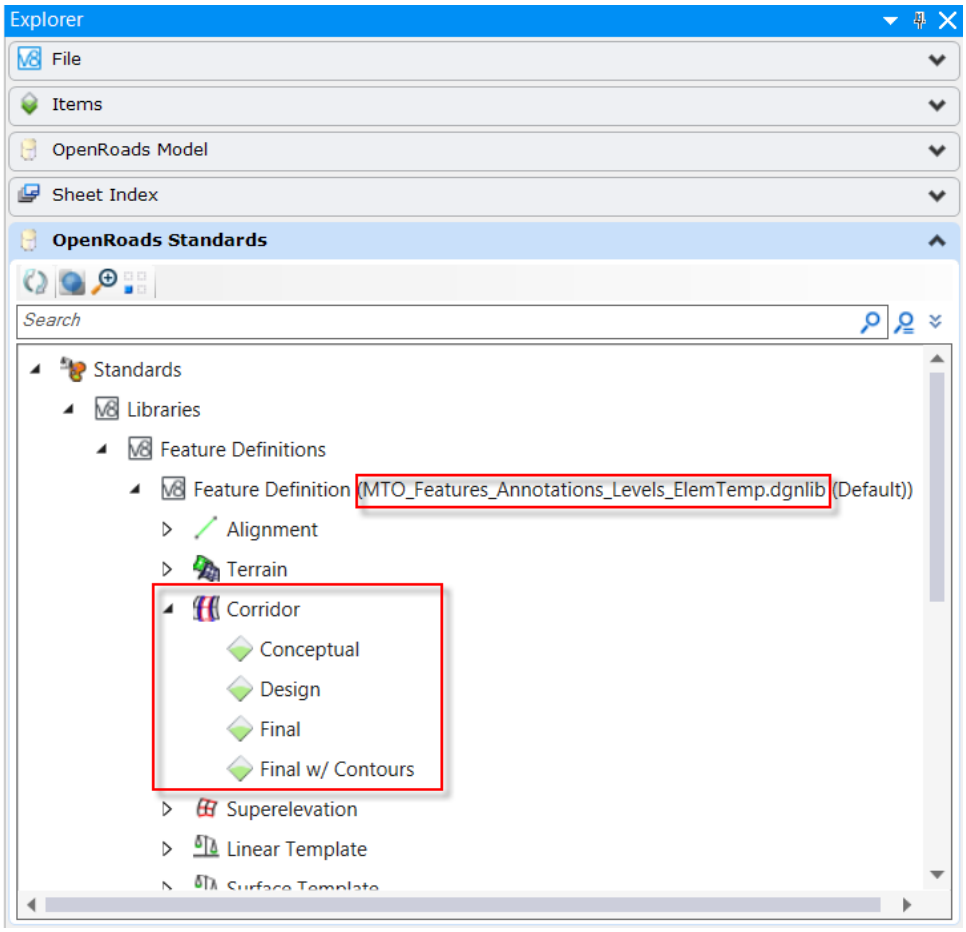
1. Create a 2D design (dgn) file.
2. Attach existing terrain model as a reference file and set the active terrain.
3. Attach geometry dgn as a reference (both horizontal and vertical geometry are required)
4. Create a corridor.
5. Add template drop(s).
6. Add horizontal and vertical controls to template points (as needed).
7. Define transitions (as needed)
8. Assign superelevation (as needed).
9. Review 3D model and dynamic cross sections
10. Make adjustments or add additional controls.

7.2 Design Stages

OpenRoads uses corridor feature definitions (also referred to as design stages) to save commonly used settings for a corridor. Each corridor can have its own design stage within a project and can be changed at any time.

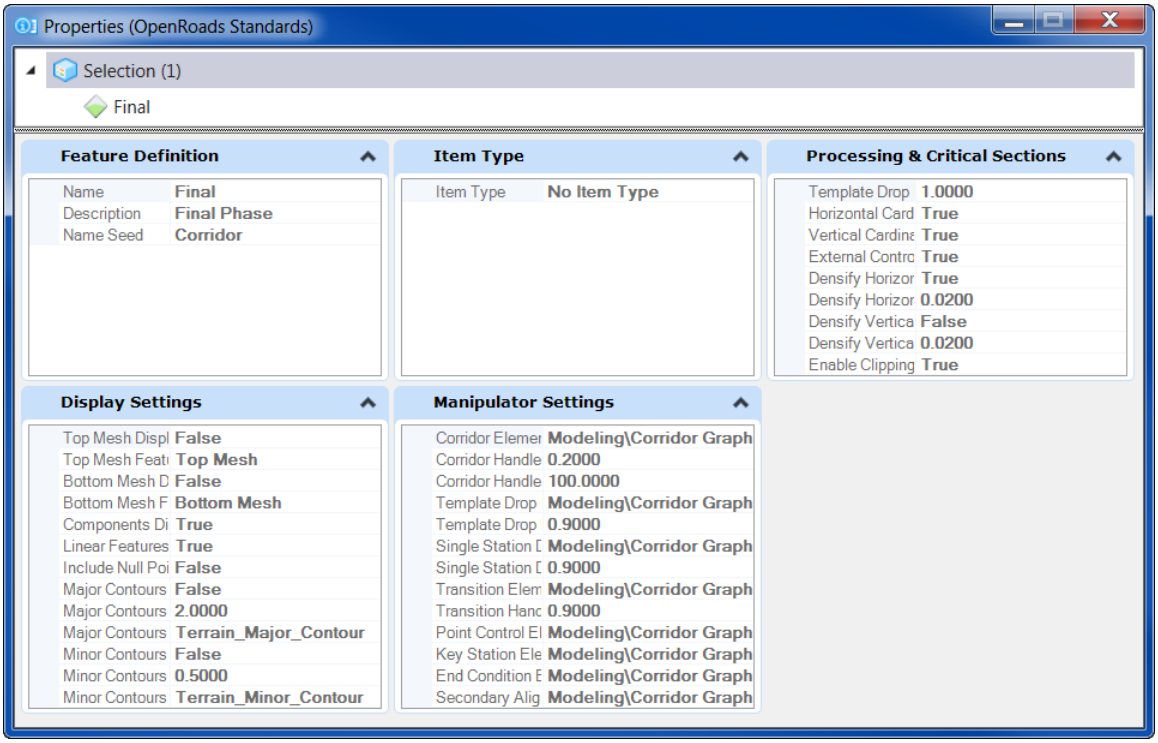
The corridor feature definitions are defined and stored in dgn library **MTO_Features_Annotations_Levels_ElemTemp.dgnlib** under Feature Definitions > Corridor.

The design stage is selected when creating a corridor. Once used, the design stage is copied into the design file and can be adjusted based on the project need. Set the design stage based on the design phase and change it as the design progresses. This will help to manage the mount of detail needed to improve the processing speed/performance.



The design stage has five sections define a variety of settings and options. They are Feature Definitions, Item Type, Processing and Critical Sections, Display Settings and Manipulator Settings.

Right-click on a Design Stage and select Properties from the context sensitive menu to open the ***Properties*** (Element Information) dialog. The settings of the selected design stage will be populated. Shown below are the settings for Final stage.



Template drop and critical sections settings:

Feature Definition Name	Conceptual	Design	Final	Final w/ Contours
Template Drop Interval Multiplier	5	2	1	1
Critical Sections				
Horizontal Cardinal Points Display	False	True	True	True
Vertical Cardinal Points Display	False	True	True	True
External Control Points Display	False	False	True	True
Densify Horizontal	False	True	True	True
Densify Vertical	False	False	False	False

7.3 Superelevation

In OpenRoads Designer, the superelevation data can be created and stored in its own 2D design (dgn) file, or it can be created in the geometry or corridor files. Tools are provided for creating, calculating and editing superelevation.

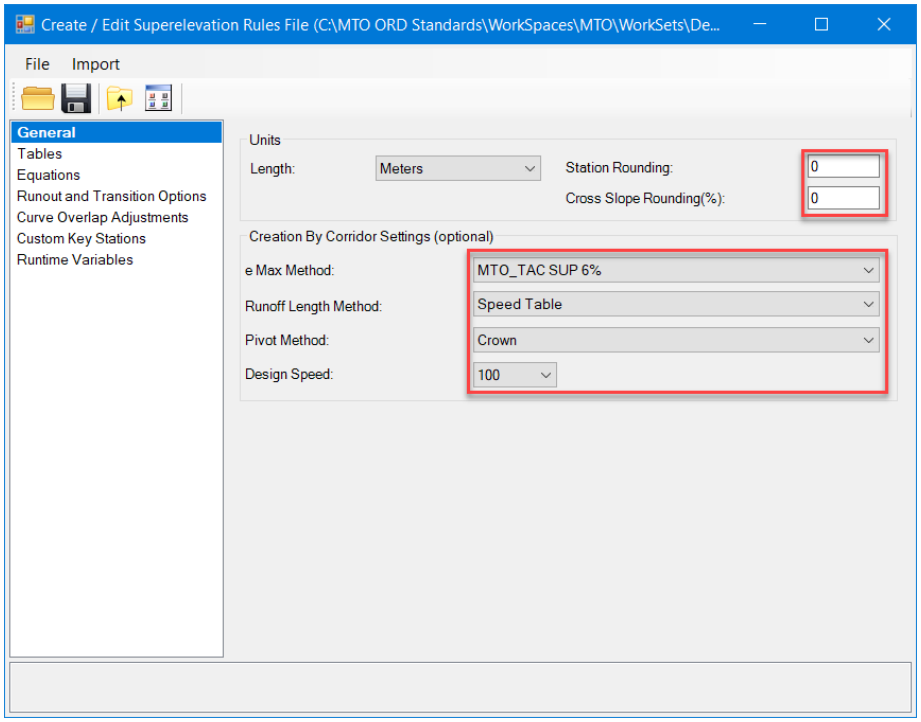
To create superelevation, the minimum requirements are one horizontal alignment geometry and superelevation rate and transition values calculated using XML-based superelevation rule file or imported through a CSV file.

The superelevation rules file has been defined for MTO ORD WorkSpace. It is in the following folder:

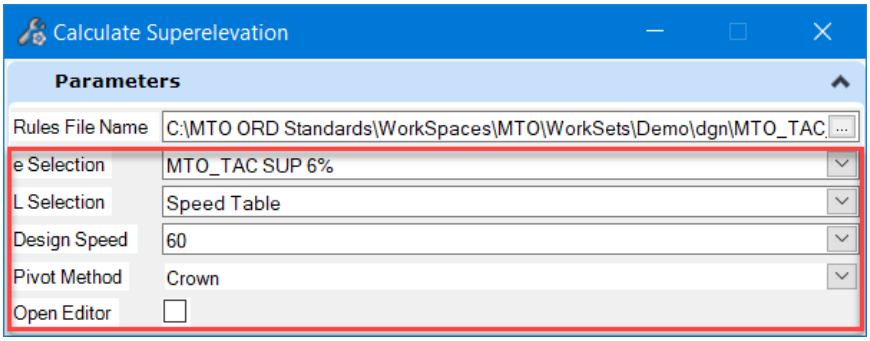
……\Organization-Civil\MTO\Superelevation\

The rules file is defined based on TAC Geometric Design Guide for Canadian Roads – June 2017. As the file name **MTO_TAC_06.xml** indicated, the max superelevation rate e = 6%. Settings for each category are shown below.

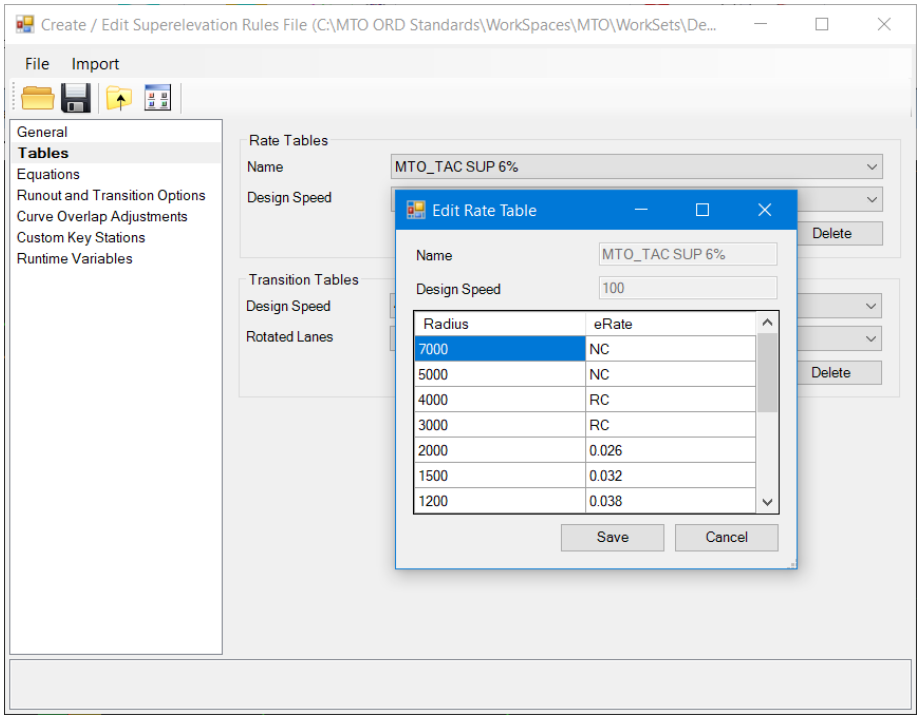
General

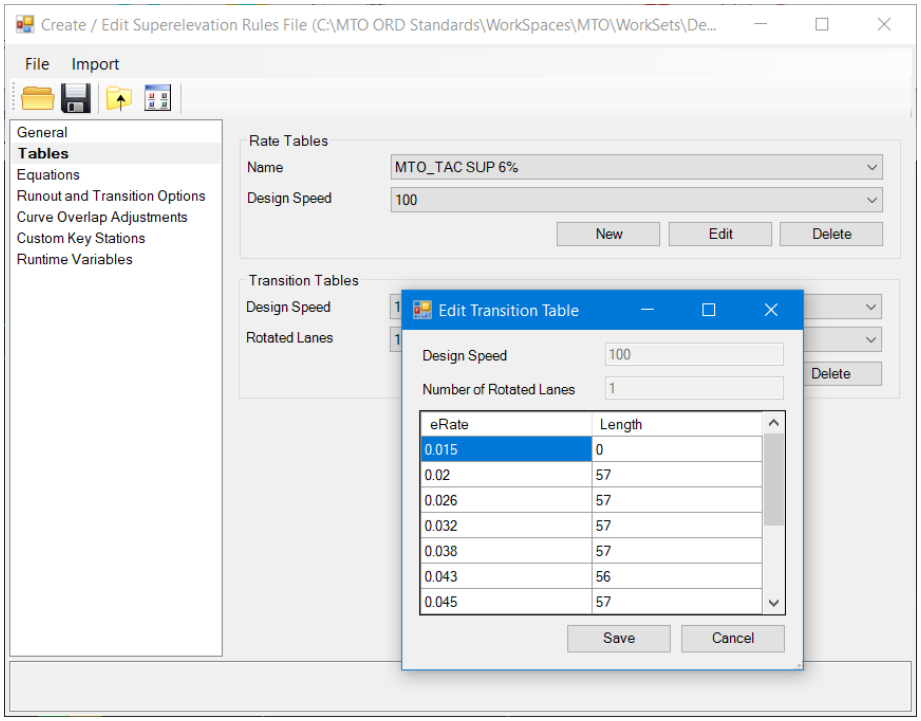


Options of creation on this page (above) can be changed at the time of superelevation calculation. See below ***Calculate Superelevation*** dialog.



Tables





The table 3.2.6 of Chapter 3 - Alignment and Lane Configuration, TAC Geometric Design Guide for Canadian Roads – June 2017 is used to populate the rate and transition lookup tables of this superelevation rules file **MTO_TAC_06.xml**.

Runout and Transition Options

Runout Options:

The default option is set to ***Fixed Length***. The tangent runout must be calculated and inputted into the rules file for superelevation calculation. According to MTO (TAC) standards, the tangent runout length is based on a 1:400 slope.

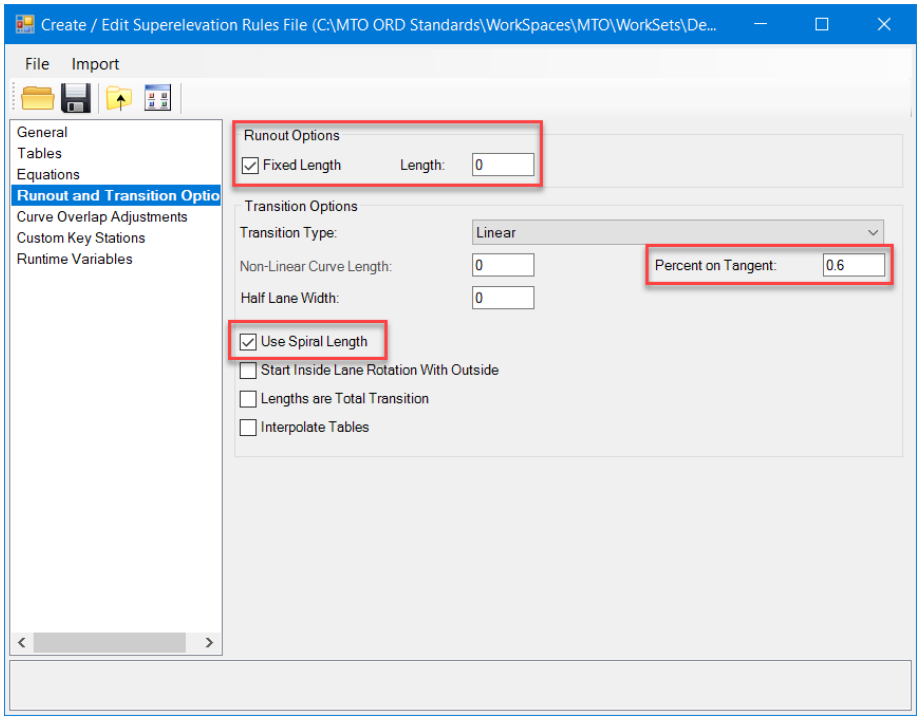
For example, a roadway has a normal cross slope of 2% and 7m cross section to be superelevated, the length of runout will be:

L = 400 * 0.02 (NC) * 7.0 (pavement width) = 56m

When this option is disabled, the runout length is calculated using the same gradient as the runoff section.

Transition Options:

By default, the ***Use Spiral Length*** option is enabled. If a spiral exists, the spiral length will be used as the transition (runoff) length rather than the calculated transition length. In this situation, the ***Percent on Tangent*** value will be ignored. For curve without spirals, 60% of the runoff occurs will be on the tangent approach and 40% on the curve.

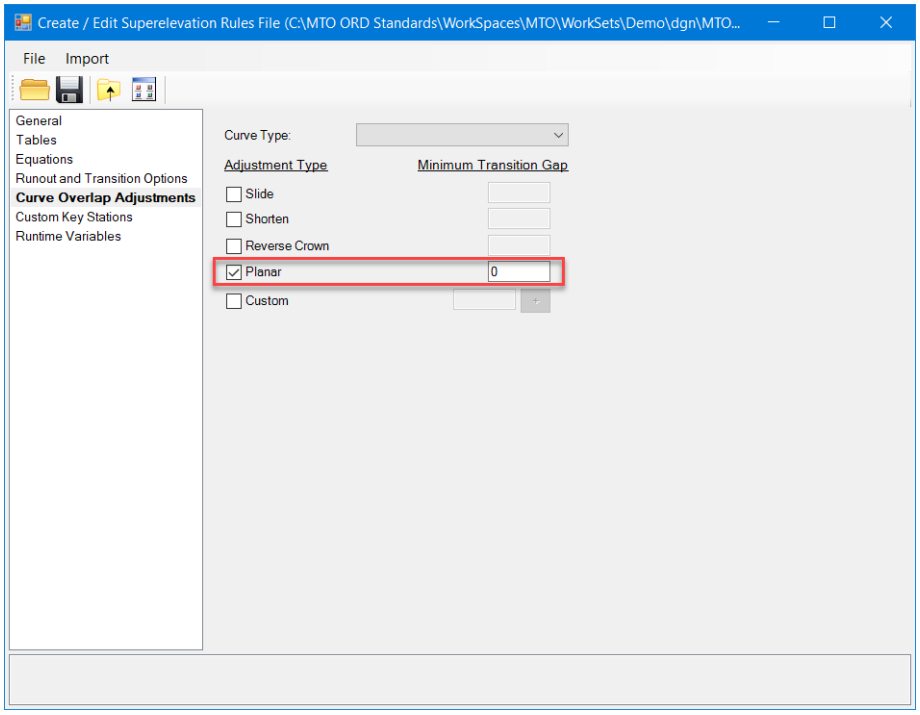


Curve Overlap Adjustments

The options on this page define how superelevation stations are adjusted when the exit transition from one curve overlaps the entry transition for the next curve.

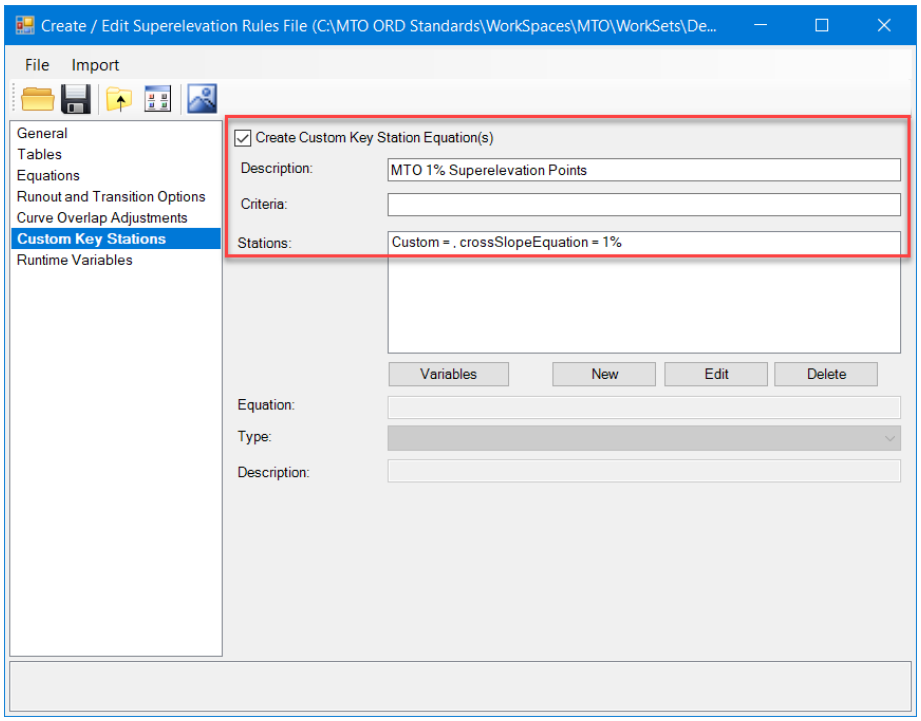
The ***Planar*** option is enabled. With this option the road will transition planer from Full Super to Full Super. The Zero Crown and Normal Crown Stations are eliminated.

If multiple options (Slide, Shorten, etcetera) are defined for a curve type (reverse curve or curve curve) the one with smallest Minimum Transition Gap that is larger than the actual gap will be used.



Custom Key Stations

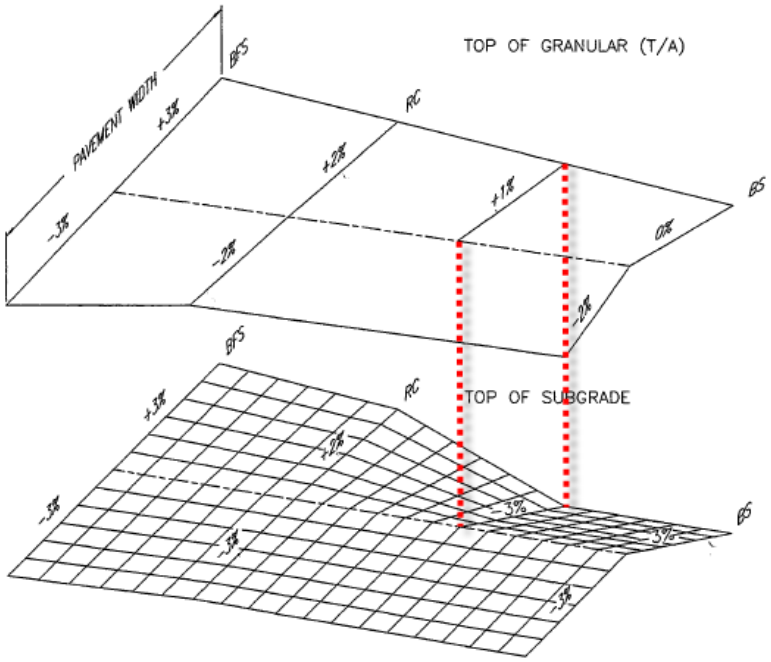
Custom key stations have been defined to add points where the outside lane is at 1%. These points are used for subgrade superelevation.



Station	Cross Slope	Point Type	Transition Type
10+500.000	-2.00%	Normal Crown	
10+555.563	-2.00%	Normal Crown	Linear
10+611.563	0.00%	Level Crown	Linear
10+628.545	1.00%	Undefined	Linear
10+645.528	2.00%	Reverse Crown	Linear
10+708.363	5.70%	Full Super	Linear
10+786.102	5.70%	Full Super	Linear
10+848.937	2.00%	Reverse Crown	Linear
10+865.919	1.00%	Undefined	Linear
10+882.902	0.00%	Level Crown	Linear
10+938.902	-2.00%	Normal Crown	Linear
11+000.000	-2.00%	Normal Crown	Linear

7.4 Subgrade Transition Into Superelevation

The following diagram illustrates the subgrade transition in superelevated sections.



8.0 Quantities and Earthwork Volume

OpenRoads Designer provides various tools and methods to compute and report quantities and earthwork volume.

8.1 Volumes

OpenRoads Designer uses 3D mesh elements to represent the cut and fill volumes between the existing terrain model and the bottom mesh of the design elements. The earthwork quantities are calculated from the 3D mesh solids using true prismoidal method.

The **Create Cut and Fill Volumes** tool creates a 3D mesh solid for cut and a 3D mesh solid for fill. The tool calculates cut and fill volumes between two surfaces. Vertical edges are drawn from the Design Surface to the Existing Surface and the volume (in master units) is calculated directly from the closed 3D solid. No longer need to create a set of cross sections to get the cut and fill volumes.

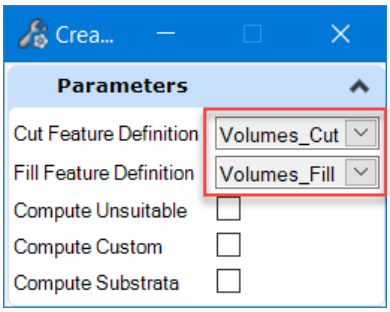
This tool can be accessed from both the OpenRoads Modeling and OpenRoads Drawing Production workflow ribbon.

OpenRoads Modeling > Terrain > Analysis > Volumes

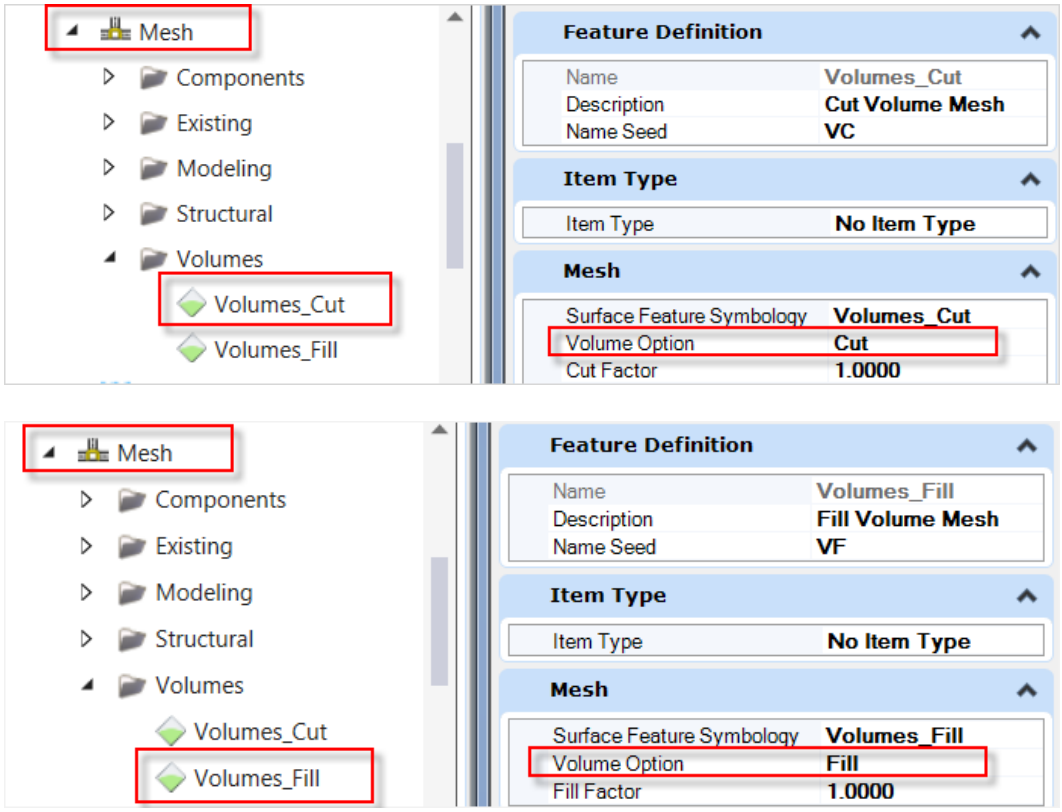
OpenRoads Modeling > Home > Model Analysis and Reporting > Civil Analysis

OpenRoads Drawing Production > Home > Model Analysis and Reporting > Civil Analysis

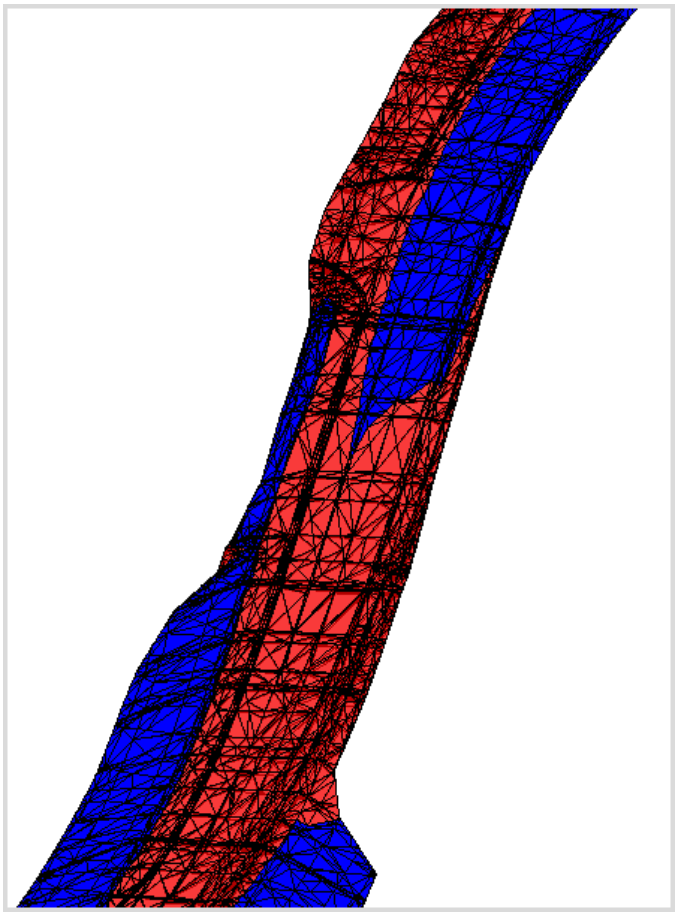
Two feature definitions **Volumes_Cut** and **Volumes_Fill** are used for this calculation.



They are defined under **Mesh > Volumes** with the *Volume Option* set to **Cut** and **Fill** respectively.

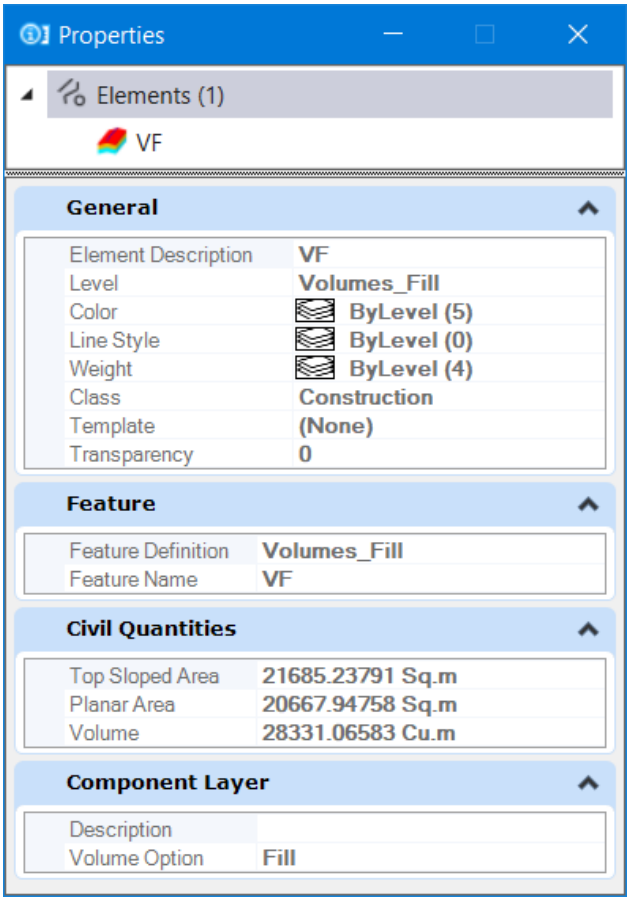


This tool will create the cut/fill 3D mesh elements to display where the cut and fill are located in the model. The blue 3D mesh element indicates fill and the red 3D mesh element indicated cut.



The volumes of the 3D solids can be viewed in Quick Properties (accessed from the context sensitive menu) or ***Properties*** dialog.

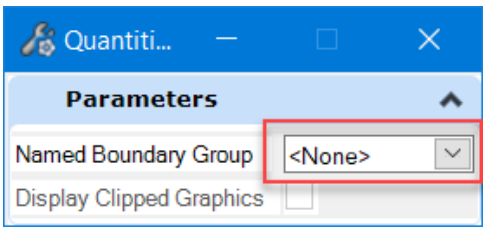
Feature Definition	**Volumes_Fill**
Feature Name	**VF**
Top Sloped Area	**21685.23791 Sq.m**
Planar Area	**20667.94758 Sq.m**
Volume	**28331.06583 Cu.m**
Description	
Volume Option	**Fill**

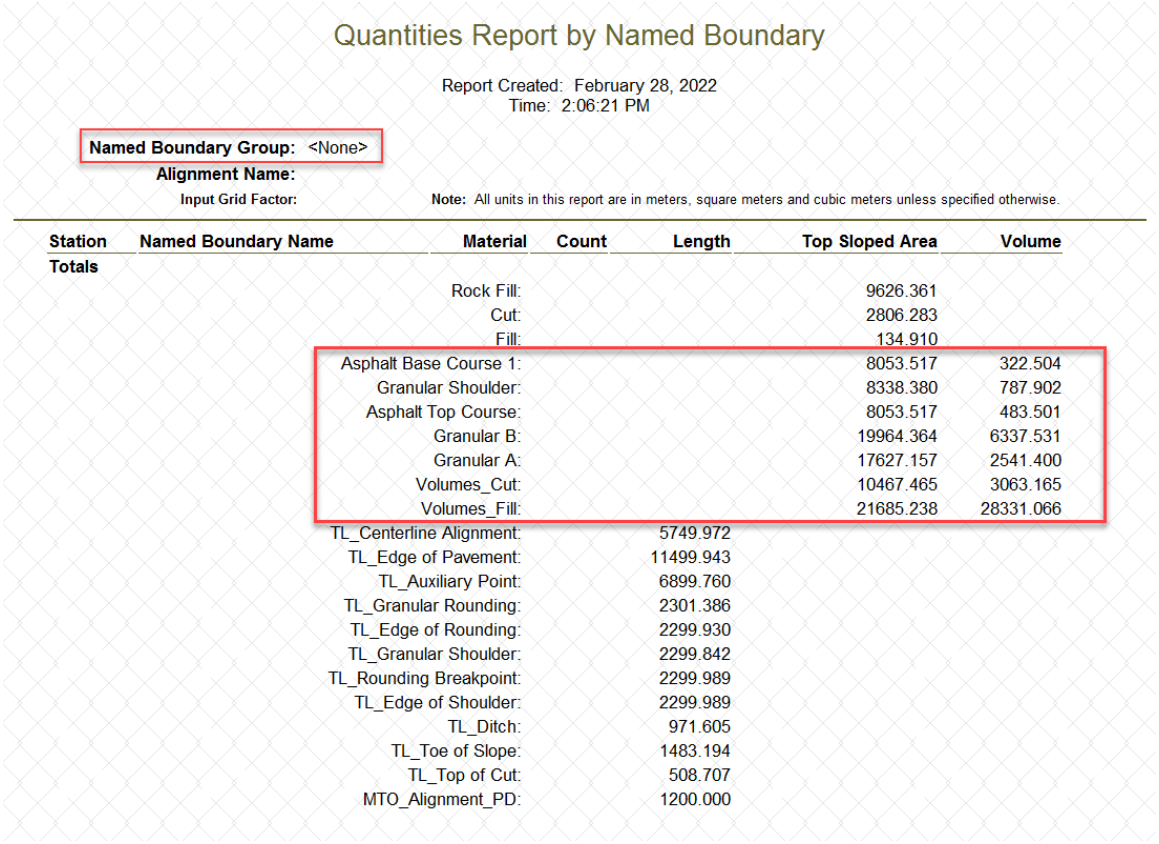


8.2 Quantities and Volumes Report

The **Quantities Report By Named Boundary** tool allows to report the corridor quantities and volumes for the entire corridor model or for specific station ranges and/or sheet clipping.

The cut and fill volumes are determined from the 3D mesh solids using the Create Cut Fill Volume tool. The other material quantities are computer from the 3D corridor models. When a Named Boundary does not exist or no **Named Boundary Group** is selected on the ***Quantities Report By Named Boundary*** dialog, the quantities are the total quantities from the entire 3D model.





Quantities Report by Named Boundary

Report Created: February 28, 2022
Time: 2:06:21 PM

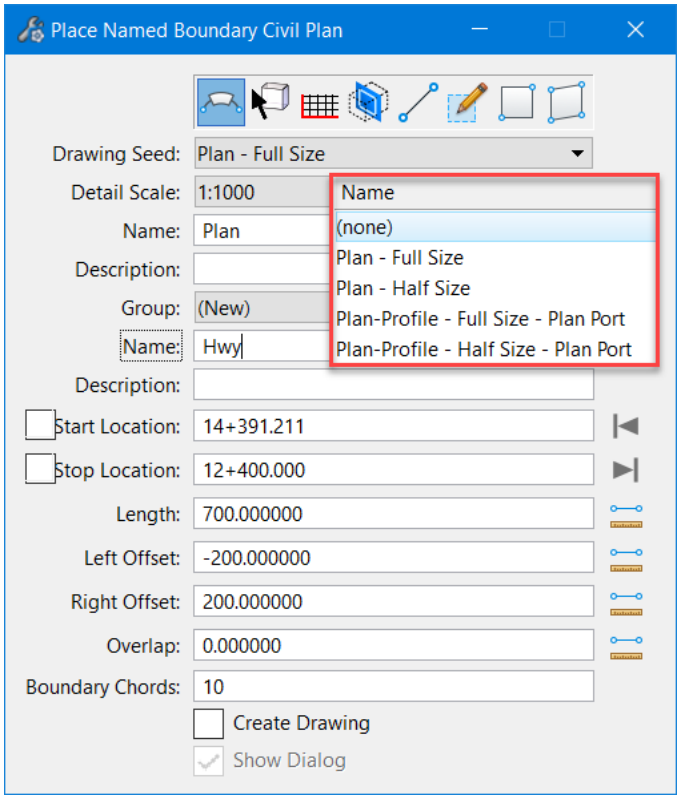
Named Boundary Group: <None>
Alignment Name:
Input Grid Factor:

Note: All units in this report are in meters, square meters and cubic meters unless specified otherwise.

Station	Named Boundary Name	Material	Count	Length	Top Sloped Area	Volume
Totals						
		Rock Fill:			9626.361	
		Cut:			2806.283	
		Fill:			134.910	
		Asphalt Base Course 1:			8053.517	322.504
		Granular Shoulder:			8338.380	787.902
		Asphalt Top Course:			8053.517	483.501
		Granular B:			19964.364	6337.531
		Granular A:			17627.157	2541.400
		Volumes_Cut:			10467.465	3063.165
		Volumes_Fill:			21685.238	28331.066
		TL_Centerline Alignment:		5749.972		
		TL_Edge of Pavement:		11499.943		
		TL_Auxiliary Point:		6899.760		
		TL_Granular Rounding:		2301.386		
		TL_Edge of Rounding:		2299.930		
		TL_Granular Shoulder:		2299.842		
		TL_Rounding Breakpoint:		2299.989		
		TL_Edge of Shoulder:		2299.989		
		TL_Ditch:		971.605		
		TL_Toe of Slope:		1483.194		
		TL_Top of Cut:		508.707		
		MTO_Alignment_PD:		1200.000		

The **Place Named Boundary** tool is used to create custom boundary shape along the corridor, quantities can then be calculated within a Named Boundary using the Quantities Report by Named Boundary tool.

The sheet definitions have been setup for creating the named boundary and drawings in MTO workspace. Select a drawing seed will automatically populate the ***Place Named Boundary*** dialog with a set of predefined values.



Quantities Report by Named Boundary

Report Created: February 28, 2022
Time: 3:46:23 PM

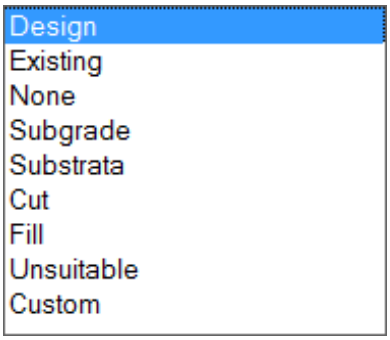
Named Boundary Group: Hwy
Alignment Name: Hwy
Input Grid Factor:

Note: All units in this report are in meters, square meters and cubic meters unless specified otherwise.

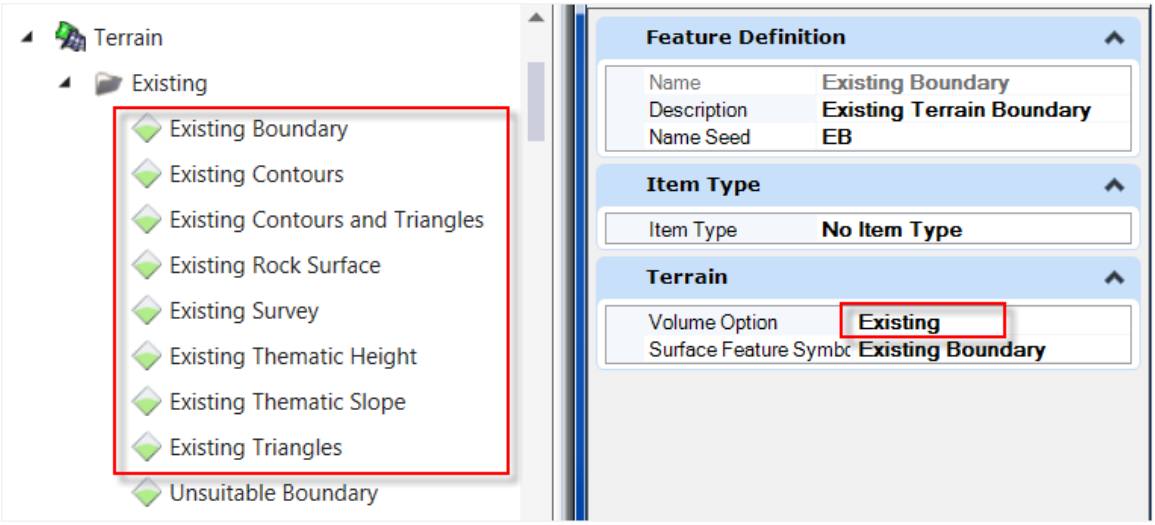
Station	Named Boundary Name	Material	Count	Length	Top Sloped Area	Volume
14225.000	Plan 1					
		Cut:			245.150	
		Rock Fill:			1085.398	
		Fill:			134.858	
		Asphalt Base Course 1:			1225.568	0.141
		Granular Shoulder:			1267.082	120.110
		Asphalt Top Course:			1225.434	73.356
		Granular A:			2678.379	386.518
		Granular B:			3062.937	1003.341
		Volumes_Fill:			1214.085	294.456
		Volumes_Cut:			3306.149	1371.326
		TL_Centerline Alignment:		874.995		
		TL_Edge of Pavement:		1749.990		
		TL_Auxiliary Point:		1049.954		
		TL_Granular Rounding:		350.271		
		TL_Edge of Rounding:		349.987		
		TL_Granular Shoulder:		349.970		
		TL_Rounding Breakpoint:		349.998		
		TL_Edge of Shoulder:		349.998		
		TL_Ditch:		108.203		
		TL_Toe of Slope:		269.091		
		TL_Top of Cut:		32.201		
		MTO_Alignment_PD:		175.000		

8.3 Feature Definition Volume Options

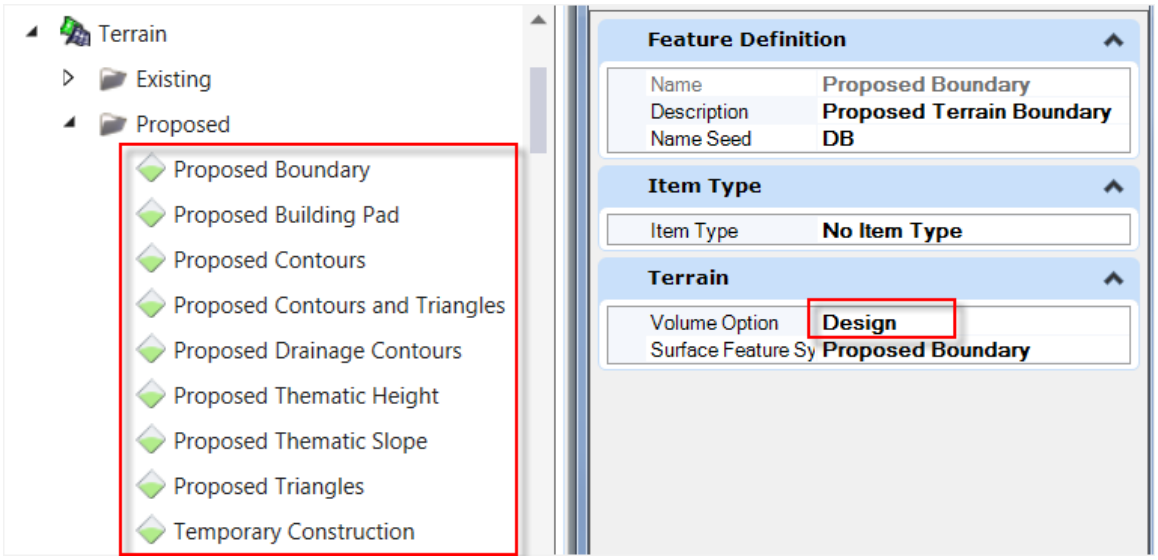
Feature Definitions are used to define various properties of the geometric elements. The mesh feature definition has a volume option which controls how earthwork will be classified and calculated, as well as the display of the 3D meshes. Options include None, Design, Existing, Subgrade, Substrata, Cut, Fill, Unsuitable and Custom.

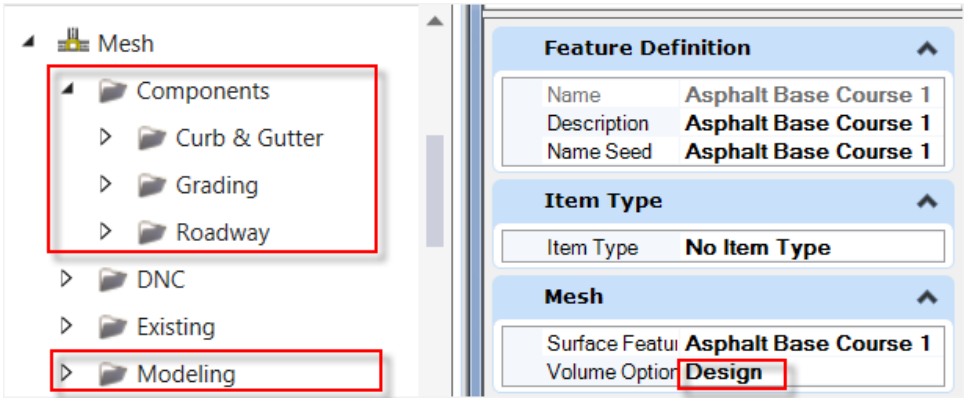


To create and calculated the cut and fill volumes, the Existing and Design volume option must be defined between any two terrains or corridors. All the feature definitions for existing terrain except the **Unsuitable Boundary** have volume option set to **Existing or Substrata**.

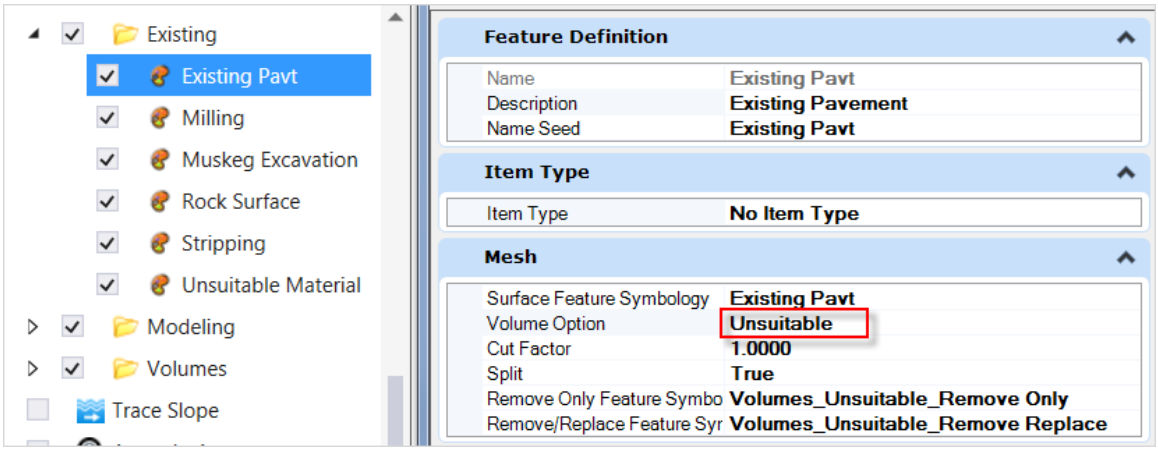


All the feature definitions for proposed terrain and proposed corridor components have volume option set to **Design**.





Under Mesh > Existing, feature definitions have volume option set to **Substrate** or **Unsuitable**.



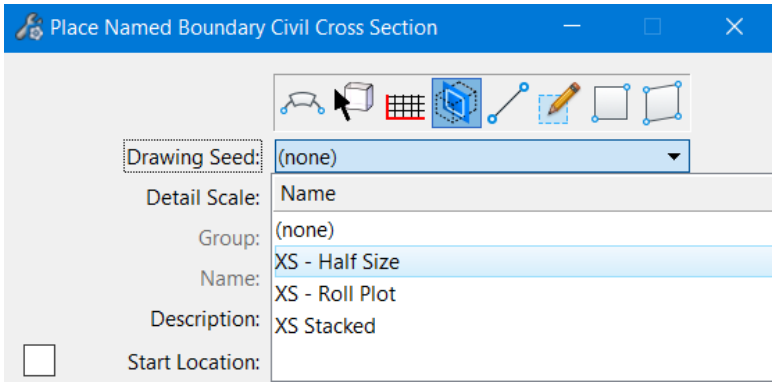
The Unsuitable material is able to be split into **Remove Only** and **Remove & Replace**.

8.4 End-Area Volume

The End Area Volumes Report tool is used to extract the traditional end-area volume using a series of cross sections defined with the cross section named boundaries along an alignment. The terrain model for existing conditions and proposed 3D model are required for this volume calculation. You can also add unsuitable material to calculations and/or add volume exceptions. The quantities are reported on a station-by-station basis.

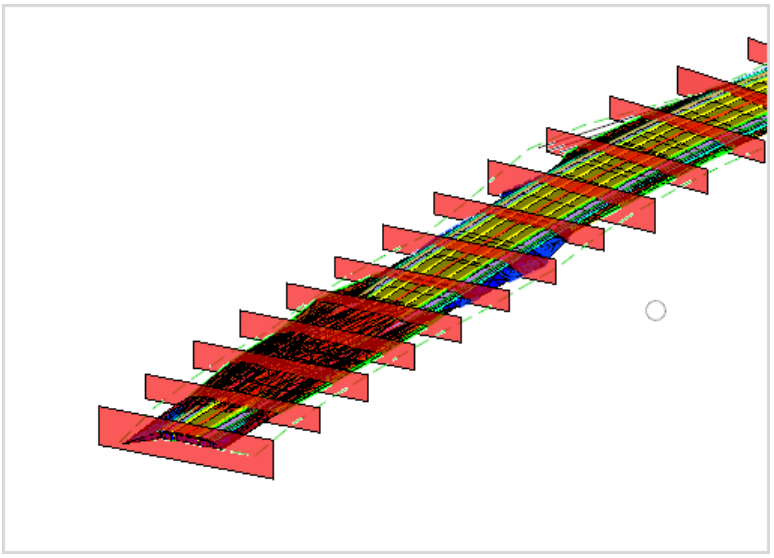
Refer to Plan Production section for (cross section) Named Boundary creation.

There are three predefined drawing seeds for placing cross section named boundaries in MTO workspace. Depending on the drawings to be produced, select a drawing seed from the *Drawing Seed* drop drown list to place the cross section named boundaries.



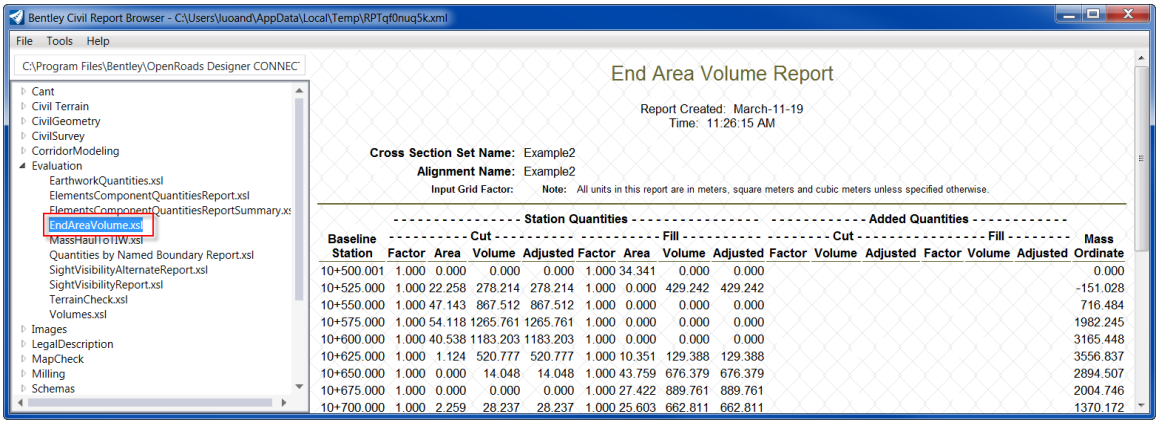
Adjust the left and right offset and the top and bottom clearance to fit the 3D model elements inside the named boundaries.

The Cross Section Named Boundaries will be placed in the 3D model.



Select **Home > Model Analysis and Reporting > Civil Analysis > End Area Volumes Report**

Follow the heads-up prompts to select the named boundary group and decide the volume exceptions, the ***Bentley Civil Report Browser*** will be displayed with calculated volumes. By default, the **EndAreaVolume.xsl** style sheet is used. Select other style sheet from the ***Evaluation*** folder on the left panel of the browser will present the data in different format.

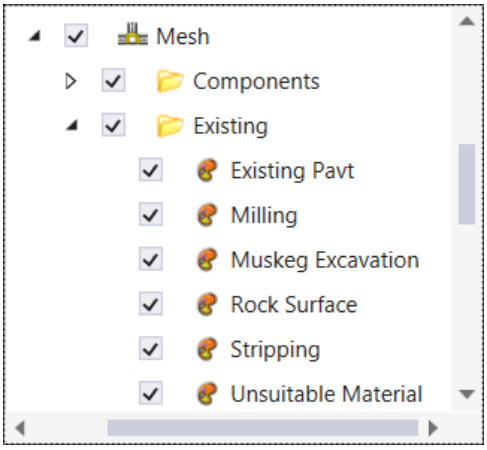


8.5 Unsuitable materials

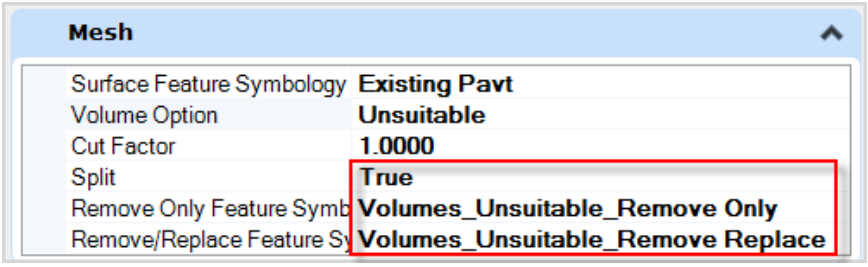
OpenRoads Designer is able to calculate the unsuitable materials like topsoil and pavement removal. When the ***Volume*** is set to **Unsuitable** in the feature definition, the material can be quantified as removed only or removed and replaced with fill material. If the ***Split*** option is set to **True**, the calculation will differentiate the quantities from what is to be removed only and what is to be removed and replaced.

The feature definitions for unsuitable material are located at:

……Mesh\Existing\



Some of these feature definitions are set to split. Change the ***Split*** option as per the project requirements.



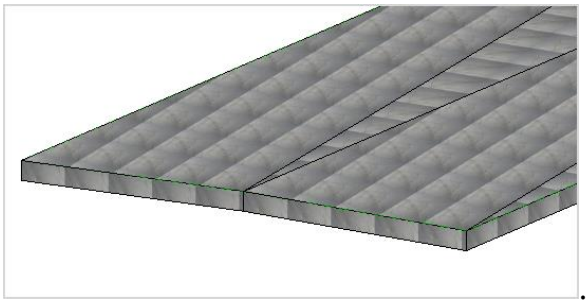
To calculate the Unsuitable Materials volume, a surface template is to be applied to a terrain model representing the top surface of the unsuitable material. Then the terrain model can be attached to the file used for volume calculation.

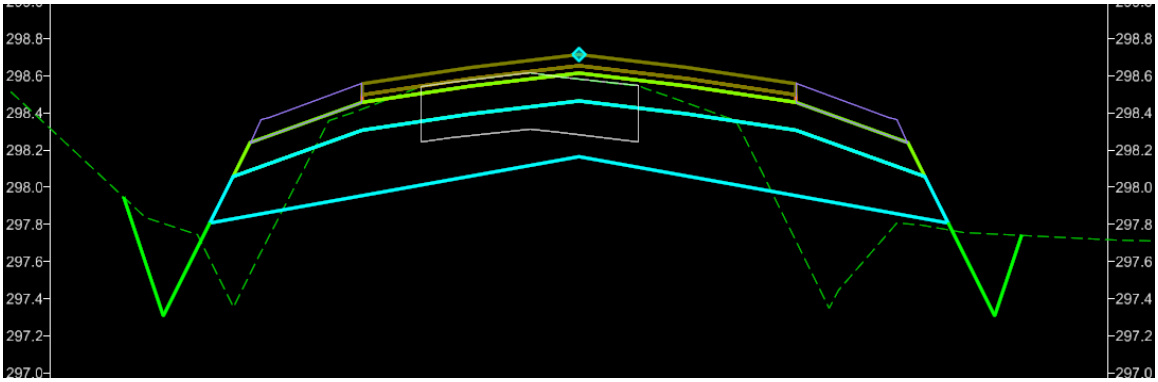
MTO standard template library contains predefined surface templates in the following folder:

MTO Library\Surface Templates\

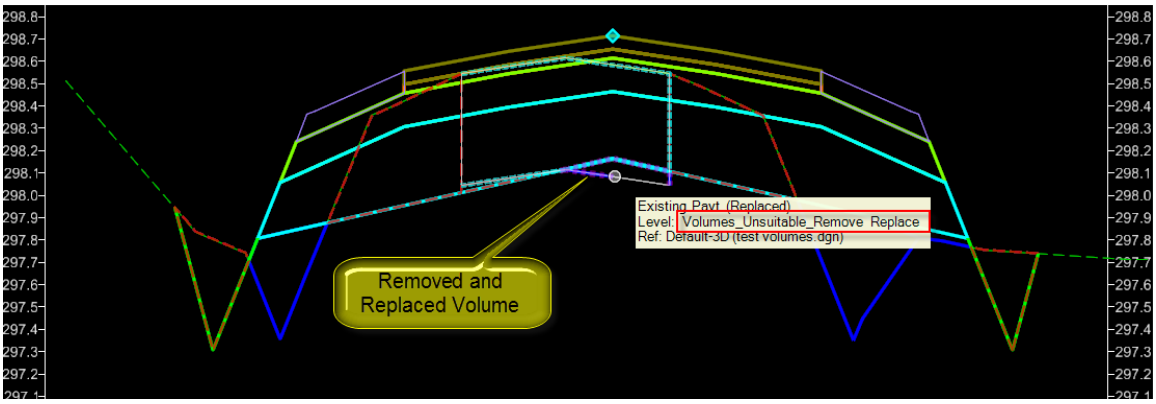
Use the surface template to apply a material thickness to the unsuitable material terrain model. Change the depth of the template as required.

Shown below existing pavement.





Once attached the unsuitable material terrain model, use the *Create Cut and Fill Volumes* tool to create 3D cut and fill meshes. When prompt "*Use Unsuitable*", select **Yes**. The calculation will take into account the unsuitable material's volumes.



Use the *Quantities Report By Named Boundary* tool to create a report of the quantities and volumes for the corridor model. Select Volumes.xsl to change the report type. Shown below the existing pavement volume is split into *Replaced and Removed (not replaced)*.

Cross Section Set Name: <None>

Alignment Name:

Input Grid Factor:

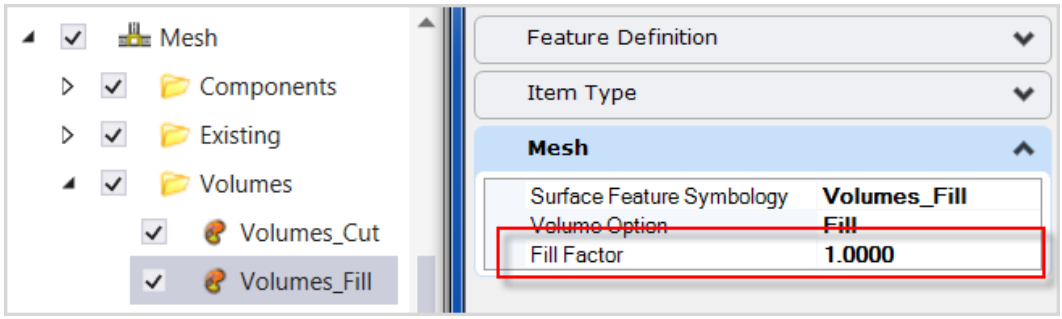
Note: All units in this report are in meters, square meters and cubic meters unless specified otherwise.

Station	Type	Area	Volume	Factor	Adjusted Volume	Included in Mass Ordinate?	Mass Ordinate
0+000.000							2210.673
	Volumes_Cut:		5982.043	1.000	5982.043	Yes	
	Volumes_Fill:		3771.370	1.000	3771.370	Yes	
	Existing Pavt (replaced):		62.979	1.000	62.979	No	
	Existing Pavt (not replaced):		922.650	1.000	922.650	No	
	Total Existing Pavt:		985.629	1.000	985.629		
	Asphalt Base Course 1:		278.313	1.000	278.313	No	
	Asphalt Top Course:		417.325	1.000	417.325	No	
	Granular A:		1625.955	1.000	1625.955	No	
	Granular B:		3588.838	1.000	3588.838	No	
	Granular Shoulder:		343.047	1.000	343.047	No	

8.6 Cut/Fill Factor

To account for any swell or shrinkage that may occur when remove/place material, a factor can be applied to the cut or fill volume.

The *Volumes_Cut* and *Volumes_Fill* have a setting to define the cut/fill factors.



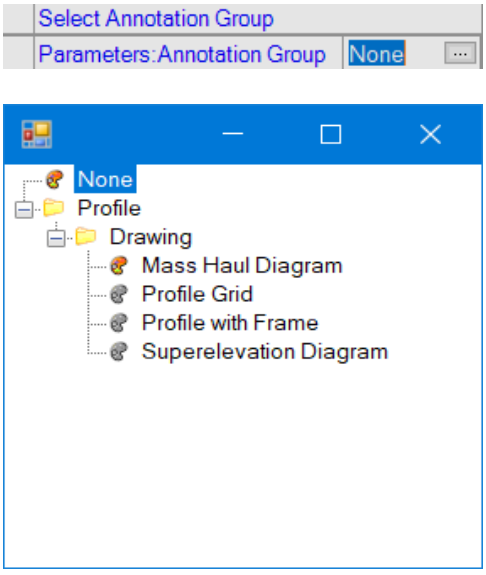
8.7 Mass Haul Diagram

This command generates a Mass Haul diagram representing the cumulative total of cut and fill volumes along a horizontal alignment or defined plan or cross section boundary group. Before you generate a Mass-Haul diagram, have the 3D Cut Fill meshes created.

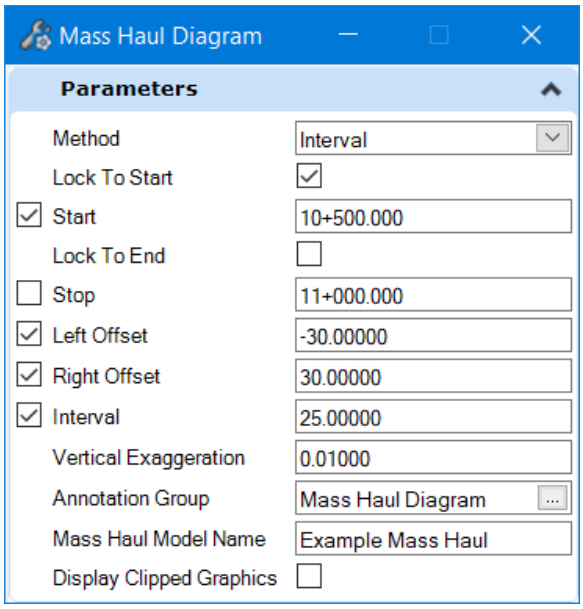
Select **Home > Model Analysis and Reporting > Civil Analysis > Mass-Haul Diagram**

Follow the heads up prompts to select and input values.

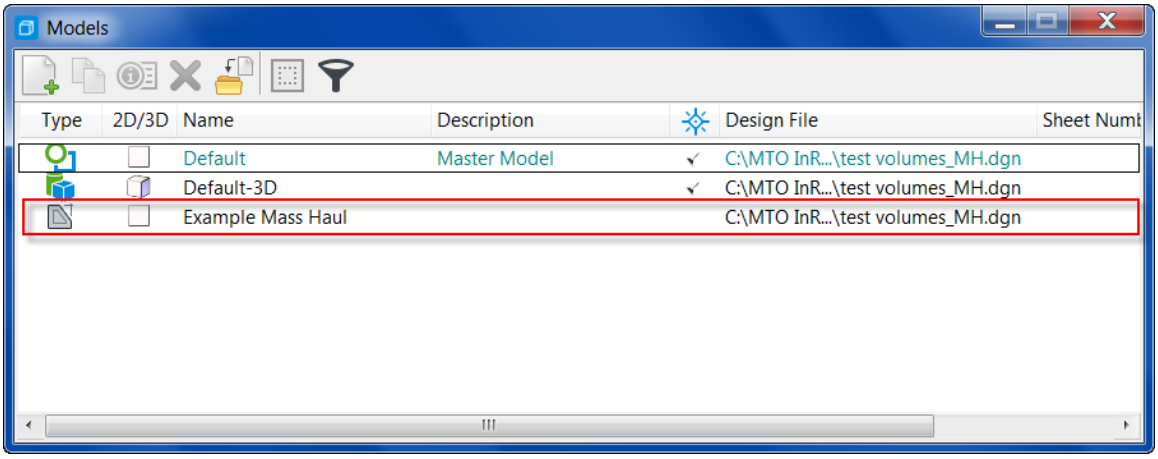
When prompt for *Annotation Group*, press and hold <ALT> Down Arrow and select **Profile > Drawing > Mass Haul Diagram**

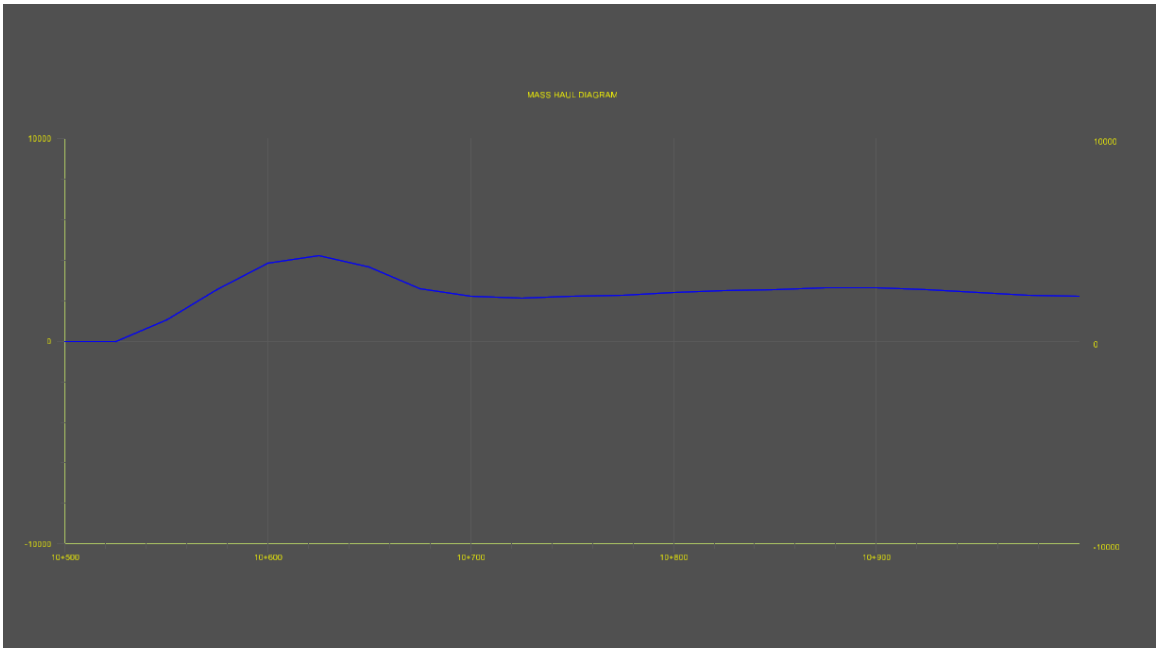


The accepted values are displayed in the ***Mass Haul Diagram*** dialog as shown below.

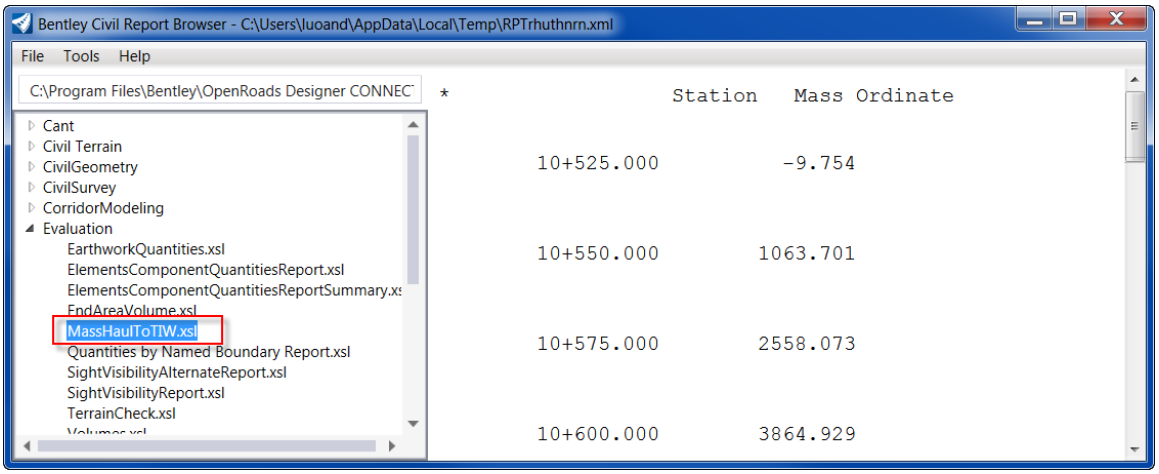


The *Mass Haul Diagram* will be created and opened in a separate *Drawing Model*.

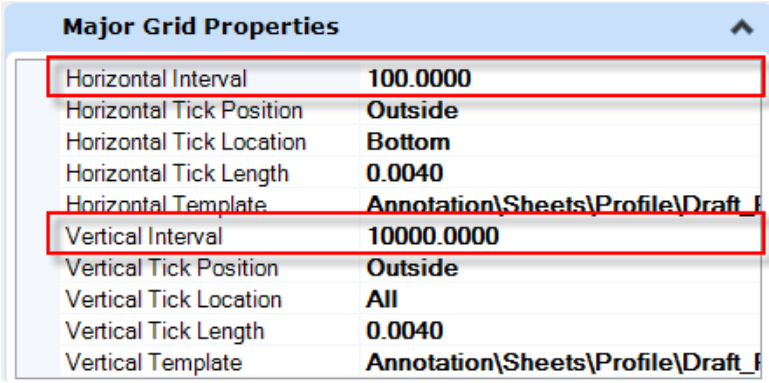




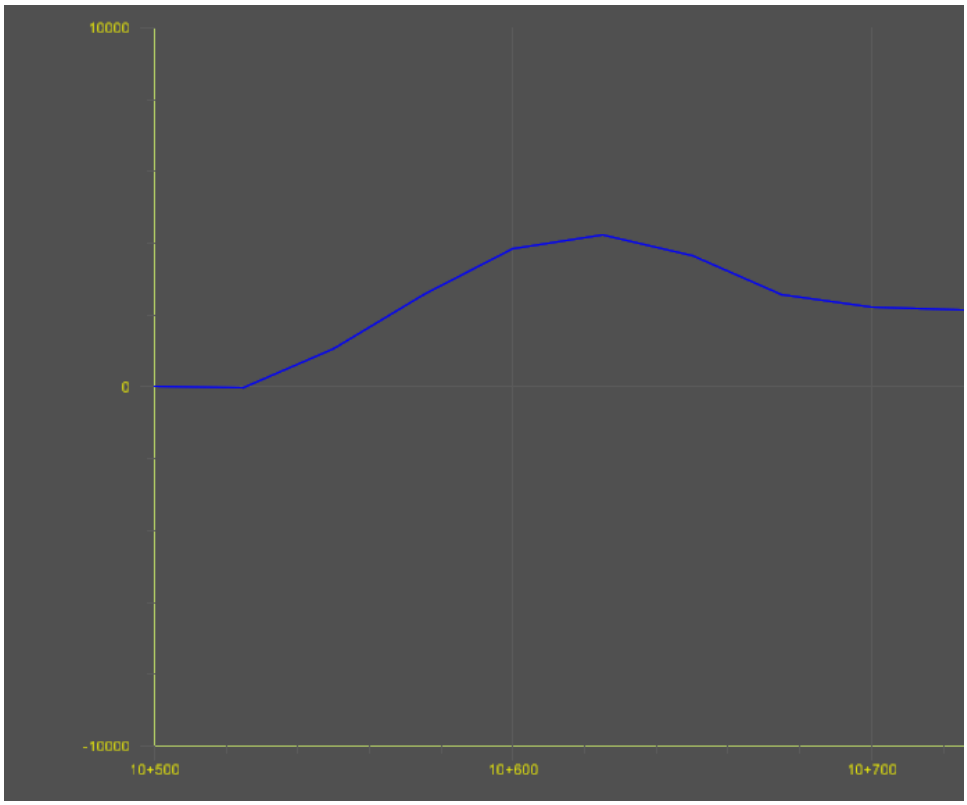
The Mass Haul report is displayed in the *Bentley Civil Report Browser*.



The major grid of the annotation group **Mass Haul Diagram** is set to 100 for the Horizontal Interval and 10000 for the Vertical Interval.



Each horizontal major grid is 100m and each vertical major grid is 10000 m^3. With vertical exaggeration of 0.01, each grid is 100 x 100 drawing master unit.



9.0 Drawing Production

OpenRoads Designer provides drawing production workflow and tools for automated Plan, Profile, and cross section sheet creation.

Named Boundaries are used to define the extent of what is to be displayed on the sheet, and to create and manage the sheets. Seed files and sheet seed definitions are created for generating the customized sheets.

9.1 Seed Files

The Drawing Seed and Sheet Seed are required to generate customized sheets. Two seed files ***MTO_SheetSeed.dgn*** and ***MTO_DrawingSeed.dgn*** are provided in the following folder:

……\Organization-Civil\MTO\Seed\Sheets\

The following 4 variables are set with these seed files for the sheet creation.

MS_DRAWINGMODELSEED

MS_DRAWINGMODELSEEDNAME

MS_SHEETMODELSEED

MS_SHEETMODELSEEDNAME

9.2 Sheet Seed Definitions

The following sheet definitions have been setup for creating the named boundary and drawings. Each of this sheet definition has a set of predefined values. Chang settings on the ***Place Named Boundary*** dialog to meet project specific requirements.

- Civil Plan
  - *Plan - Full Size*
  - *Plan - Half Size*
  - *Plan-Profile - Full Size (Plan Port)*
  - *Plan-Profile - Half Size (Plan Port)*

- Civil Profile
  - *Profile - Full Size*
  - *Profile - Half Size*
  - *Plan-Profile - Full Size (Profile Port)*
  - *Plan-Profile - Half Size (Profile Port)*
  - *Profile-Profile - Half Size (Top Port)*

- Civil Cross Section
  - *Cross Section - Half Size*
  - *Cross Section - Roll Plot*
  - *Cross Section - Stacked*

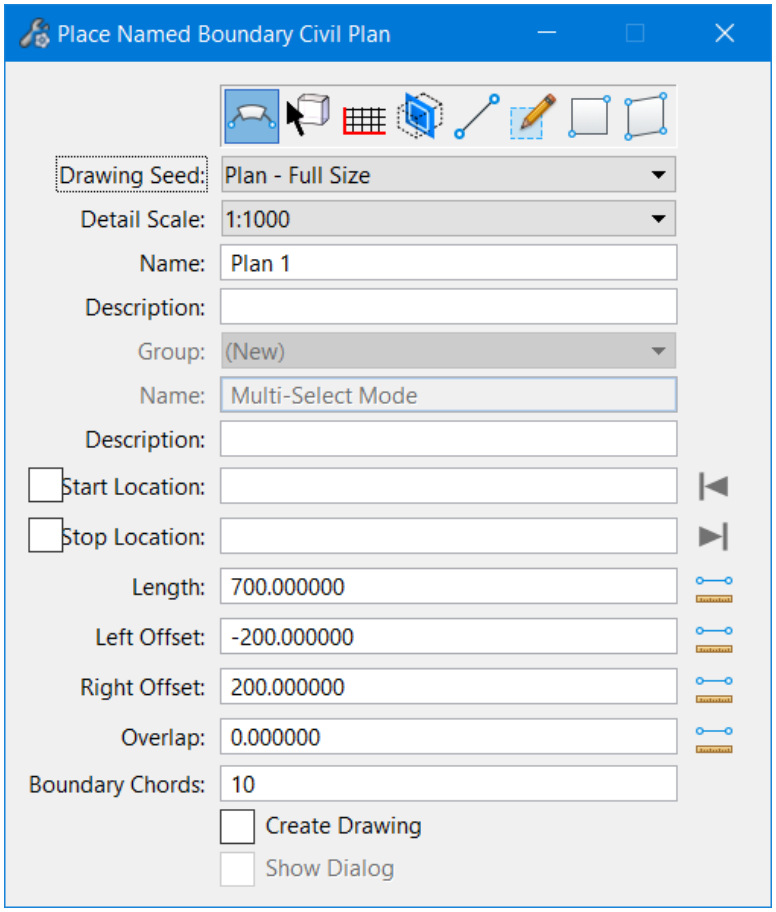
9.3 Named Boundaries

Select the **Place Named Boundary** command from the ***Drawing Production*** tab ***Named Boundaries*** group on the OpenRoads Modeling workflow ribbon, or on the OpenRoads Drawing Production workflow ribbon.

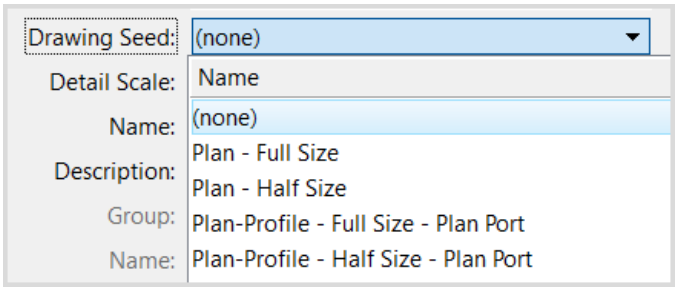
Drawing Production > Named Boundaries > Named Boundary

Civil Plan

For plan named boundaries, select **Civil Plan** mode,



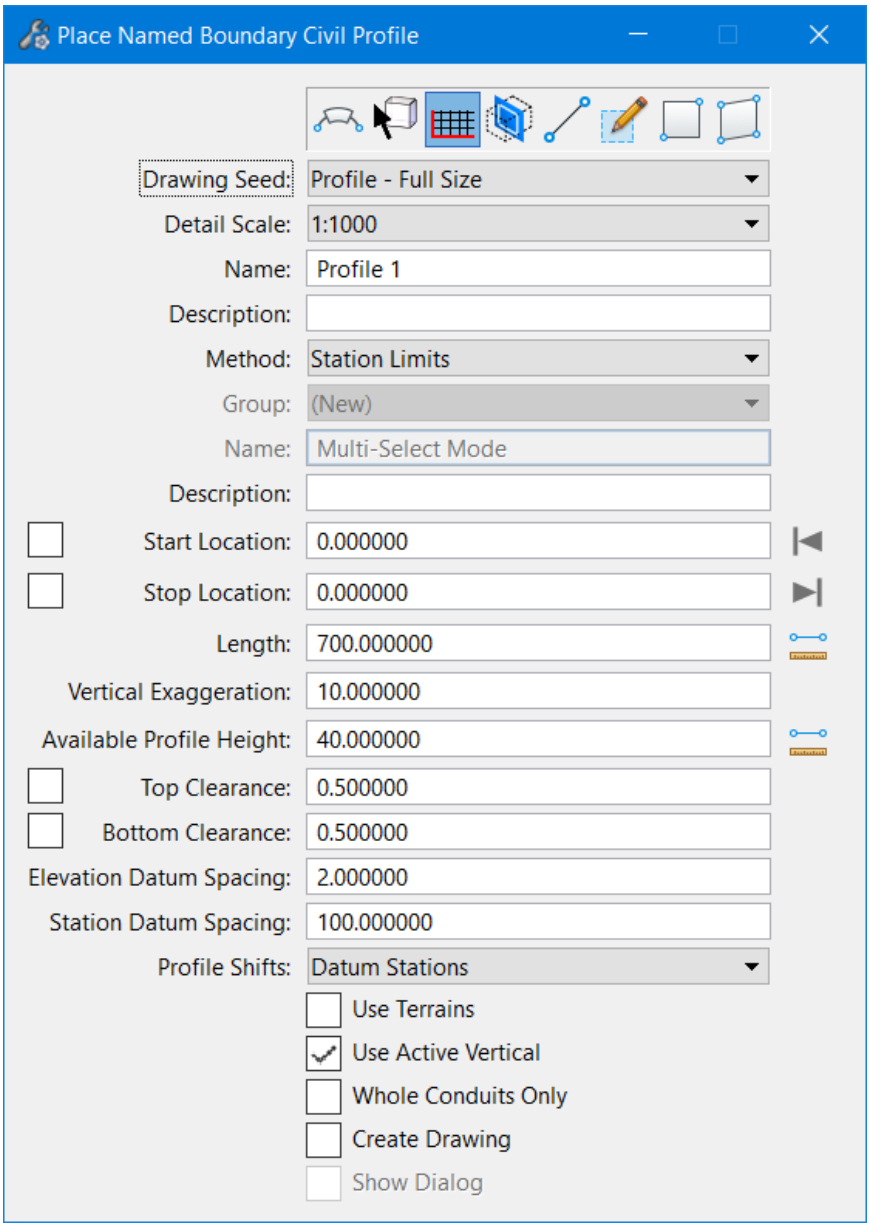
Select a sheet definition from the **Drawing Seed** drop drown list. There are four drawing seeds (two for plan and profile) are available in the workspace.



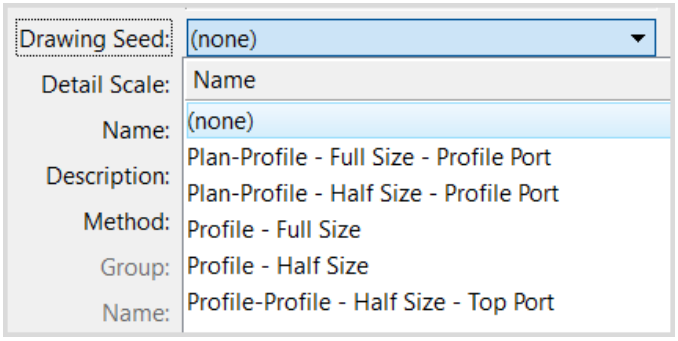
Some of the settings on the dialog have been set for each of these drawing seed. They can be changed for project specific requirements. Some of the fields need to be filled by user.

Civil Profile

For profile named boundaries, select **Civil Profile** mode,

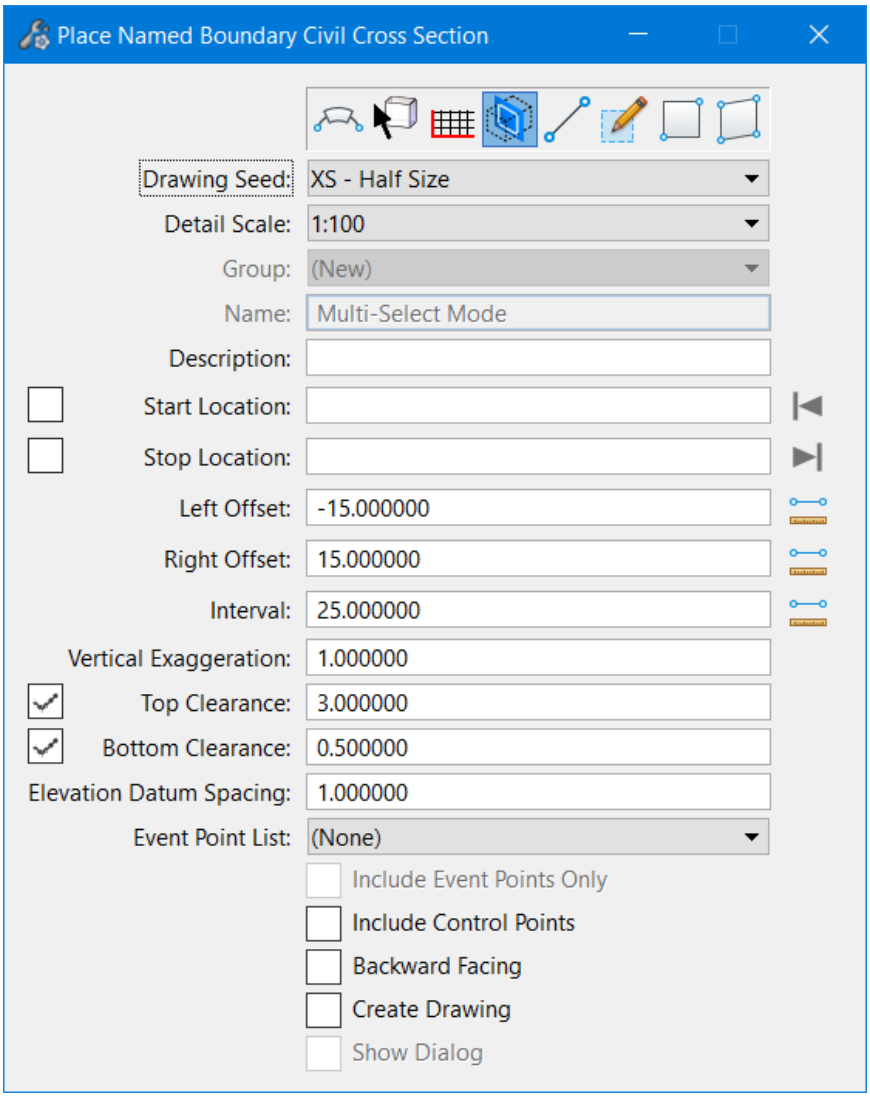


Select a sheet definition from the **Drawing Seed** drop drown list. There are five drawing seeds (two for plan and profile) are available in the workspace. Change the default values if desired.

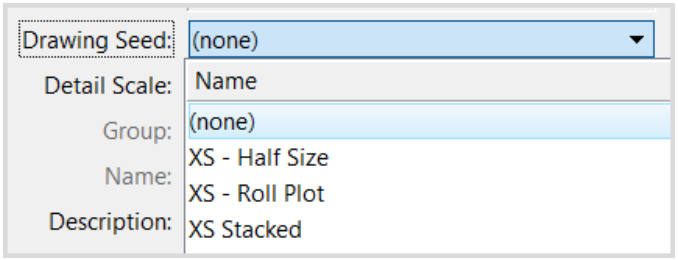


Civil Cross Section

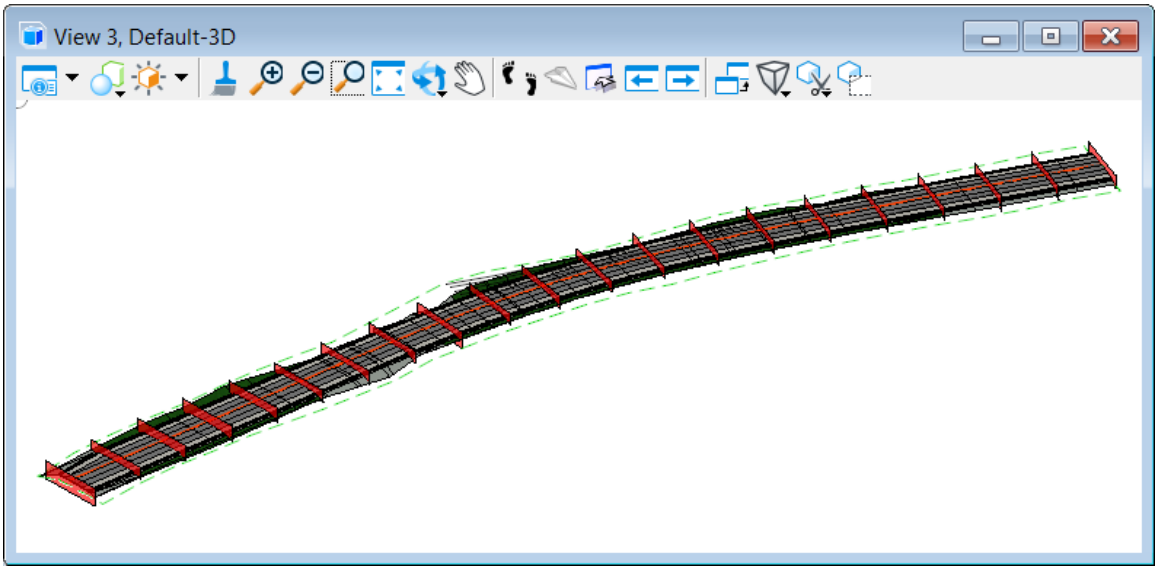
To place cross section named boundaries, the 3D model must be open and available. Select **Civil Cross Section** mode.



Select a sheet definition from the **Drawing Seed** drop drown list. There are three drawing seeds are available in the workspace. Each drawing seed has a set of default values such as offsets, intervals, and clearances that can be changed for project specific needs when creating the cross section named boundaries.



Shown below, cross section name boundaries created and displayed in 3D model.



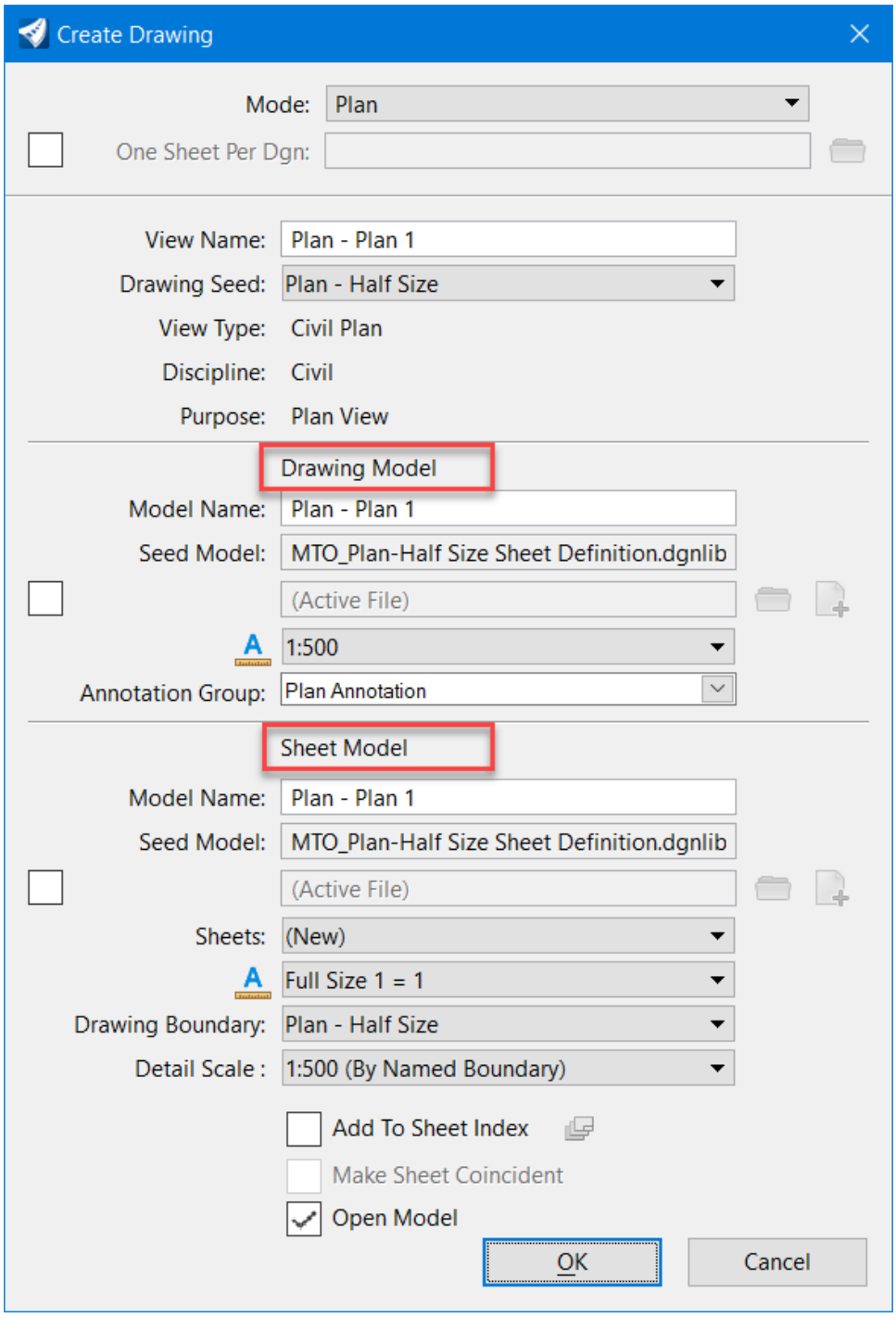
9.4 Sheet Creation

The **Create Drawing** tool is used to create Drawing models and Sheet models. The tool can be activated through the ***Place Named Boundary*** dialog once the Named Boundaries are created, or from the ***Named Boundaries*** manager (dialog) after the Named Boundaries have been placed.

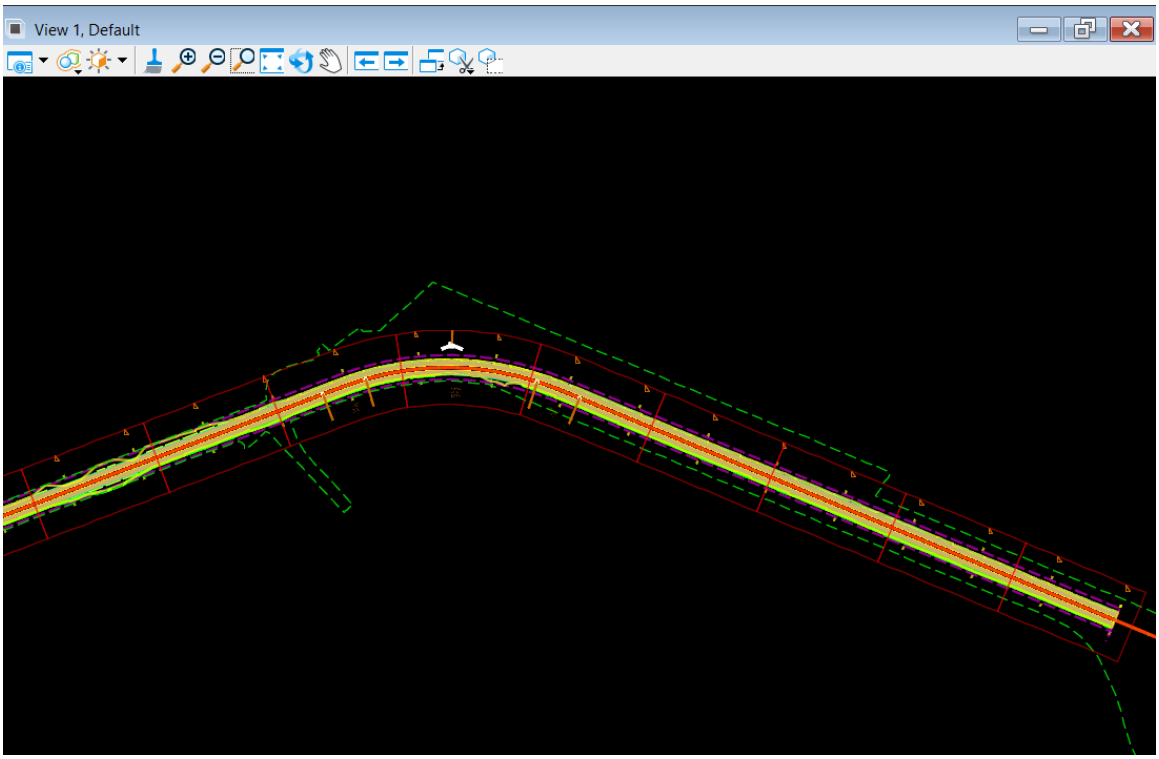
One Drawing model is created for each Named Boundary. One or more Drawing models is then referenced onto a Sheet model for sheet creation. The drawing model and the sheet model will be automatically updated as the model changes.

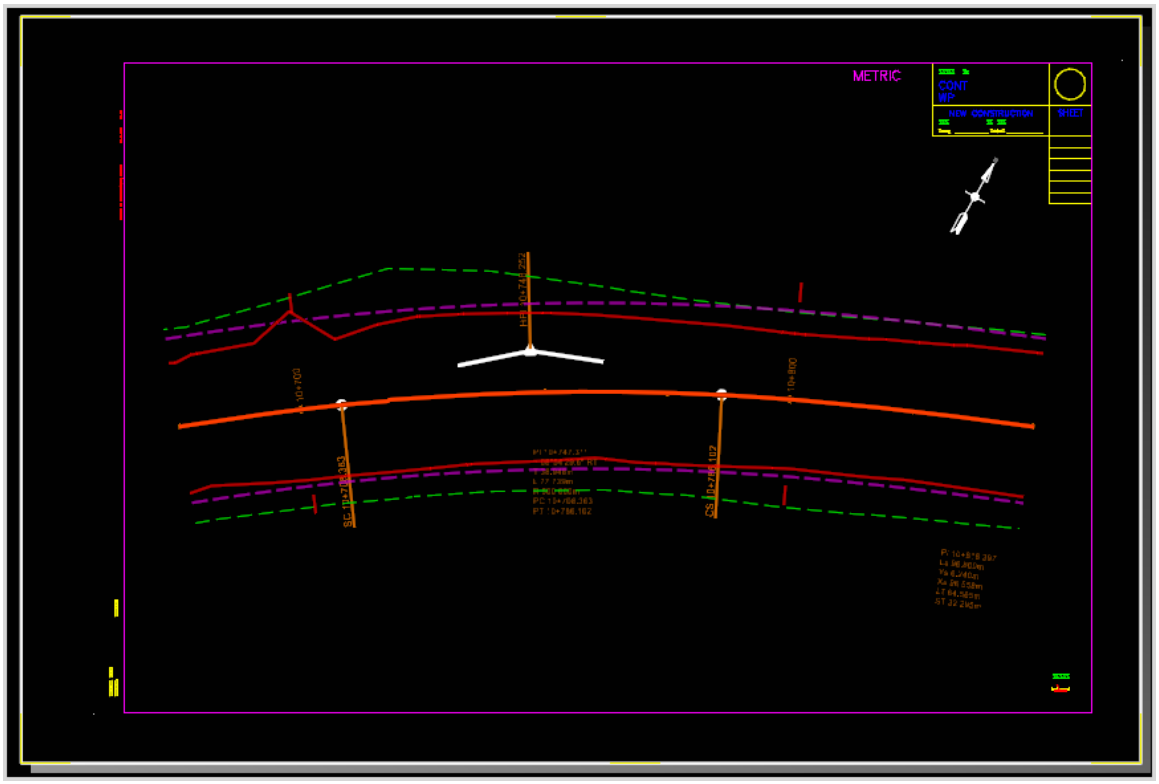
On the ***Create Drawing*** dialog, there are additional settings for both Drawing Model and Sheet Model (e.g., Annotation Group, scales, etc.). The default options and values on this dialog can be changed if desired when creating the sheets.

Plan ***Create Drawing*** dialog:

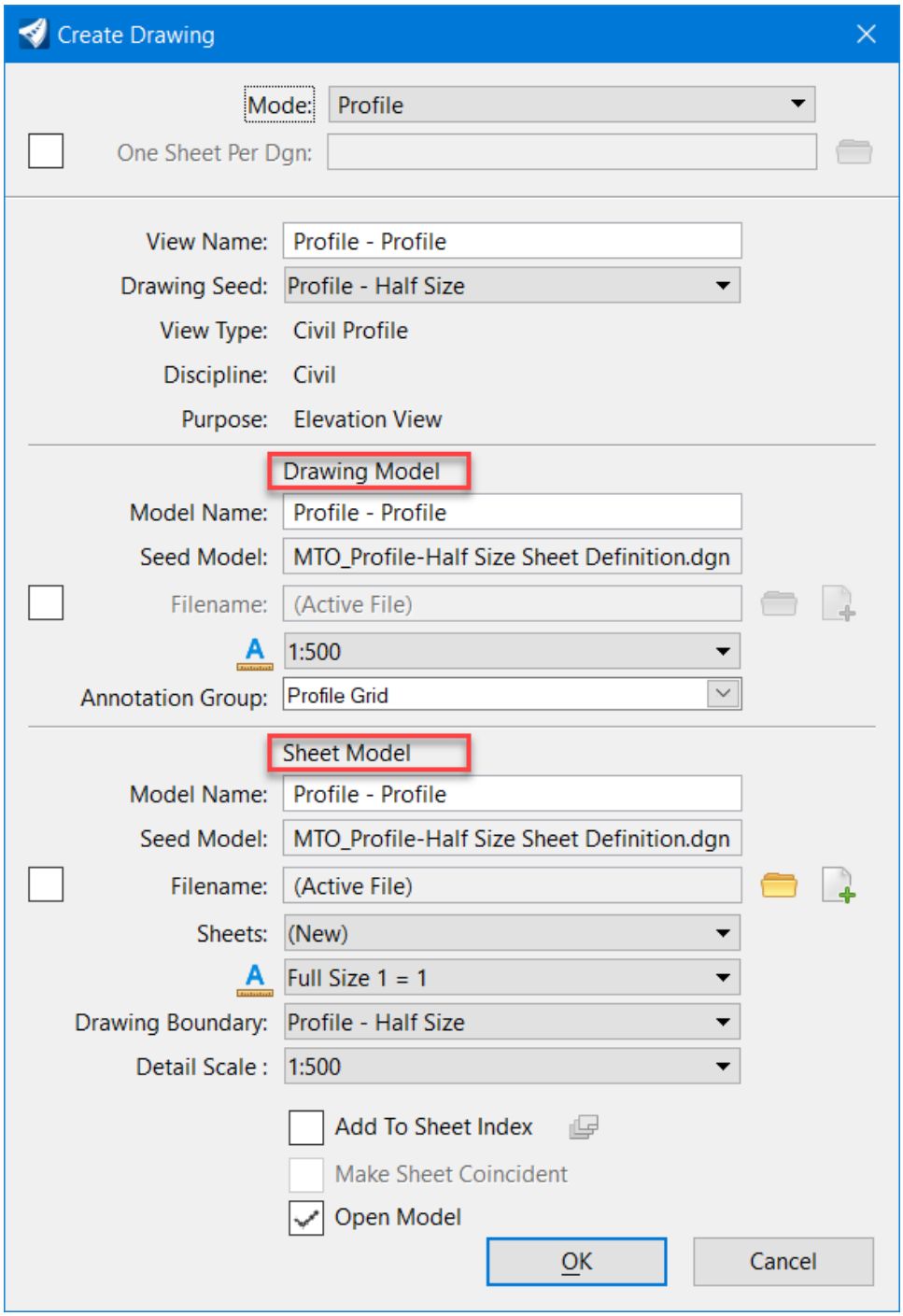


Plan Named Boundaries and sheet:

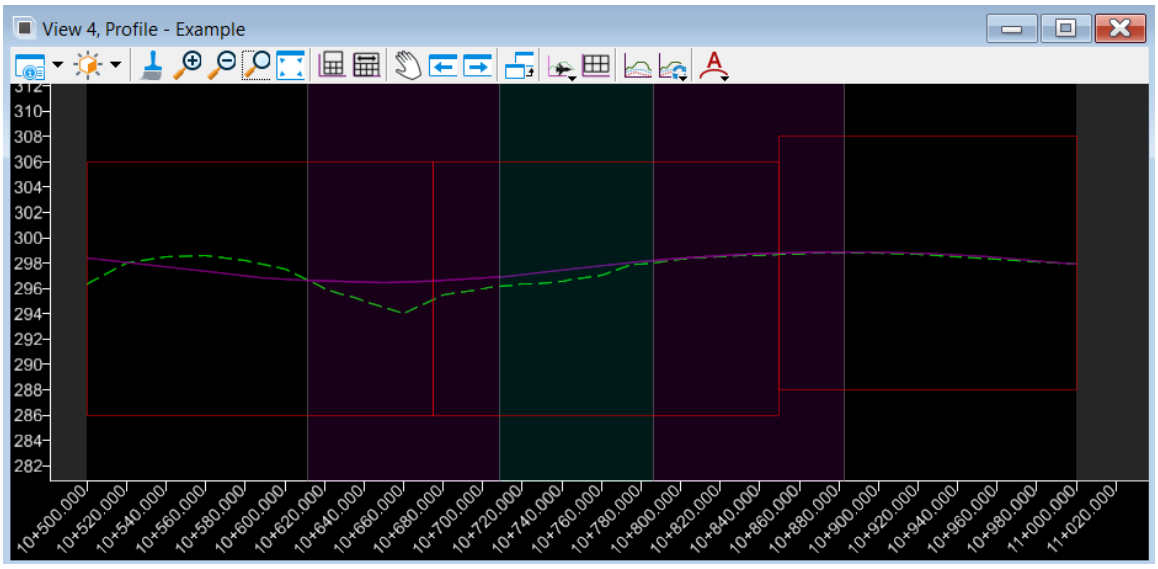


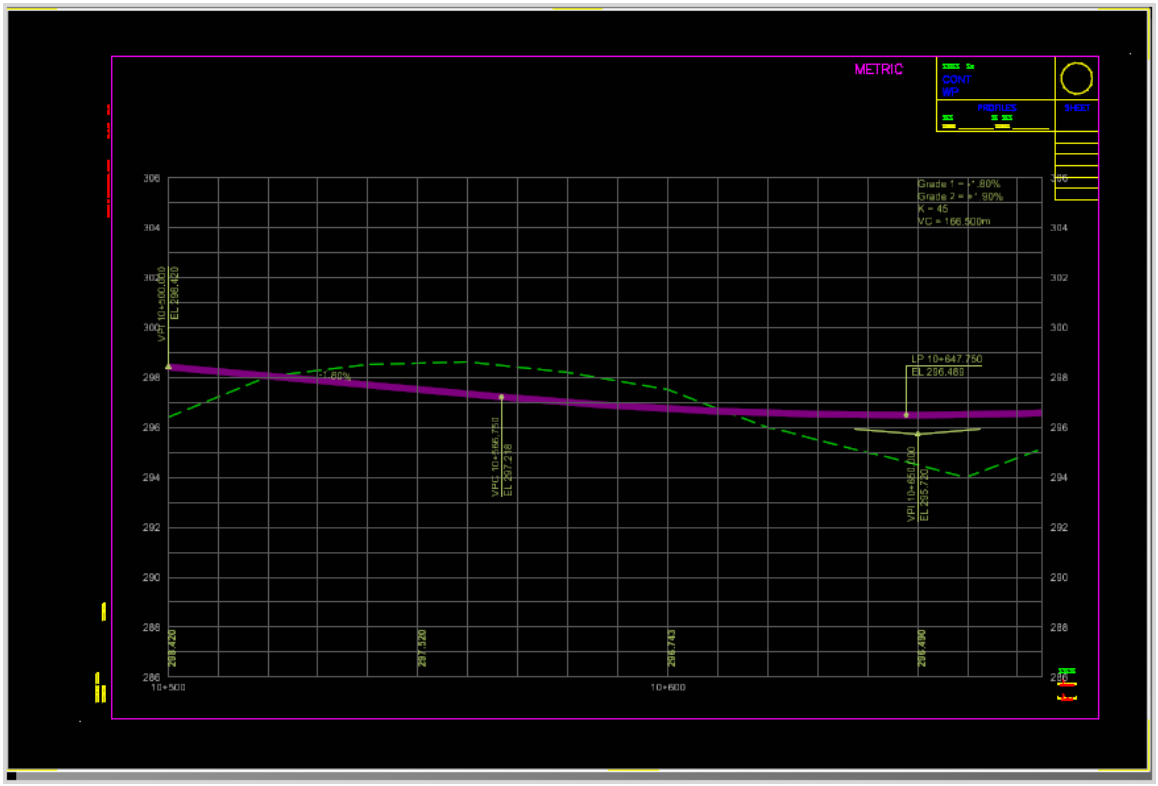


Profile ***Create Drawing*** dialog:

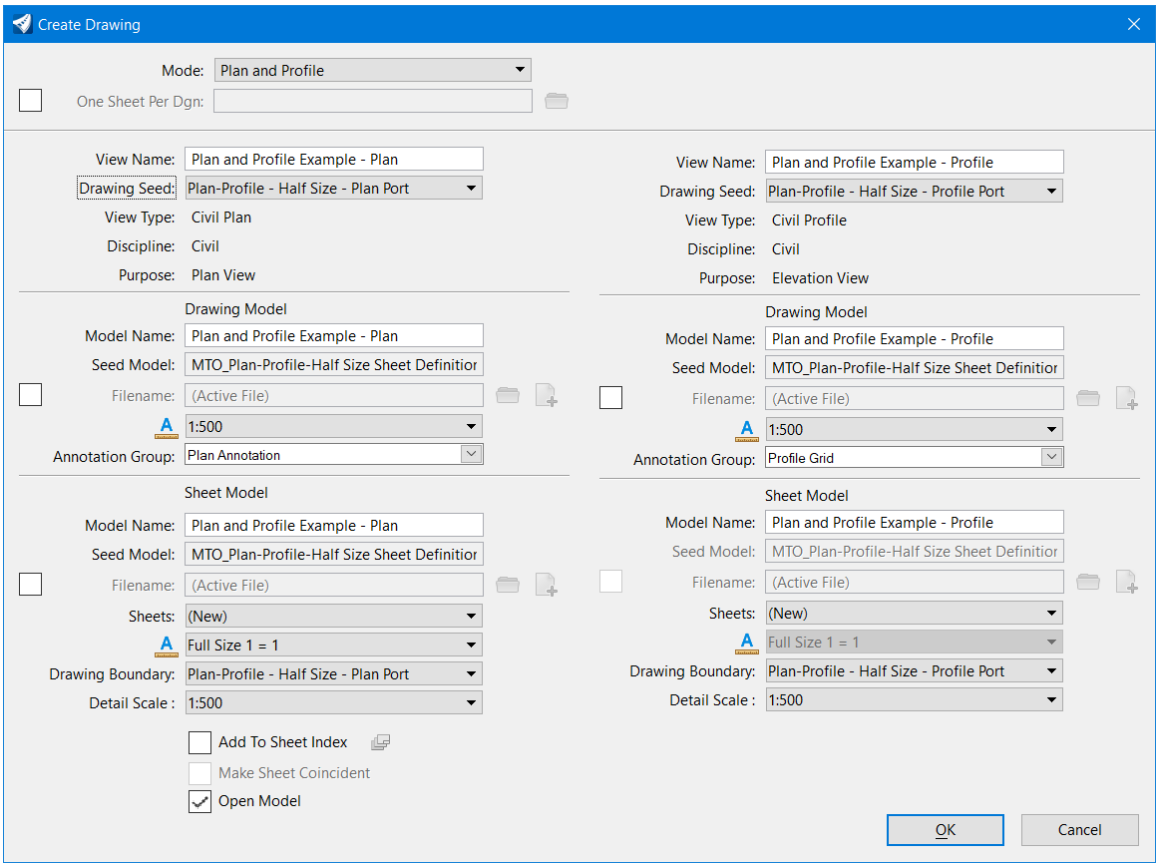


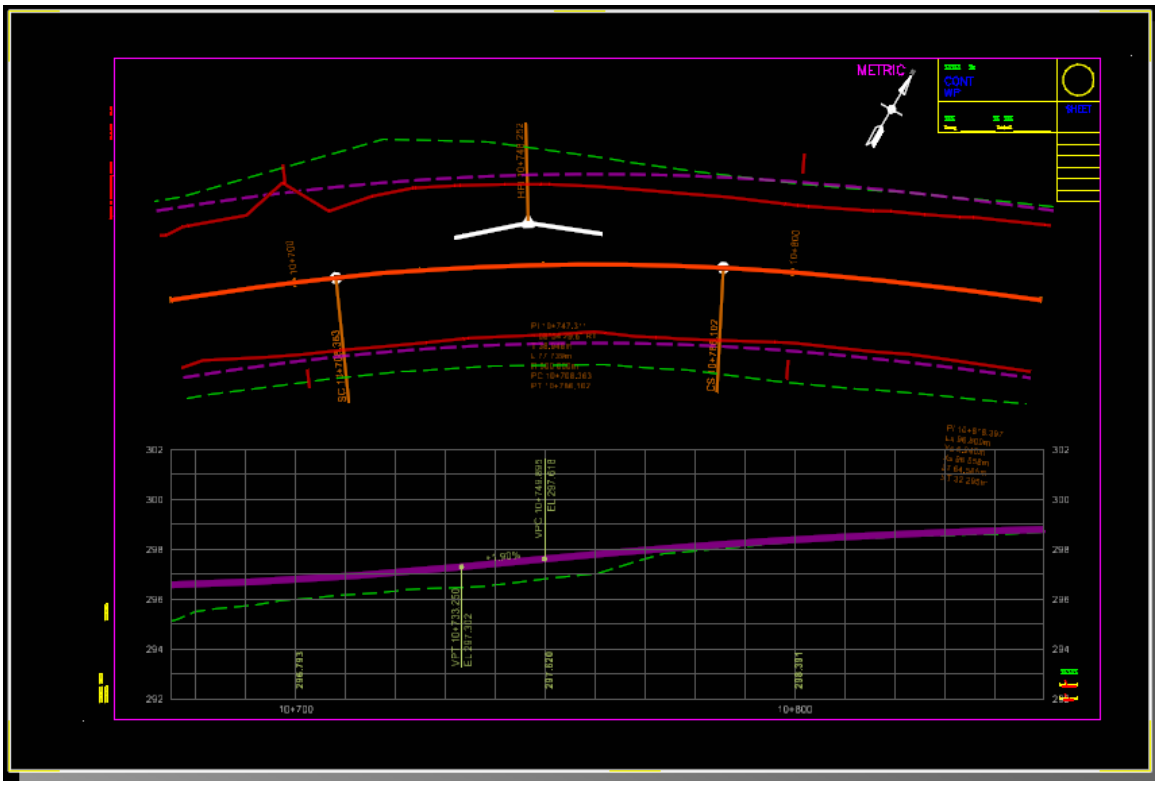
Profile Named Boundaries and sheet:



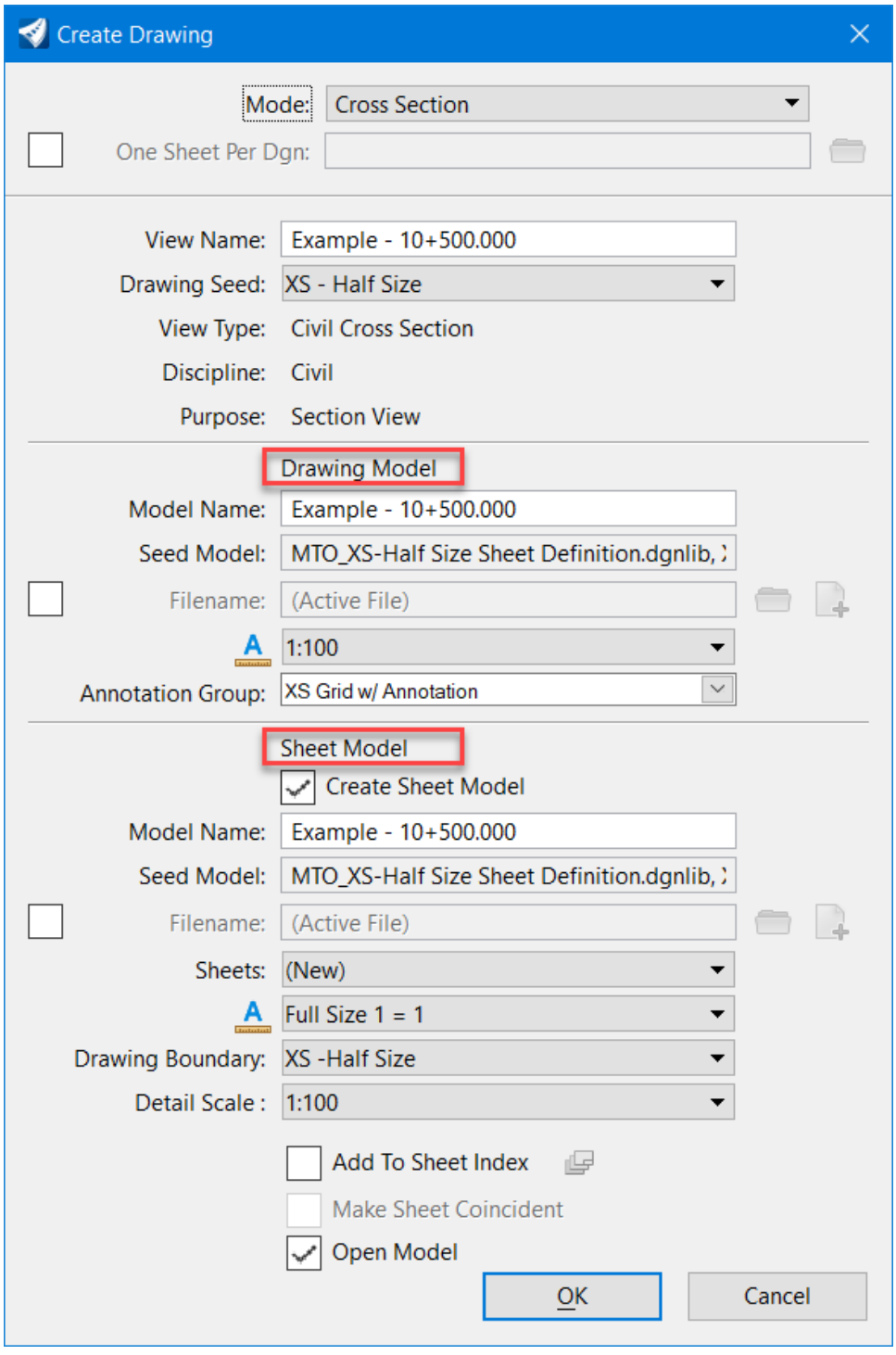


For Plan and Profile sheet, the ***Create Drawing*** dialog has settings for both ***Plan*** and ***Profile***:

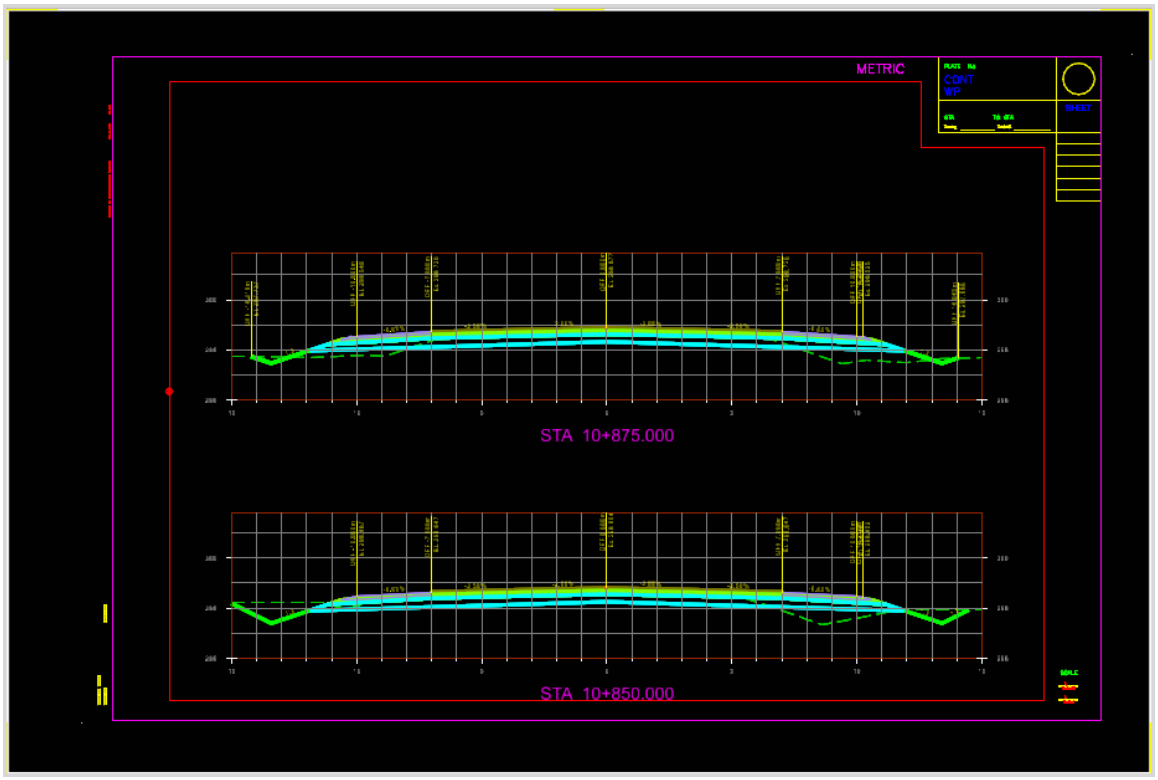


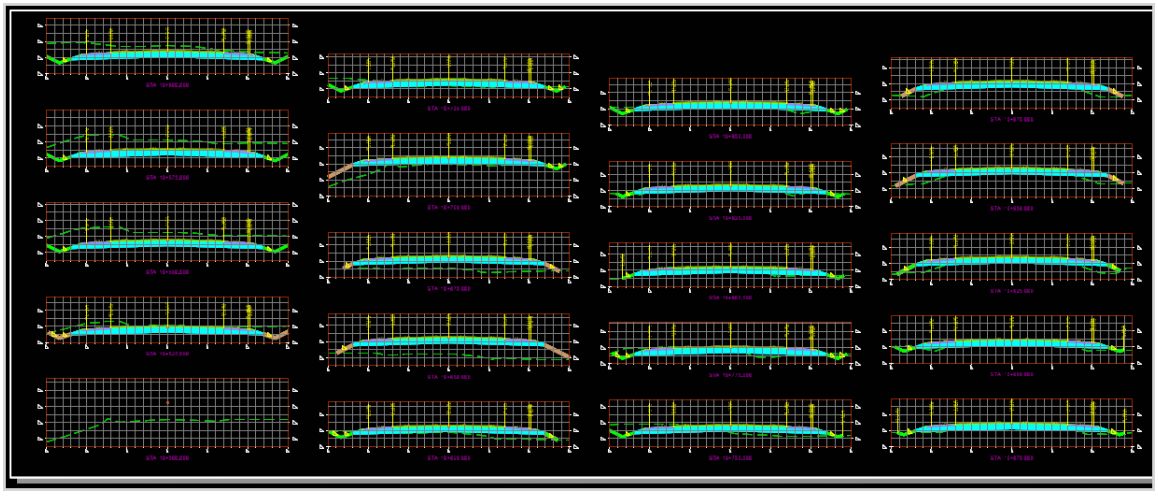


Cross Section ***Create Drawing*** dialog:



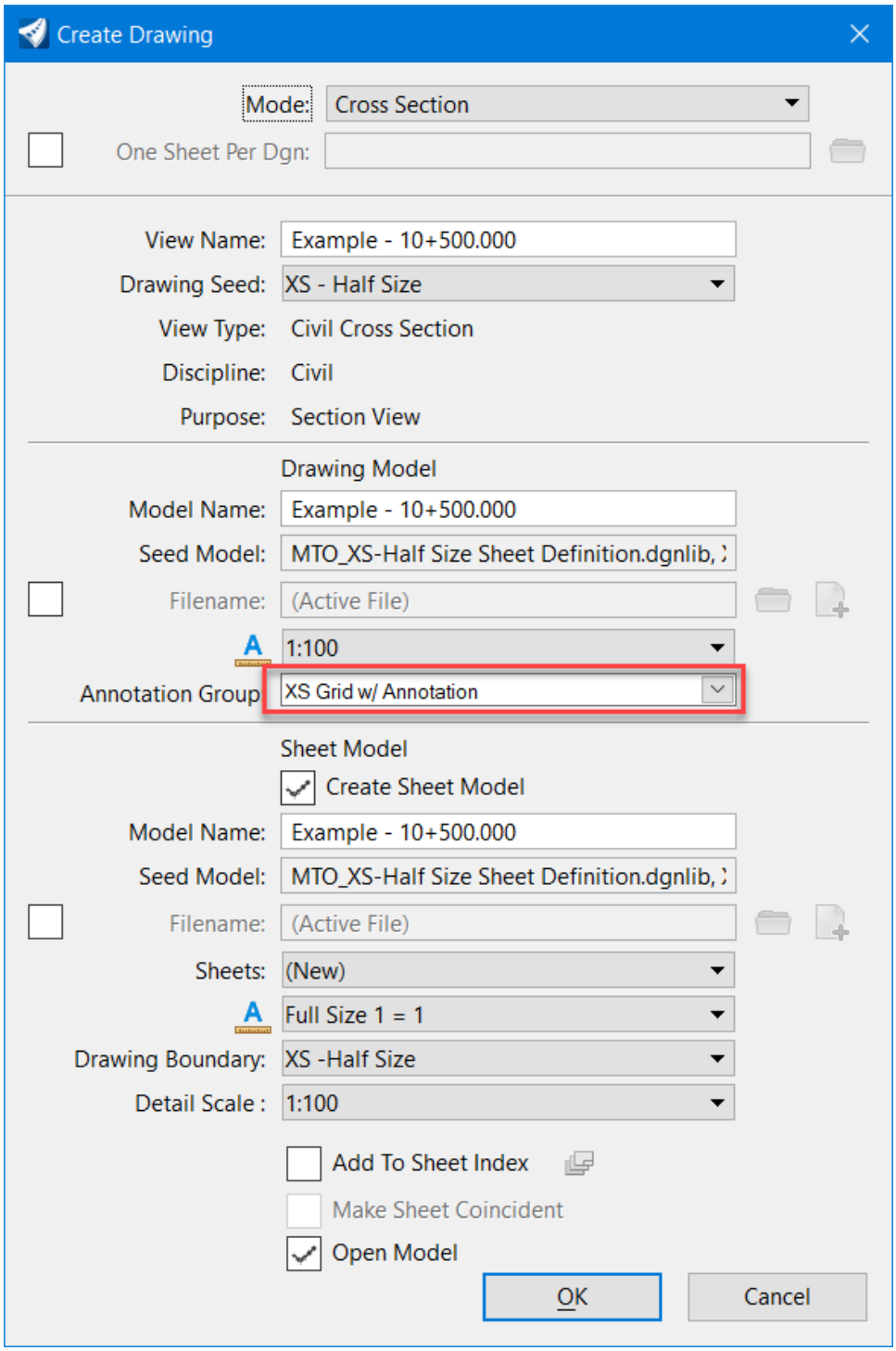
Cross Sections generated in sheet and roll:





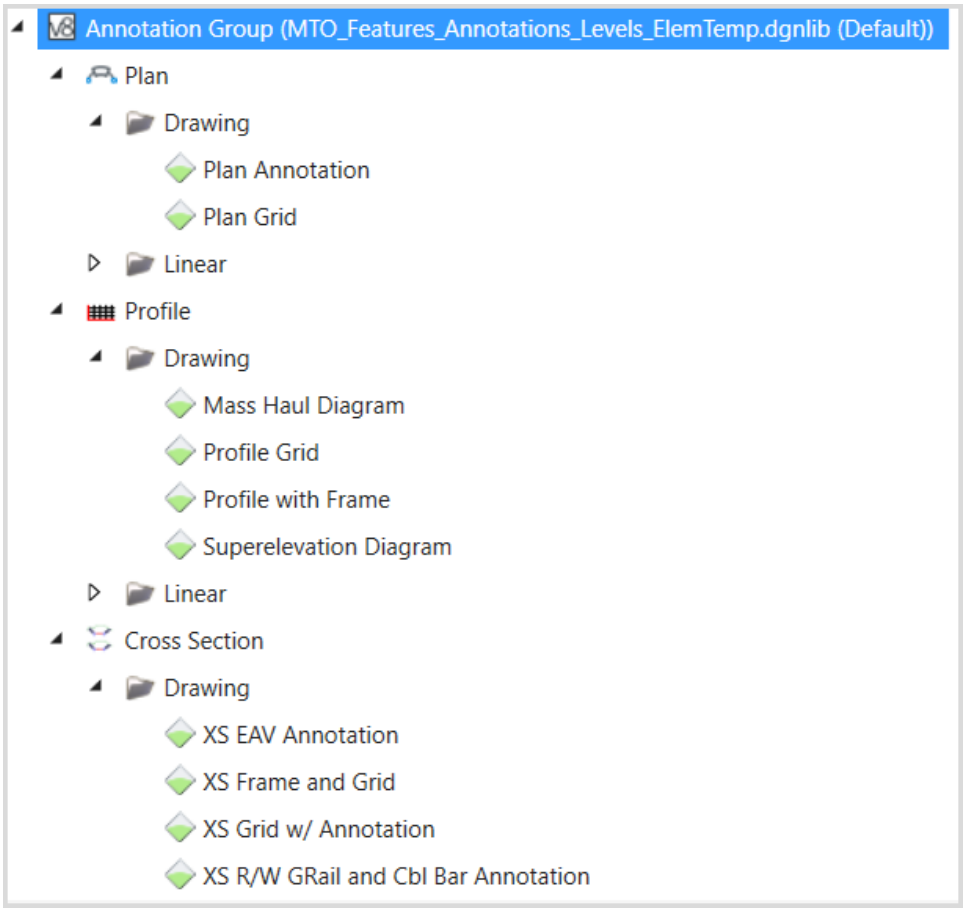
9.5 Drawing Annotation

Annotation Groups are defined for Plan, Profile and Cross Sections annotations. When an annotation group is assigned on the ***Create Drawing*** dialog, sheets will be created and annotated automatically. Annotation can also be added after the sheets are created. For project specific requirements, the annotation groups can be modified with additional annotation definitions either from other annotation groups or created by users, or use multiple annotation groups.



Each sheet seed definition in the workspace has an annotation group assigned. This annotation group can be removed or replaced with a different available annotation group on the ***Create Drawing*** dialog. Annotation groups can also be applied after sheets are created.

Shown below are available drawing annotation groups.



9.6 Cross Sections Annotation and Report

The cross section annotation can be placed automatically with assigning an annotation group when creating cross section sheets or manually placed in the drawing model after the cross sections are generated.

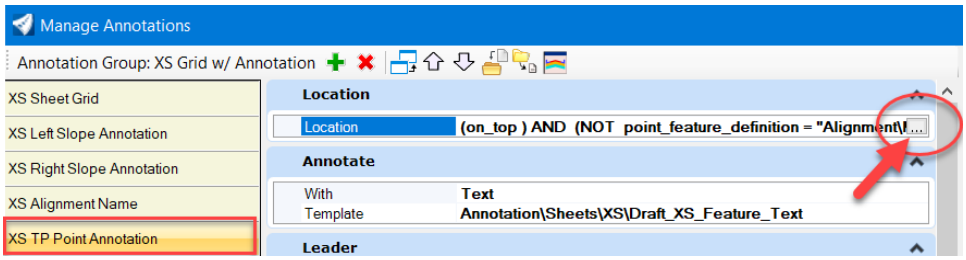
9.6.1 Point Annotation

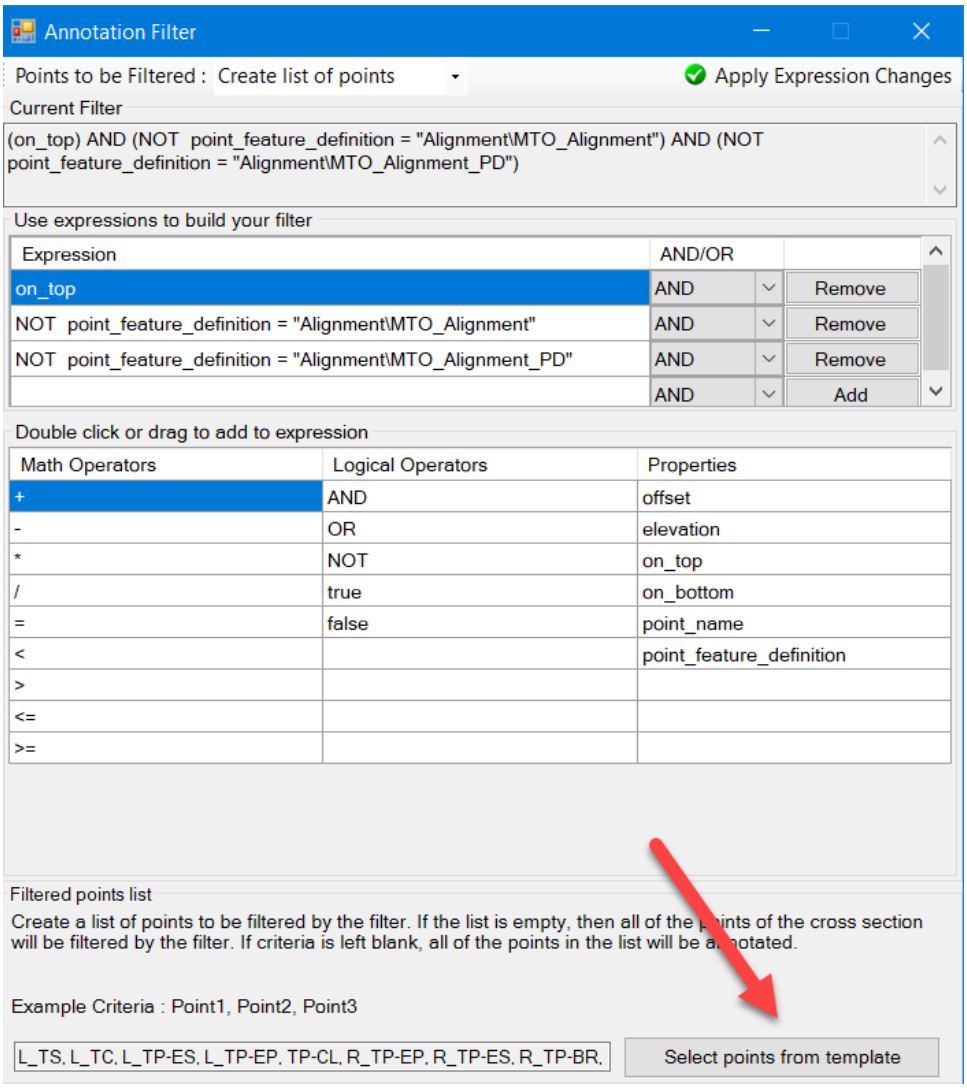
The annotation group ***XS Grid w/ Annotation*** can be used to annotate cross section points and segments. This annotation group contains annotation definitions to annotate the top layer slope and points.

The points listed in the annotation definition **XS TP Point Annotation** are from a template in MTO's template library. Check the point list and make necessary adjustment so all the points to be annotated are included. It may be necessary to recreate the point list by selecting points from the project cross section templates.

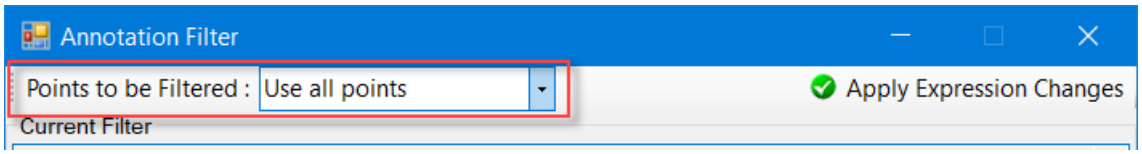
Expand the ***Annotation Groups*** category from the **OpenRoads Standards** tab on ***Explorer*** dialog, right click on the annotation group and select **Manage** to open the ***Manage Annotations*** dialog.

Select the **XS TP Point Annotation** definition and click on the ellipsis button at the end of the location field to open the *Annotation Filter* dialog. The point list is at the bottom of the page.

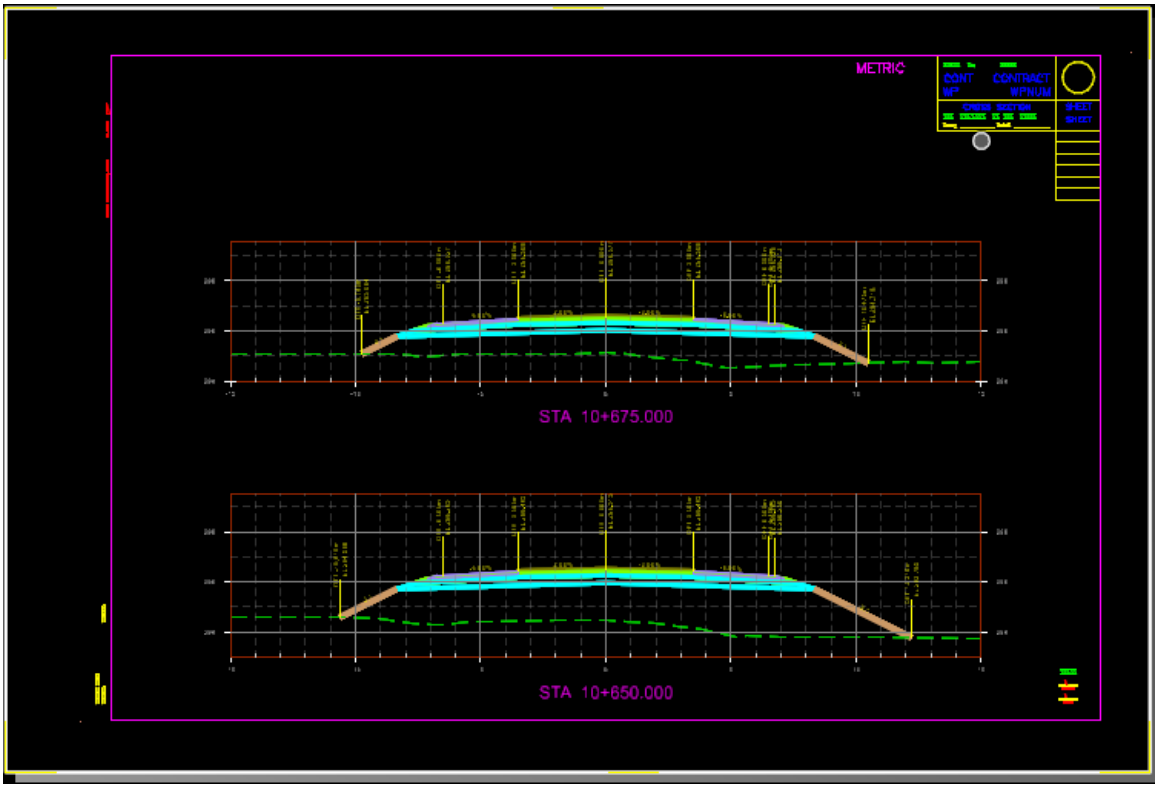


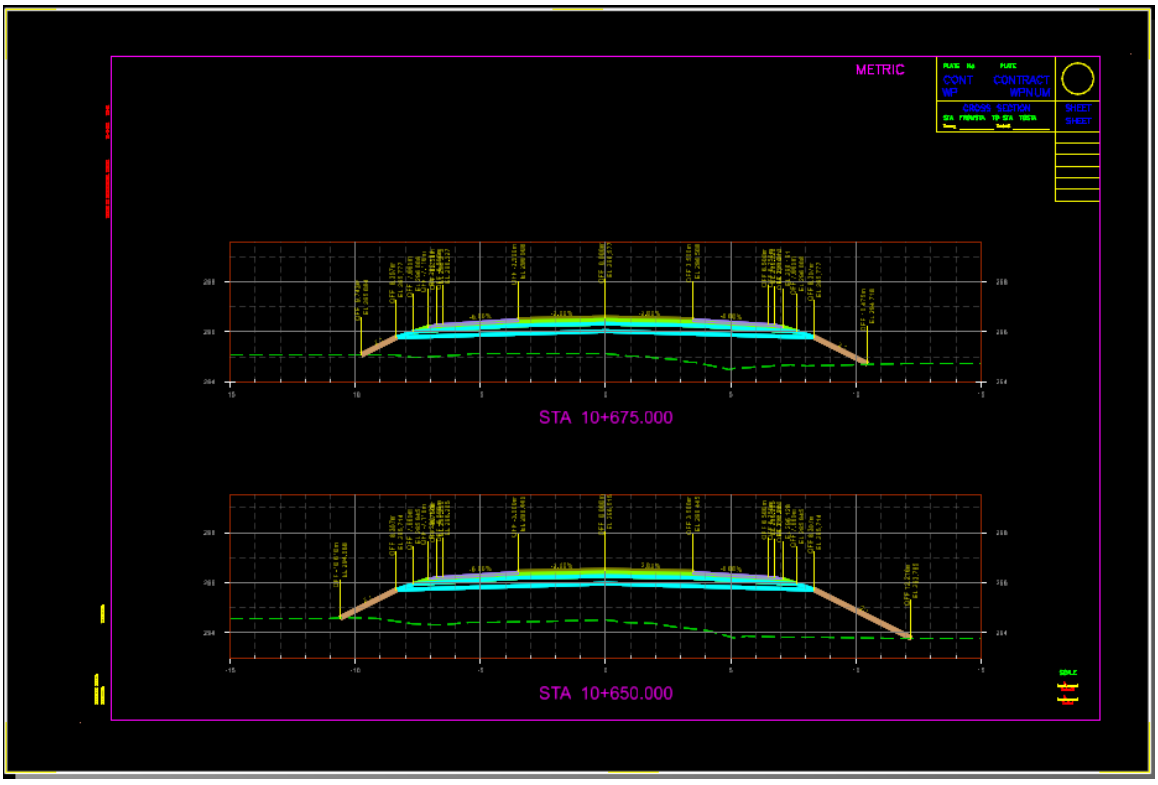


When the **Points to be Filtered** option on the *Annotation Filter* dialog is set to ***Use all points***, all the points from specified location will be annotated (no list required).



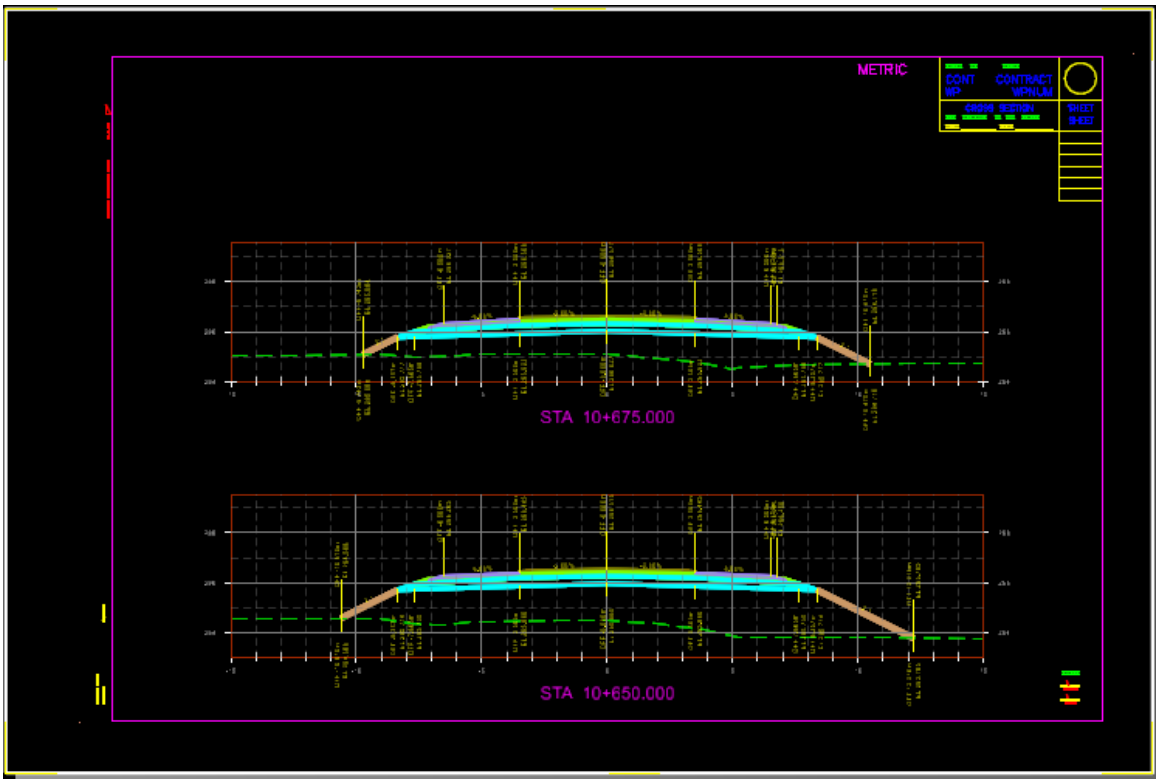
Shown below Annotation for top layer with selected points and with all points.



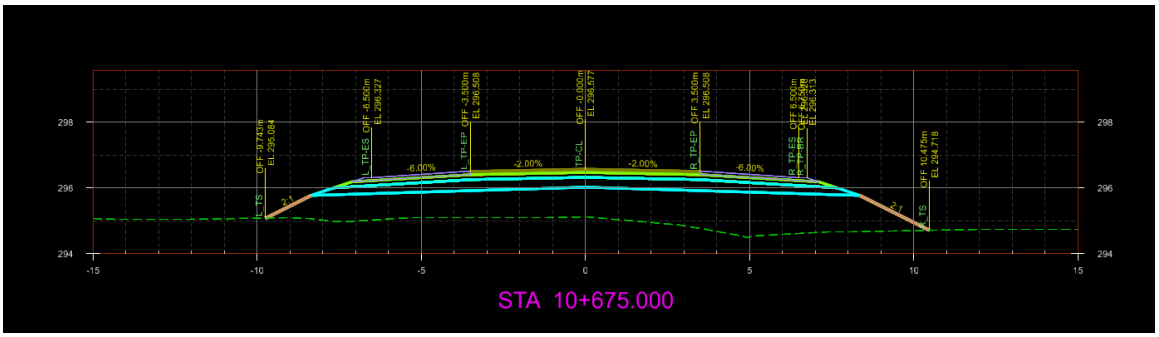


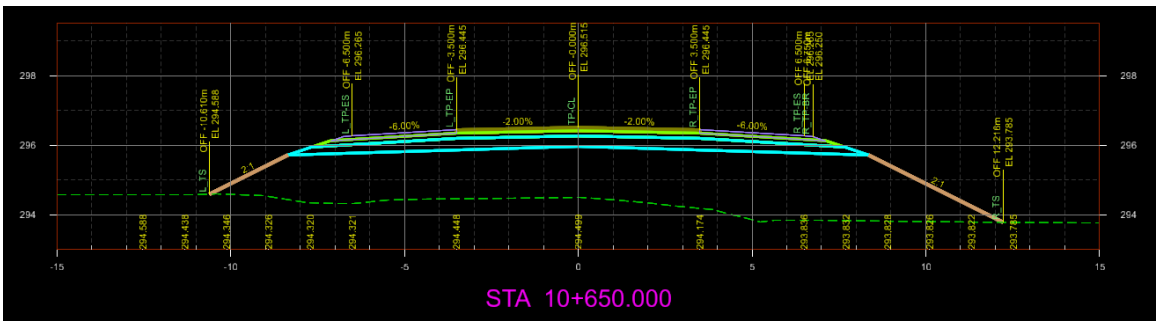
The **Point Annotation** definition can be modified to annotate point from different layers (e.g. subgrade) and/or for existing features (e.g. existing ES, EP etc.).

Shown below Annotation for both top and subgrade layers.



Additional Annotation Definitions can be added to the annotation group from other annotation group or user defined annotation group/definition. Shown below annotation with point names and existing ground elevation.

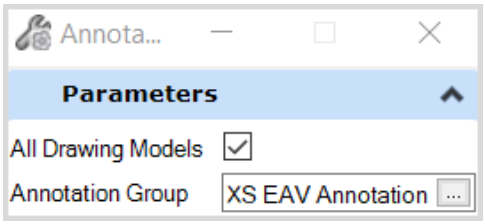




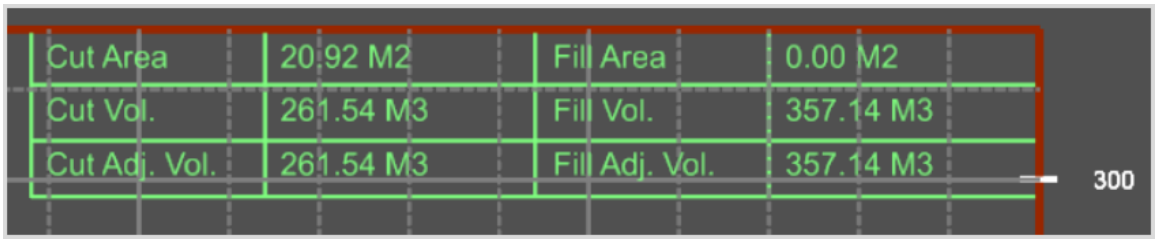
9.6.2 End Area Volume Annotation

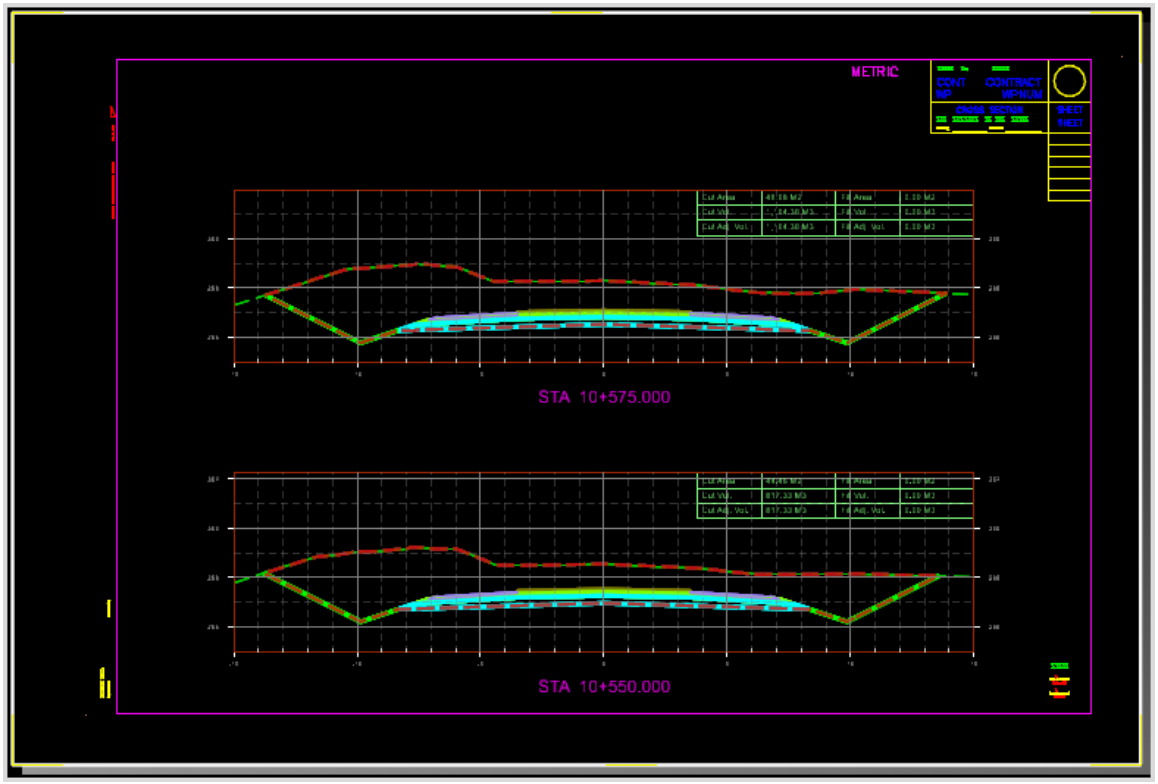
The annotation group ***XS EAV Annotation*** can be used to annotate EAV on cross sections.

The annotation group can be applied on the ***Create Drawing*** dialog when create the cross section drawings or using the ***Annotate Drawing Model*** tool after the drawings are created.



The default cut/fill annotation is set to be at the top right corner of the cross section.

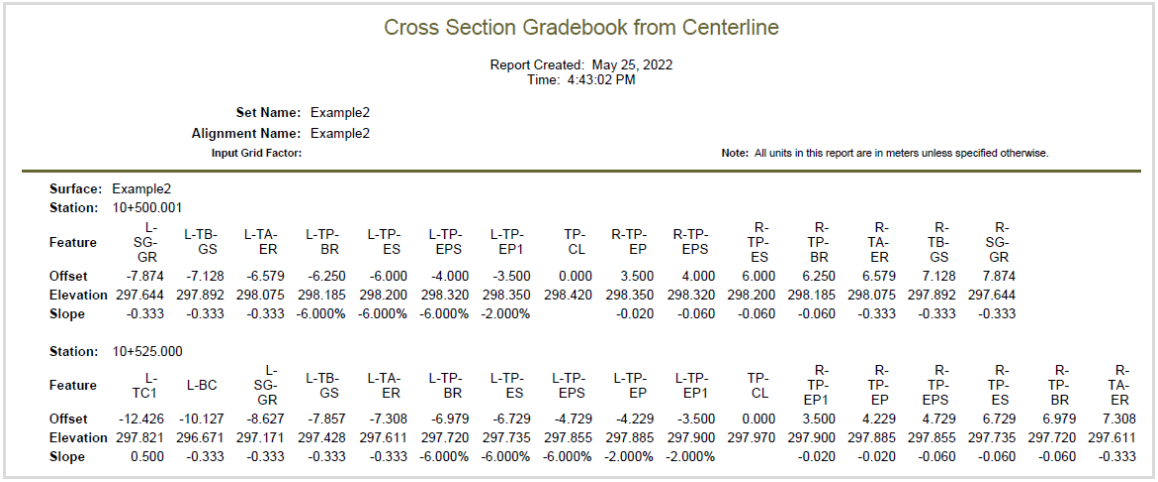




9.6.3 Cross Section Report

The Cross Section Report tool creates a station, offset, and elevation report for a specified cross section *Named Boundary Group*.

The ***Bentley Civil Report Browser***, along with the style sheet are used to view and print the reports. Select **Evaluation > CrossSectionGradebook.xsl, CrossSectionGradebookfromCL.xsl** (design surface) or **CrossSectionGradebookWide.xsl** (subsurface).



Cross Section Gradebook from Centerline

Report Created: May 25, 2022
Time: 4:43:02 PM

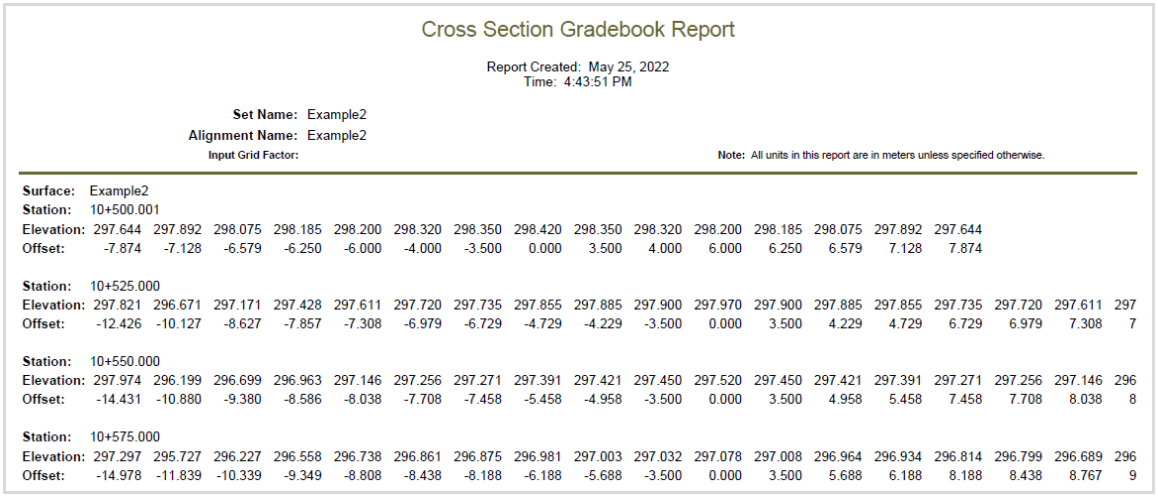
Set Name: Example2
Alignment Name: Example2
Input Grid Factor:
Note: All units in this report are in meters unless specified otherwise.

Surface: Example2
Station: 10+500.001

Feature	L-SG-GR	L-TB-GS	L-TA-ER	L-TP-BR	L-TP-ES	L-TP-EPS	L-TP-EP1	TP-CL	R-TP-EP	R-TP-EPS	R-TP-ES	R-TP-BR	R-TA-ER	R-TB-GS	R-SG-GR
Offset	-7.874	-7.128	-6.579	-6.250	-6.000	-4.000	-3.500	0.000	3.500	4.000	6.000	6.250	6.579	7.128	7.874
Elevation	297.644	297.892	298.075	298.185	298.200	298.320	298.350	298.420	298.350	298.320	298.200	298.185	298.075	297.892	297.644
Slope	-0.333	-0.333	-0.333	-6.000%	-6.000%	-6.000%	-2.000%		-0.020	-0.060	-0.060	-0.060	-0.333	-0.333	-0.333

Station: 10+525.000

Feature	L-TC1	L-BC	L-SG-GR	L-TB-GS	L-TA-ER	L-TP-BR	L-TP-ES	L-TP-EPS	L-TP-EP	L-TP-EP1	TP-CL	R-TP-EP1	R-TP-EP	R-TP-EPS	R-TP-ES	R-TP-BR	R-TA-ER
Offset	-12.426	-10.127	-8.627	-7.857	-7.308	-6.979	-6.729	-4.729	-4.229	-3.500	0.000	3.500	4.229	4.729	6.729	6.979	7.308
Elevation	297.821	296.671	297.171	297.428	297.611	297.720	297.735	297.855	297.885	297.900	297.970	297.900	297.885	297.855	297.735	297.720	297.611
Slope	0.500	-0.333	-0.333	-0.333	-0.333	-6.000%	-6.000%	-6.000%	-2.000%	-2.000%		-0.020	-0.020	-0.060	-0.060	-0.060	-0.333



Cross Section Gradebook Report

Report Created: May 25, 2022
Time: 4:43:51 PM

Set Name: Example2
Alignment Name: Example2
Input Grid Factor:
Note: All units in this report are in meters unless specified otherwise.

Surface: Example2
Station: 10+500.001

Elevation:	297.644	297.892	298.075	298.185	298.200	298.320	298.350	298.420	298.350	298.320	298.200	298.185	298.075	297.892	297.644	
Offset:	-7.874	-7.128	-6.579	-6.250	-6.000	-4.000	-3.500	0.000	3.500	4.000	6.000	6.250	6.579	7.128	7.874	

Station: 10+525.000

Elevation:	297.821	296.671	297.171	297.428	297.611	297.720	297.735	297.855	297.885	297.900	297.970	297.900	297.885	297.855	297.735	297.720	297.611	297
Offset:	-12.426	-10.127	-8.627	-7.857	-7.308	-6.979	-6.729	-4.729	-4.229	-3.500	0.000	3.500	4.229	4.729	6.729	6.979	7.308	7

Station: 10+550.000

Elevation:	297.974	296.199	296.699	296.963	297.146	297.256	297.271	297.391	297.421	297.450	297.520	297.450	297.421	297.391	297.271	297.256	297.146	296
Offset:	-14.431	-10.880	-9.380	-8.586	-8.038	-7.708	-7.458	-5.458	-4.958	-3.500	0.000	3.500	4.958	5.458	7.458	7.708	8.038	8

Station: 10+575.000

Elevation:	297.297	295.727	296.227	296.558	296.738	296.861	296.875	296.981	297.003	297.032	297.078	297.008	296.964	296.934	296.814	296.799	296.689	296
Offset:	-14.978	-11.839	-10.339	-9.349	-8.808	-8.438	-8.188	-6.188	-5.688	-3.500	0.000	3.500	5.688	6.188	8.188	8.438	8.767	9

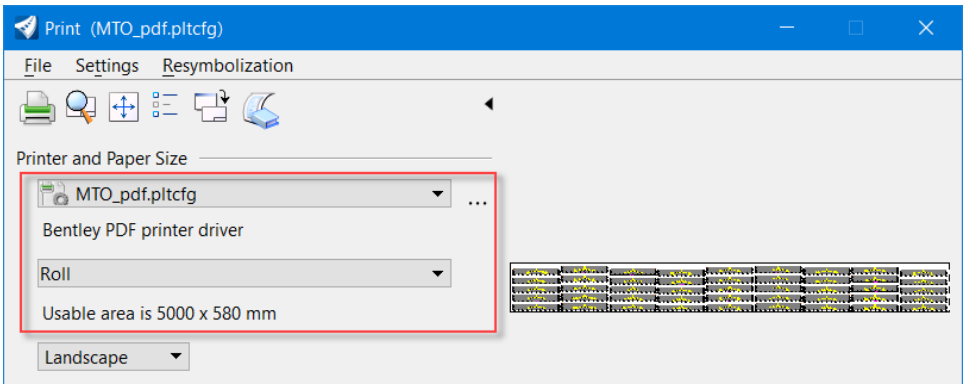
9.7 Print/Plot

Two pen table files ***MTO_monochrome_Full_Size.tbl*** & ***MTO_monochrome_Half_Size.tbl*** are provided. They are equivalent to the IESCAD plot styles *MTO_monochrome_Full_Size.ctb* and *MTO_monochrome_Half_Size.ctb* with Construction Class elements excluded from printing.

These files are located at:

…\MTO ORD Standards\Organization-Civil\MTO\Pen Tables\

The printer driver configuration file ***MTO_PDF.pltcfg*** provides a “Roll” paper size with maximum 5000 x 580mm usable area.

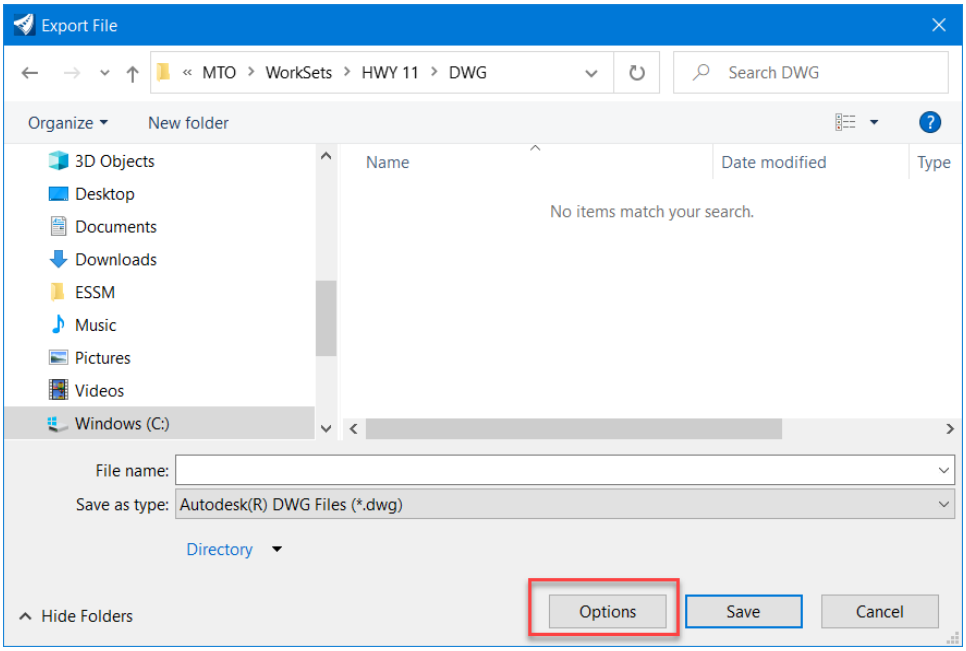


9.8 Export to DWG

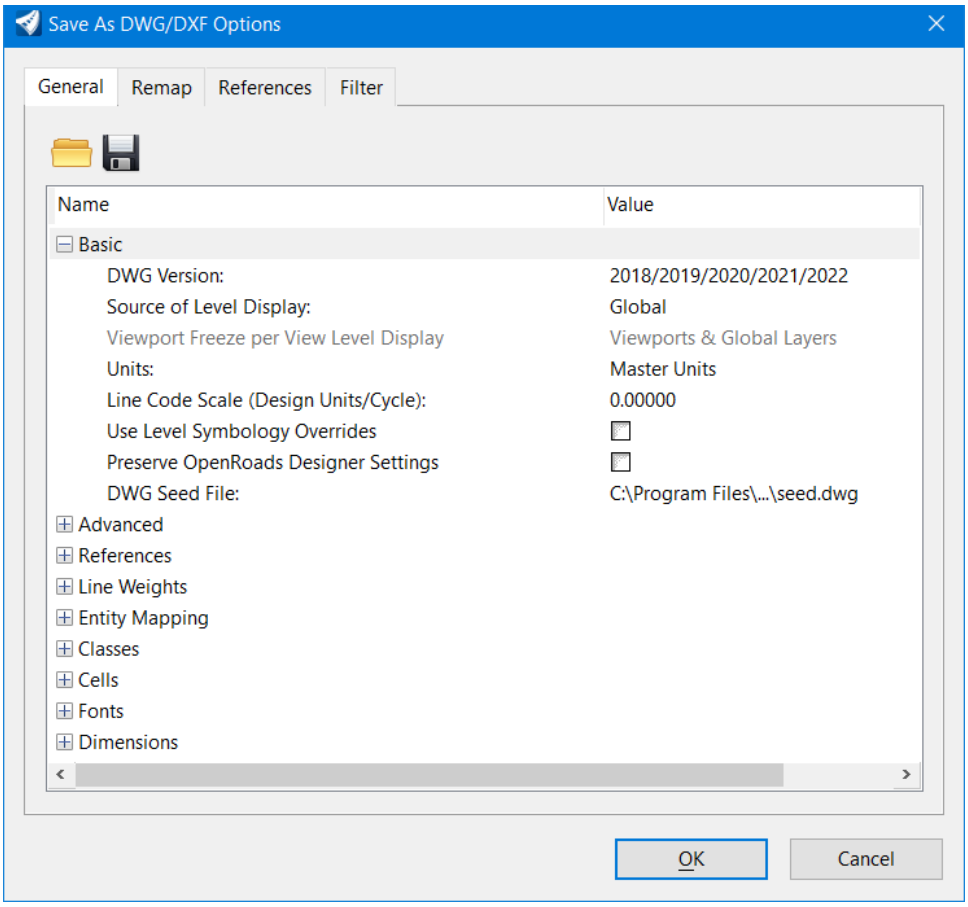
DGN file in ORD can be exported to common file types including DWG drawing file.

Select the **File** tab to open the backstage view then select **Export > Common File Types > DWG (*.dwg)**.

This will open the ***Export File*** dialog.



Click ***Options*** button on the bottom of the dialog will open the ***Save As DWG/DXF Options*** dialog to allow user more precisely to define what and how the DGN file will be exported to DWG format. Controls are grouped in tabbed sections.

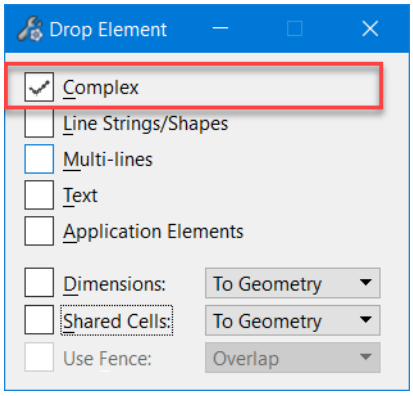


The General tab contains basic options for saving to DWG/DXF files. The Reference tab controls how references are handled when the DGN file is saved to a DWG/DXF file. The Filter tab is used to filter the data that is saved to the output file.

The annotation group ***XS EAV Annotation*** is used for the cross-section quantity annotation and the *End Area Volumes* are annotated with the **XS_EAV_Table** cell. To export the cross sections with the quantity annotation to DWG, the annotation group properties of the **XS_EAV_Table** cell need to be removed in order for the annotated quantities to be properly exported to DWG format.

Select all the **XS_EAV_Table** cells, then select **Drop Element** command from the ***Drawing*** tab Groups on the OpenRoads Modeling workflow ribbon to drop their annotation group properties.

On the ***Drop Element*** dialog, check the **Complex** option and follow the prompt to Accept.


Drop Element
Complex
Line Strings/Shapes
Multi-lines
Text
Application Elements
Dimensions:
To Geometry
Shared Cells:
To Geometry
Use Fence:
Overlap

10.0 Deliverables

Electronic Design Data is required for all MTO design projects. The ORD design submission shall include ALL files and data used in the preparation of the cross-section drawings, quantities, and reports. Project data should be identical to the contents presented in the contract book.

These may include but not limited to:

a. Surface file (.tin, .dtm)
b. 2D & 3D individual design models (terrain, geometry, superelevation, corridors, drainage, bridge, etc.) (.dgn)
c. Master model (contain all terrain, geometry, corridors, superelevation, etc. for plan sheets, cross section, quantities, reports) (.dgn)
d. Exported data from design models (.xml, .imodel, .ifc, .dwg)
e. ORD project Template file (.itl)
f. Superelevation rule file (.xml)
g. Reports (.xml, .xlsx, .docx, .pdf, .txt)
h. Project drawing sheets (.dwg, .dgn, .pdf)
i. Supporting, import/export, data exchange files (various format)

A project content/summary file should also be submitted along with the ORD project data set. This file contains specific project information, software used in design process and their version, special settings and customizations, and descriptions of the files and data contained in the submitted project data set. This file is an important reference for MTO staff and contractors who may use the information to identify the design files and use the project data for construction, quantities, and asset management.