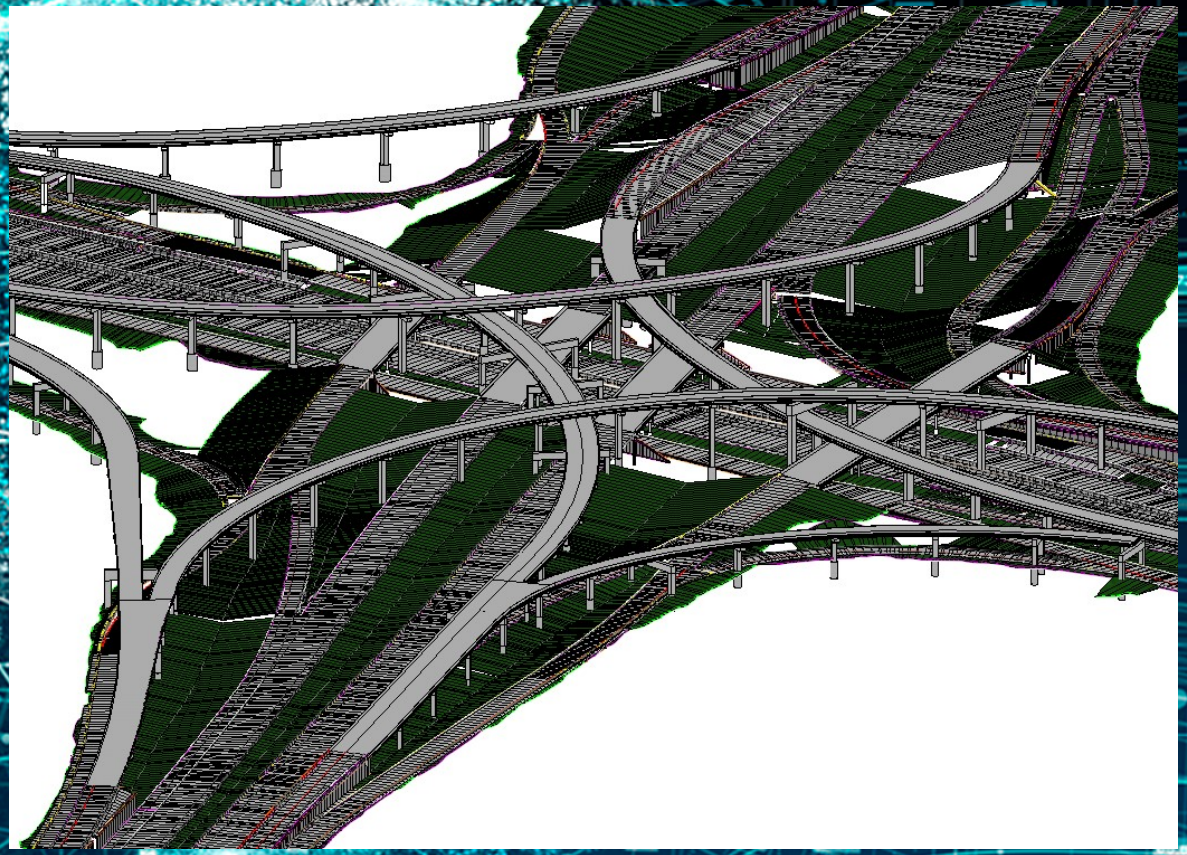
PARSONS

CDOT ORD TRAINING



Workspace 10.10.01.03

Albert Herrera & Marc Bachand

03/28/2022

AGENDA

1. Introductions
2. SS4 vs. ORD
3. Project Files
4. File Naming Convention
5. ProjectWise Folder Structure
6. Horizontal Geometry
7. Vertical Geometry
8. Modeling in ORD
9. Terrain Models
10. Plan Production
11. Calculating Earthwork
12. 3D Modeling Deliverables

INTRODUCTIONS

ALBERT HERRERA

- 21 yrs Experience (18 yrs w/ Parsons)
- Colorado Native (CSU Graduate)
- Denver Office (Roadway Design Manager)
- Parsons Mobility Solutions (80+ Employees)

MARC BACHAND

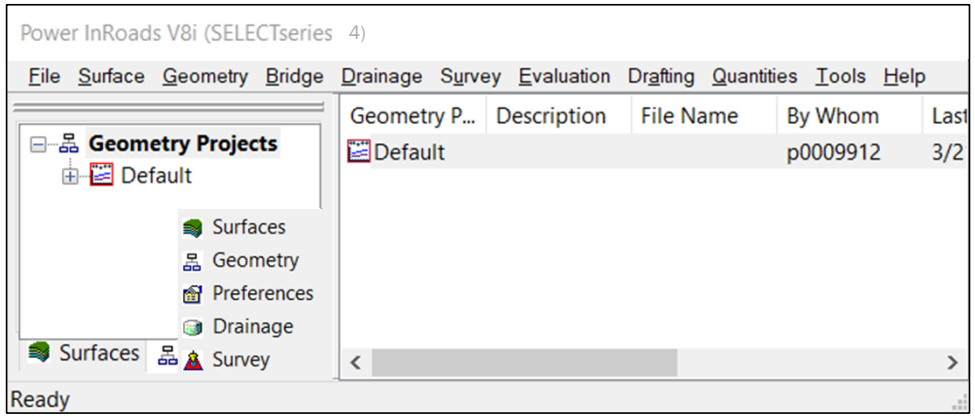
- 22 yrs Experience (9 yrs w/ Parsons)
- Albany, New York
- Parsons XD Services Group
- Training, Support, & 3D Modeling Lead
- Bentley Premier Scholar

SS4 vs. ORD

- InRoads Explorer
- Preferences
- Interface
- Geometry
- Surfaces
- Templates
- Corridors
- Plan Production

SS4 vs. ORD (Similarities and Differences)

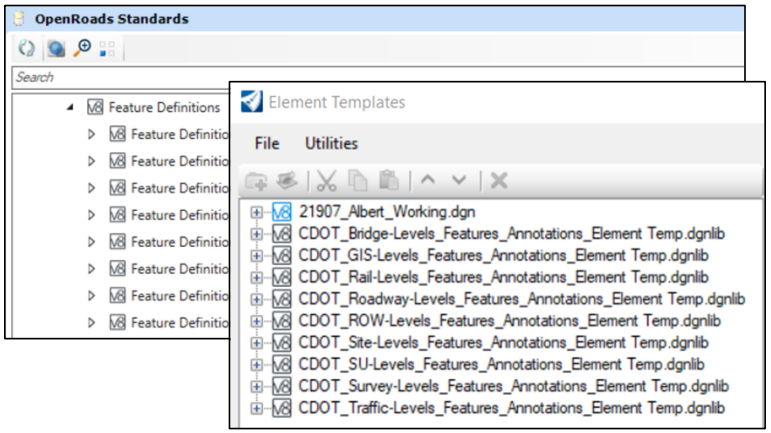
InRoads Explorer:



- No Longer Used or Needed
- External Files (Not Used)
  - ALG – Alignments
  - DTM – Digital Terrain Models
  - XIN - Preferences
  - IRD – Roadway Designer

Preferences:

CDOT_Civil_SS4.xin →

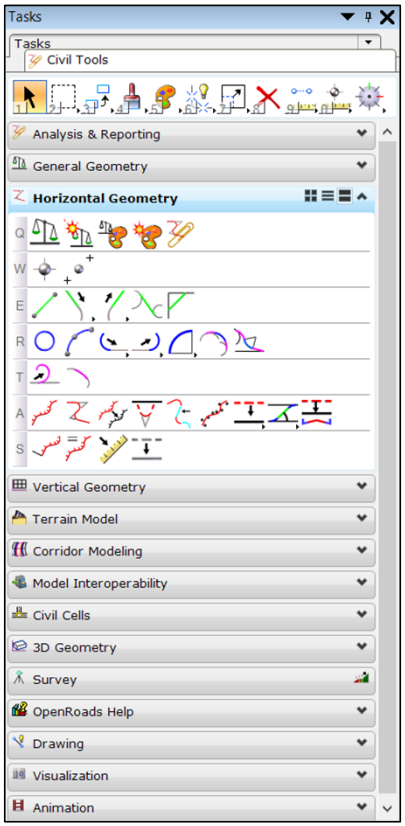


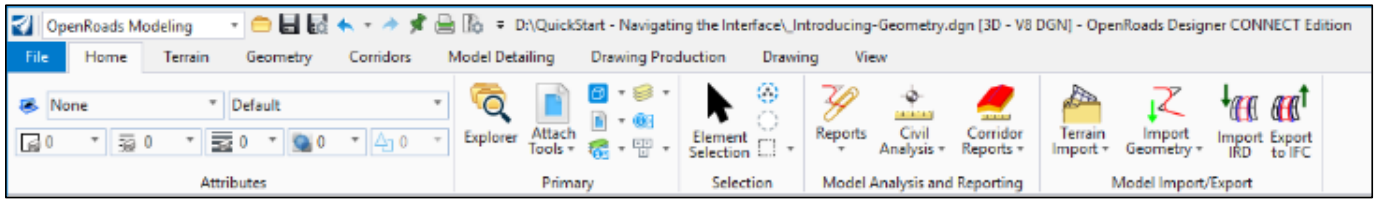
Settings to control display of Civil Data:

- SS4:
  - XIN
  - Element Templates
  - Feature Definitions
- ORD:
  - Element Templates
  - Feature Definitions

INTERFACE:

(Similarities and Differences)

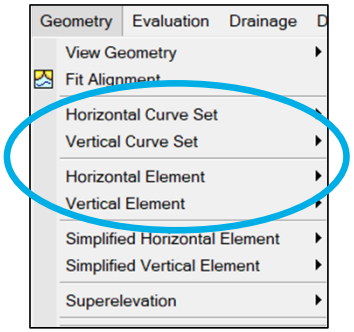


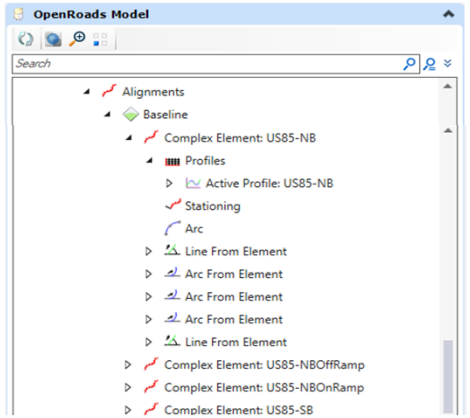


- Task Menu replaced by Ribbon Menu.
- Civil Tools Menu similar to OpenRoads Modeling Workflow.
- Commands and icons are similar located under Ribbon Tabs.

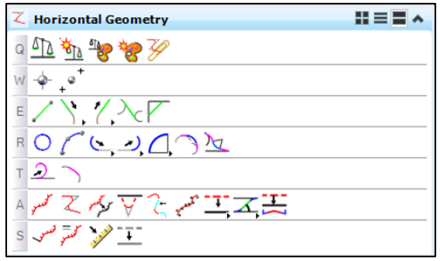
GEOMETRY:

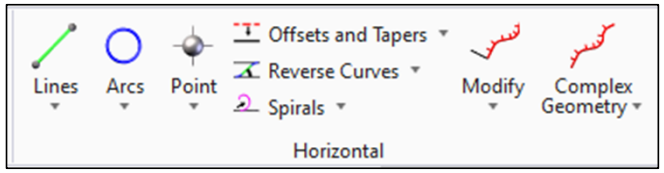
(Similarities and Differences)

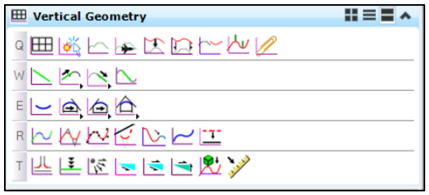


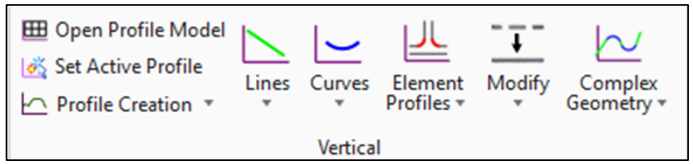


- SS4 InRoads Horizontal and Vertical commands no longer available.
- Geometry still embedded within DGN's (Referenced).
- Horizontal and Vertical geometry commands all still there under the new Geometry Ribbon tab.



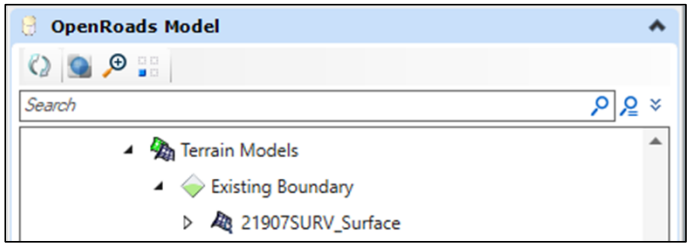


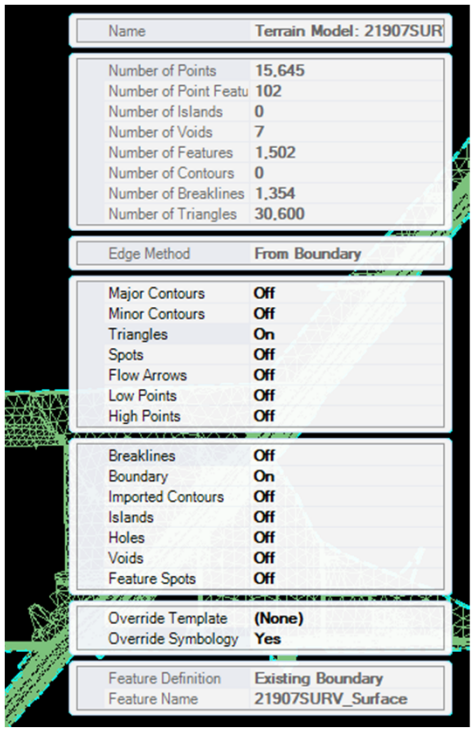




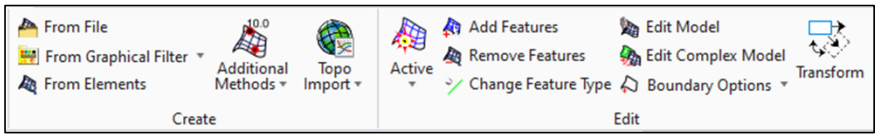
SURFACES:

(Similarities and Differences)



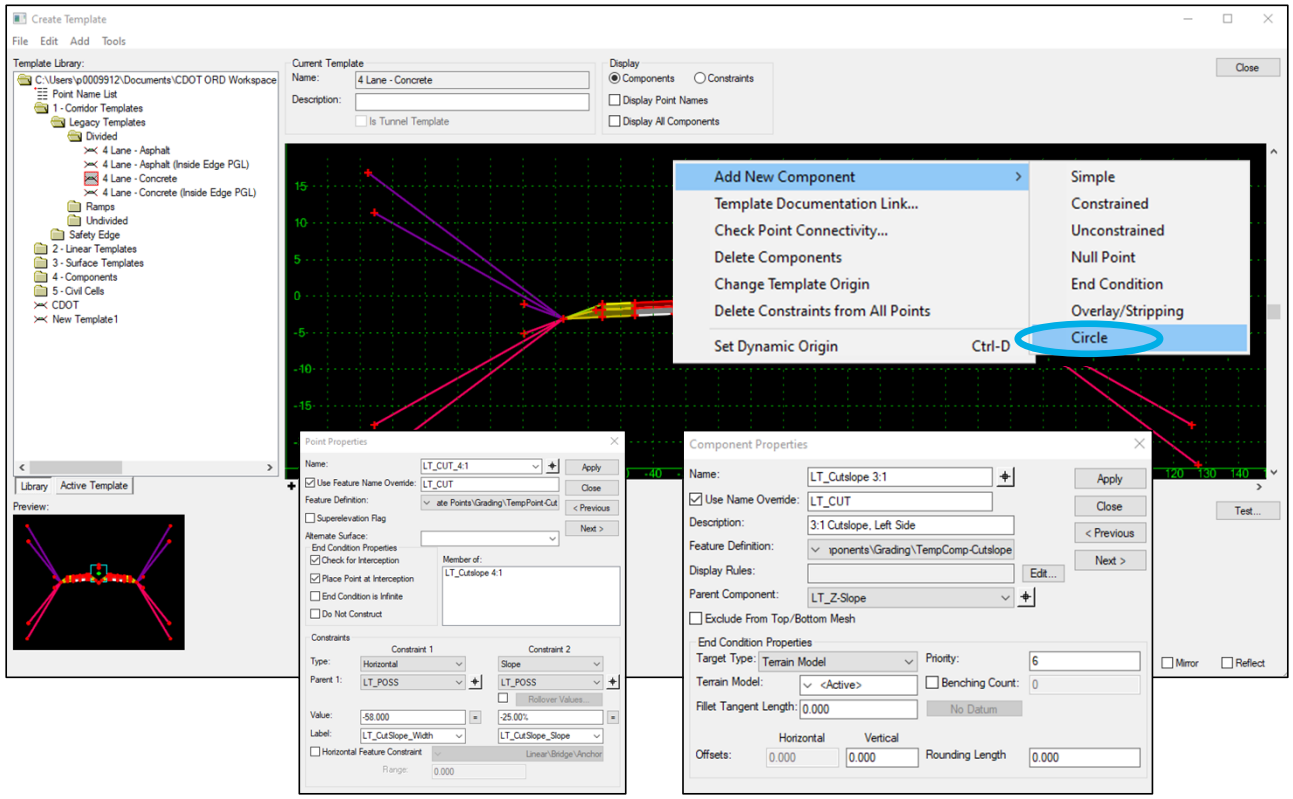


- Terrain Models (TM's) still used for Existing and Proposed surfaces.
- TM's still embedded within DGN's (Referenced).
- Display of triangles, breaklines, contours, & etc. still done through TM properties.
- DTM's no longer needed for plan production (creating profiles).
- TM commands all still there under the new Terrain Ribbon tab.



TEMPLATES:

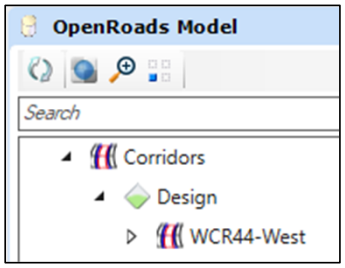
(Similarities and Differences)

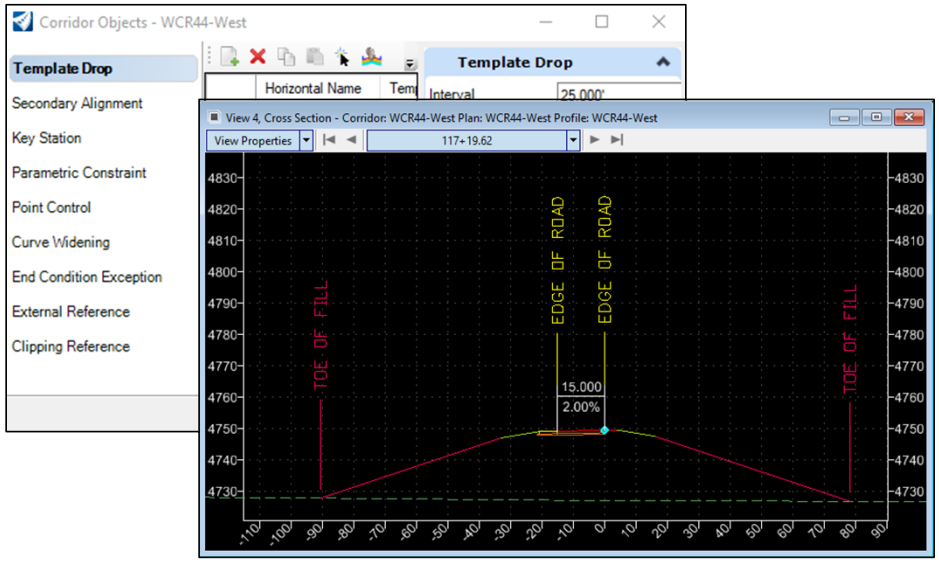


- ITL (External File) still used to manage and create templates.
- Feature Definitions still used for Points and Components.
- Template Points:
  - Same Constraint Types
  - Labels = Parametric Constraints
- Components:
  - Component Types same with addition of Circle
  - Display Rules
  - End Conditions with same Target Types

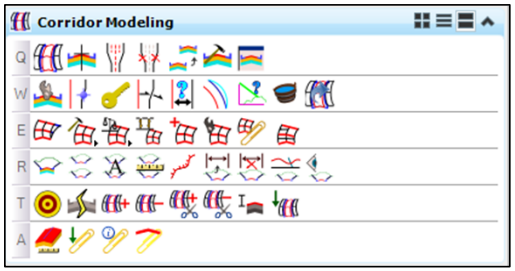
CORRIDORS:

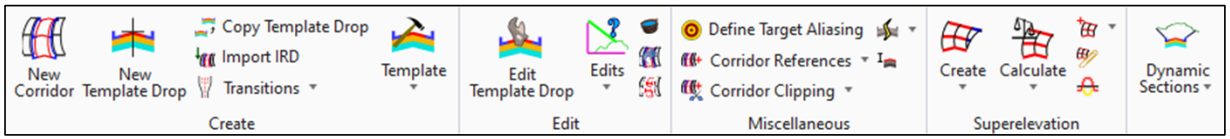
(Similarities and Differences)





- Corridors still embedded within DGN's (Referenced).
- Corridors still manipulated through Corridor Objects.
- Dynamic Cross Sections with Temporary Dimensions.
- Corridor commands all still there under the new Corridors Ribbon tab.

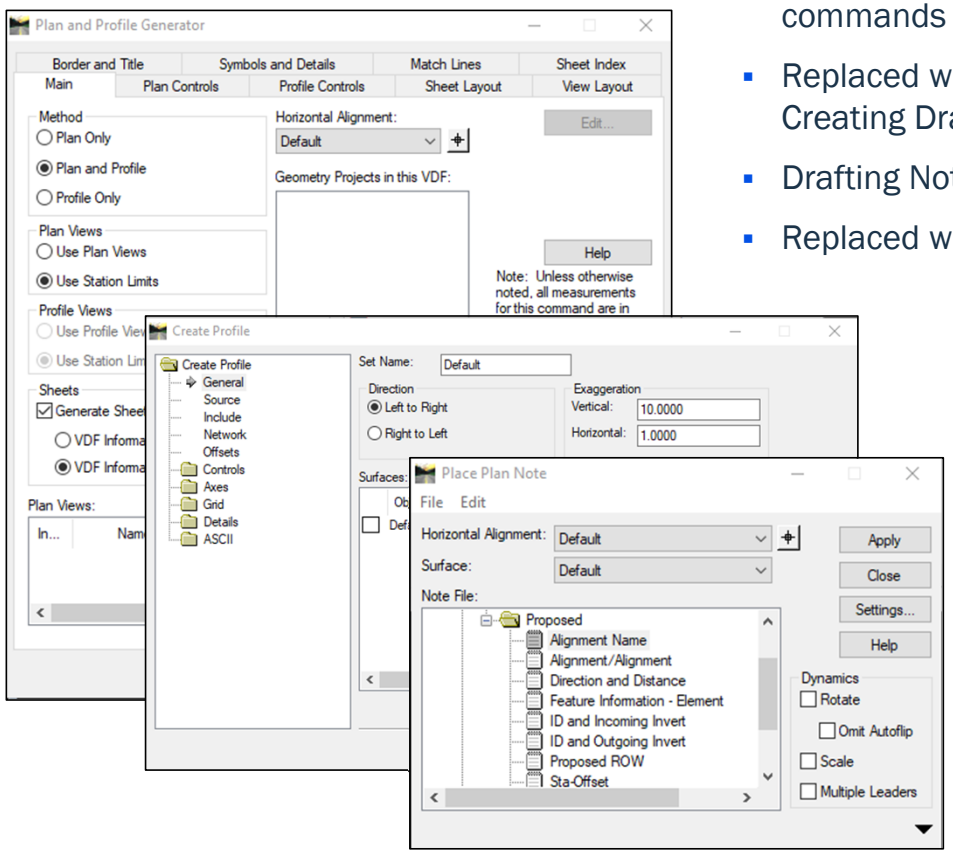


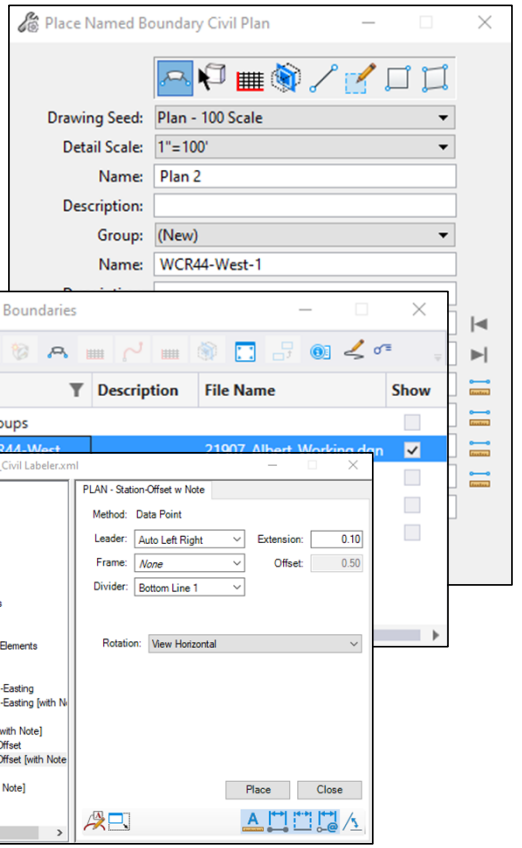


PLANS PRODUCTION:

(Similarities and Differences)

- Plan and Profile Generator and Create Profile commands Not Used.
- Replaced with Named Boundaries and Creating Drawings from Named Boundaries.
- Drafting Notes Not Used.
- Replaced with Civil Labeler.





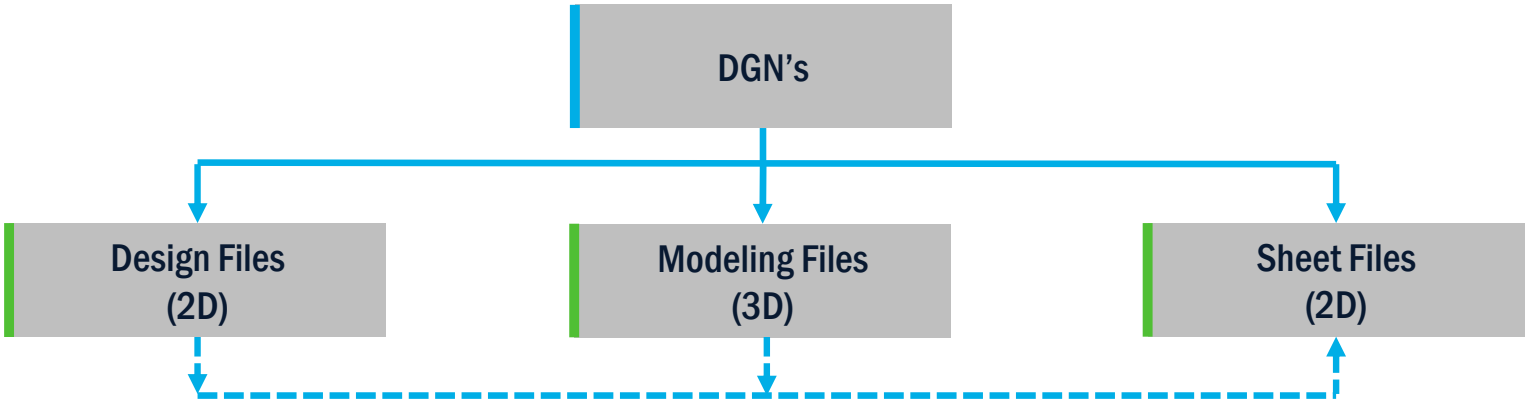
QUESTIONS?

PROJECT FILES

- Design vs. Modeling vs. Sheet - File Types
- Included in each File Type

PROJECT FILES

Design Files vs. Modeling Files vs. Sheet Files



Design Files

- Roadway
- Drainage
- Structures
- Striping
- Utilities
- ROW
- Topo
- Etc.

Modeling Files

- Geometry
- Corridors
- Terrain Models
- Controls
- Model Container
- Model Seed

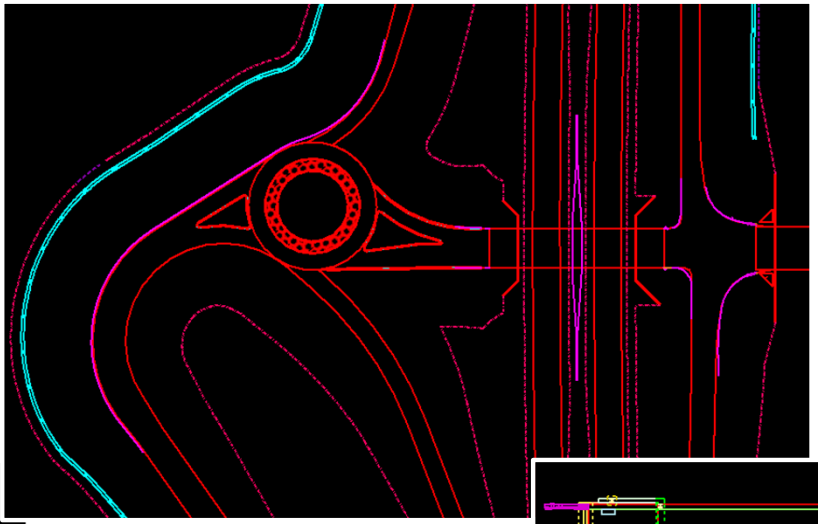
Sheet Files (Plan Production)

- Sheet Containers
- Named Boundaries
- Sheet Sources
- Title Sheet
- Typical Sections
- SAQ Sheets
- Tabulation Sheets
- Roadway Plans
- Drainage Plans
- Utility Plans
- Cross Sections
- Etc.

DESIGN FILES

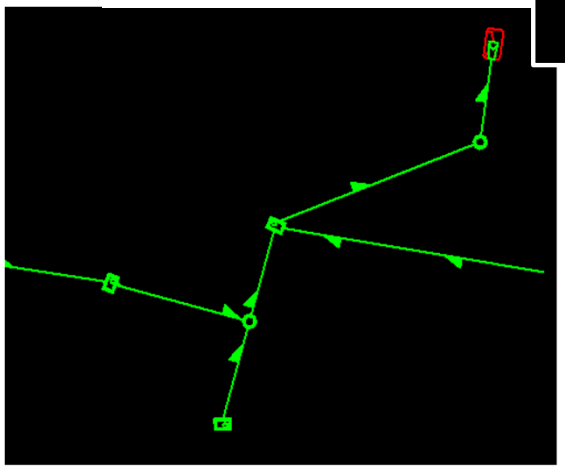
Roadway Design File

- Edge of Pavement
- Sawcut Lines
- Curb & Gutter
- Guardrail/Barrier
- Retaining Walls
- Cut/Fill Lines
- Etc.



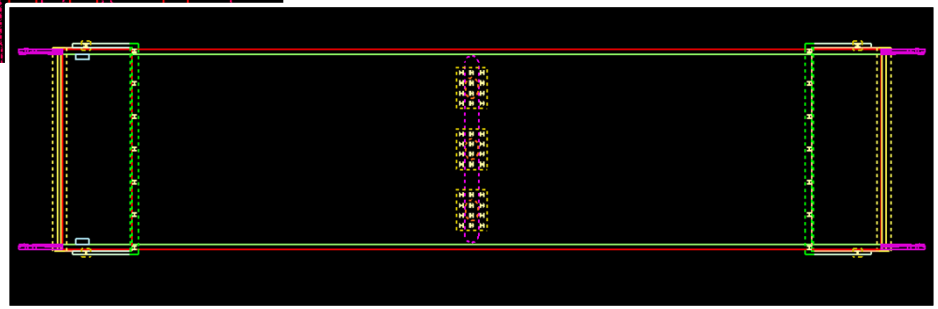
Structures Design File

- Bridge Deck
- Abutments
- Approach Slabs
- Wing Walls
- Piers/Foundations
- Etc.



Drainage Design File

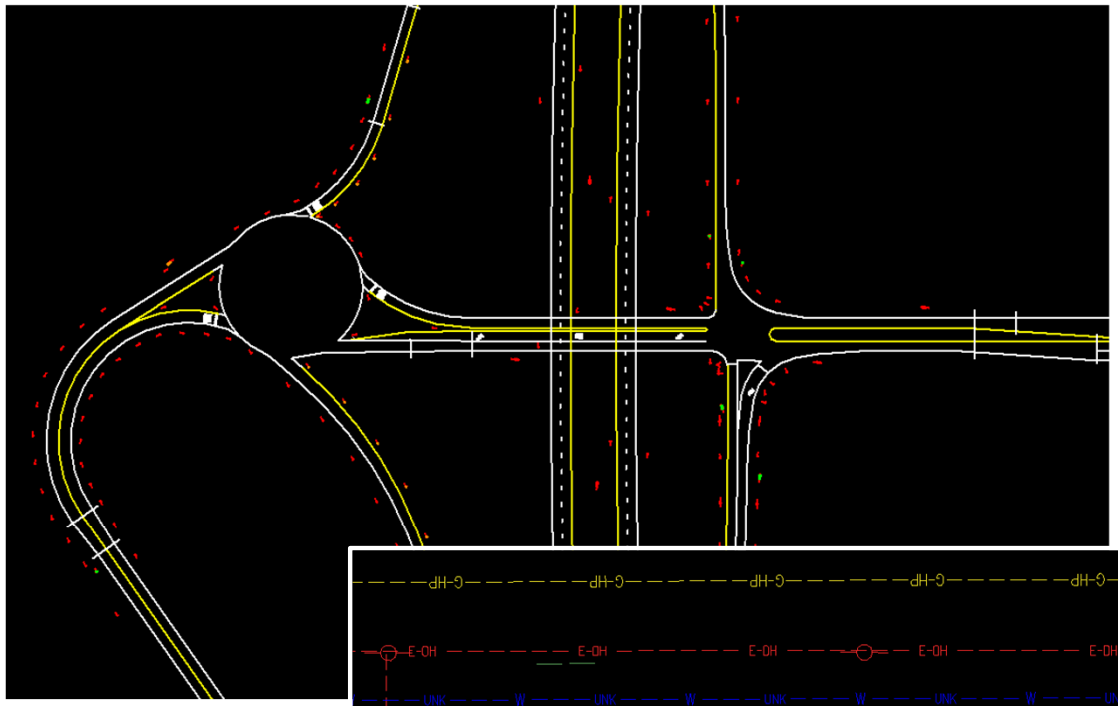
- Pipes
- Inlets
- Manholes
- Flared End Sections
- Culverts
- Etc.

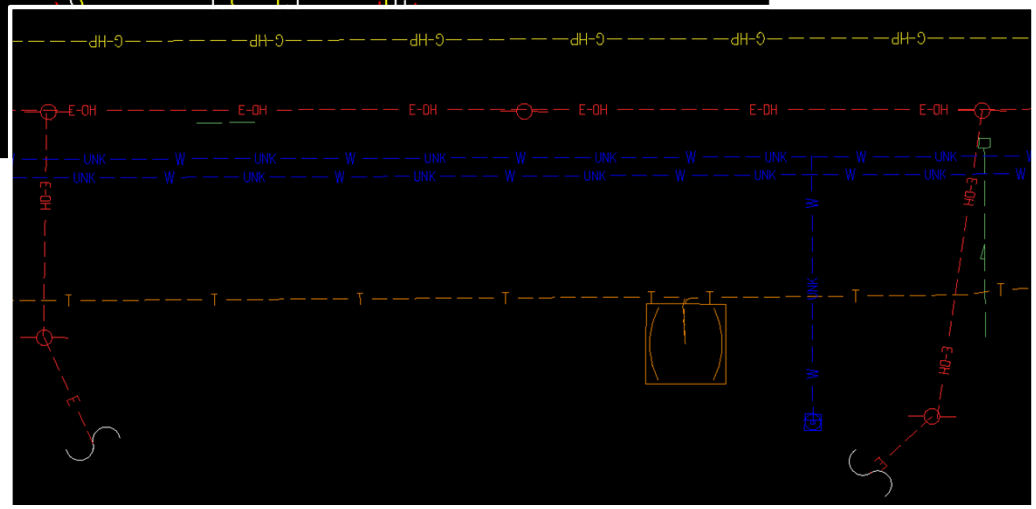


DESIGN FILES

Striping Design File

- Edge of Travel Lines
- Lane Lines
- Stop Bars
- Cross Walks
- Pavement Markings
- Etc.





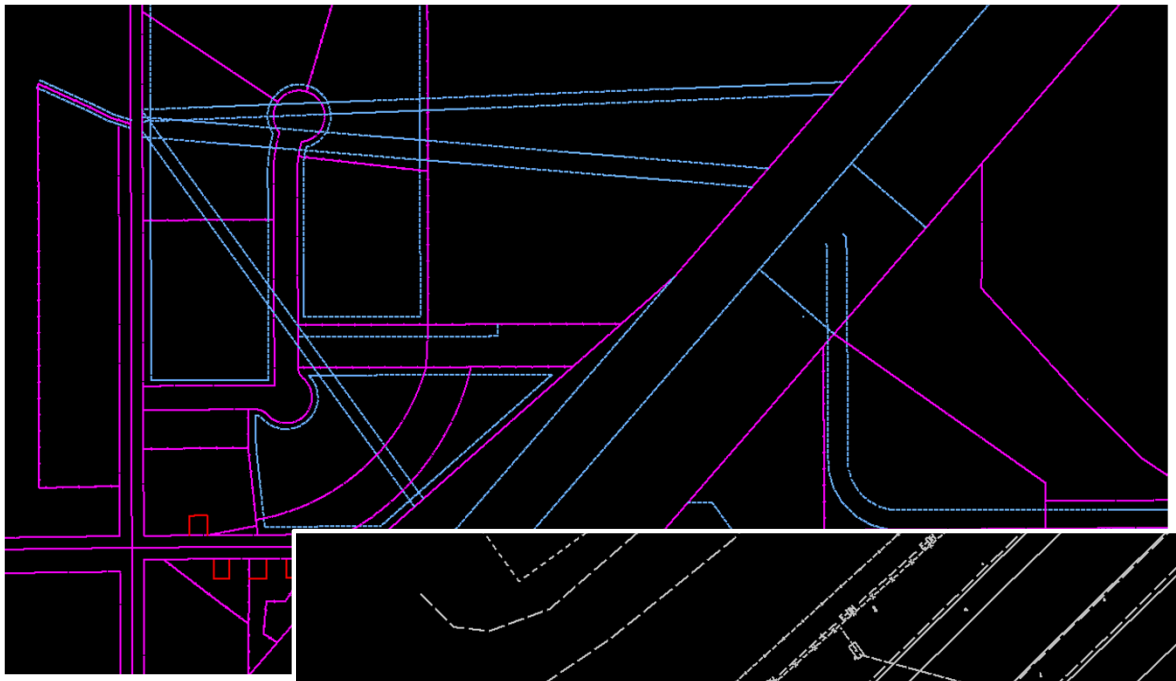
Utility Design File

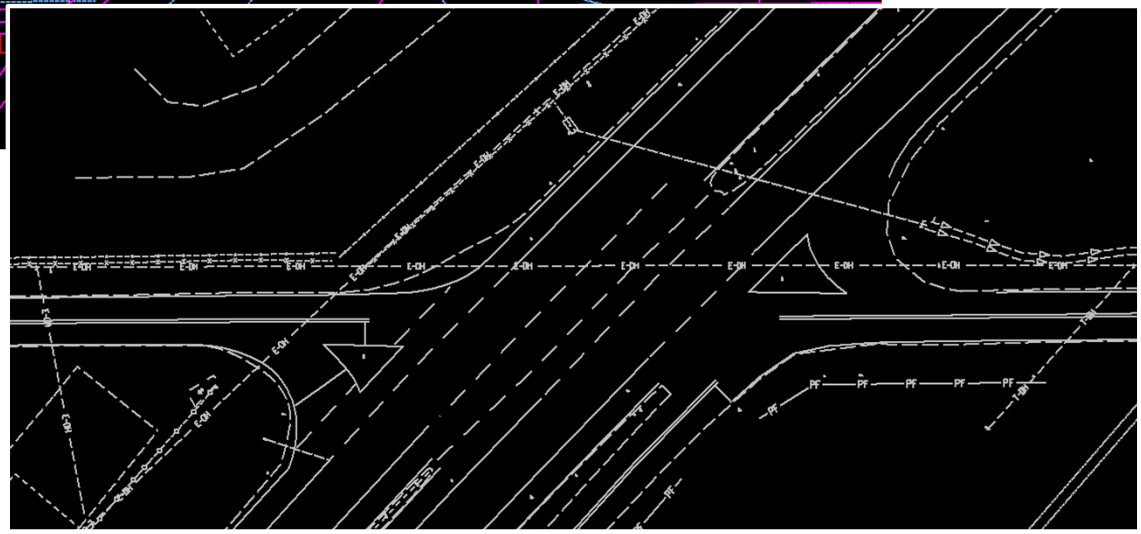
- Water Lines
- Gas Lines
- Fiber Optic
- Telephone
- Sewer
- Electric
- Etc.

DESIGN FILES

ROW Design File

- Existing ROW Lines
- Proposed ROW Lines
- Perm. Easements
- Temp. Constr. Easements
- Property Boundaries
- Etc.

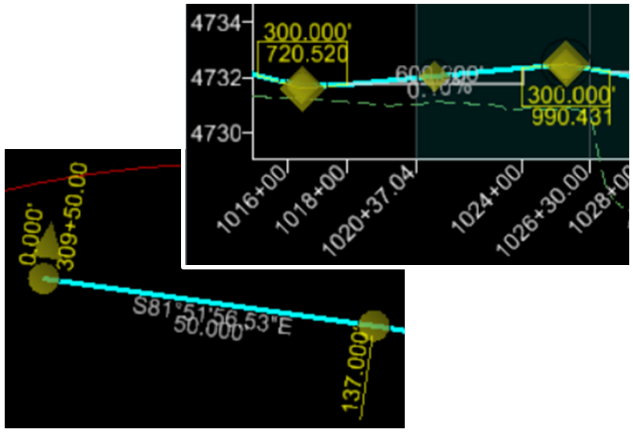


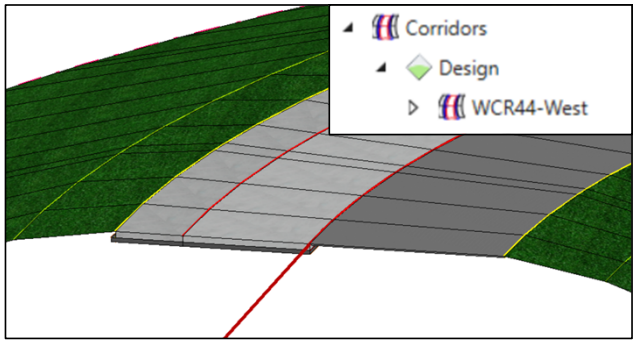


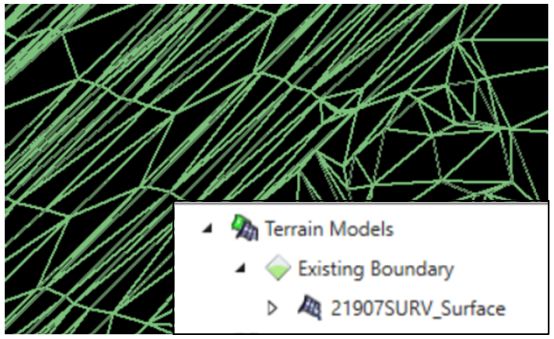
Topo Design File

- Exist Edge of Road
- Exist Striping
- Exist Guardrail/Barrier
- Exist Curb & Gutter
- Exist Fence
- Exist Buildings
- Etc.

MODELING FILES







Geometry File

- A DGN file containing roadway Horizontal and Vertical ORD Geometry used as the bases for Design, Modeling and Plan Production.

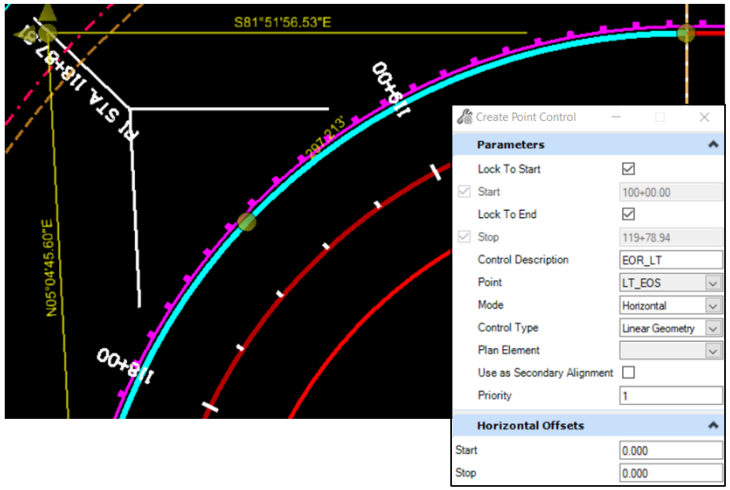
Corridor File

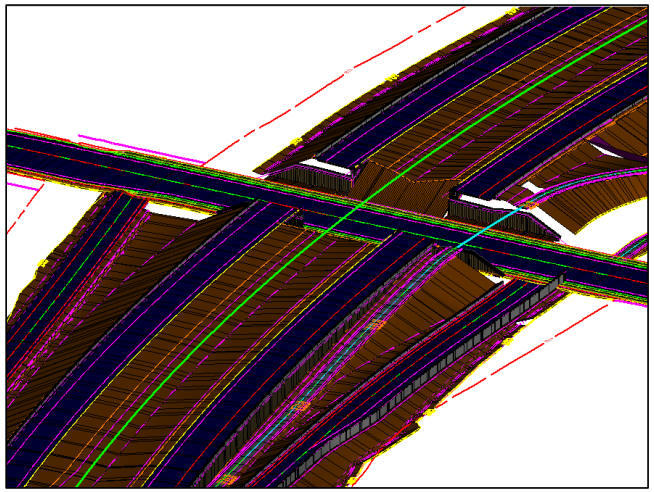
- A DGN file containing an ORD corridor based on geometry, templates and superelevation (3D Model of pavement section, end conditions, grading, retaining walls, swales, etc).

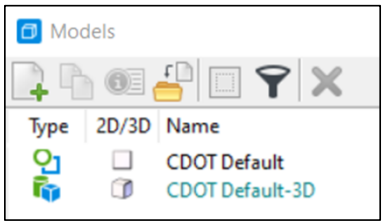
Terrain Model File

- A DGN file containing an existing or proposed surface in the form of an ORD Terrain Model.

MODELING FILES







Control File

- A DGN file containing civil geometry used to help develop and control corridor files. This civil geometry could represent the edge of pavement tapers/transitions, sawcut lines, raised median configuration, etc.

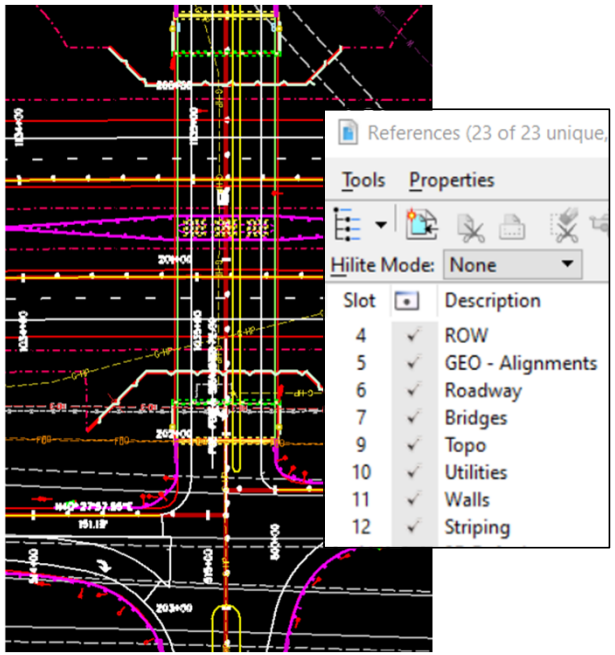
Model Container File

- An empty DGN file that references other Modeling files such as corridor files. This is the full model file used for visualization purposes and in the development of other DGN files.

Seed Model File

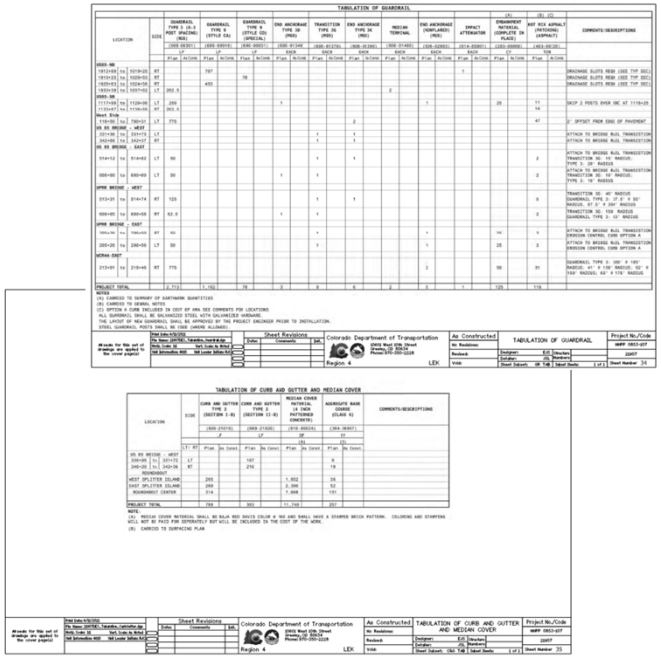
- A DGN file created from a CDOT 2D Seed file containing an ORD CDOT Default-3D model space tied to a project coordinate system. This is a project seed file used to create new modeling files.

SHEET FILES



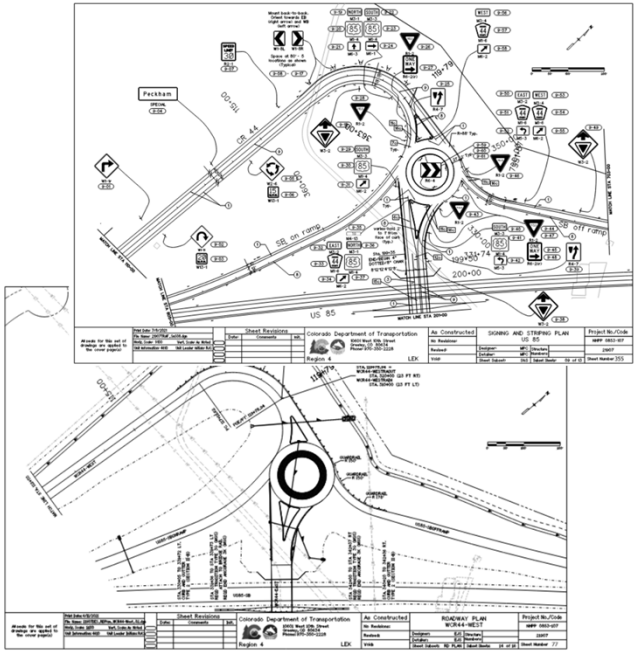
Sheet Container File

- An empty DGN file that references other Design files used to display the appropriate references to be shown on plans. Sheet Container file created per type of discipline sheet.



Tabulation Sheet Files

- DGN files that consist of a CDOT border and linked data from spreadsheets with no design files referenced. Sheets belong to plan set and printed to PDF format.



Discipline Sheet Files

- DGN files consisting of CDOT border and Sheet Container files along with annotation to represent the design plans per discipline. Information shown derived from Design files and Modeling files.

QUESTIONS?

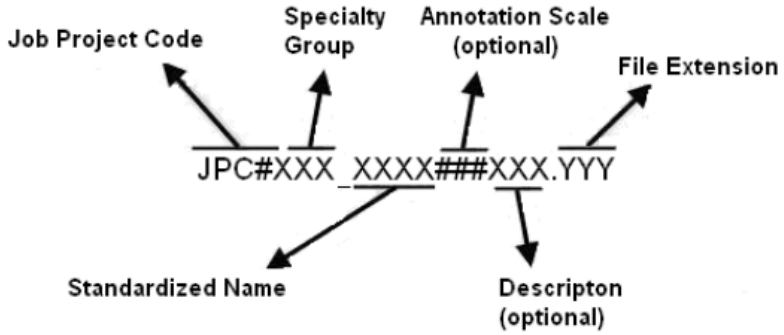
FILE NAMING CONVENTION

(RECOMMENDATION)

- CDOT Traditional Naming Convention
- Design Files
- Modeling Files
- Sheet Files

CDOT TRADITIONAL NAMING CONVENTION

Pre-ORD Technology



- **Job Project Code (JPC)** is the CDOT project code, formerly known as the project subaccount number.
- **Specialty Group** is the standardized abbreviation for the specialty group that the owner of the file is with.
- **Standardized Name** denotes the type of data that is contained in the file.
- **Annotation Scale** including the annotation scale in the file name is optional. However, it should be included in file names for projects that use multiple annotation scales.
- **Description** A brief description can be used to further identify a model file. For sheet files, this field is used as a counter to differentiate between multiple files of a specific type.
- **File Extensions** define the product used for its creation. Examples would be DGN for MicroStation, DTM for an InRoads surface, etc.

Specialty Groups:

- DES = Roadway
- HYDR = Drainage
- ROW = Right of Way
- SURV = Survey
- TRAF = Traffic
- LAND = Landscape
- UTIL = Utilities
- ENVI = Environmental

File Extensions:

- DGN = CADD
- ITL = Template Library
- ALG = Alignments
- DTM = Digital Terrain Model
- IRD = Roadway Designer
- XIN = Preferences

No Longer Used

Roadway Design File Example:

21907DES_Model.dgn

Confusing: Model = 3D Model

DESIGN FILE NAMING CONVENTION

(Recommendation)

Traditional Specialty Groups:

- DES = Roadway
- HYDR = Drainage
- ROW = Right of Way
- SURV = Survey
- TRAF = Traffic
- LAND = Landscape
- UTIL = Utilities
- ENVI = Environmental

Recommended Specialty Groups:

- RDWY = Roadway
- HYDR = Drainage
- ROW = Right of Way
- SURV = Survey
- TRAF = Traffic
- LAND = Landscape
- UTIL = Utilities
- ENVI = Environmental

Traditional Roadway Design File:

21907DES_Model.dgn

(Replace "Model")

Recommended Roadway Design File:

21907RDWY_Design.dgn

Additional Design File Examples:			
Drainage	21907HYDR_Design.dgn	Striping	21907TRAF_Striping.dgn
Irrigation	21907HYDR_IRR_Design.dgn	Utilities	21907UTIL_Design.dgn
Bridges	21907BRDG_Design.dgn	Survey	21907SURV_Topo.dgn
Walls	21907WALL_Design.dgn	ROW	21907ROW_Design.dgn

MODELING FILE TYPES

- **TM** – (Terrain Model) A DGN file containing an existing or proposed surface in the form of an ORD Terrain Model.
- **GEO** – (Geometry) A DGN file containing roadway Horizontal and Vertical ORD Geometry used as the bases for Design, Modeling and Plan Production.
- **COR** – (Corridor) A DGN file containing an ORD corridor based on geometry, templates and superelevation (3D Model of pavement section, end conditions, grading, retaining walls, swales, etc).
- **CNTRL** – (Control) A DGN file containing civil geometry used to help develop and control corridor files. This civil geometry could represent the edge of pavement tapers/transitions, sawcut lines, raised median configuration, etc.
- **CNT** – (Container) An empty DGN file that references other Modeling files such as corridor files. This is the full model file used for visualization purposes and in the development of other DGN files.
- **SUP** – (Superelevation) A DGN file containing superelevation information used in ORD modeling. File may be omitted and information contained in corridor file.
- **SEED** – A DGN file created from a CDOT 2D Seed file containing an ORD CDOT Default-3D model space tied to a project coordinate system. This is a project seed file used to create new modeling files.
- **XSEC** – (Cross Sections) A DGN file containing cross section sets cut along roadway geometry.

MODELING FILE NAMING CONVENTION

(Recommendation)

The modeling file naming convention should easily identify the project, project specific details (i.e. roadway alignment) and what is contained within each DGN file.

For typical CDOT projects, the modeling file naming convention shall consist of the following:

- **Project** – The five-digit job project code number.
- **Specialty Group** – Standardized abbreviation for the specialty group as identified in the design file naming convention.
- **Name** – Represents data that is contained in the file (Design, Alignment, Design State).
- **Type** – The type of information contained within the model.

Additional Modeling File Examples:			
TM	21907RDWY_Proposed_TM.dgn	CNTRL	21907RDWY_Design_CNTRL.dgn
TM	21907SURV_Existing_TM.dgn	CNT	21907RDWY_3DModel_CNT.dgn
GEO	21907RDWY_Alignments_GEO.dgn	SUP	21907RDWY_Alignments_SUP.dgn
COR	21907RDWY_WCR44-West_COR.dgn	SEED	21907RDWY_Design_SEED.dgn

SHEET FILE TYPES

- **CNT** – (Container) An empty DGN file that references other Design files used to display the appropriate references to be shown on plans. Sheet Container file created per type of discipline sheet.
- **NMBD** – (Named Boundary) A DGN file containing plan and profile named boundaries which will be used to create Plan, Double Plan, Plan & Profile or Double Profile sheets for Plan Production.
- **SOURCE** – (Source) A DGN file that references the Container file and Named Boundary file. This file will be used to create the sheets for Plan Production based on the Named Boundary referenced. This file controls what levels to turn on and off to control what will be displayed in the sheet files created from this Source file.

SHEET FILE NAMING CONVENTION (Recommendation)

The sheet file naming convention matches the traditional CDOT file naming convention and should easily identify the project, specialty group, sheet type and sequential number for that sheet type.

For typical CDOT projects, the modeling file naming convention shall consist of the following:

- **Project** – The five-digit job project code number.
- **Specialty Group** – Standardized abbreviation for the specialty group as identified in the design file naming convention.
- **Type** – The information contained within the sheet. Additional descriptor may be added to further describe the sheet.
- **Number** – The sequential number for that sheet type which typically begins with the number 01.

Additional Sheet File Examples:			
Title Sheet	21907RDWY_Title_001.dgn	Profile	21907RDWY_Profile_US85-SB_001.dgn
Typical	21907RDWY_Typical_001.dgn	Utility	21907UTIL_Plan_001.dgn
SAQ	21907RDWY_SAQ_001.dgn	Container	21907RDWY_Plan_CNT.dgn
Tabulation	21907RDWY_TAB_Guardrail_001.dgn	Name Boundary	21907RDWY_Plan_40_NMBD.dgn
Geometry	21907RDWY_Geometric_US85-SB_001.dgn	Source	21907RDWY_Plan_40_SOURCE.dgn

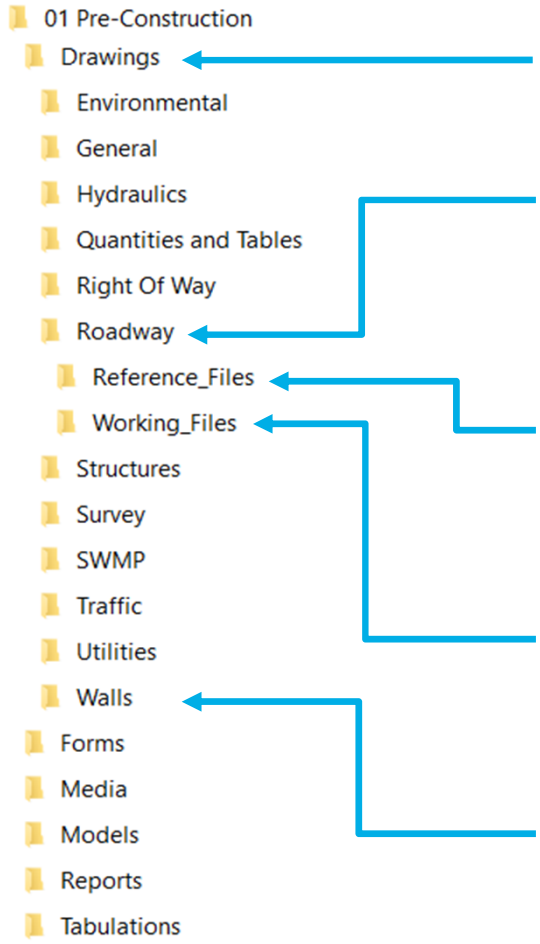
QUESTIONS?

PROJECTWISE FOLDER STRUCTURE

(RECOMMENDATION)

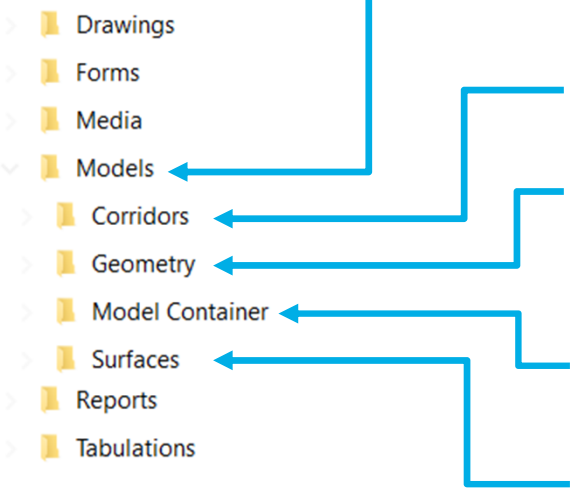
- CDOT ProjectWise Folders
- Model Folders

CDOT PROJECTWISE FOLDERS (Recommendation)



- All **Design files** and **Sheet files** are stored under the **"Drawings"** folder.
- The **"Design"** folder has been replaced by the **"Roadway"** folder where all roadway related files are stored. All roadway **Sheet files** are stored directly under the **"Roadway"** folder including **Sheet Container files**.
- All **Design files** are stored under the **"Reference_Files"** folders. Each discipline folder contains its own **"Reference_Files"** folder.
- A **"Working_Files"** folder may be added under each discipline folder where working files are stored. i.e. **"21907_John_Working.dgn".**
- Additional discipline folders may be added as needed per project.

MODEL FOLDERS (Recommendation)



- The **“InRoads”** folder has been replaced by the **“Models”** folder where all modeling related files are stored. Additional sub-folders may be added to further organize modeling files by type.
- All **Corridor files** are stored under the **“Corridors”** folder.
- All **Geometry files** are stored under the **“Geometry”** folder. Additional **“ALG”** and/or **“XML”** sub-folders may be added as needed.
- All **Model Container files** are stored under the **“Model Container”** folder.
- All proposed **Terrain Model files** are stored under the **“Surfaces”** folder. Additional **“DTM”** and/or **“XML”** sub-folders may be added as needed.

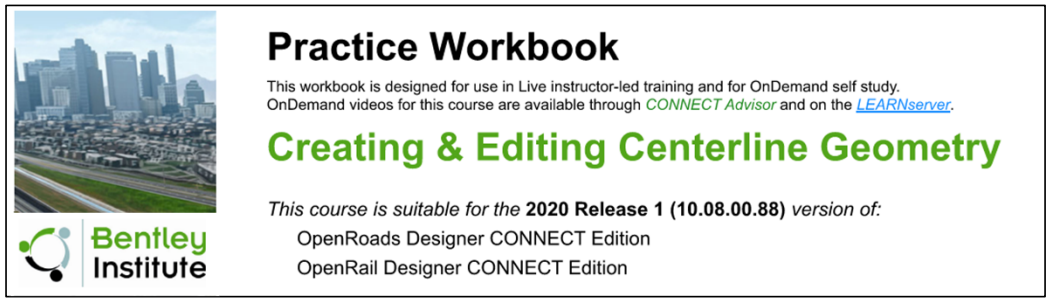
QUESTIONS?

HORIZONTAL GEOMETRY

- Creating
- Editing

CREATING

Horizontal Geometry

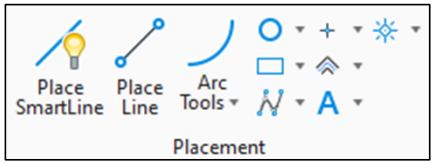


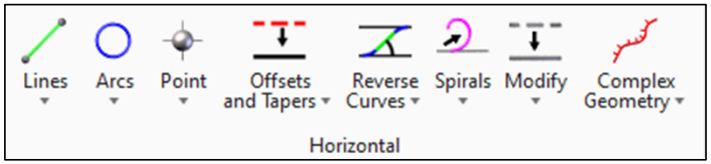
https://drive.google.com/file/d/139oM4Ga88gePKE80VJK6vTkAUDziEu-H/view?usp=sharing

Please Copy & Paste Link Url to Browser For best results.

Keep it Simple

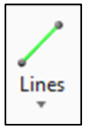
- Draw in CAD using traditional methods.
- Trace over using fixed elements.
- Safest method:
  - best for point controls
  - preliminary geometry where large scale changes are possible





Connected

- Establish base elements (i.e. fixed at known positions).
- Connect fixed elements with floating and free geometry (dependent geometry).
- Changes to base geometry affects locations of dependent geometry.
- Best for final design where small changes only would be required.
- Can be dangerous.

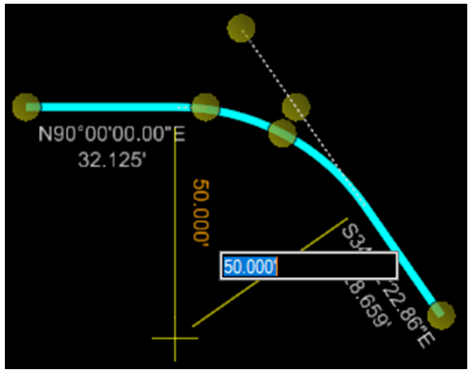


= Fixed Geometry

= Dependent Geometry

EDITING

Horizontal Geometry

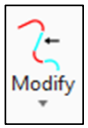


Rule Edits

- Change location of geometry based on rules established during geometric creation.

Appending

- Adding geometric elements to complex geometry.
- Must be careful with element order.
- Order is important for CL geometry and vertical point controls. Order does not matter for horizontal point controls.
- Best used to add elements at the beginning or ending of geometry for CL.



Insert PVI/Curves

- Use Insert PVI to add PVI and Curve (note, curve length of 0 will simply insert a vertex). Alternatively, you can use MicroStation “Insert Vertex” command to insert a simple PVI with no curve.

Complex Redefine

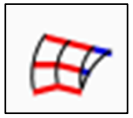
- Best for large scale edits when multiple base rules must be changed or a rule edit is not possible with current complex rules.

EDITING

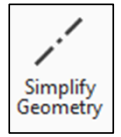
Horizontal Geometry

Horizontal geometry <u>CAN NOT</u> be deleted without <u>SIGNIFICANT</u> impacts to dependent elements!

- Specifically, profile drawings and superelevation.



- “Simplify Geometry” can be used to salvage dependent horizontal elements if deletion is required.

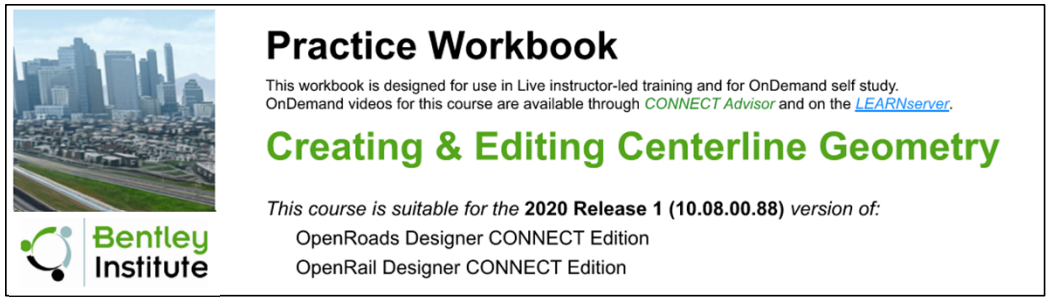


QUESTIONS?

VERTICAL GEOMETRY

- Creating
- Editing

VERTICAL GEOMETRY



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Please Copy & Paste Link Url to Browser For best results.

Creating and Editing

- Best to use tangents with free parabolas.

- Civil Accudraw can be used to set specific PVI locations.

- Profiles can be dropped and recreated with little to no impacts to dependent elements.

- Vertical point controls do not always need vertical curves.
- When creating vertical point controls, if projections are needed to establish vertical locations, it is best to trace over these projections with fixed geometry rather than using the projections.
  - i.e. Projections should only be used to establish elevation and not used in controls.

QUESTIONS?

MODELING IN ORD

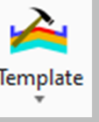
- Modeling Outline
- Templates
- End Conditions
- Corridor to Corridor
- Superelevation

MODELING OUTLINE

3D model outline still the same in ORD.

Establish preliminary horizontal & vertical roadway geometry.

Develop templates meeting project requirements.

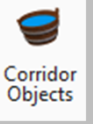


Create corridors using templates & apply to preliminary geometry.

Produce edge of pavement civil geometry to control pavement of corridors.

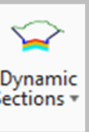
Calculate & apply superelevation to roadway sections if applicable.

Remove major pavement & grading overlaps between corridors.



Use corridors to determine cut/fill limits, Right-of-Way needs, & other roadway elements.

Cut preliminary cross sections to determine rough earthwork quantities.

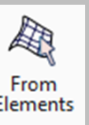


Review model with designers & incorporate feedback into model.

Refine geometry & corridors to eliminate or reduce roadway elements.

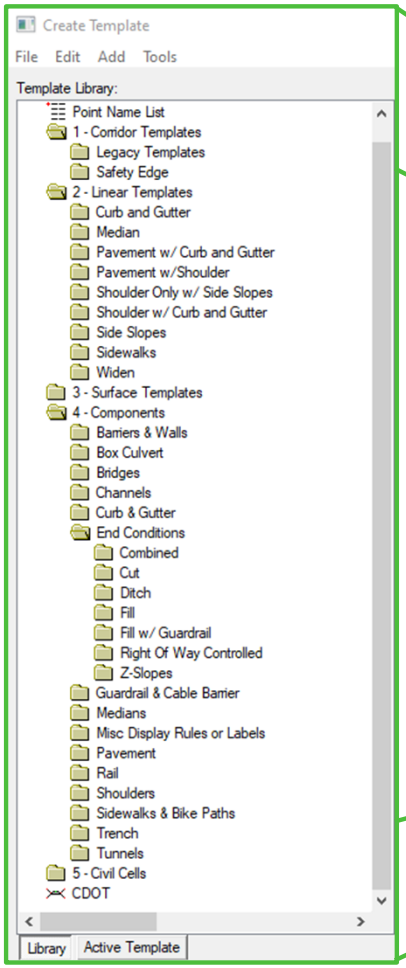
Continue refinements & remove grading overlaps to develop finished model.

Generate a TM to be used for plan production.



TEMPLATES

TEMPLATE LIBRARIES

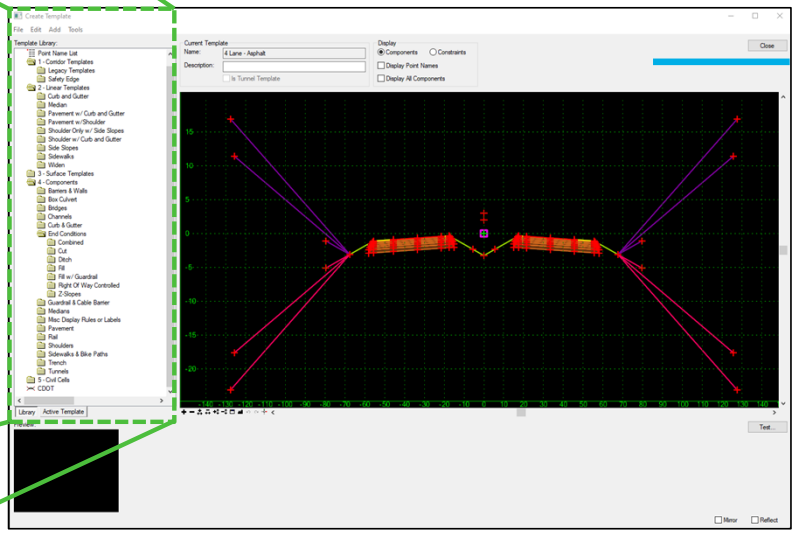


https://drive.google.com/file/d/139oM4Ga88gePKE80VJK6vTkAUDziEu-H/view?usp=sharing

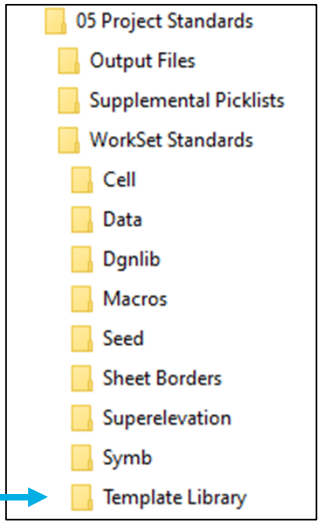
Please Copy & Paste Link Url to Browser For best results.

Project Template Library (.ITL)

- One Library per Project.
- Copy & Rename CDOT Standard Library (21907_CDOT_Template Library.itl).

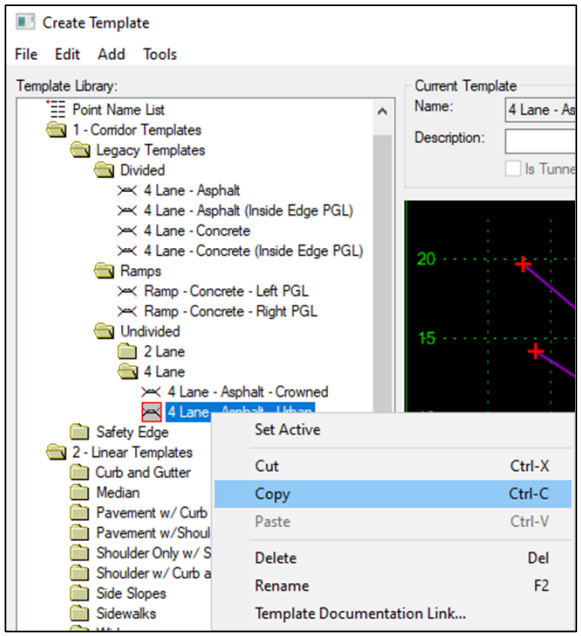


SAVE (Recommendation)



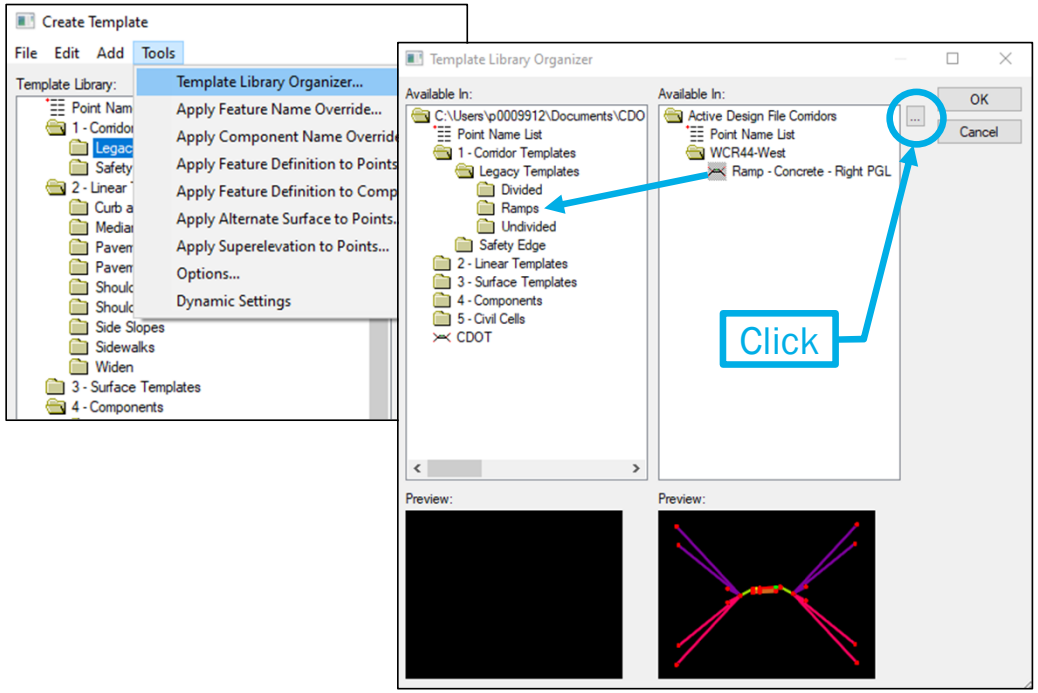
- Template Organization:
  - 1 – Corridor Templates
  - 2 – Linear Templates
  - 3 – Surface Templates
  - 4 – Components
  - 5 – Civil Cells

COPYING TEMPLATES



Copying Templates within Library

- Right Click Template (Select Copy).
- Right Click Folder (Select Paste).
- Rename Template.

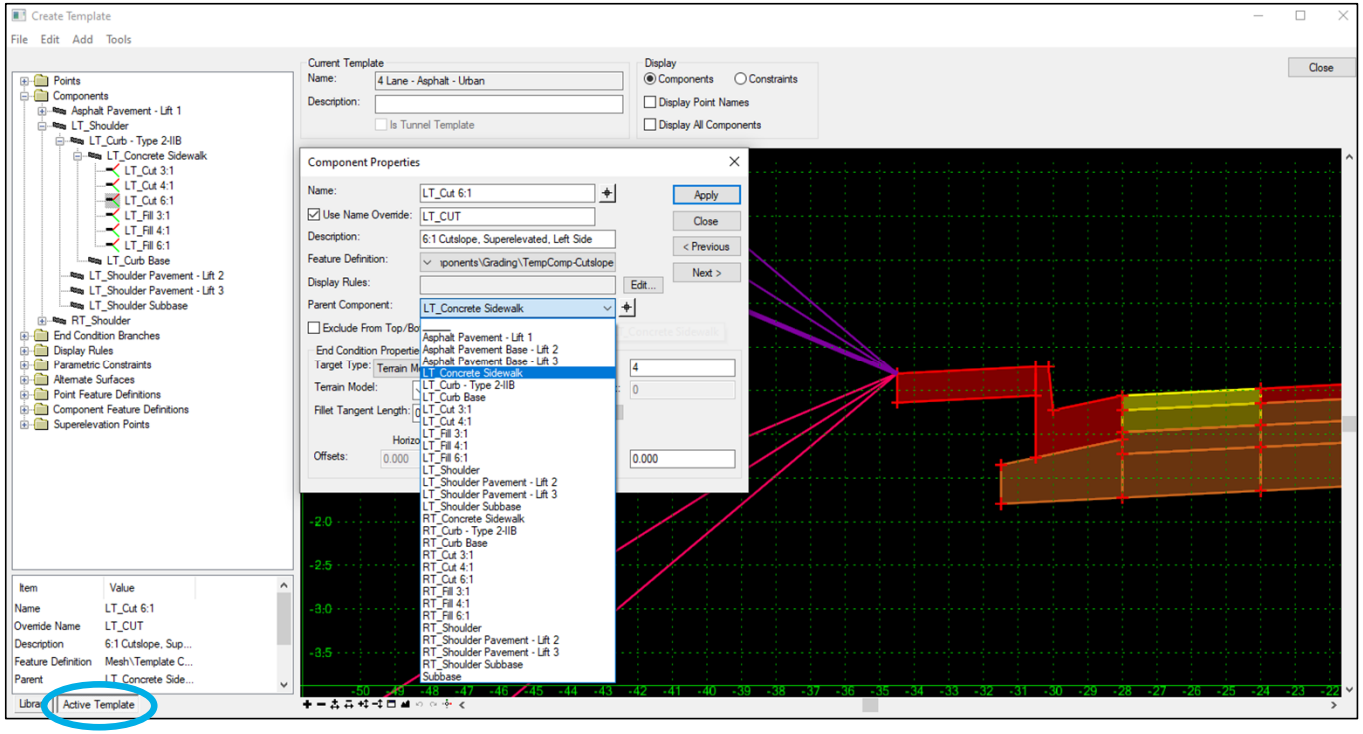


Copying Templates between Libraries & Corridors

- Click on Tools (Select Template Library Organizer).
  - Current Library displayed on left side.
- Click on Selection icon (Select Library or Corridor to copy from).
  - Templates from Library or Corridor will display on Right Side.
- Select Template (Drag Template to left into desired folder).

PARENT-CHILD RELATIONSHIPS

Templates

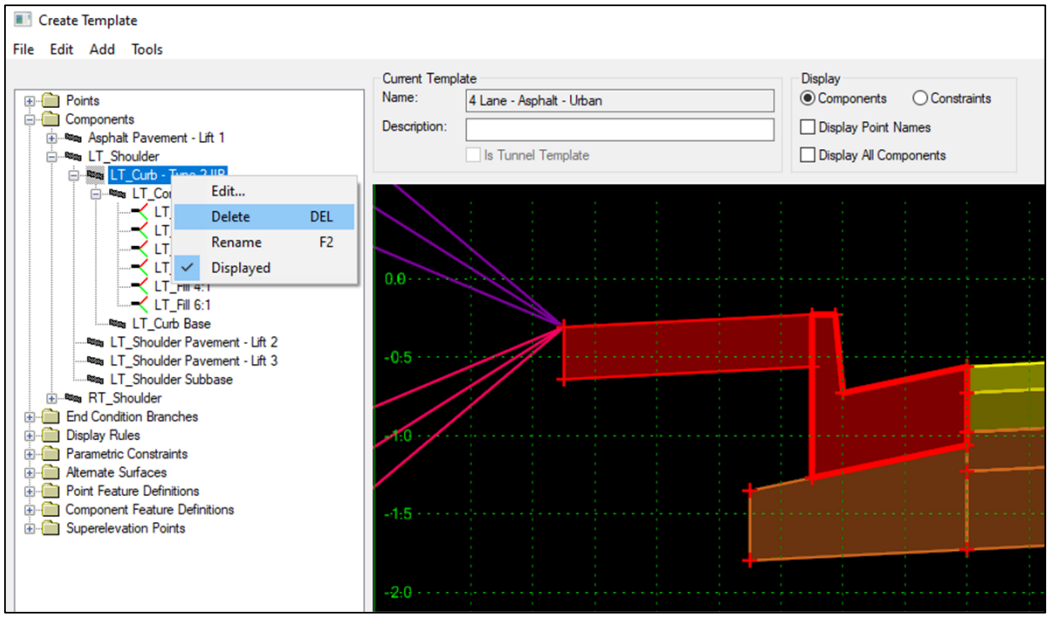


Organize Components and End Conditions within Template

- Click on Active Template tab to see detailed information about Template.
- Double Click on Component to display Component Properties dialog box.
- Choose Parent Component from list of Components from Template.

PARENT-CHILD RELATIONSHIP: BENEFITS

Templates

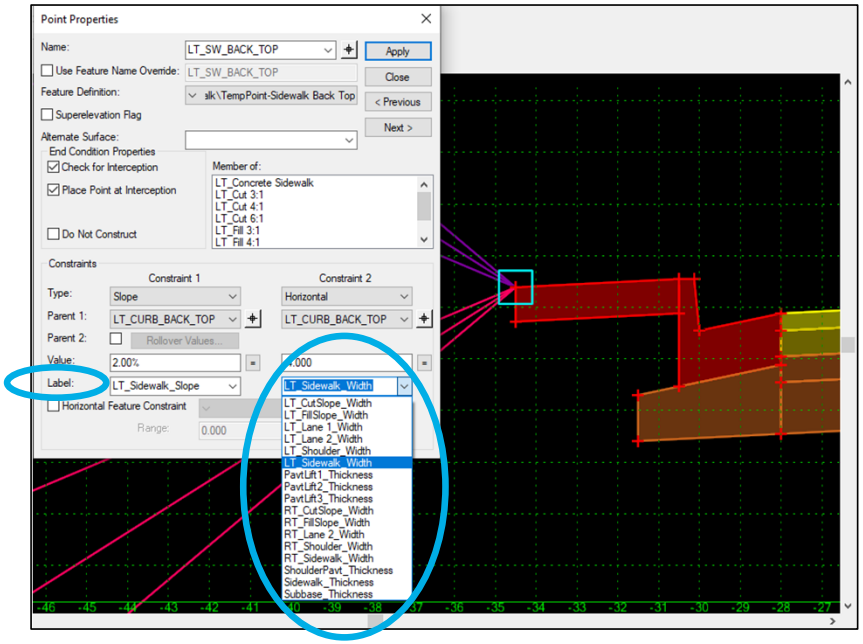


Benefits:

- Organized Template becomes easier to understand, manage, and edit.
- Deleting Parent will delete Children.
- Displaying Parent will display Children.
- Assigning Display Rule to Parent will cause Children to behave like the Parent.

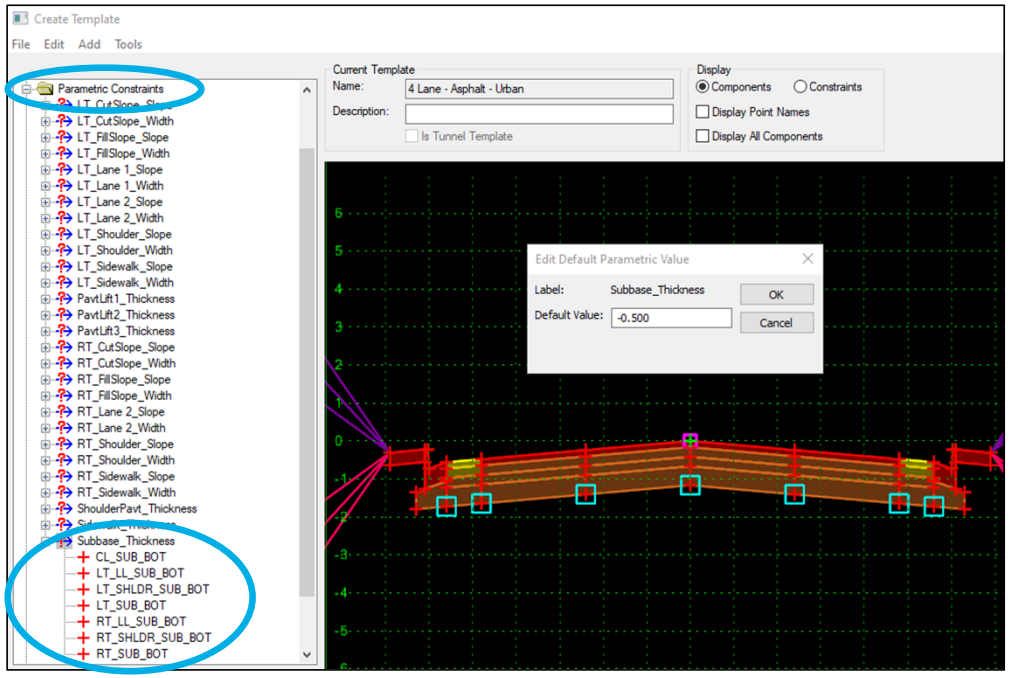
PARAMETRIC CONSTRAINTS

Templates



Point Constraint Labels

- Become Parametric Constraints in Corridors.
- Ability to control point constraints by changing label values.
- Labels appear in drop down menu for consistency.

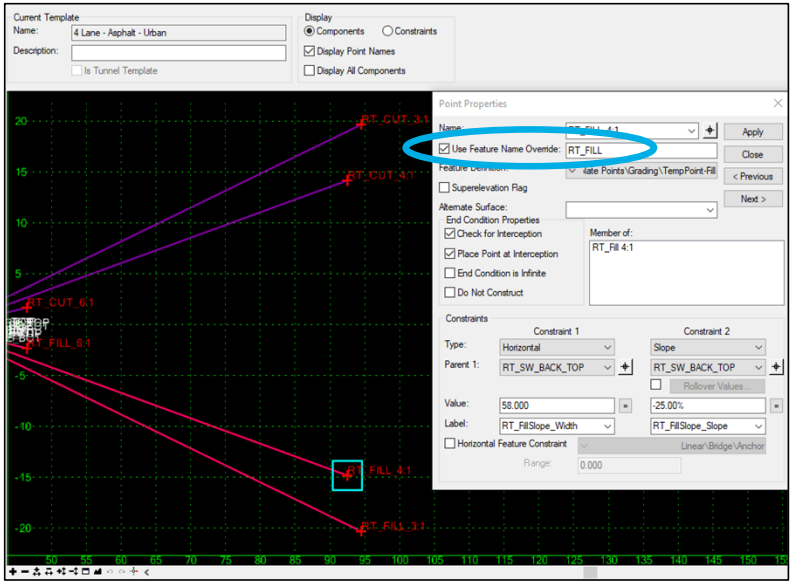


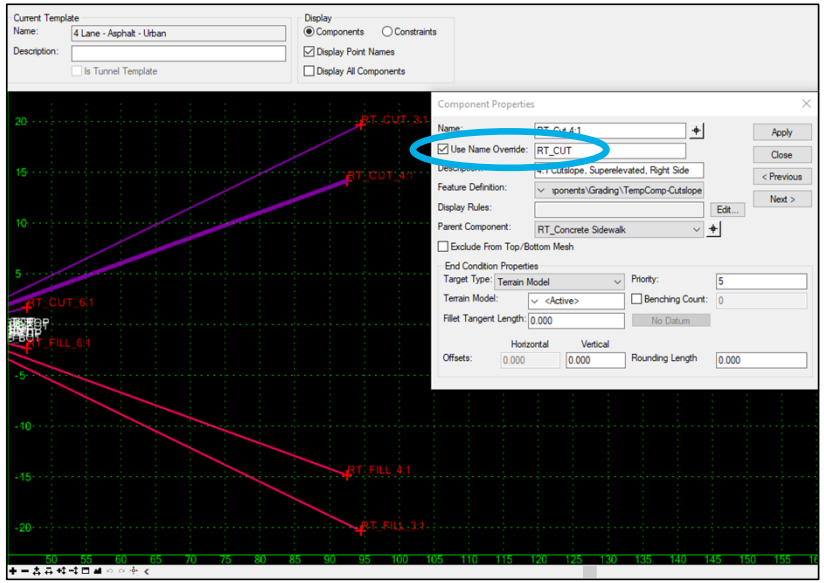
Parametric Constraints Folder

- Parametric Constraints appear in Template.
- Quickly modify a template using parametric constraints.
- Selecting parametric constraint highlights all points with label.
- Revise names of parametric constraint labels.

FEATURE/COMPONENT NAME OVERRIDES

Templates





Feature Name Override

- Typically used for feature points in end conditions.
- Provides consistent name for feature point no matter which end condition is solved.
- Feature point names with overrides are displayed in red.
- Check Override box within point properties.

Component Name Override

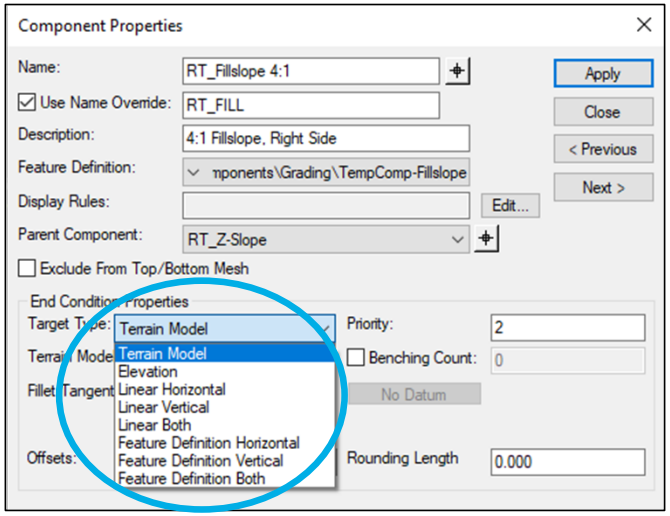
- Typically used for components in end conditions.
- Provides consistent name for component no matter which end condition is solved.
- No simple way to determine if override applied.
- Check Override box within component properties.

QUESTIONS?

END CONDITIONS

END CONDITION TARGETS

Templates



Defining Template End Conditions

This course is suitable for the **2020 Release 1 (10.08.00.88)** *version of:*

OpenRail Designer CONNECT Edition
OpenRoads Designer CONNECT Edition
OpenSite Designer CONNECT Edition

https://drive.google.com/file/d/139oM4Ga88gePKE80VJK6vTkAUDziEu-H/view?usp=sharing

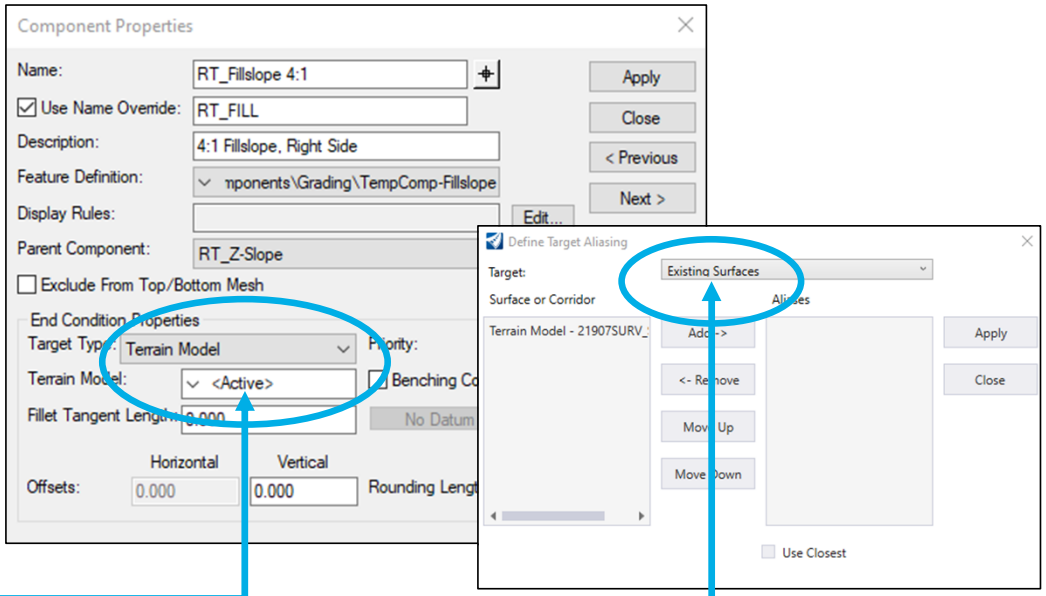
Please Copy & Paste Link Url to Browser For best results.

End Conditions

- All End Conditions seek a target to determine if a condition may be solved.
- There are several Target Types that all End Conditions may seek.
  - Terrain Model
  - Elevation
  - Linear Horizontal
  - Linear Vertical
  - Linear Both
  - Feature Definition Horizontal
  - Feature Definition Vertical
  - Feature Definition Both

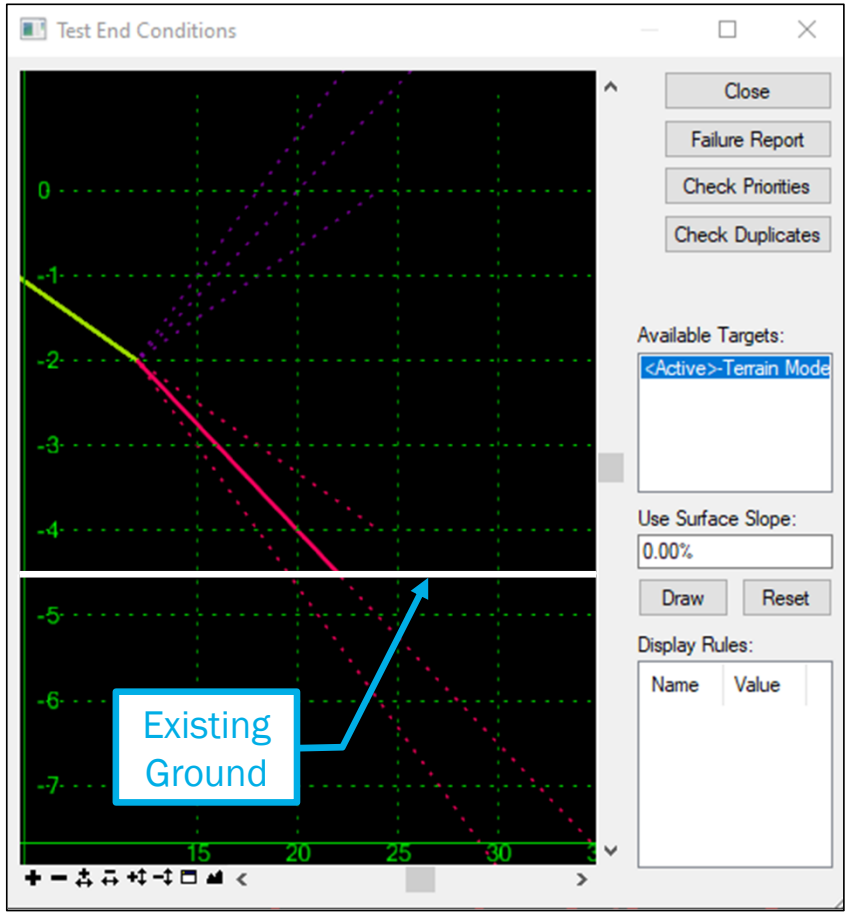
TERRAIN MODEL

End Condition Targets



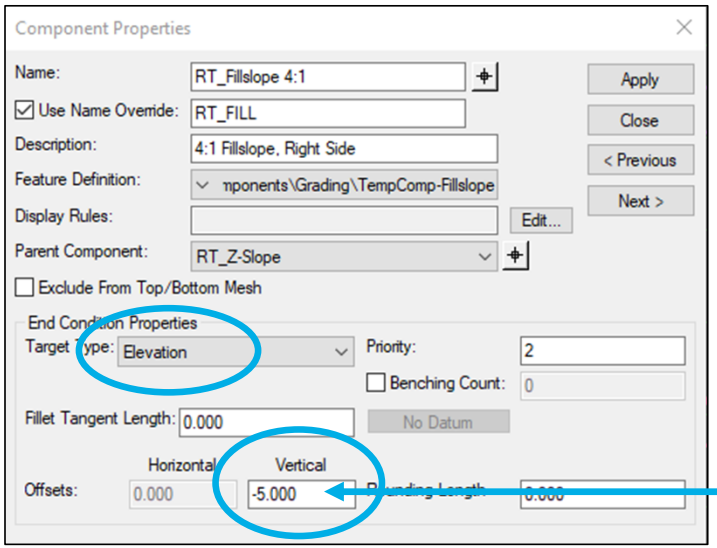
Target Type: Terrain Model

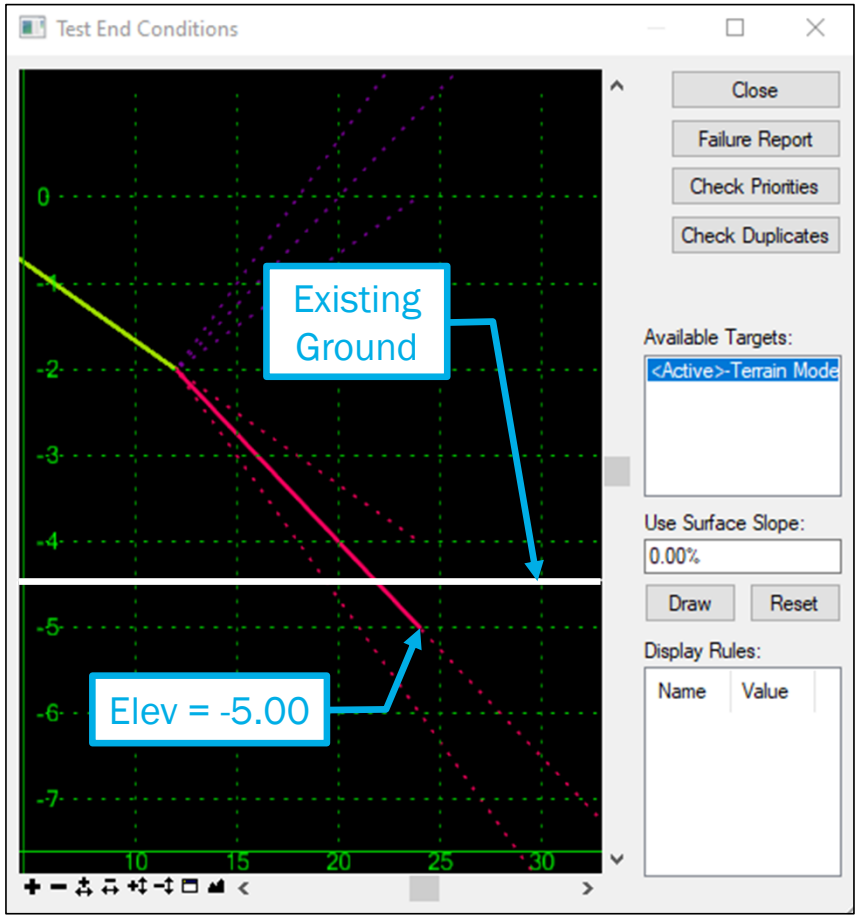
- Default Target Type for all End Conditions.
- End Condition seeks Terrain Model set as “<Active>”.
- “<Active>” may be replaced with any word and will appear within Target Alias list (i.e. “Existing Surfaces”) (Ex: Targeting multiple Existing TM’s all at once).



ELEVATION

End Condition Targets



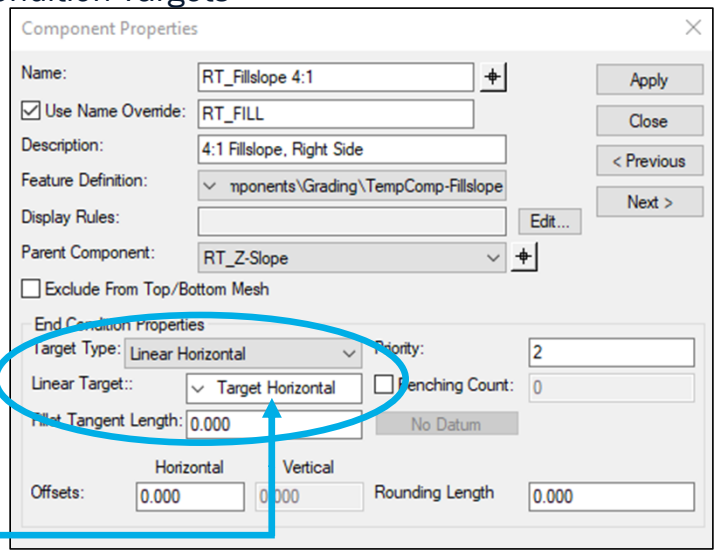


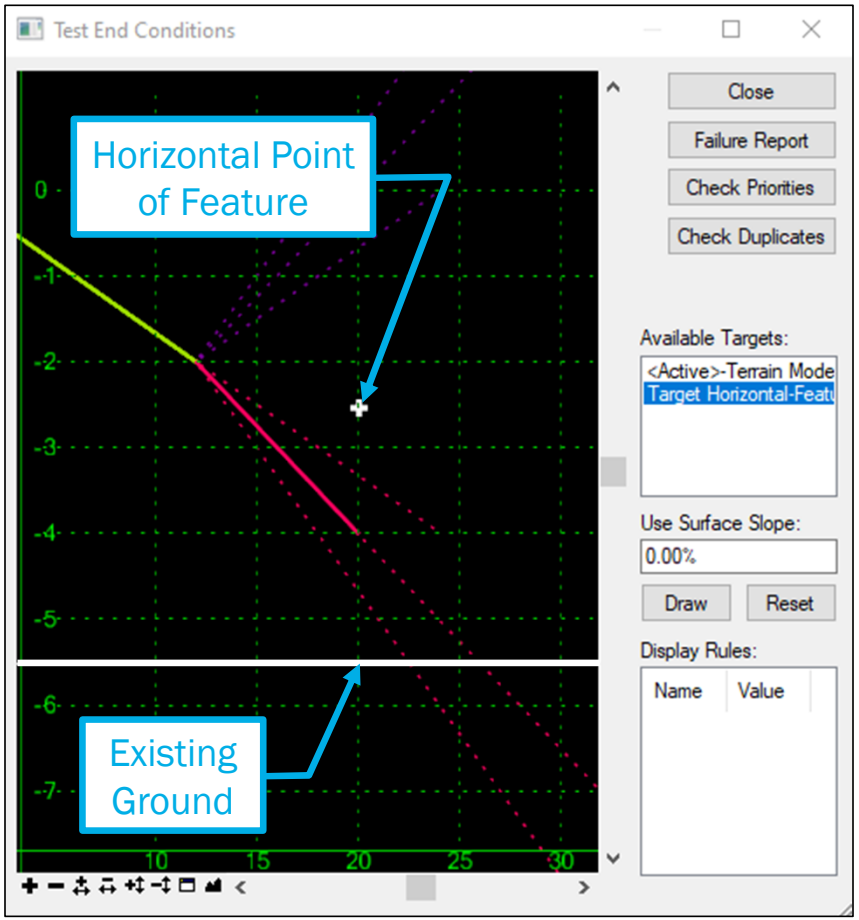
Target Type: Elevation

- End Condition will Target any Elevation.
- Enter value within the Vertical Offsets field (i.e. -5.00) (Ex: Targeting bottom of pond elevation).
- End Condition will not solve if Elevation is not within End Condition parameters.

LINEAR HORIZONTAL

End Condition Targets



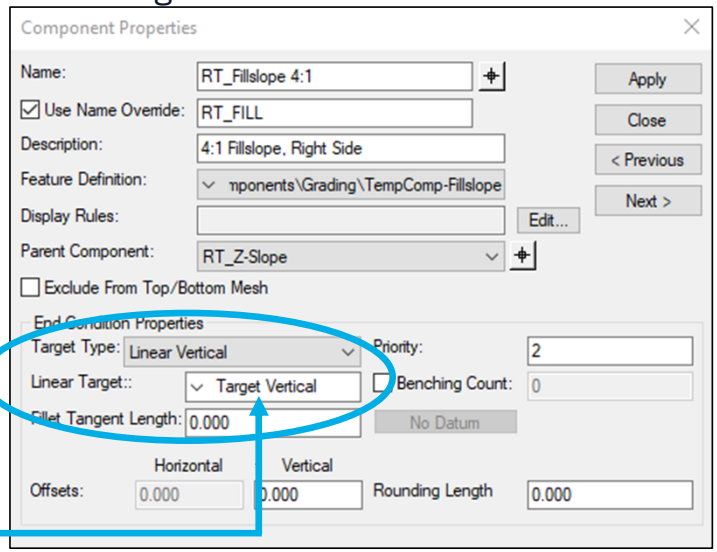


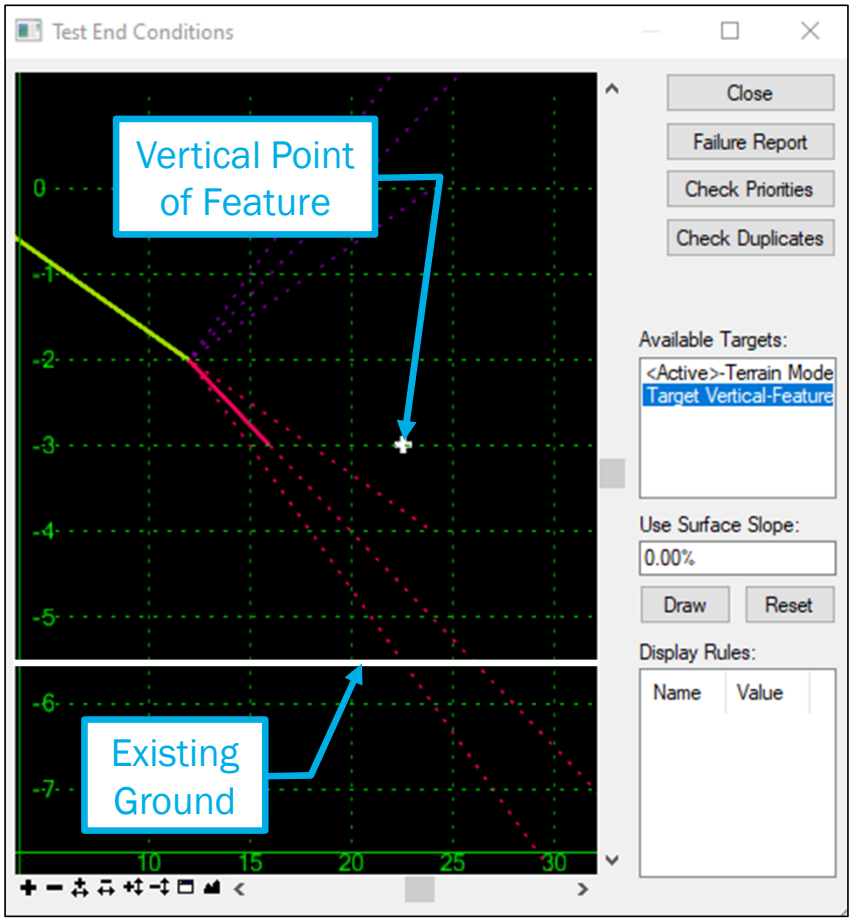
Target Type: Linear Horizontal

- End Condition will Target the horizontal position of any Feature (Ex: Face of retaining wall).
- Linear Target: may be replaced with any word which will then appear within Target Alias list.
- End Condition will continue in defined direction until it seeks horizontal position of feature, Active Terrain Model will have no impact on End Condition.

LINEAR VERTICAL

End Condition Targets



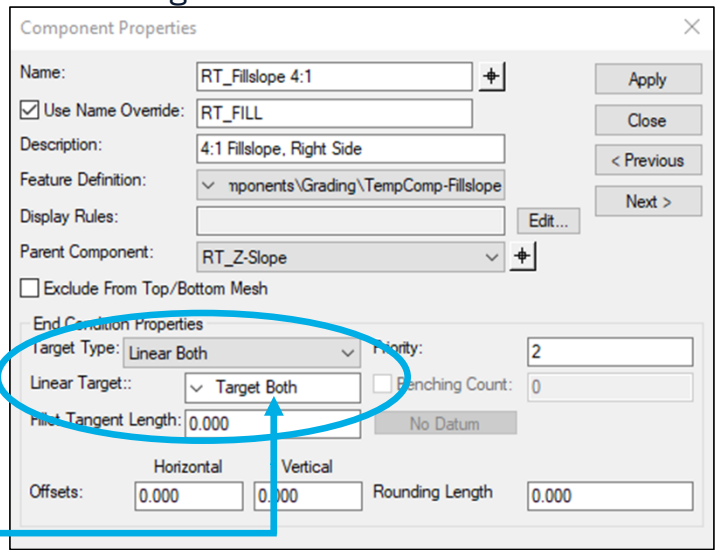


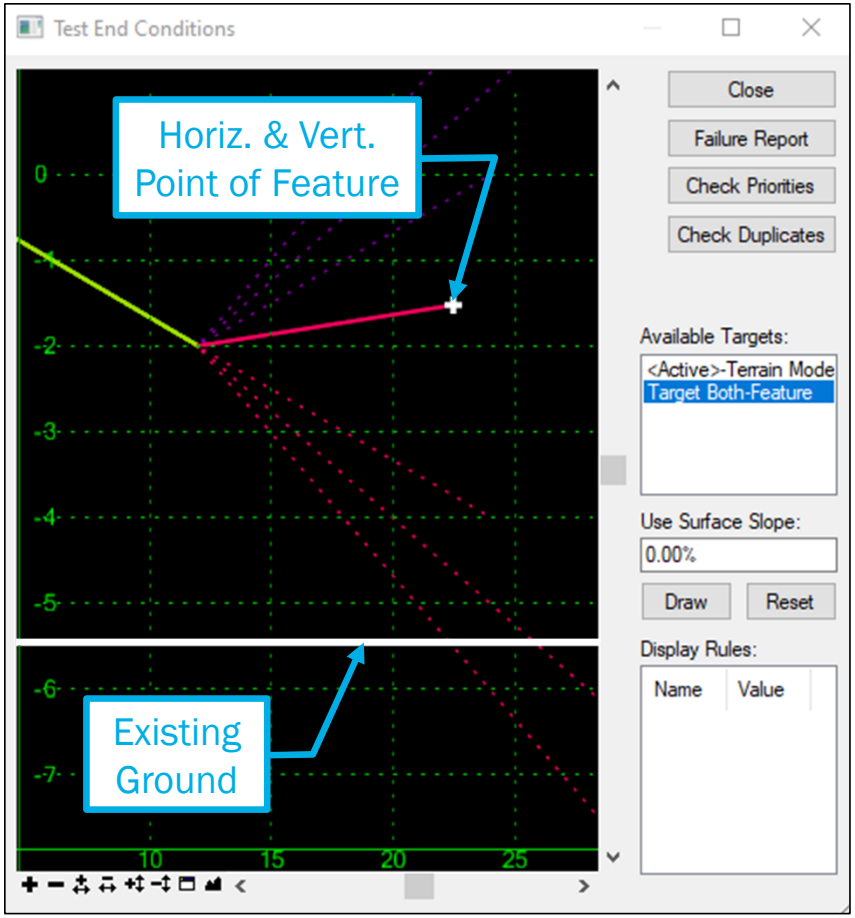
Target Type: Linear Vertical

- End Condition will Target the vertical position of any Feature (Ex: Top of retaining wall).
- Linear Target: may be replaced with any word which will then appear within Target Alias list.
- End Condition will continue in defined direction until it seeks vertical position of feature, Active Terrain Model will have no impact on End Condition.

LINEAR BOTH

End Condition Targets



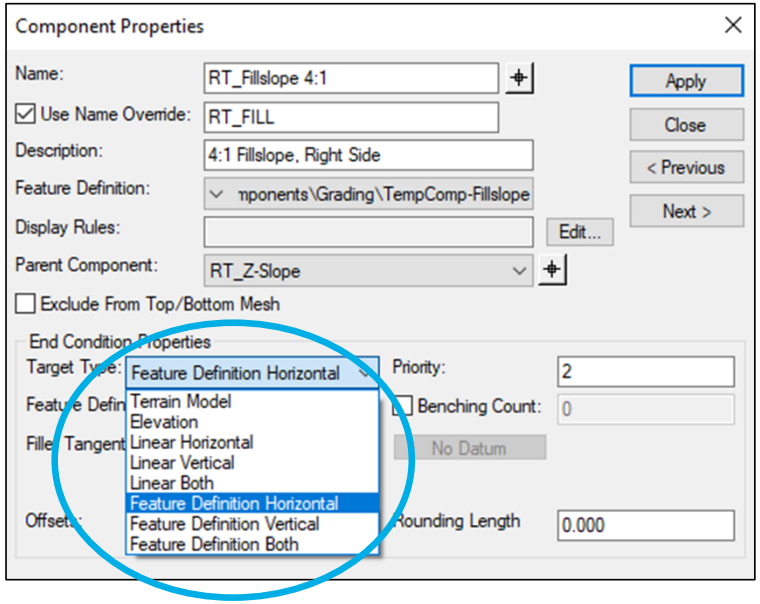


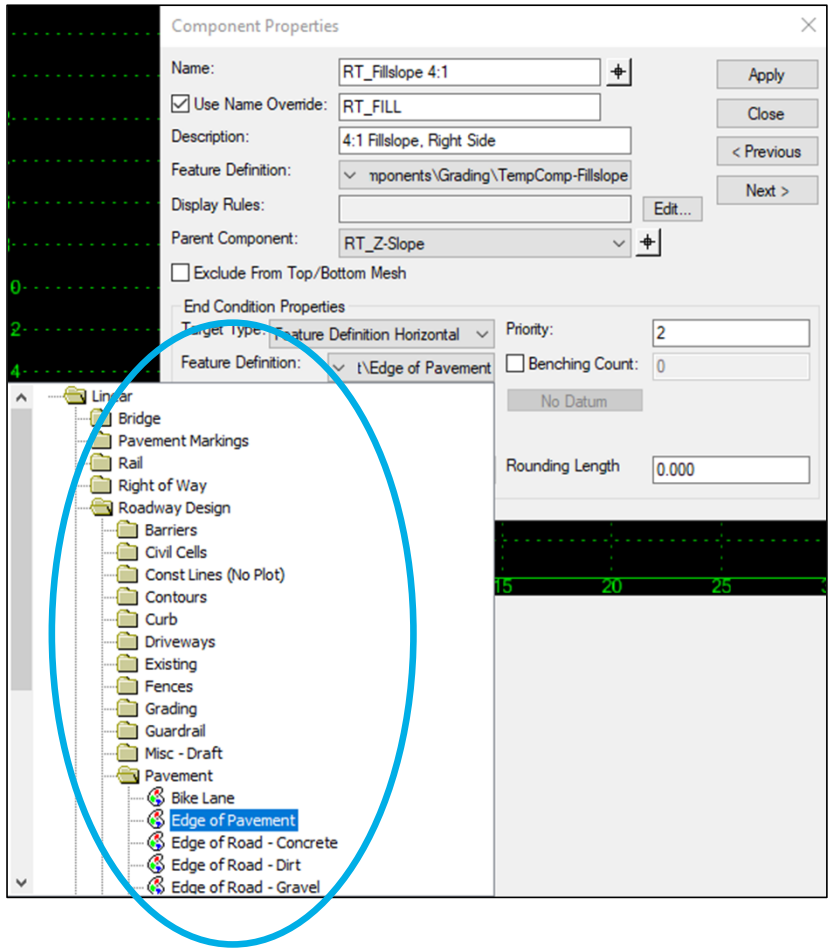
Target Type: Linear Both

- End Condition will Target the horiz. & vert. position of any Feature (Ex: POSS of nearby road).
- Linear Target: may be replaced with any word which will then appear within Target Alias list.
- End Condition constraints will be superseded by horiz. & vert. position of feature, Active Terrain Model will have no impact on End Condition.

FEATURE DEFINITION

End Condition Targets



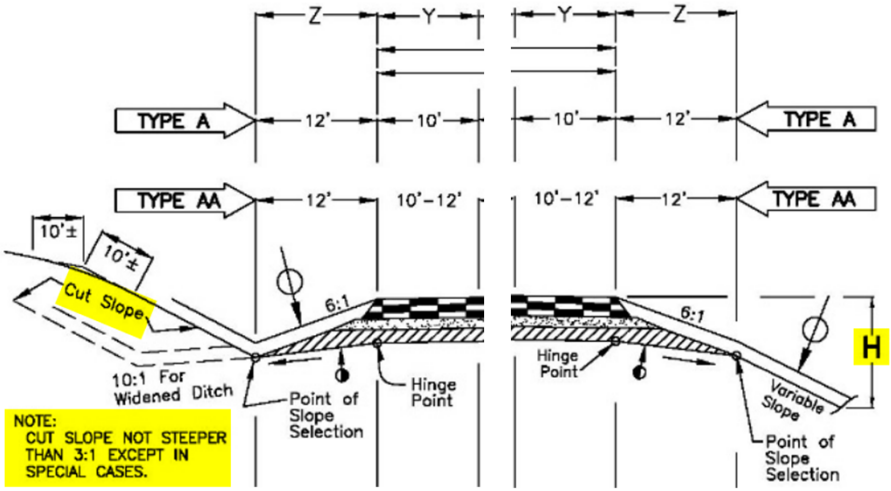


Target Type: Feature Definition Horizontal/Vertical/Both

- These Target Types behave similar to Linear Target Types except they are defined by a Feature Definition.
- Feature Definition pull down menu will appear and list all available Feature Definitions found within dgnlib.
- Feature Definition list will appear within Target Alias.

CDOT SIDE SLOPES

Templates



H = THE VERTICAL DISTANCE FROM THE TOP SURFACE OF THE EDGE OF OIL TO THE TOE OF SLOPE.

Highway Type	* H	Terrain	
		Plains	Rolling and Mountainous
		Slope Ratio**	
4 or more lanes (Z=12' @ 6:1)	≤ 4'	Z, then 6:1	Z, then 4:1
	> 4' to 10'	Z, then 4:1	Z, then 4:1
	> 10' to 15'	Z, then 4:1	Z, then 3:1
	> 15'	Z, then 3:1	Z, then 3:1
‡2 lane (Z=8' @ 6:1 or 6' @6:1 or 4' @ 6:1)	≤ 4'	Z, then 6:1	Z, then 4:1
	> 4' to 10'	Z, then 4:1	Z, then 4:1
	> 10' to 15'	Z, then 4:1	Z, then 3:1
	> 15'	Z, then 2:1	Z, then 2:1

* H is the vertical distance between outside edge of top layer of pavement and catch point where fill meets natural ground.
Slopes 3:1 or steeper should be reviewed for safety and guardrail warrants See Figures 4-1 to 4-5 for determination of Z width.
**May be steeper in special cases.
‡ In constrained situations on a 2 lane roadway, the Z slope may be constructed as steep as 4:1.

Table 4-2 Fill Slopes

4.7.6 Clearance from Slope to Right of Way Line

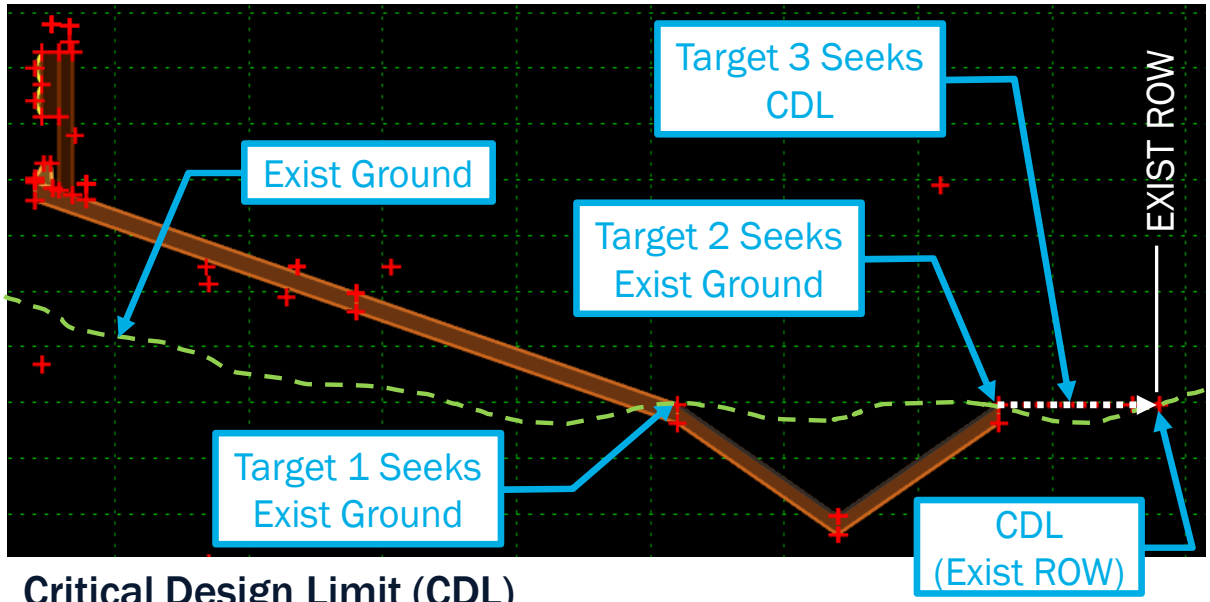
The minimum clearance from the right of way line to the catch point of a cut or fill slope should be 10 feet for all types of cross sections, but the desirable clearance is 20 feet. Access for maintenance activities should be considered.

CDOT Templates based on CDOT Criteria

- Fill slope heights “H” are based on “Table 4-2 Fill Slopes” of CDOT Roadway Design Guide.
- Missing criteria for section “4.7.6 Clearance from Slope to Right of Way Line”.

CRITICAL DESIGN LIMIT (CDL)

Templates

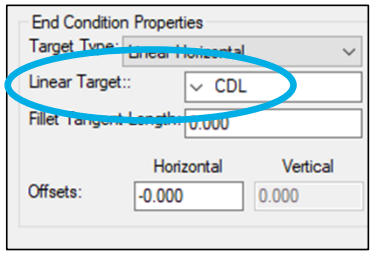


Critical Design Limit (CDL)

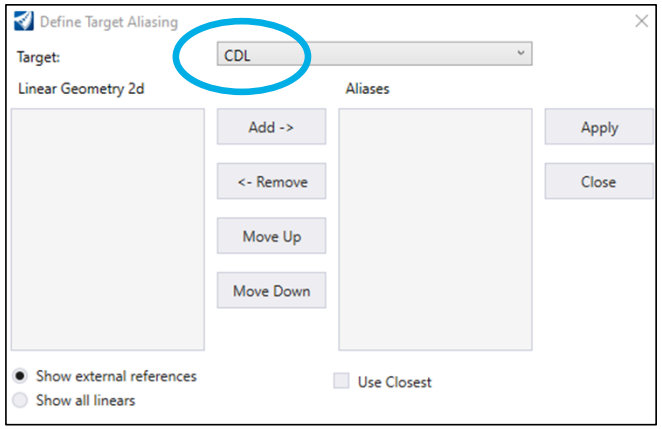
- Elements along a project that define boundaries/obstacles to design against:
  - Exist/Prop ROW
  - Bodies of Water
  - Roads/Railroads
  - Utilities
- Setting Template Targets using Target Aliasing to these type of CDL's will help automate the roadside slopes that are necessary based on priorities.
- Typical order of priority include:
  - Clear Zone Slopes
  - Guardrail
  - Barrier
  - Retaining Wall

TARGET TYPE TO TARGET ALIASING

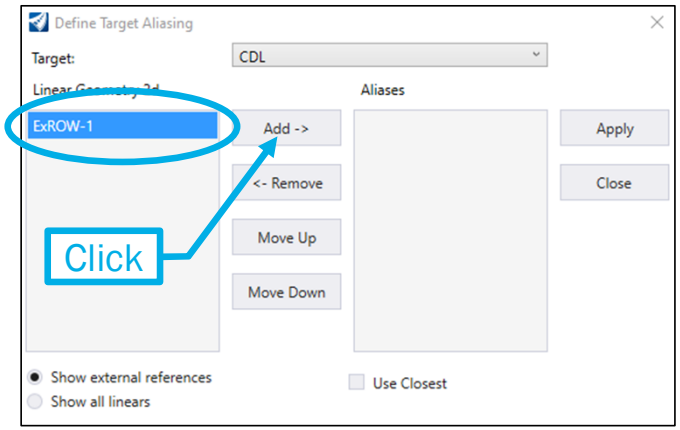
Templates

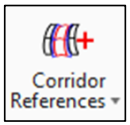


- Setting up the Target Type to Linear Horizontal with the word “CDL” in the Linear Target field will create a Target Folder named “CDL” within Target Aliasing for Corridors.



- Defining Target Aliasing for a corridor will show the “CDL” Target within the list, but the targets must be set up first within the corridors by adding Corridor References.





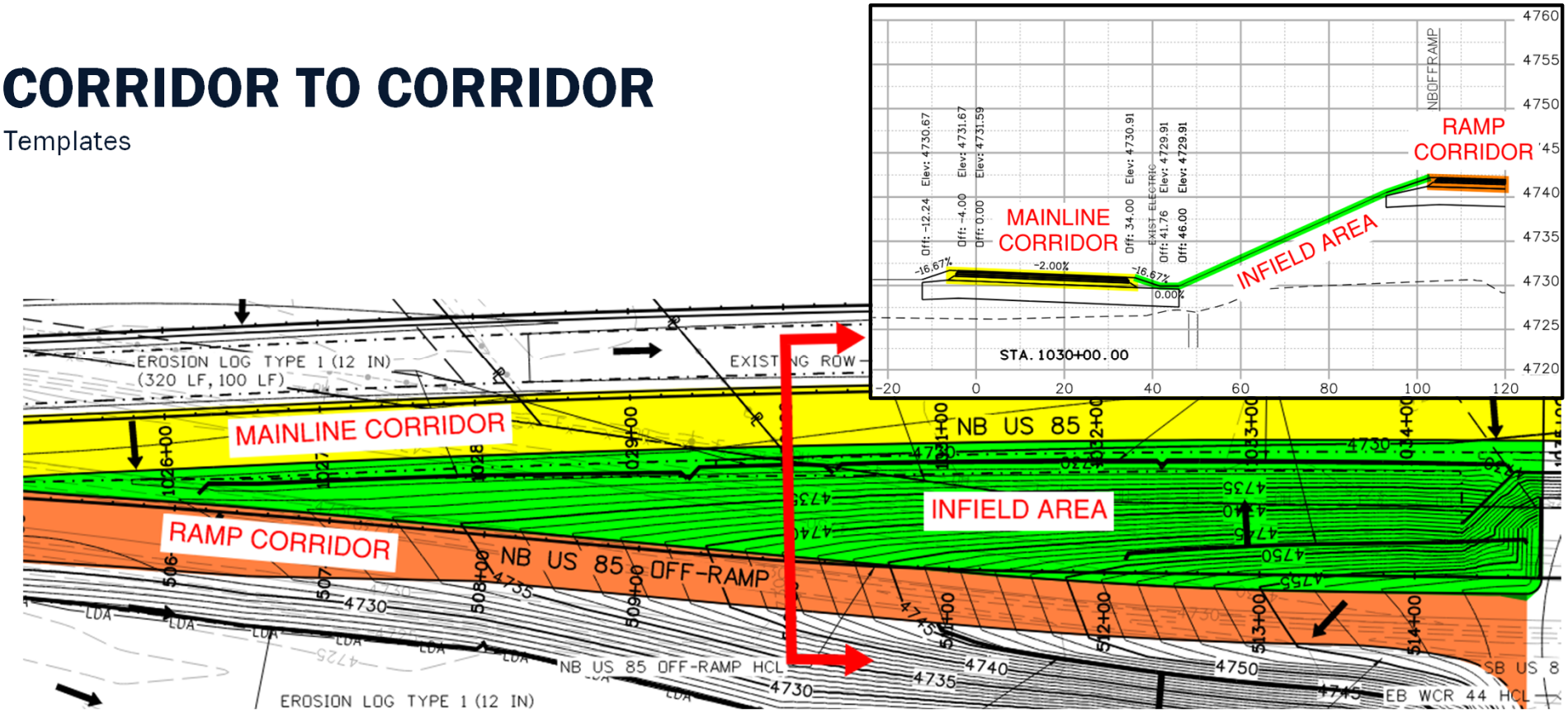
- After setting up the targets using Corridor References, the targets will appear and can be added to the “CDL” Alias.

QUESTIONS?

CORRIDOR TO CORRIDOR

CORRIDOR TO CORRIDOR

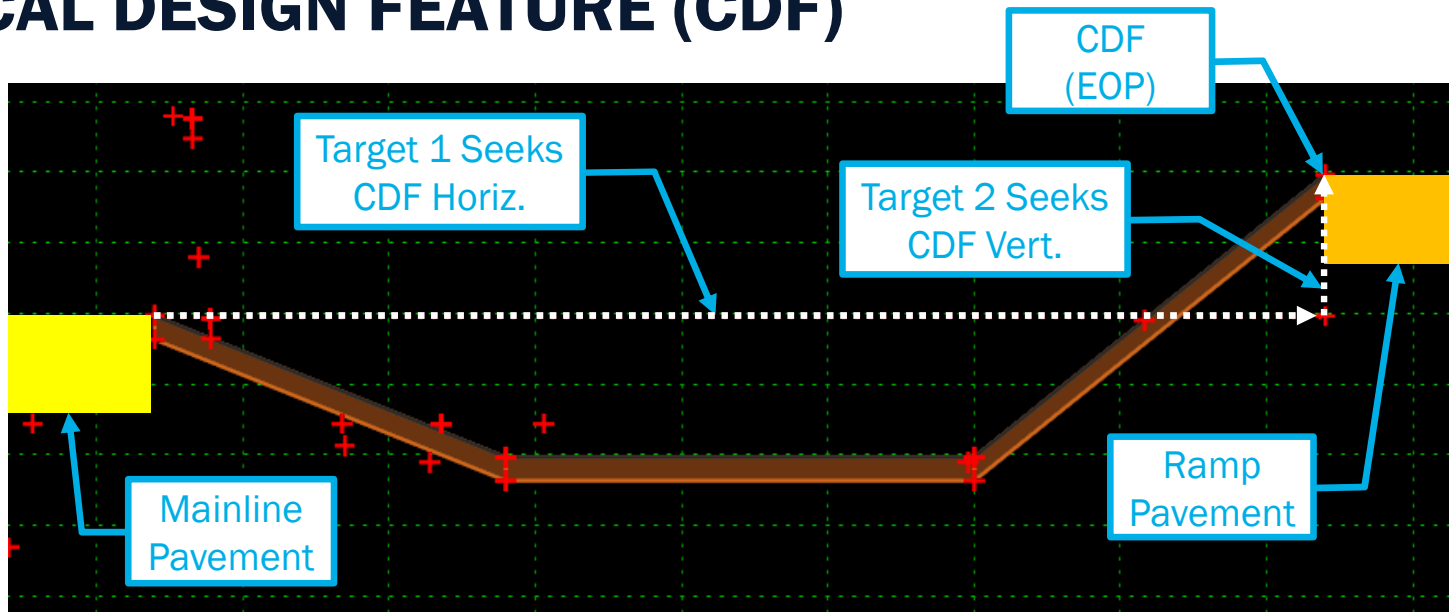
Templates



- Corridors running parallel to each other in close proximities pose issues of overlapping side slopes. (i.e. Infield areas within interchanges).
- Corridor clipping may be an option but not ideal.
- Cleanest modeling approach is to model entire infield area from one corridor connected to the second corridor.

CRITICAL DESIGN FEATURE (CDF)

Templates



Critical Design Feature (CDF)

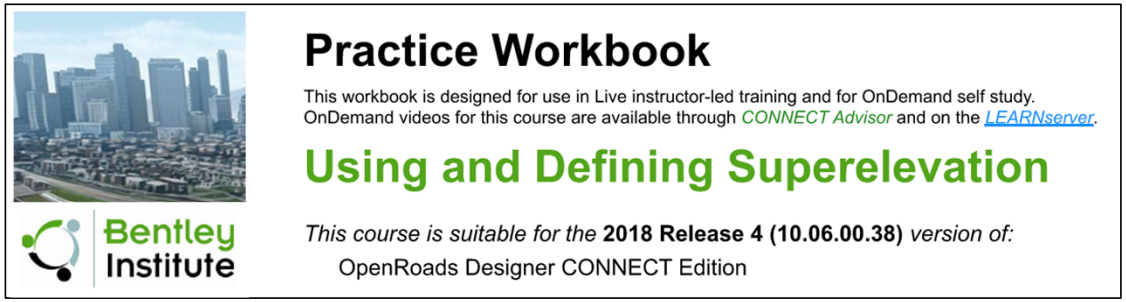
- Features along a corridor that should be tied to by another corridor in order to complete the design between the corridors:
  - Edge of Pavement
  - POSS
  - Bottom of Ditch
- Similar to a CDL, setting Template Targets using Target Aliasing to these type of CDF's will help automate the design between corridors based on display rules.
- Setup for the CDF's within a template and corridor are the same procedures as taken for setting up the CDL's.

QUESTIONS?

SUPERELEVATION

SUPERELEVATION

Creating

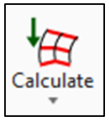


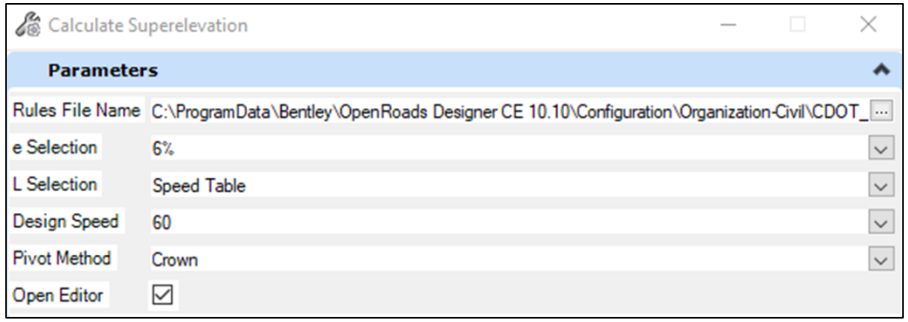
https://drive.google.com/file/d/139oM4Ga88gePKE80VJK6vTkAUDziEu-H/view?usp=sharing

Please Copy & Paste Link Url to Browser For best results.

Two methods to calculate superelevation:

1. Via XML/Standards file. 

2. Manual calculation and import from CSV file. 



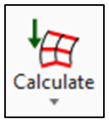
XML/Standards file

- Best for preliminary design.
- Quickly calculate transition locations.
- Edits can be made after calculation BUT if geometry changes ALL manual changes are lost and must be redone.

SUPERELEVATION

Creating

Import from CSV file



- Lane names in superelevation object must match names in CSV file.
- Cross slope sign (+/-) is from pivot point out.
- Changes are made to CSV file.
  - To import changes, delete all super transitions first then reimport.
- Changes to geometry requires calculation BUT changes to other parts of geometry/super are preserved.

SuperelevationLane	Station	CrossSlope	PivotAbout	PointType	TransitionType	NonLinearCurveLength
R	10+00.0000	-0.0200	LS	U	L	0
R	12+09.8700	-0.0200	LS	U	L	0
R	13+53.8700	-0.0200	LS	U	L	0
R	14+97.8700	-0.0600	LS	U	L	0
L	10+00.0000	-0.0200	RS	U	L	0
L	12+09.8700	-0.0200	RS	U	L	0
L	13+53.8700	-0.0200	RS	U	L	0
L	14+97.8700	-0.0600	RS	U	L	0

Note:

- If using XML file the correct lane widths are more important to get correct calculations. Using manual input method only requires lanes to exist. Width/offset are irrelevant.

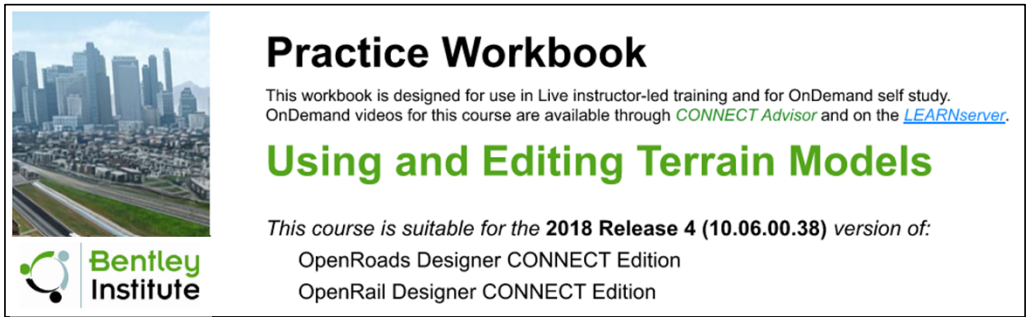
QUESTIONS?

TERRAIN MODELS

- Creating
  - Finished Grade
  - Alternate Surface
- Editing
- Displaying Contours

CREATING

Terrain Models



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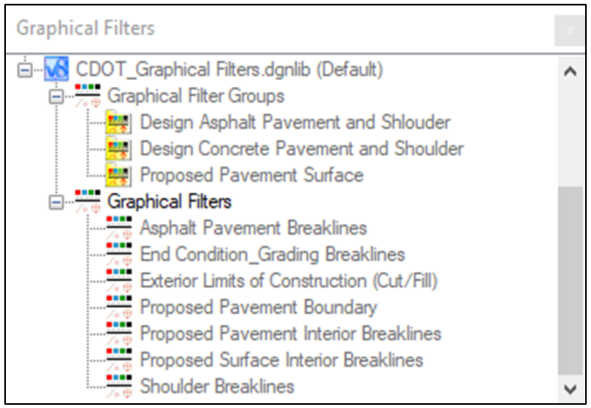
From Elements

- Used for simple terrain models, primarily in modeling.
- Requires good boundary elements, add breaklines as necessary. Surface template is usually applied to surface after creation.

From Graphical Filter

- Used for overall project terrain model.
- Usually feature definition specific but other filter methods are also available.
- Creation of templates and template points is critical for a successful finished terrain model.



From Corridor Alternate Surfaces

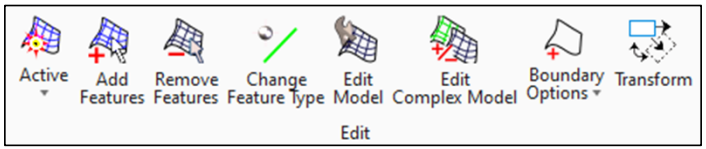
- Used for below finished grade surfaces (i.e. Subgrade).
- Creation of templates and template points is critical for a successful alternate surface.

EDITING

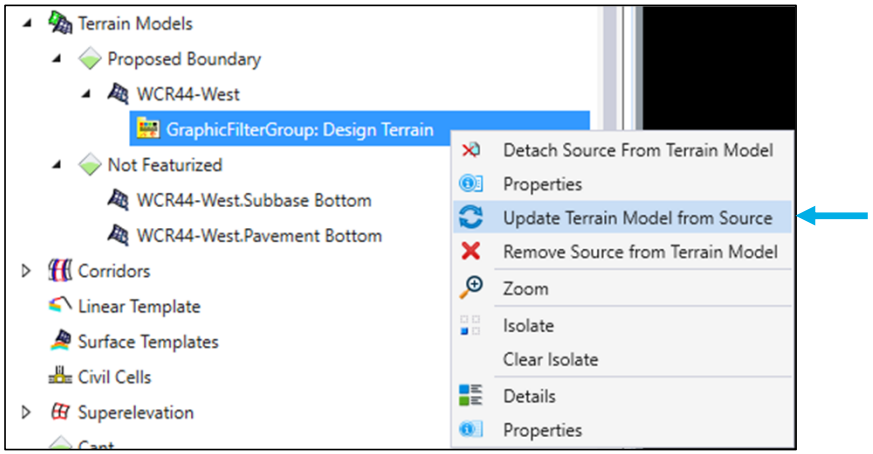
Terrain Models

Edit method depends on creation method

- If “By Elements” is used, then editing would simply require edits to the elements used in creation.



- If “Graphical Filter” is used, then:
  - Updates are sometimes automatic.
  - Terrain model can be refreshed from source to re-query the graphics.
  - Sometimes a refresh does not work. User must delete the TM and recreate from graphical filter.



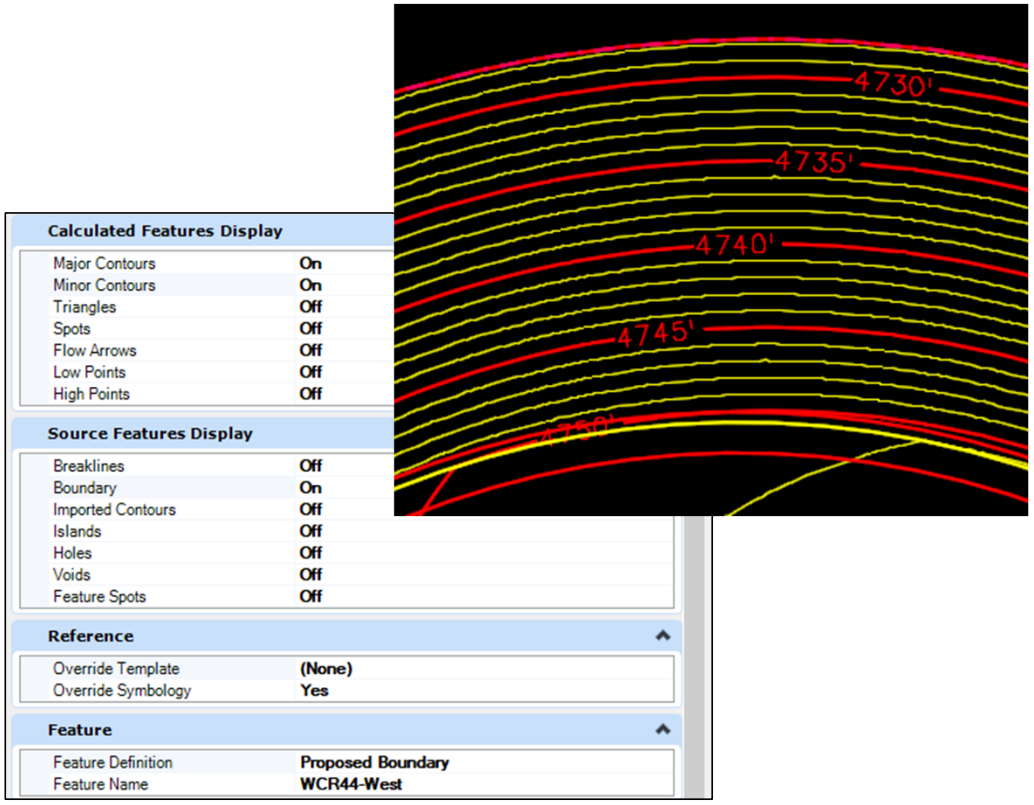
DISPLAYING CONTOURS

Terrain Models

Two methods:

1. By Feature Definition.

2. By element template override.
   - Changing settings in element template.



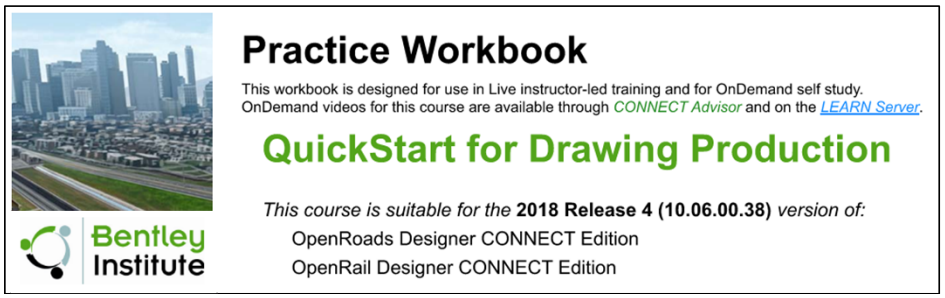
QUESTIONS?

PLAN PRODUCTION

- Outline
- Named Boundaries & Creating Plans
  - Civil Plan
  - Civil Profile
  - Civil Plan & Profile
  - Cross Sections
    - Sheets/Skewed/Stacking
    - Displaying ROW/Utilities
- Annotation
  - Element Annotation
  - Model Annotation
  - Civil Labeler

OUTLINE

Plan Production



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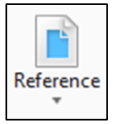
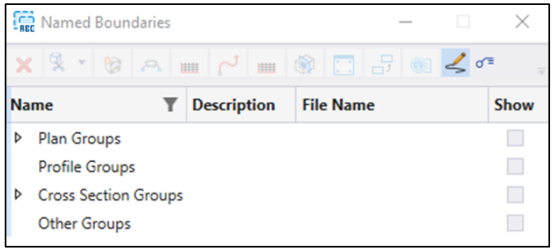
Things to Consider:



- Reference file management is critical.
- If using containers be very careful what is attached to the container.
- All plan creation includes creating two additional models, the drawing model and sheet model. The drawing model is full size while the sheet model is paper space units.

- Named boundaries in separate file or sheet file; depends on method of file creation.
  - Note: Named boundaries can always be referenced to any file for sheet file creation.



Two methods:

1. One file for each plan, including default and default 3d models.
2. Source file for plan creation; sheet files contain only drawing and sheet models.

- Notes:
  - Large sets of plans are quicker to use method 2 but tracking alignments is not possible in files without default models.
  - Detail sheets are best to use method 1.

Profile Sheets:

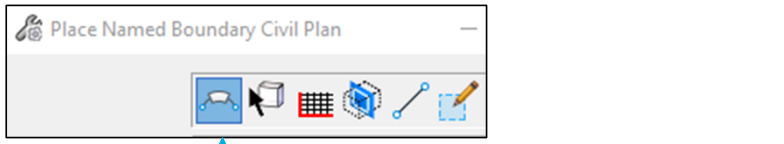
- Profile named boundaries/sheet creation follow same workflow as plans (i.e. two methods).

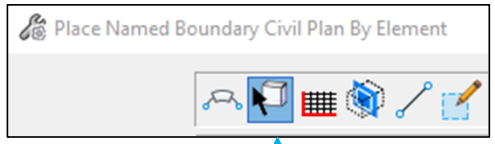
CREATING PLANS

Plan Production

Civil Plans

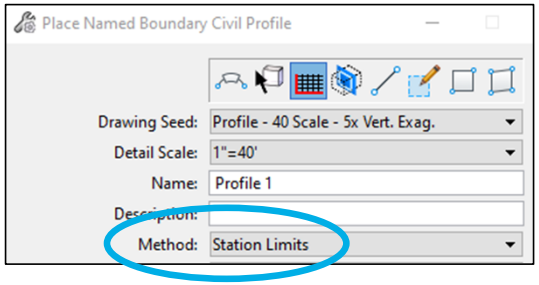
- Named boundary by “Civil Plan”.
- Named boundary by “Civil Plan By Element”.

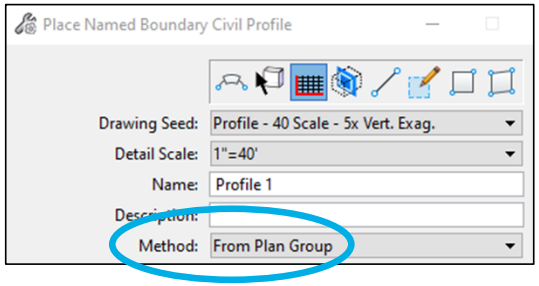




Civil Profiles

- Profile named boundary by “Station Range”.
- Profile named boundary by “From Plan Group”.





Civil Plan and Profiles

- Creating automatically can only be done if profile named boundary are created from plan group.
- It is possible to create plan drawing/sheet first and then add a profile to the sheet in subsequent step.

Cross Sections

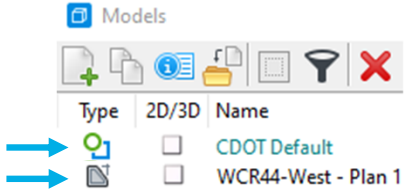
- How to create Cross Section Sheets, Skewed Cross Sections and Stacked Cross Sections.
- How to display ROW and Utilities in Cross Sections.

ANNOTATING PLANS

Plan Production

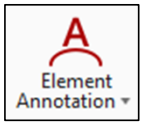
Things to Consider:

- Annotation can be done in drawing model or default model. Labels are better placed in drawing model for text orientation as that is sheet orientation.
  - Annotations of elements will honor sheet boundary limits with the exception of certain civil labeler annotations.



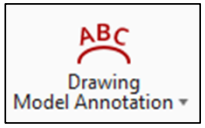
Element Annotation:

- Used to annotate elements based on feature definitions or an “Override Annotation Group (i.e. Stationing for horizontal alignments & vertical annotation for profiles).



Model Annotation:

- Used to annotate a drawing model based on Annotation Groups (i.e. North Arrow, Bar Scale & Matchlines in plan view and Elevations, Stations and Grid Lines in profile view).



Civil Labeler:

- Used to place intelligent labels to automatically annotate elements (i.e. Stations, Offsets, Elevations & Alignment Names).

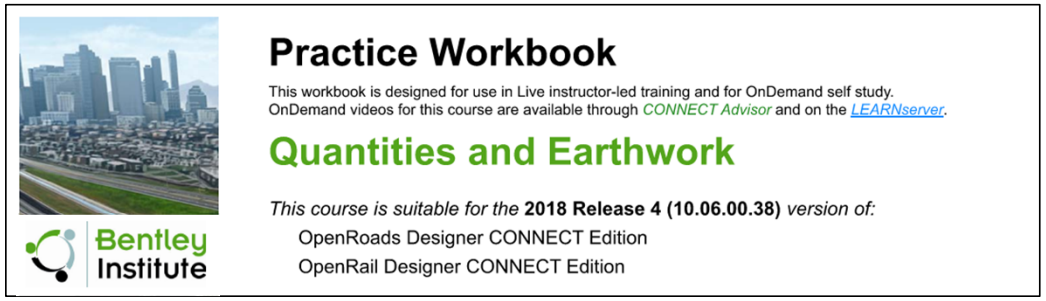
QUESTIONS?

CALCULATING EARTHWORK

- Outline
- End Area Volume vs. Volumetric

OUTLINE

Calculating Earthwork



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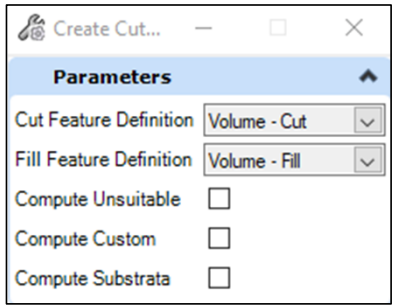
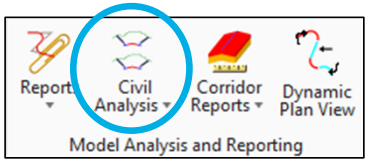
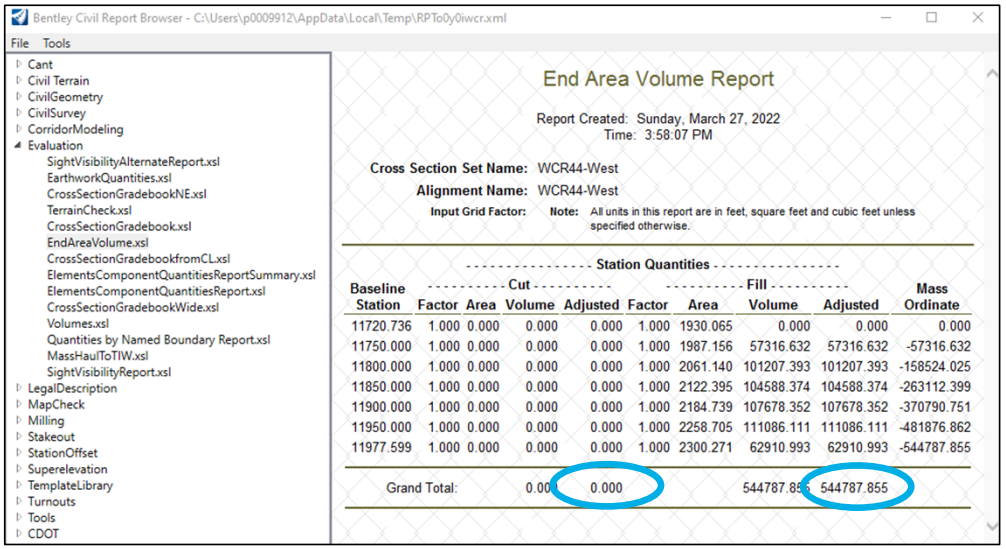
- Feature definition of mesh elements determines how earthwork volumes will be calculated.
- Creating cut/fill shapes.
- Unsuitable material?
  - Topsoil stripping
  - Existing pavement removal
  - Rock excavation

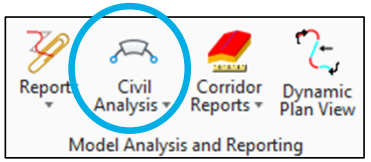


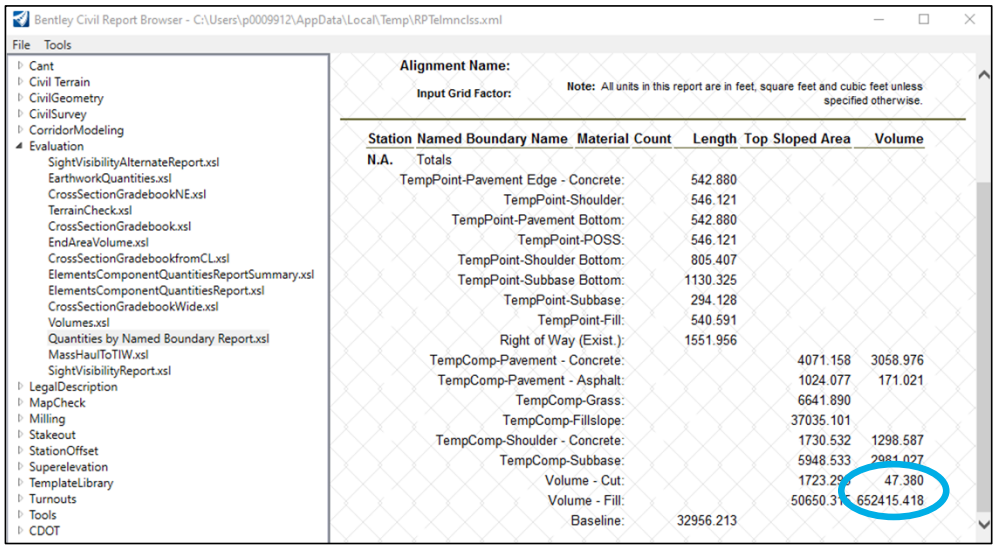
END AREA VOLUME VS. VOLUMETRIC

Calculating Earthwork









By End Area Volume

- Requires cross section named boundary.

By Named Boundary

- Provides more accurate quantities.

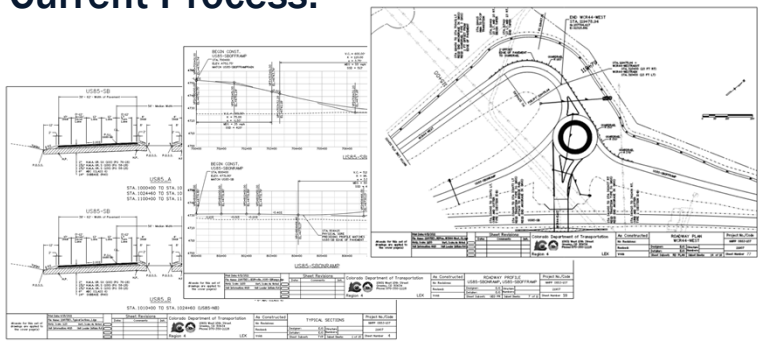
QUESTIONS?

3D MODELING DELIVERABLES

- Overview
- Alignments
- Surfaces (Existing, Finished Grade, Subgrade)
- DGN Design Files

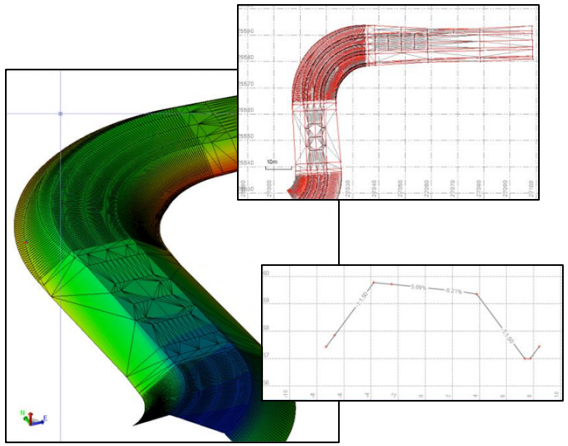
3D MODELING DELIVERABLES (Overview)

Current Process:



Trimble Business Center

AGTEK



New Process:

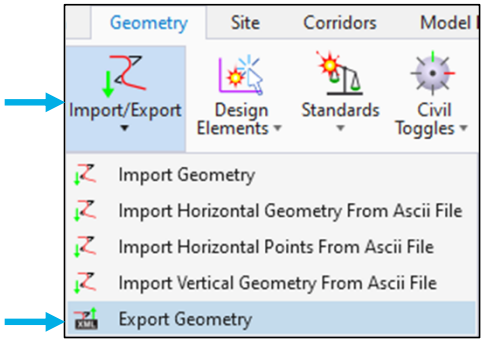
- Export to LandXML.
  - Alignments – All into one file.
  - Surfaces:
    - Existing Terrain Model
    - Finished Grade Terrain Model
    - Subgrade Terrain Models

+

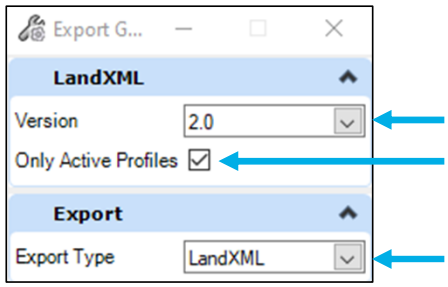
- DGN's to Include:
  - Topo
  - ROW
  - All Discipline Design Files i.e.:
    - Roadway
    - Alignments
    - Stationing
    - Cross Sections
    - Drainage
    - Bridge
    - Utilities
    - Etc.
  - 3D Components of Model Container file (Fence File).

ALIGNMENTS

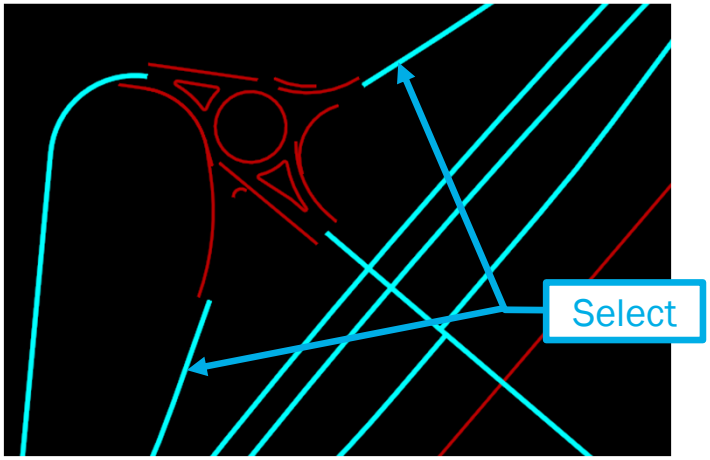
Export to LandXML (21907_Alignments.xml)



- Locate the “Import/Export” command under the Geometry ribbon tab. Click on the pull-down arrow to expand the command. Select the “Export Geometry” command.



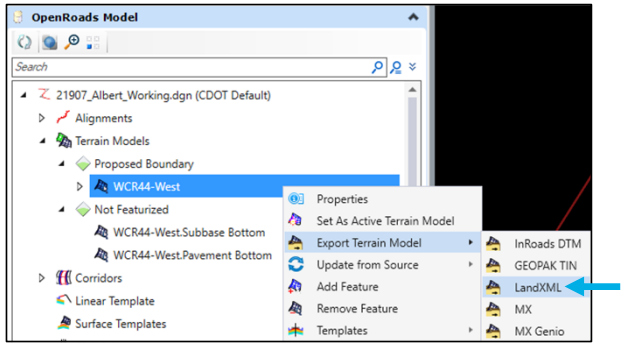
- Set up the “Export Geometry” command by selecting the “2.0” Version and checking the box to include “Only Active Profiles”. Also select the Export Type to “LandXML”.



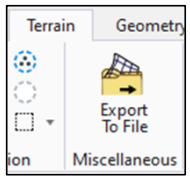
- Prior to starting the “Export Geometry” command, you may graphically select all alignments to be included within the LandXML file. If this is the method you choose to use, you will be prompted to “Data Point to Export selected elements” after accepting the Export Type. Otherwise, you will be prompted to “Locate Elements – Reset to Complete” after accepting the Export Type.
- After cycling through the prompts you will be asked where and what to name the file. Follow the following naming convention:
  - 21907_Alignments.xml

SURFACES (Export to LandXML)

Two options to open command:

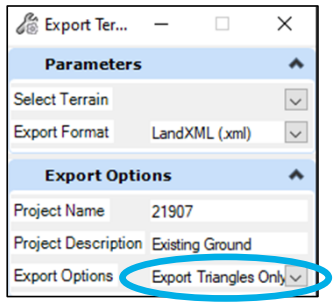


1. Using “Explorer” locate the Terrain Model under the “OpenRoads Model” and Right Click on the Terrain Model. Select “Export Terrain Model” then “LandXML”.

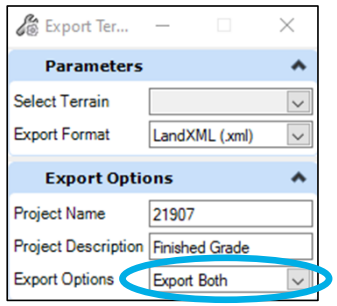


2. Locate and select the “Export to File” command under the Terrain ribbon tab.

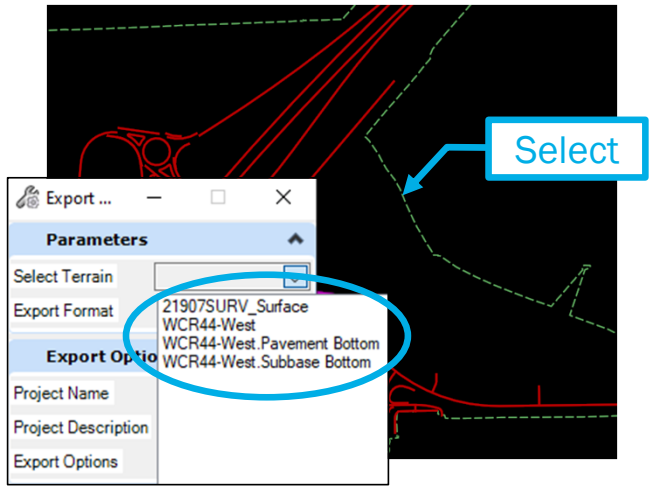
Exist. Terrain Model:



Prop. Terrain Models:



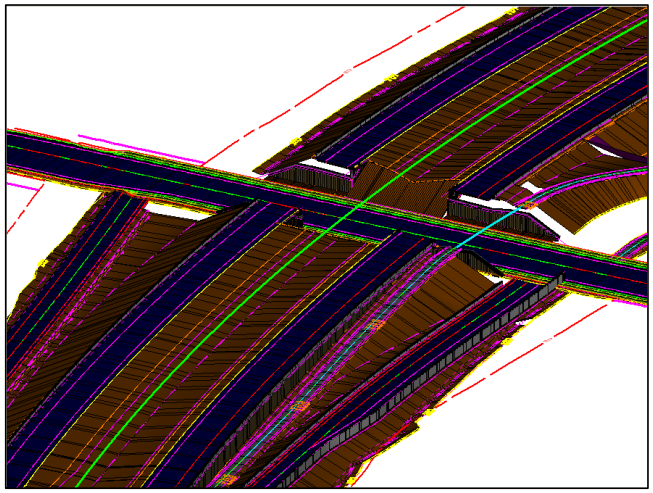
- Set up the “Export Terrain Model” command by selecting the Export Format to “LandXML (xml)”. Provide a “Project Name” and “Project Description”.
  - For Existing Terrain Models, set the Export Options to “Export Triangles Only”.
  - For Proposed Terrain Models (i.e. Finished Grade & Subgrade), set the Export Options to “Export Both”.



- To identify the Terrain Model, you may select the Terrain from the pull-down menu and select from those listed or you may select the Terrain graphically by selecting the boundary.
- After cycling through the prompts, you will be asked where and what to name the file. Follow the following naming conventions:
  - 21907_Existing Ground.xml
  - 21907_Finished Grade.xml
  - 21907_Subgrade_Alignment Name.xml

DGN's (To Include)

- DGN's (By File Name):
  - Topo – 21907SURV_Topo.dgn
  - ROW – 21907ROW_Design.dgn
  - Discipline Design Files:
    - Roadway – 21907RDWY_Design.dgn
    - Alignments – 21907RDWY_Alignments_GEO.dgn
    - Stationing – 21907RDWY_Stationing.dgn
    - Cross Sections – 21907RDWY_Design_XSEC.dgn
    - Drainage – 21907HYDR_Design.dgn
    - Bridge – 21907BRDG_Design.dgn
    - Utilities – 21907UTIL_Design.dgn
    - Striping – 21907TRAF_Striping.dgn
    - Etc. – As needed per project



- Providing 3D shapes of the corridors used to develop the Finished Grade Terrain Model will not allow the contractor to import these into their software but it will allow them to generate their own cross sections and slice through these 3D shapes helping them confirm that the Landxml files provided match the project design.
- Open the "21907RDWY_3DModel_CNT.dgn" and open the 3D model space of that file. Set the view to "Top View" and "Fit View". Place a fence around the entire 3D Model. In the key in command type "Fence File" and hit return. You will be asked where and what to name the file. Follow the following naming conventions:
  - 21907RDWY_3DModel_Components.dgn
- Click the save button followed by a Right Click anywhere in the view to accept. The resulting file is the file to include to the contractor.

QUESTIONS?