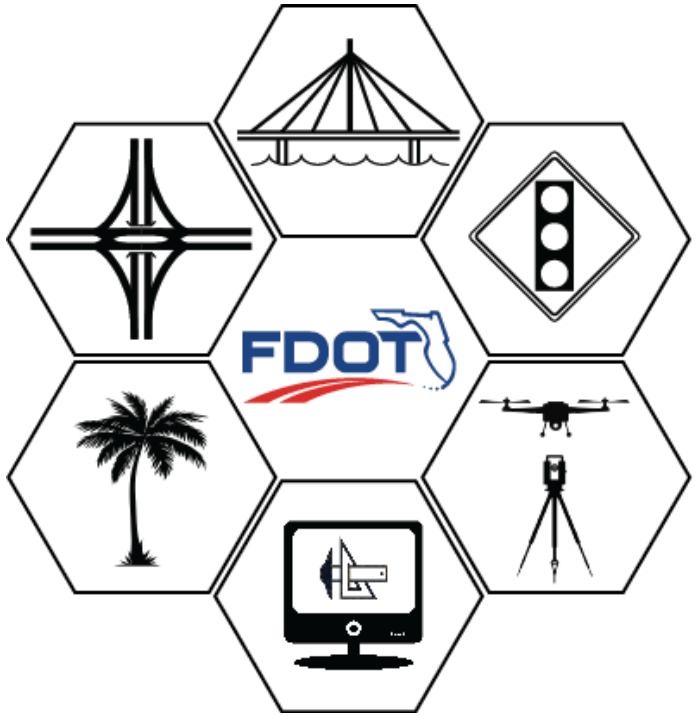


FDOT TRANSPORTATION SYMPOSIUM 2019

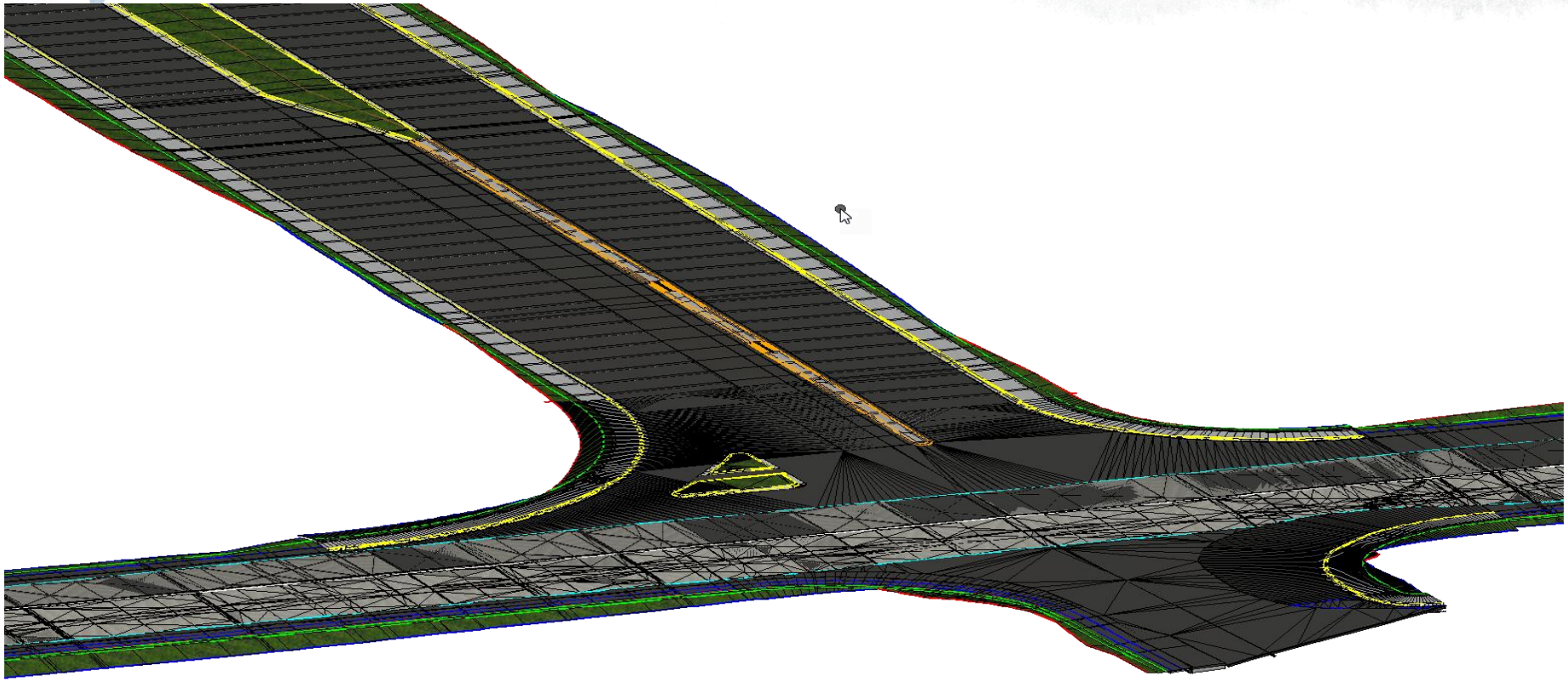
3D Deliverables for Automated Machine Guidance (AMG)

Mariano Amicarelli, Todd Holt, and Taylor Carlquist

TOPICS COVERED

- What are 3D Deliverables
- The needed 3D Deliverables
- Where the files are located
- Once you have created the 3D Deliverable now what
- Introduction to Trimble software

3D Model



3D MODELS FOR CONSTRUCTION

3D MODELS FOR CONSTRUCTION

10 CREATING 3D DELIVERABLE FILES

INTRODUCTION

This chapter will provide detailed instructions for producing the specific output files used by contractors for Automated Machine Guidance (AMG). Specifically:

- Controlling Geometry Files
- 2D CADD files
- Proposed 3D Breakline CADD files
- Existing, Proposed and Subgrade/Earthwork surface XML files

3D DELIVERABLES SUPPORTING AMG for 3D PROJECTS
(Store in project folder: 3DDeliverables)

File Name	Description
Design Alignments and Profiles	
AMG-ALGN##.xml	All Alignments and Profiles exported from the \Roadway\ALGNRD, PROF or model files and \Roadway\DSGNRD or CORRRD files in LandXML format.
2D Proposed Planimetrics Design	
AMG-2DSGN##.dwg/dgn	2D proposed Roadway design exported from the \Roadway\DSGNRD file. (Production of this file for construction is at the designer's discretion.)
AMG-2DRPR##.dwg/dgn	2D proposed Drainage design exported from the \Roadway\DRPRRD file. (Production of this file for construction is at the designer's discretion.)
AMG-2PDPL##.dwg/dgn	2D proposed Pond design exported from the \Roadway\PDPLRD file. (Production of this file for construction is at the designer's discretion.)
2D Existing Survey *(Note: These are being considered to merge into a single survey Planimetrics file)*	
AMG-2TOPO##.dwg/dgn	2D proposed existing Topography exported from the \Survey\TOPORD file. (Production of this file for construction is at the designer's discretion.)
AMG-2DREX##.dwg/dgn	2D proposed existing Drainage exported from the \Survey\DREXRD file. (Production of this file for construction is at the designer's discretion.)
AMG-2UTEX##.dwg/dgn	2D proposed existing Utilities exported from the \Survey\UTEXRD file. (Production of this file for construction is at the designer's discretion.)
3D Existing Survey Surfaces	
AMG-3SURFACEEX##.xml	3D existing terrain surface to be exported from the \Survey\GDTMRD file as LandXML format. (Production of this file for construction is at the designer's discretion. This file will be produced if the 3D Existing Surface dwg/dgn file(s) are not produced.)
3D Proposed Surfaces	
AMG-3SURFACEPR##.xml	3D proposed finished (top) surface to be exported as LandXML format from the \Roadway\MODLRD file.
AMG-3SURFACEEW##.xml	3D proposed finished (bottom) surface to be exported as LandXML format from the \Roadway\MODLRD file. This file will be used to generate surface to surface earthwork volumes.
3D Proposed Break Lines	
AMG-3DSGN##.dwg/dgn	3D proposed Roadway design exported from the \Roadway\DSGNRD file. (Production of this file for construction is at the designer's discretion. This file will be produced if the 3D Proposed Surface(s) LandXML file(s) is not produced. Geometric elements should be in vector.)

What are the 3D Deliverables

- Alignments-Horizontal and vertical Geometry
  - Individual alignments(including profiles)are extracted from the DSGNRD file
  - These are saved as a landxml EX. (AMG-ALGNRDXX.xml)

- 2D Proposed Breaklines – this is the 2D Planimetrics or the plan view line work usually placed off of the centerline using the horizontal civil tools
  - 2D proposed linework extracted from the DSGNRD file
  - These are saved as a dgn/dwg file EX. (AMG-2DSGNRDXX.dgn)

What are the 3D Deliverables cont…….

- 3D Proposed Breaklines – this line work is drawn by a template placed in a corridor along an alignment
  - 3D line work extracted from the Desgin file(DSGNRDXX.dgn) or Model file (MODLRDXX.dgn) file
  - These are saved as a dgn/dwg file EX. (AMG-3DSGNRDXX.dgn)
- 3D Exisitng Surface – this is the terrain of the existing ground
  - These are saved as a landxml EX. (AMG-3SURFACEEX.xml)
- 3D Proposed Surface – this is a surface made from the 3D breaklines
  - 3D proposed surface made from the AMG-3DSGNRDXX.dgn
  - These are saved as a landxml EX. (AMG-3SURFACEPR.xml)

SubGrade Surface

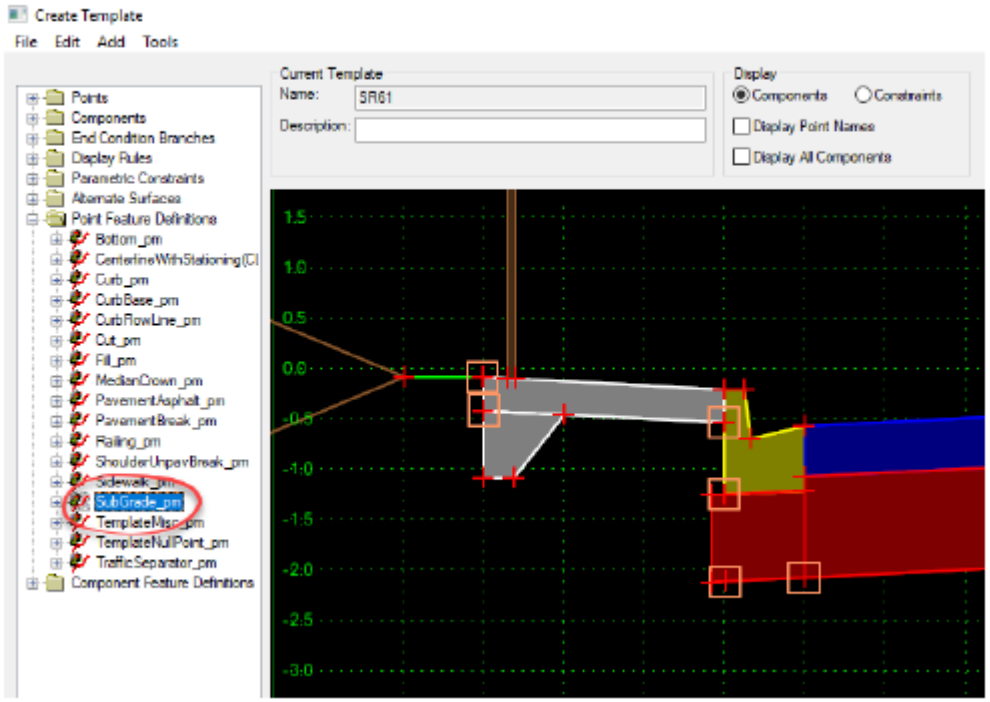
- **SubGrade_pm can be used as 3D breaklines to create a surface**
- **SubGrade_pm can be set to create an alternative Surface thru the corridor named SubGrade**

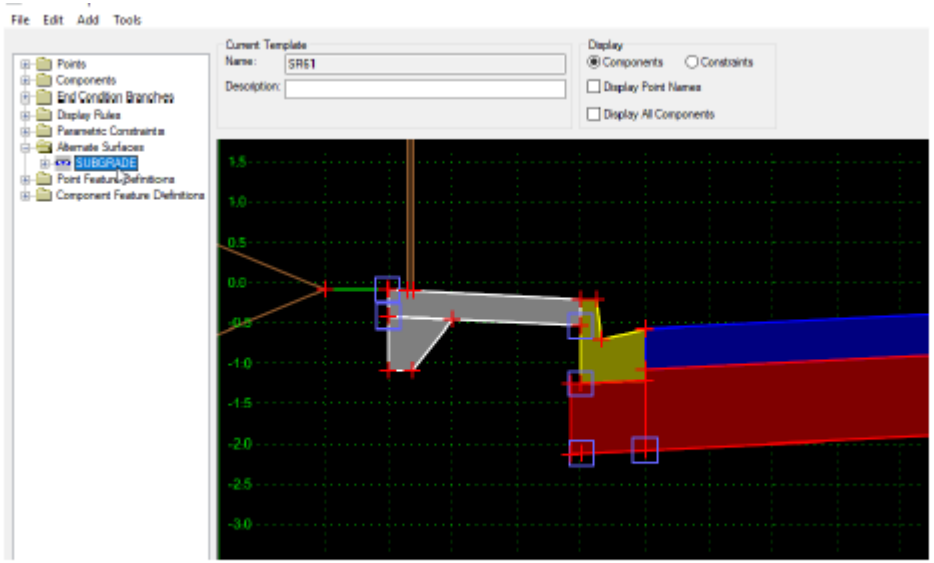
- **Vertical Faces – all lines must have different xy value. They cannot be stackedin the z plane. Therefore, set the horizontal offset value no less than 0.01 Feet on vertical component points in the project template.**

- **Caves/Cliffs – all lines must continue in the same direction. The TIN triangles will not reverse direction across a surface. Therefore, consider which points to usefor subgrade surface. I.E. base, base extensions, wall footers, etc.. Additional template points may be needed to intercept the top surface (Proposed) in these areas. As a rule, it is better to include the base, base extension, wall footers, etc… For excavation and not to include base base extensions wall footers, etc… for embankment.**

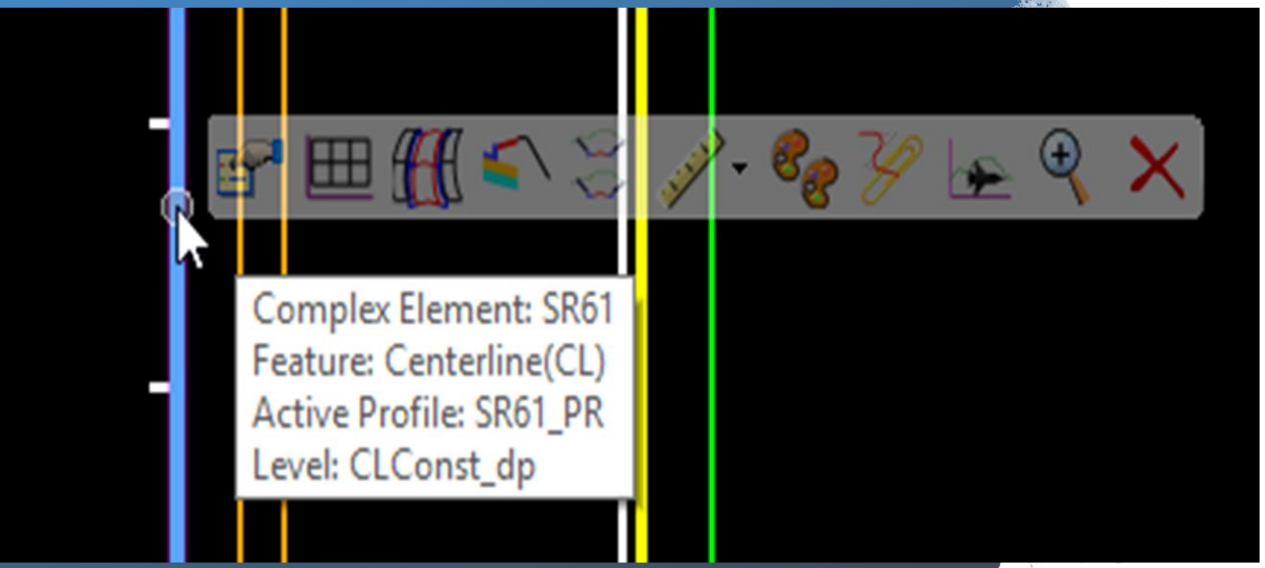
SubGrade Surface

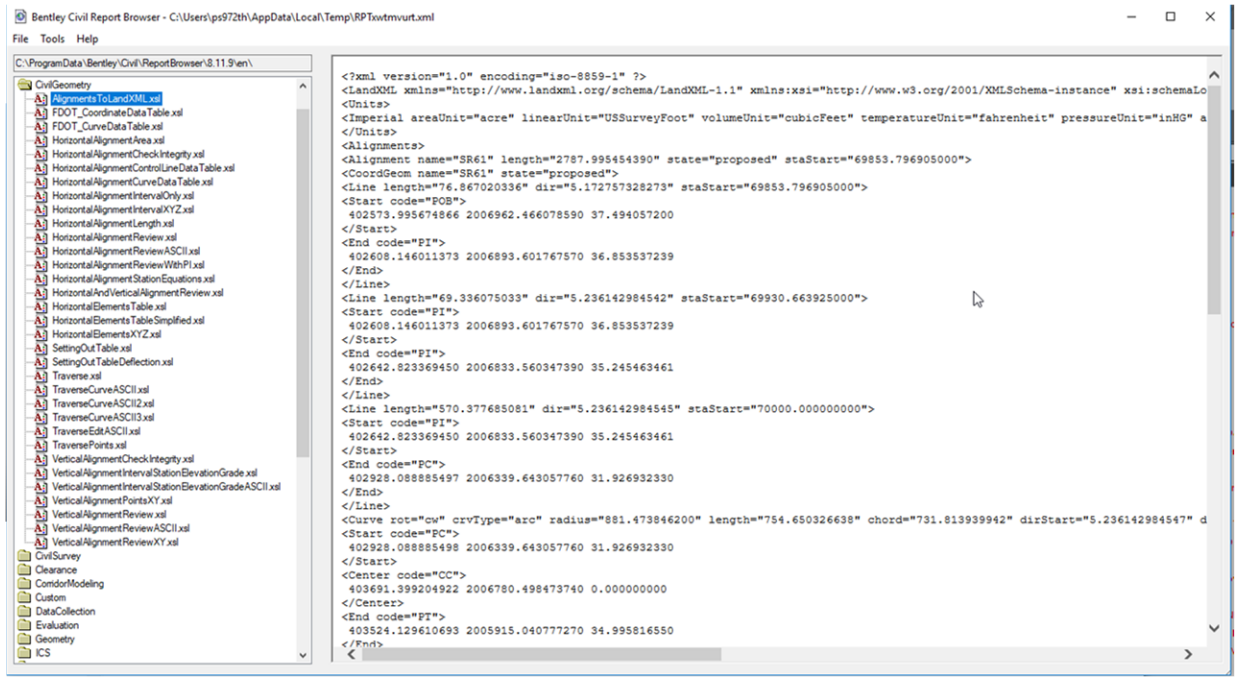
Chapter 10_____CREATING 3D DELIVERABLE FILES - Creating 3D Breaklines and Proposed Subgrade/Earthwork Files for AMG

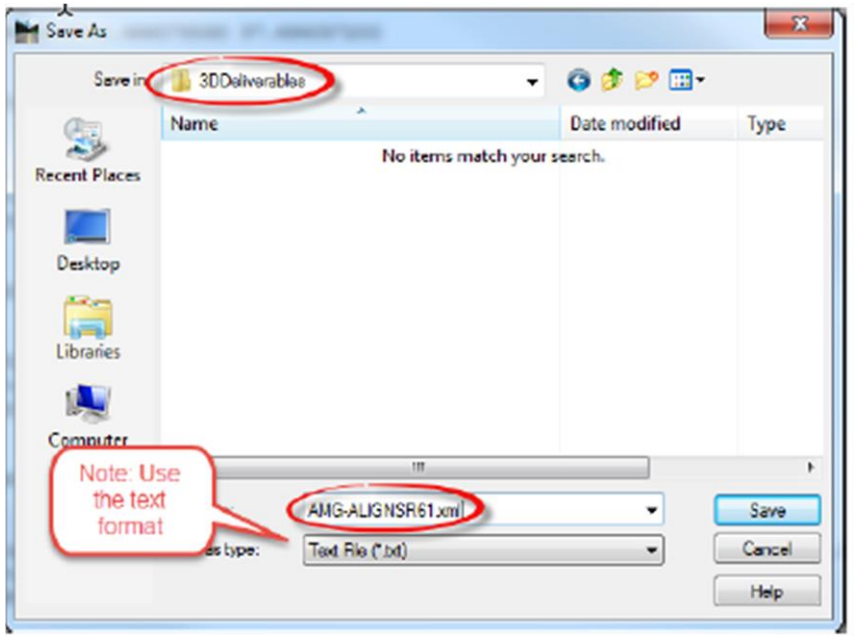




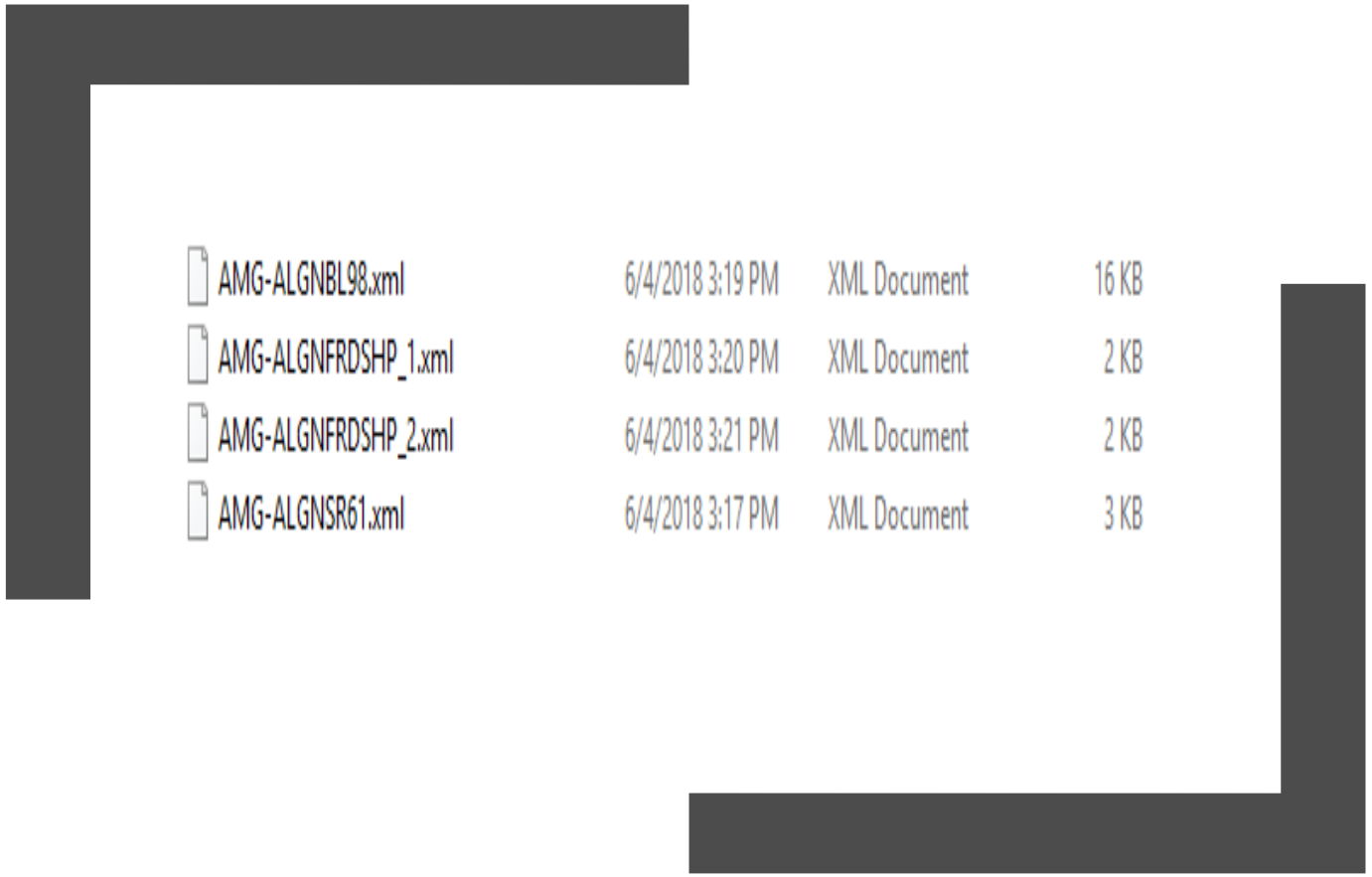
AMG-ALGNXX.xml







FDOT TRANSPORTATION SYMPOSIUM



- Verify that the file is created in the 3D Deliverables folder

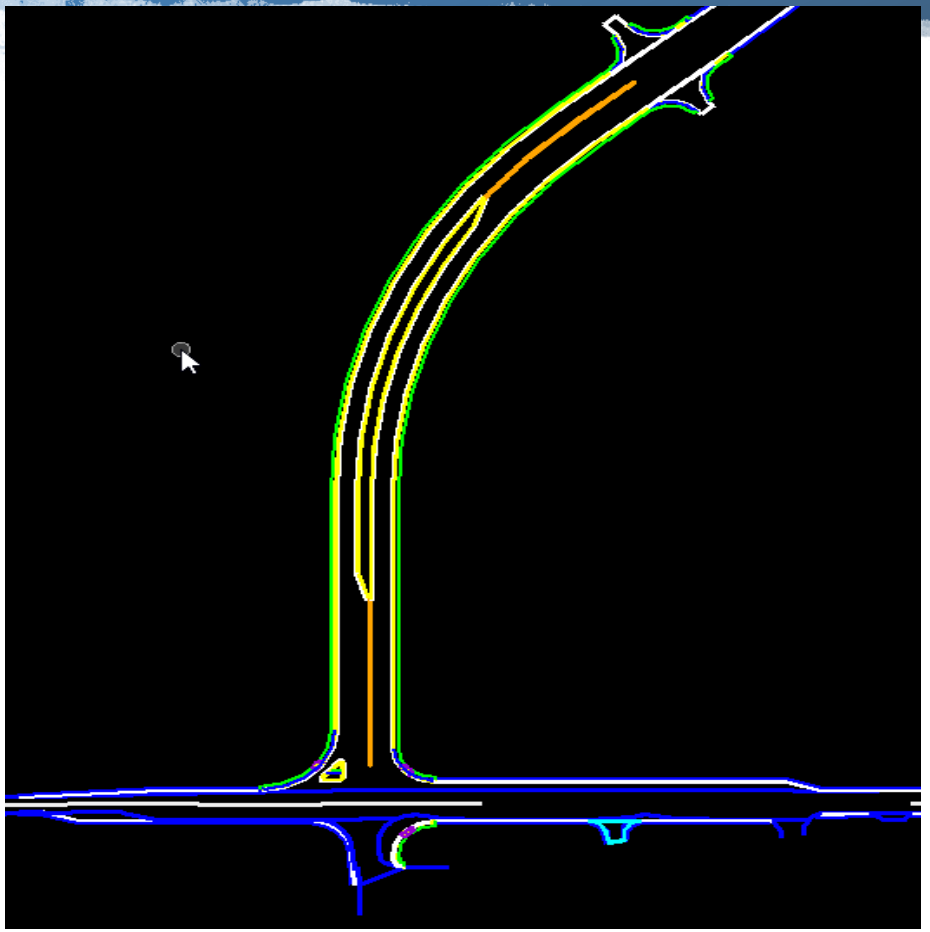
Creating 3D Deliverables

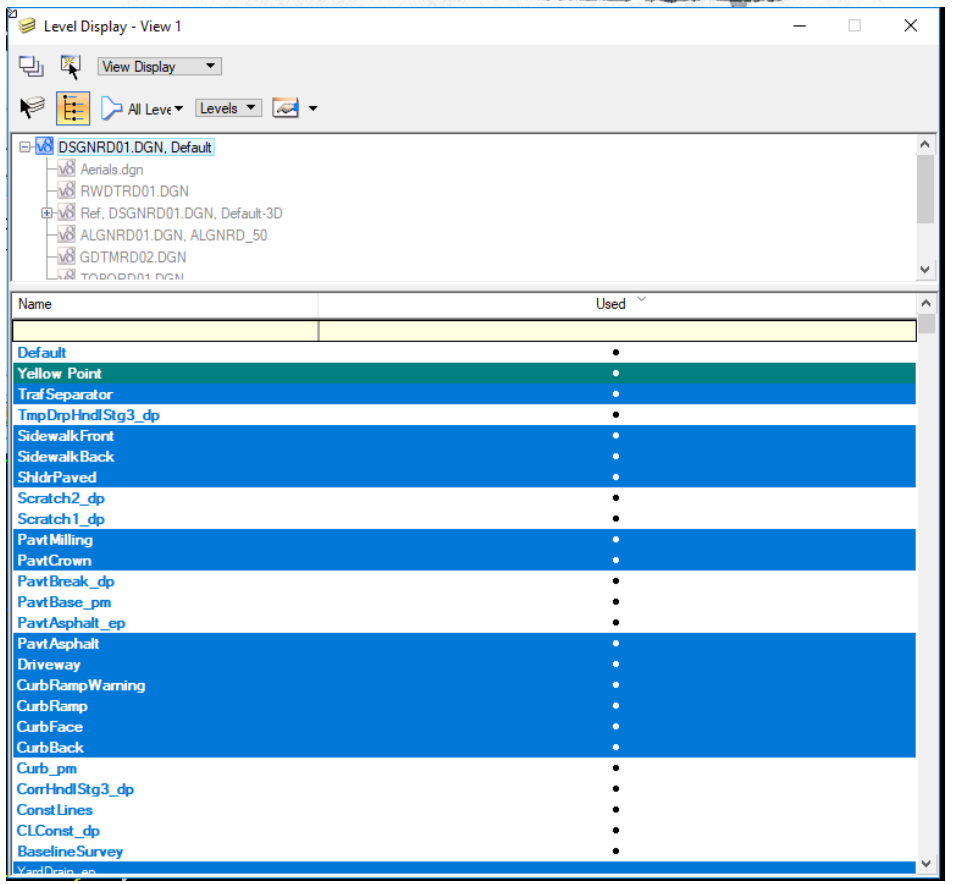
2D files

- Create Saved View for 2D planimetrics*
- Use fence copy to new file
- Save as DGN and DWG

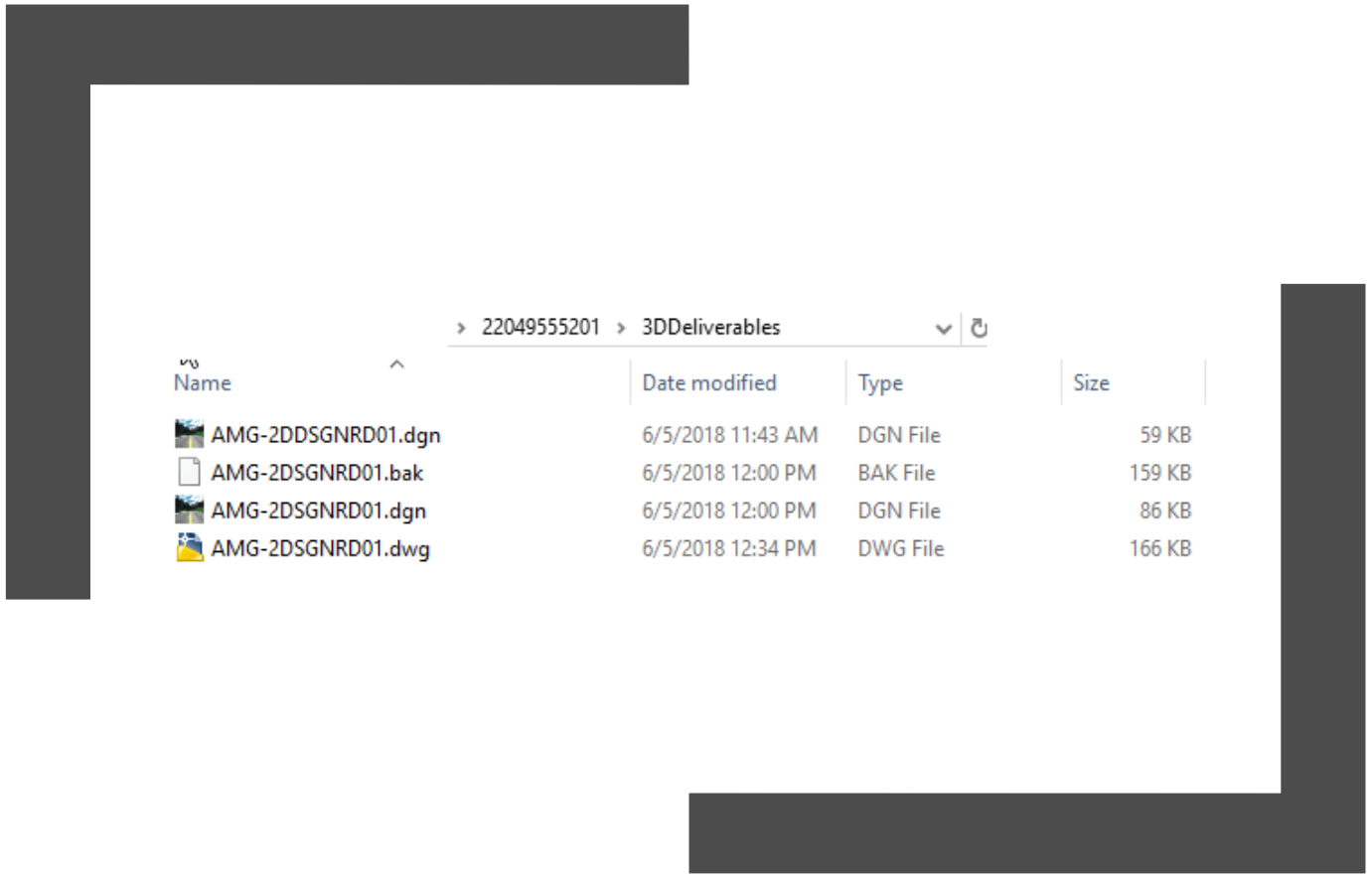
*Top view, references, levels, construction elements, etc.

Example of 2D linework





Verify that the file is created in the 3D Deliverables folder



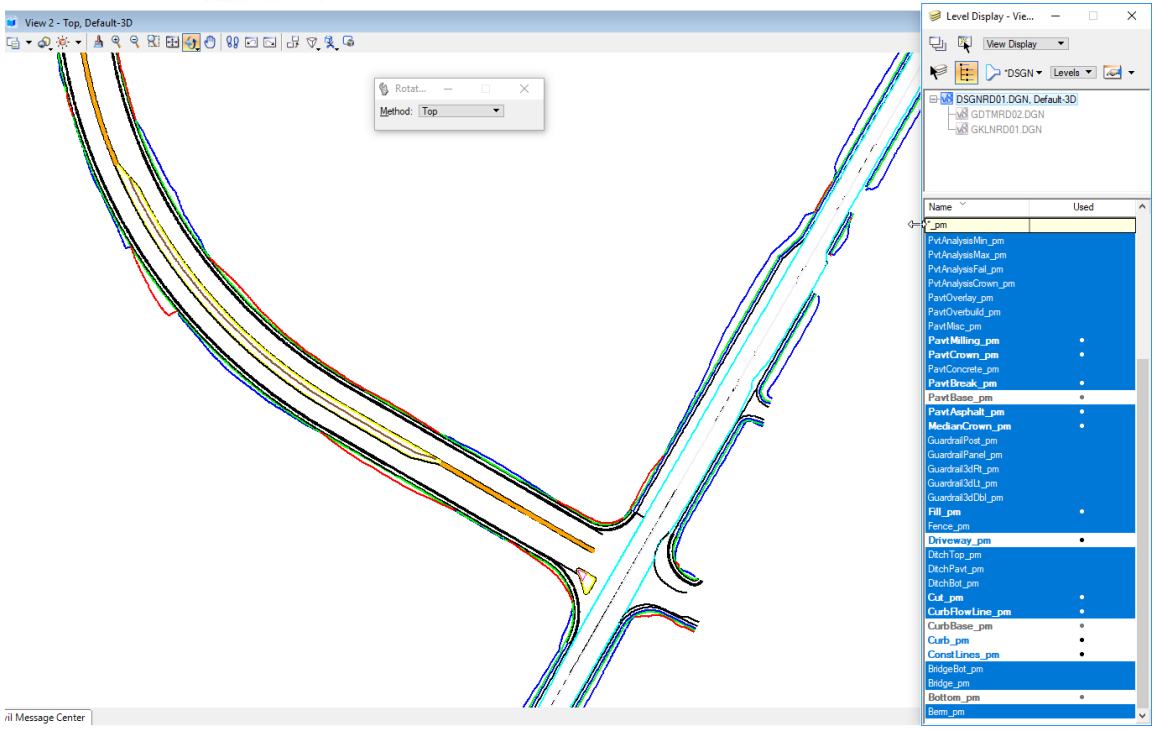
Creating 3D Deliverables

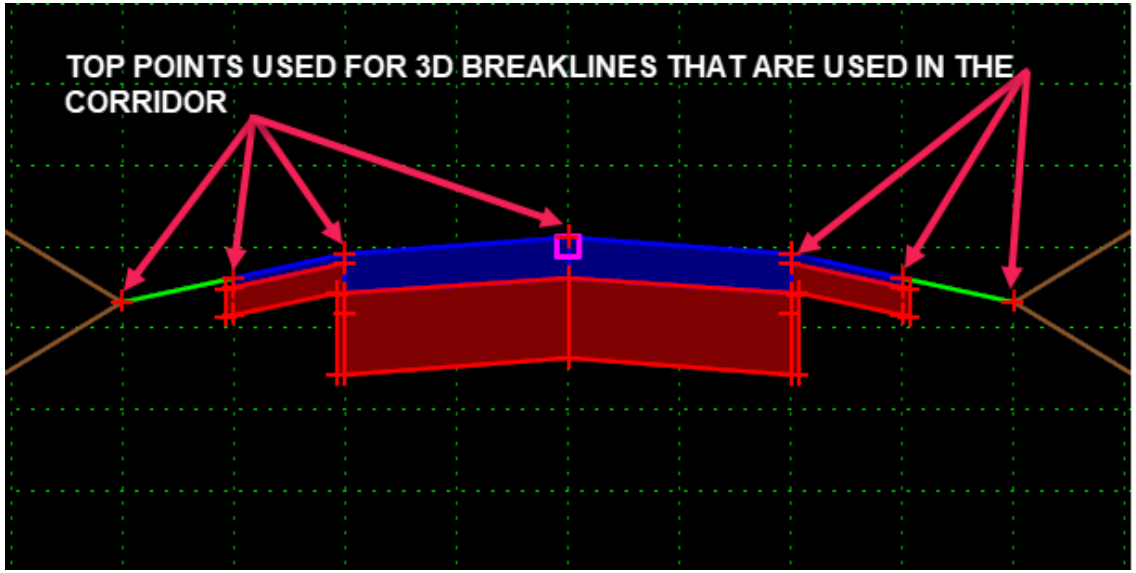
3D files

- Set Corridor Stage to final
- Create Saved View for 3D breaklines*
- Use fence copy to new file
- Save as DGN and DWG

*Top view, references, levels, construction elements, etc.

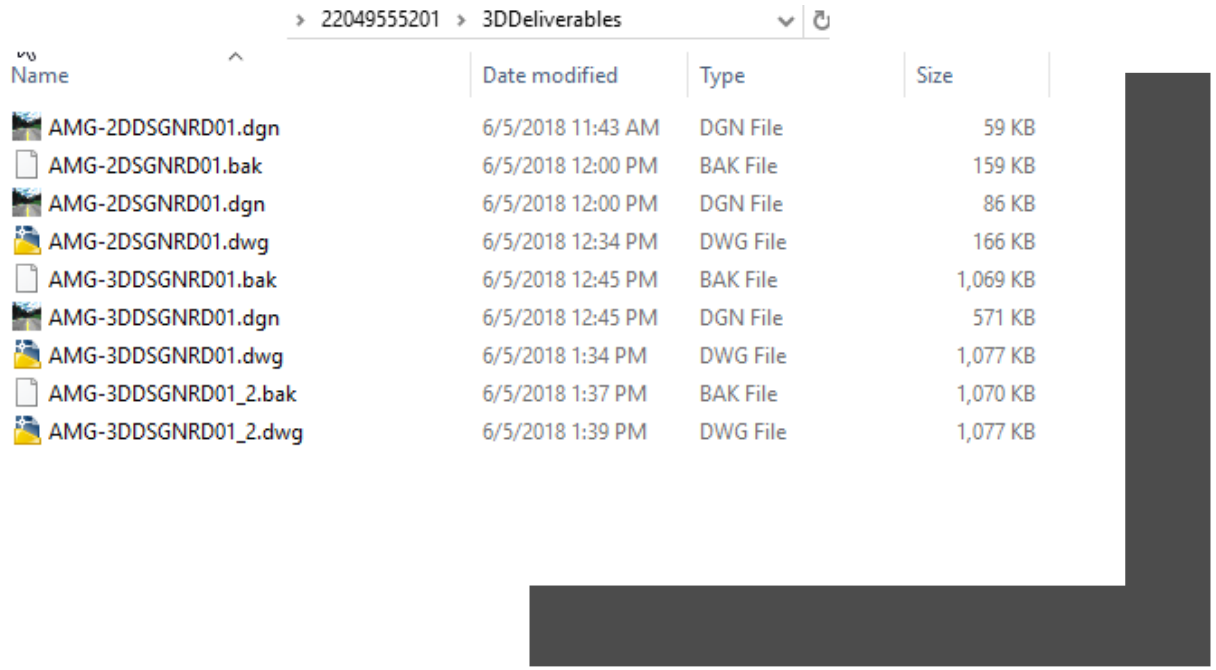
What are 3D Break Lines?





Steps to create the AMG-2DSGNRDxx.dwg

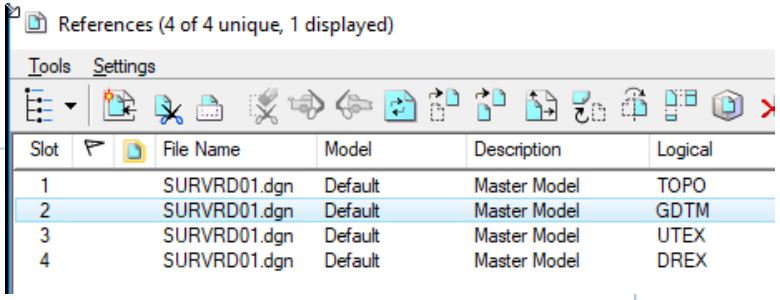
- Open the AMG-2DDSGNRD01.dgn file form the 3Deliverables folder
- Set and/or verify GeoCooridante system is attached
- Select File>Save as from Menu
- Change the Save as Type to Autodesk® DWG
- Verify the name and folder and click save
- Select Survey Feet from the next dialog box and click OK

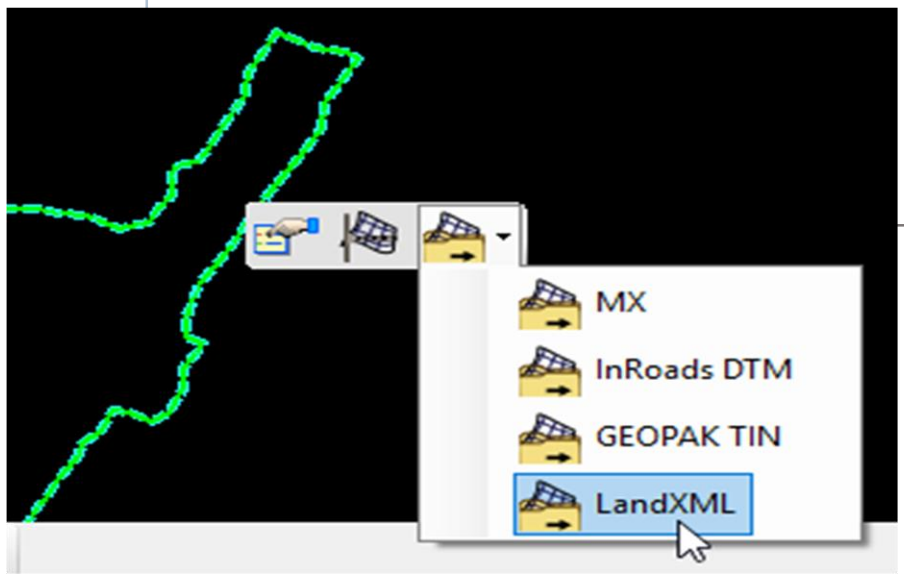


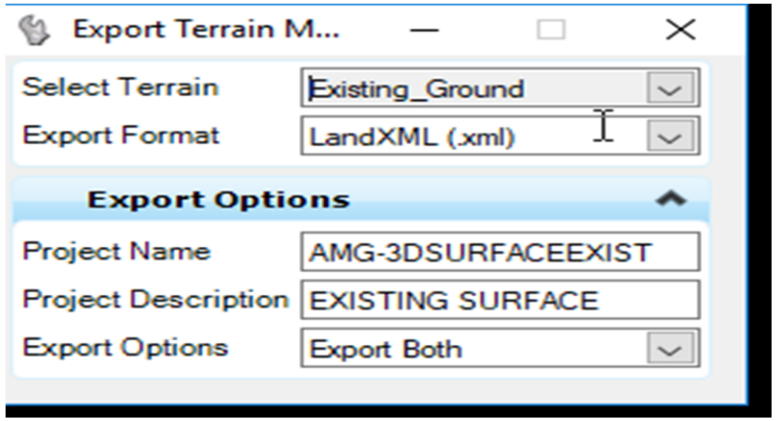
- Verify that the file is created in the 3DDeliverables folder

Existing Surface Export to LandXML

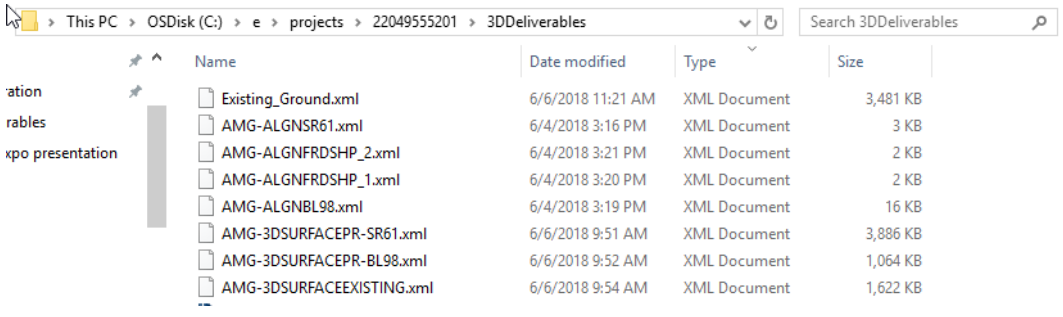
AMG-3DSURFACEEX.xml







Existing Surface AMG-3DSURFACEEX.xml



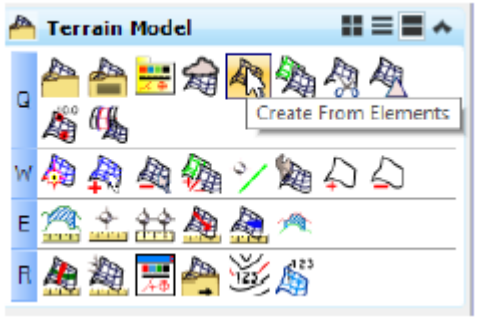
- Verify that the file is created in the 3DDeliverables folder

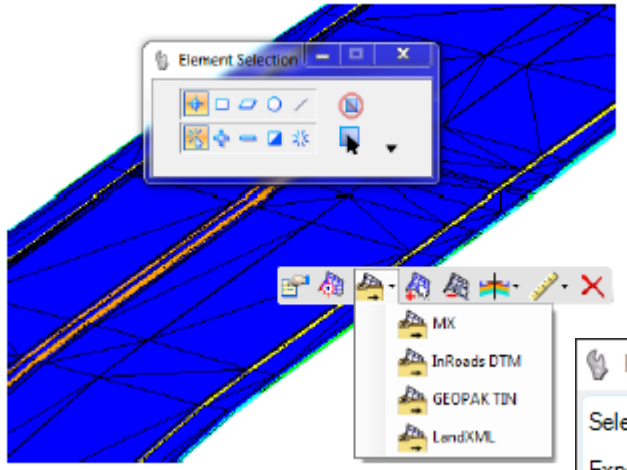
Creating 3D Deliverables continued

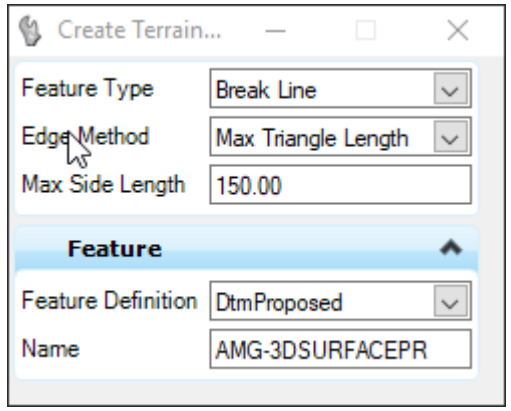
Proposed Surface

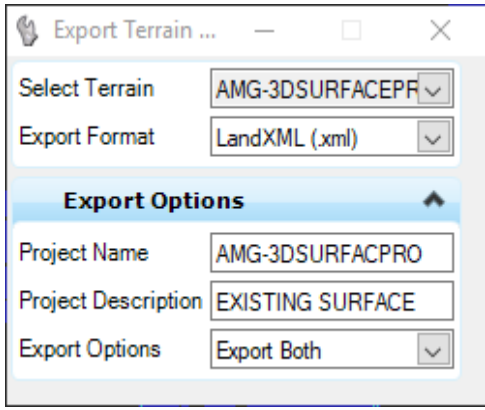
- Create Terrain from break lines located in your AMG-3DSGNRDXX.dgn
- Export to LandXML

Create the AMG-3DSURFACEPR.xml

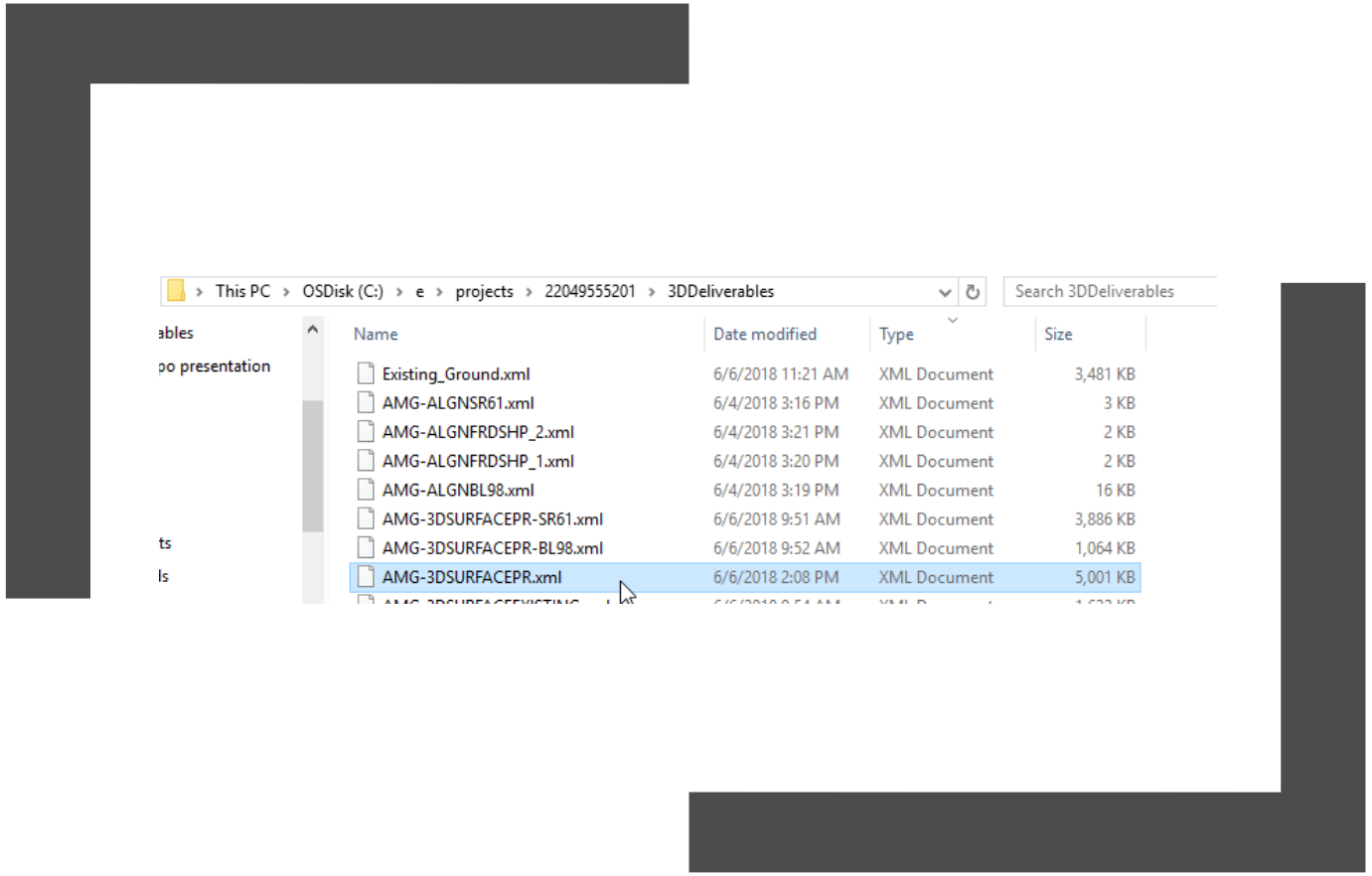






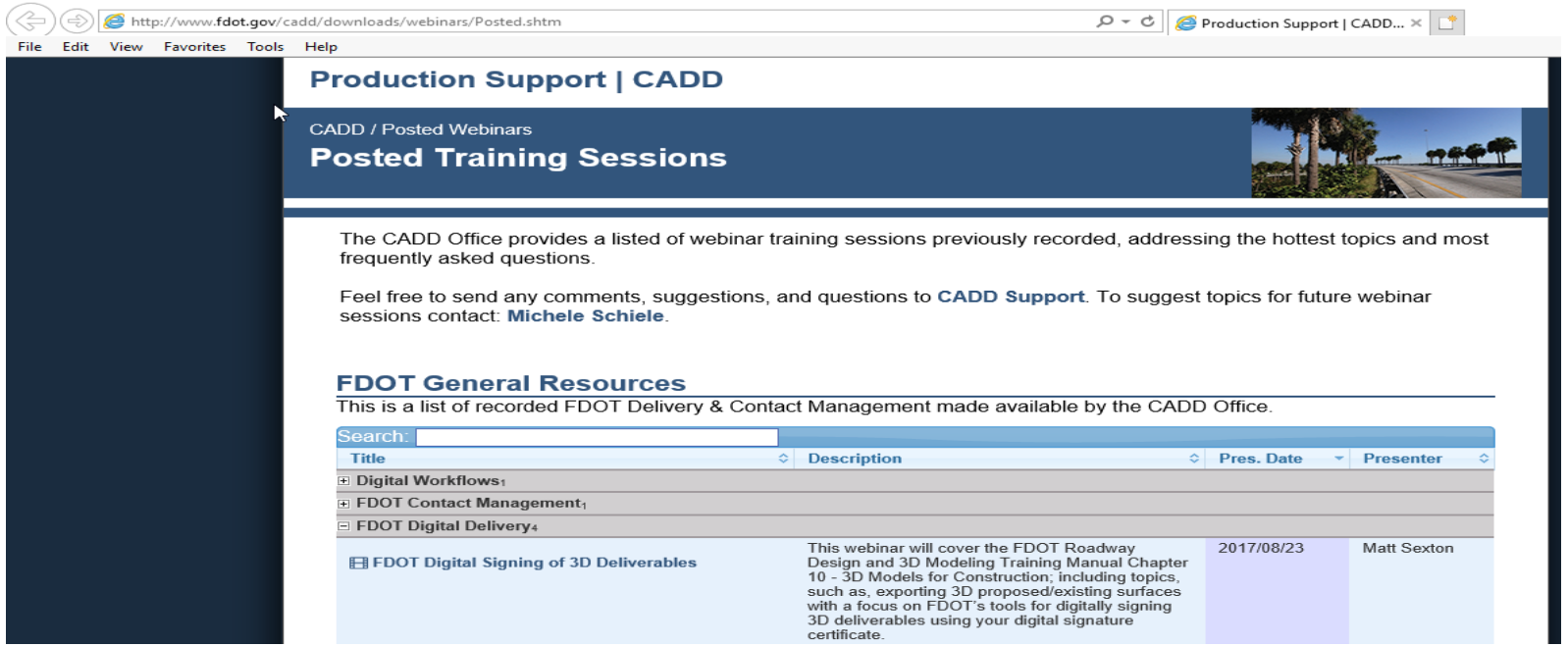


Steps to create the Existing Surface AMG-3DSURFACEPR.xml



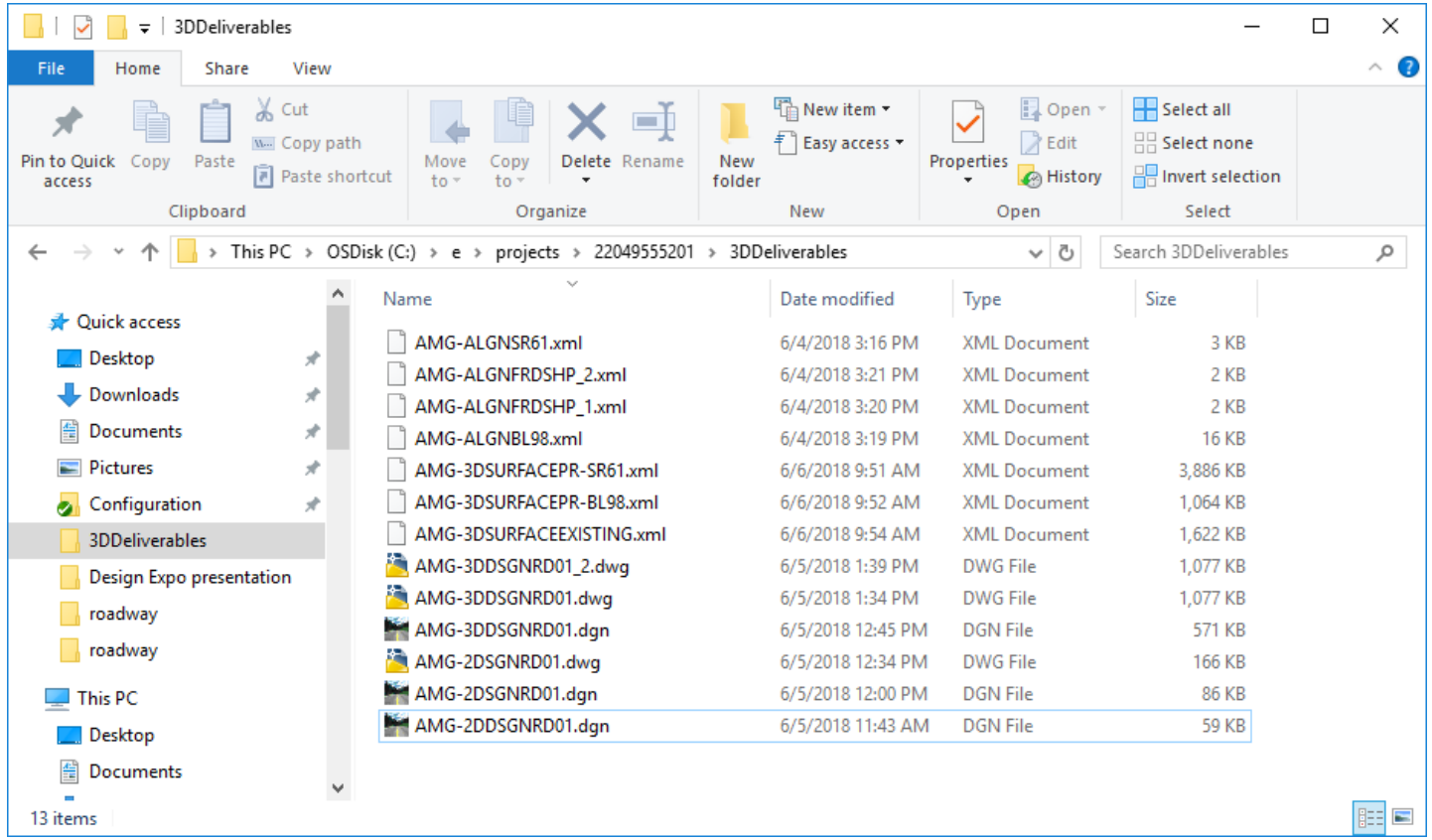
- Verify that the file is created in the 3DDeliverables folder

Digital Signature (Not required at this time)

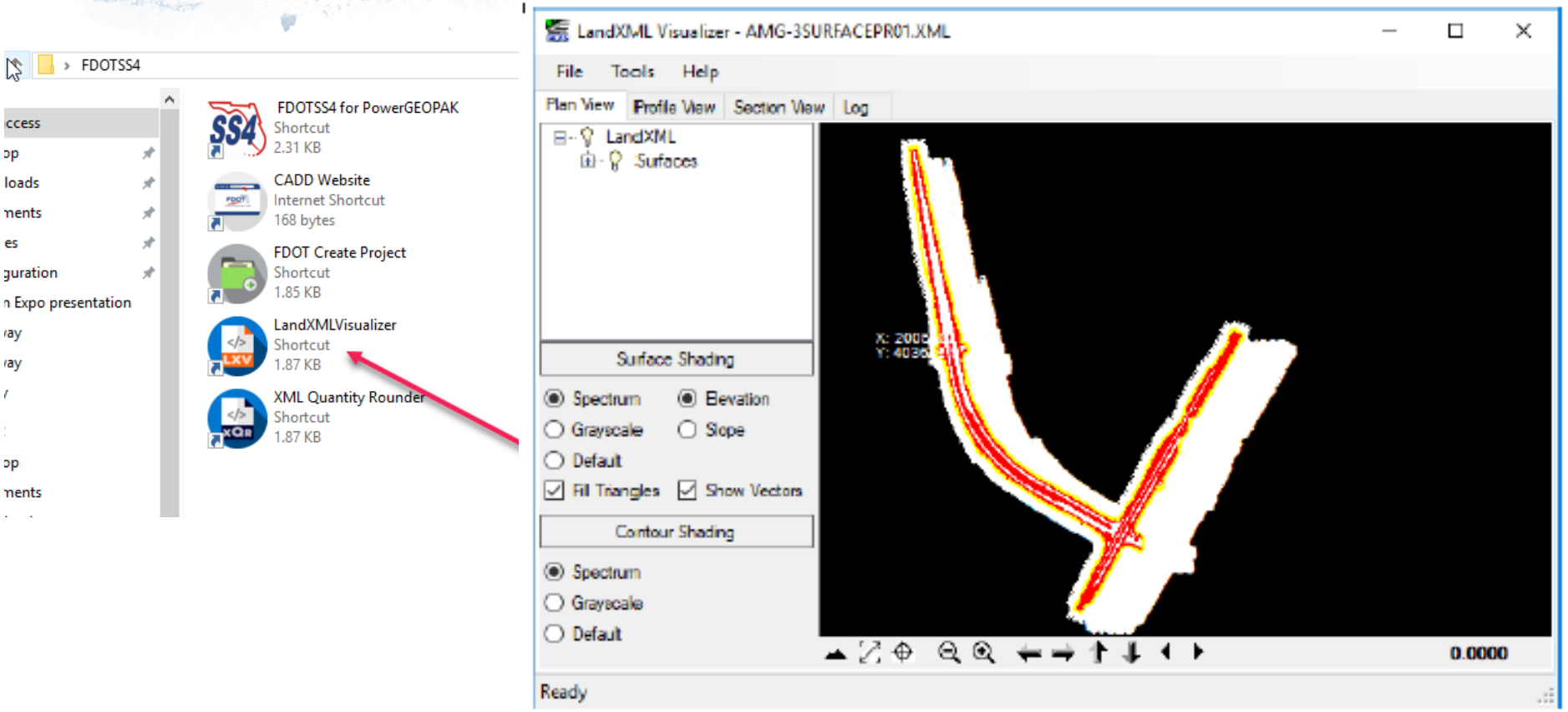


FDOT Applications Related to ... Q&A	This webinar will cover the three new tools released with FDOT2015.C3D and FDOTSS3 MR1 related to Digital Delivery. These are: the XML Signing application, the LandXML Visualizer, and the Create3DDeliverables application. These will be presented in the context of Digital Delivery.	2015/04/08	Bruce Dana
This Video accompanies the "FDOT Applications		2015/04/08	Bruce Dana

3D Deliverables folder files



Validate LandXML



Training Manuals for SS4

- Many of the processes shown today are outlined in our training manuals. These are available at the website listed below.

    1. FDOT Roadway Design and 3D Modeling for SS4

    Chapter 10 Takes you thru exercise of how to create 3D Deliverables

These manuals are available on our website at the following link:

http://www.fdot.gov/cadd/main/FDOTCaddTraining.shtm

3D QC Checklist

FLORIDA DEPARTMENT OF TRANSPORTATION

FDOT Financial Project Number _____

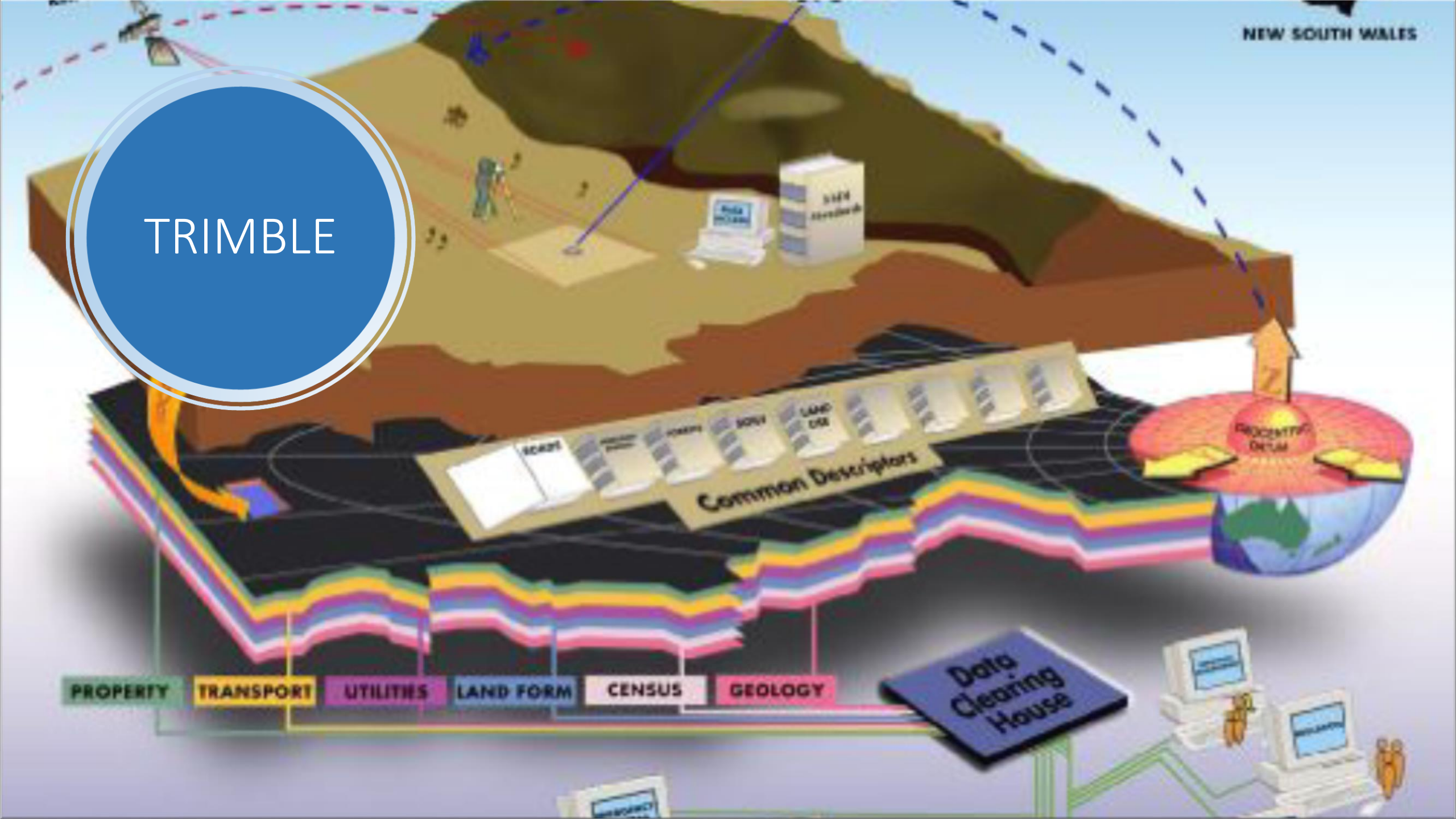
Date: _____

Phase/ Submittal _____

EOR: _____

3D Engineered Model QC Checklist

Implementation Items	Originator	Reviewer	Comments
	Initials	*Initials*	
Geographical Coordinate System has be defined in the model(s)/design file			
3D Baseline/Centerline has been displayed in the model(s)			
Referenced 3D model break lines match the 2D planimetric lines			
Review of model(s) for completeness, visually: ○ Gaps along the model ○ Spikes or lips along seams ○ Overlapping components ○ Transitions between corridors and templates ○ Transitions between varying slope values ○ Slopes harmonization with existing surface ○ Median Crossovers ○ Separator Islands			
Component Depths match the Typical Section: ○ Pavement Layers ○ Driveway ○ Sidewalk ○ Concrete			
Verify Station Offset Elevation at Critical Location: ○ EOP at Drainage Nodes ○ Begin / End Taper Transitions ○ Begin / End Radius ○			
Verify Cross Slopes: ○ Pavement Lanes ○ Shoulders ○ Sidewalk ○ Cross Over Medians ○ Slopes			
Vertical Clearance			
Clash Detection - Interference Checking			
3D Deliverable Created ○ XML files for Corridor Alignments ○ XML files for Existing and Proposed Surfaces (verified against 3D design) ○ Dgn or Dwg files for 2D and 3D lines ○ Icm file for OpenRoads Design Delivery			
other			


NEW SOUTH WALES
TRIMBLE
Common Descriptors
PROPERTY
TRANSPORT
UTILITIES
LAND FORM
CENSUS
GEOLOGY
Data Clearing House

TRIMBLE SOFTWARE

Background: “Trimble” Business Center - HCE

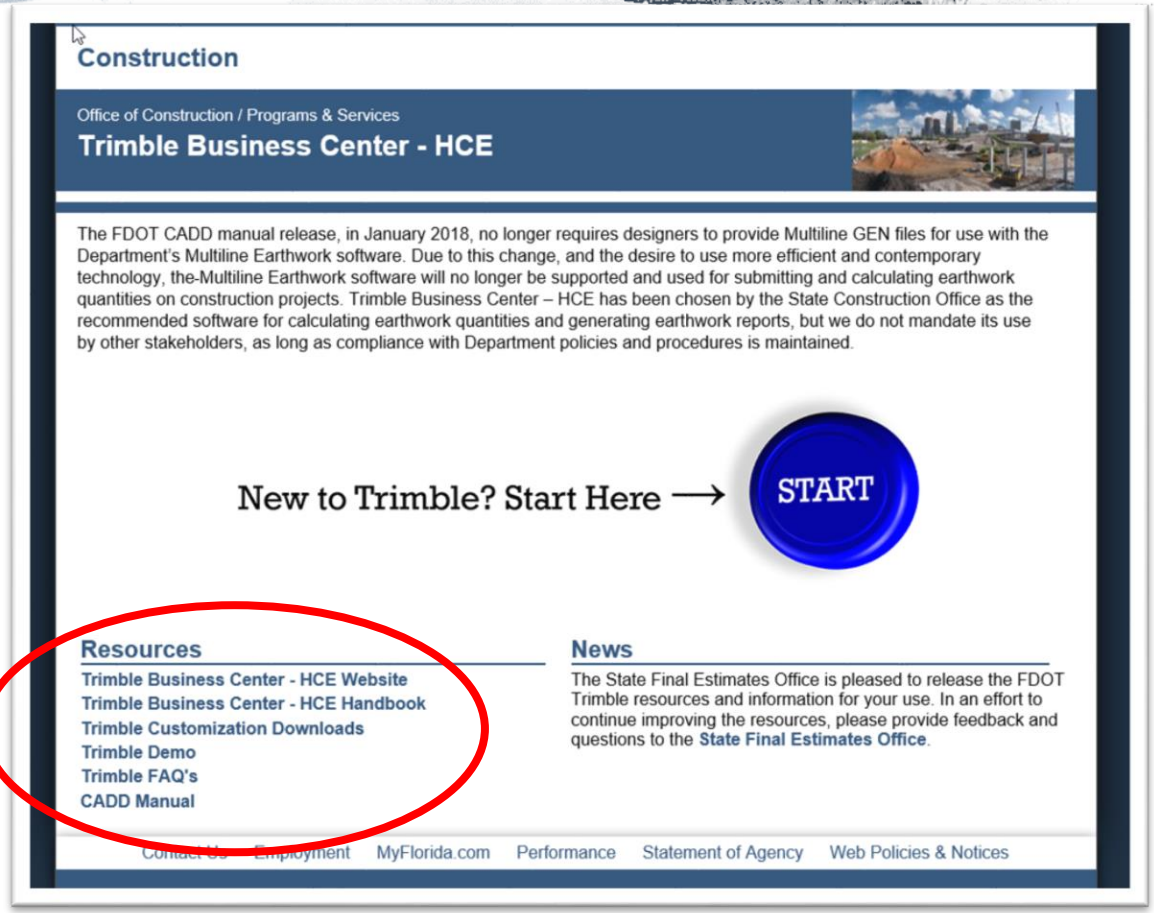
New Recommended Software to replace Multiline

Why?	How was Trimble Chosen?	How can you download Trimble?
•CADD Manual Updates in 2018 •Outdated Software •No upgrades since 2006		

TRIMBLE - DOWNLOAD

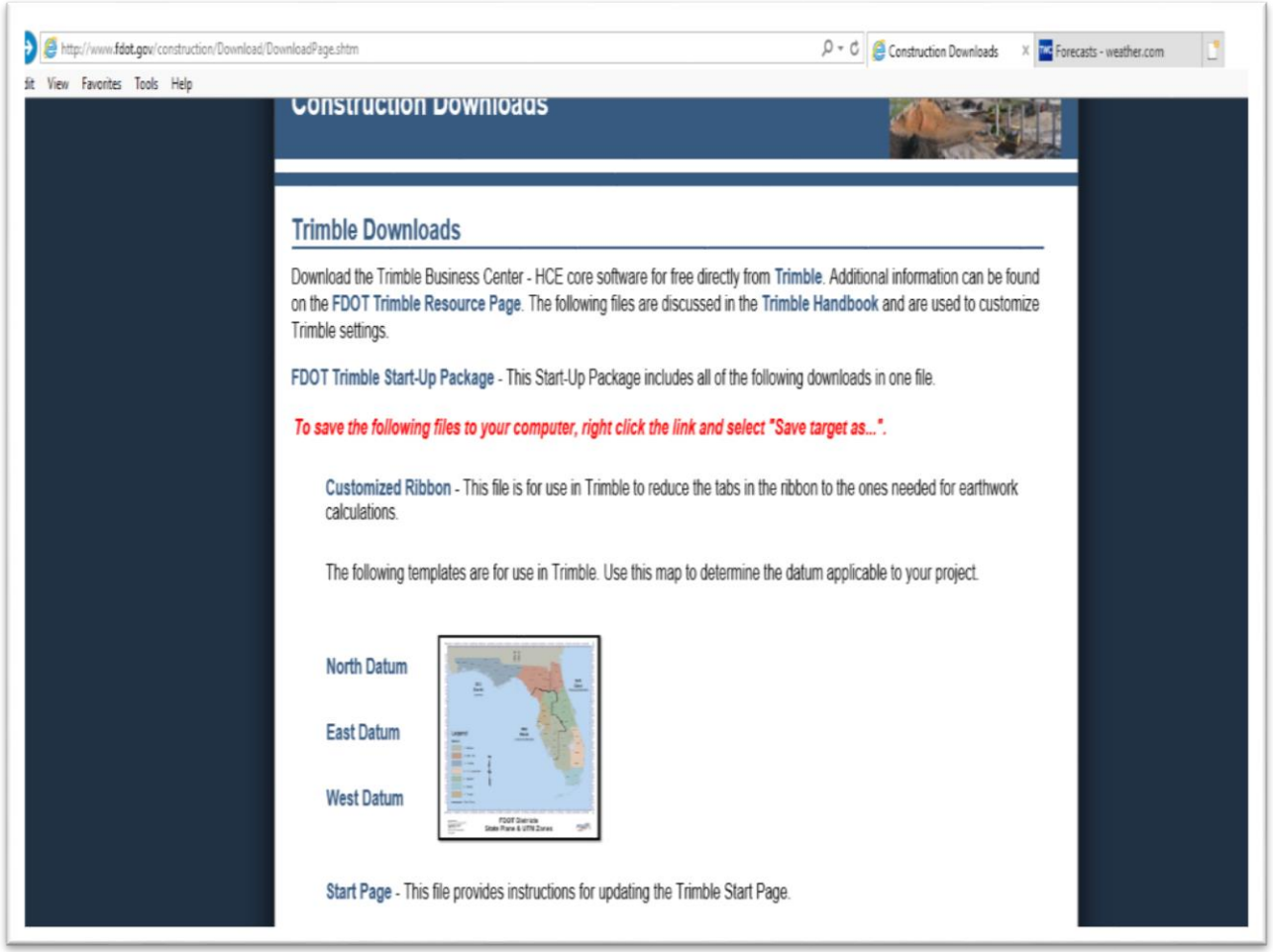
- How?
- Where?

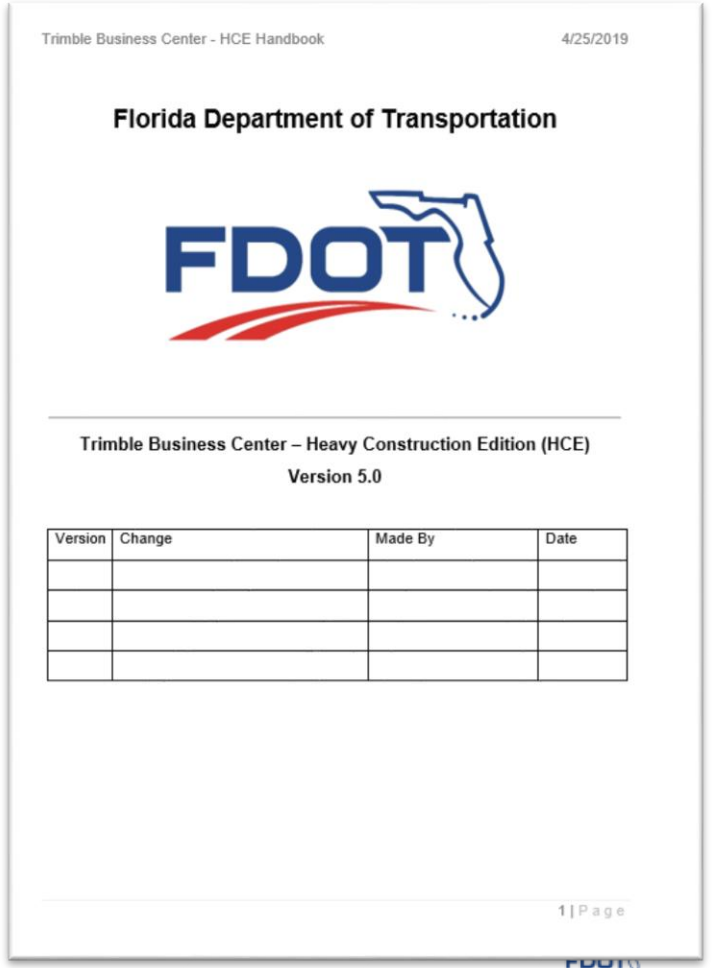
http://www.fdot.gov/construction/eConstruction/Trimble.shtm



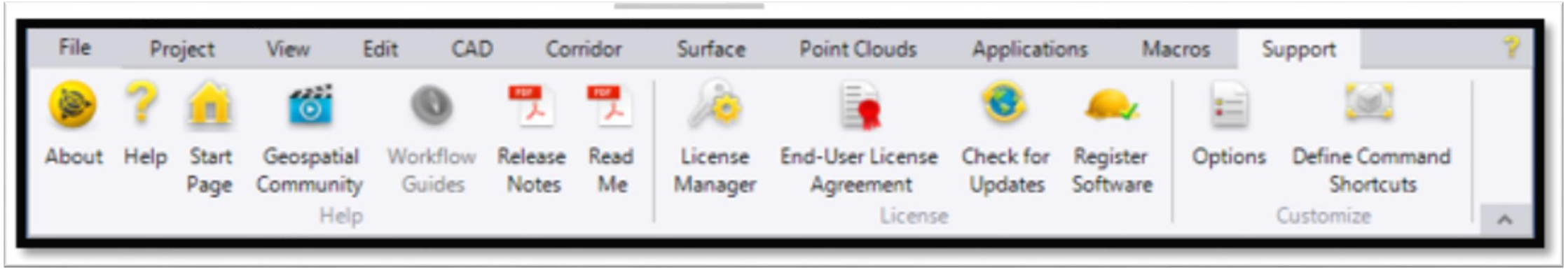
TRIMBLE – Getting Started

Trimble Download Page and Handbook





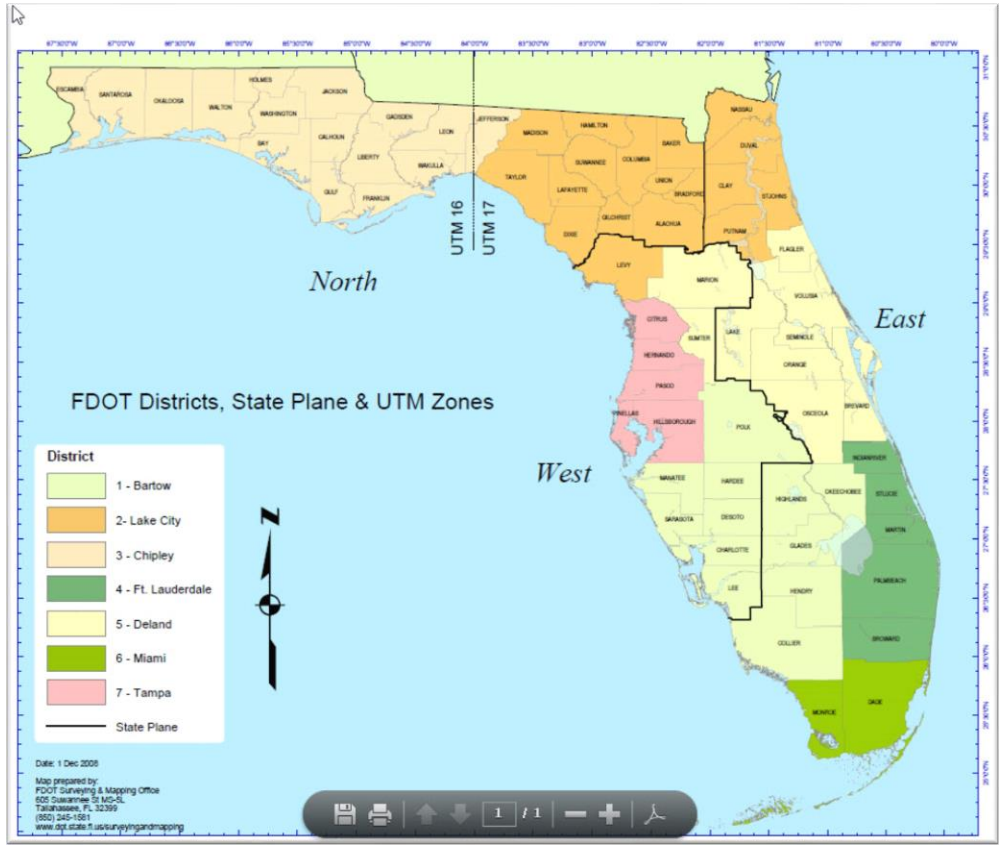
FDOT TRANSPORTATION SYMPOSIUM

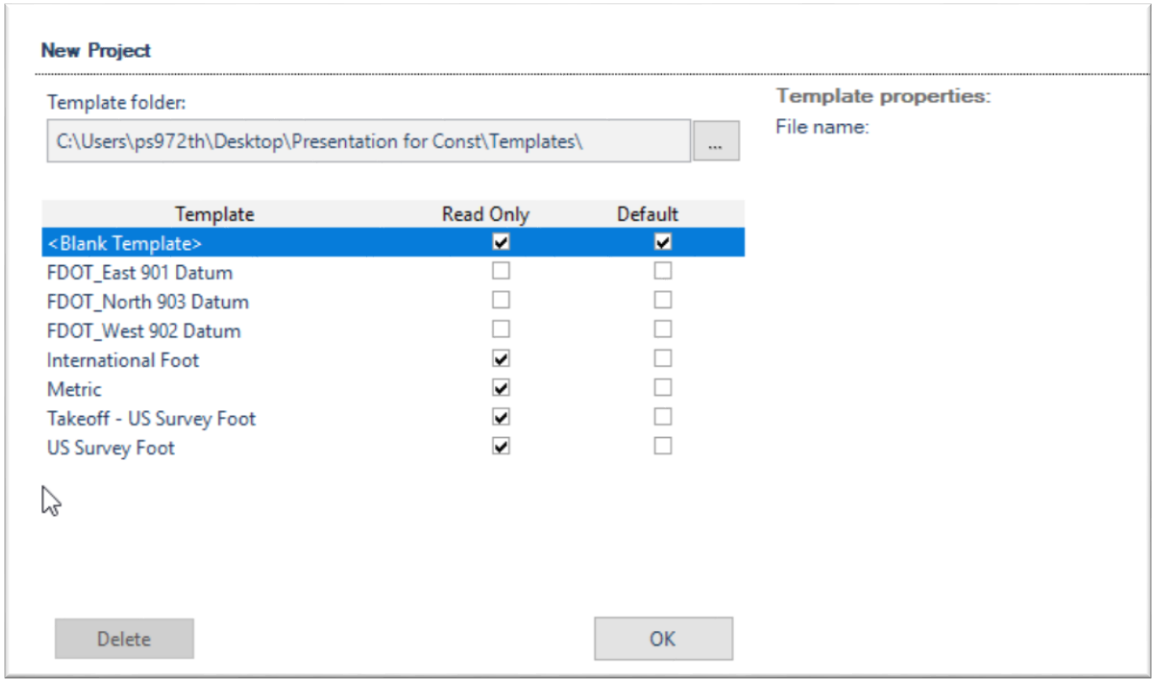


TRIMBLE – Menu Bar

- Customized FDOT Menu Bar (Ribbon)
  - What is it?
  - Where is it?
  - How is this useful?

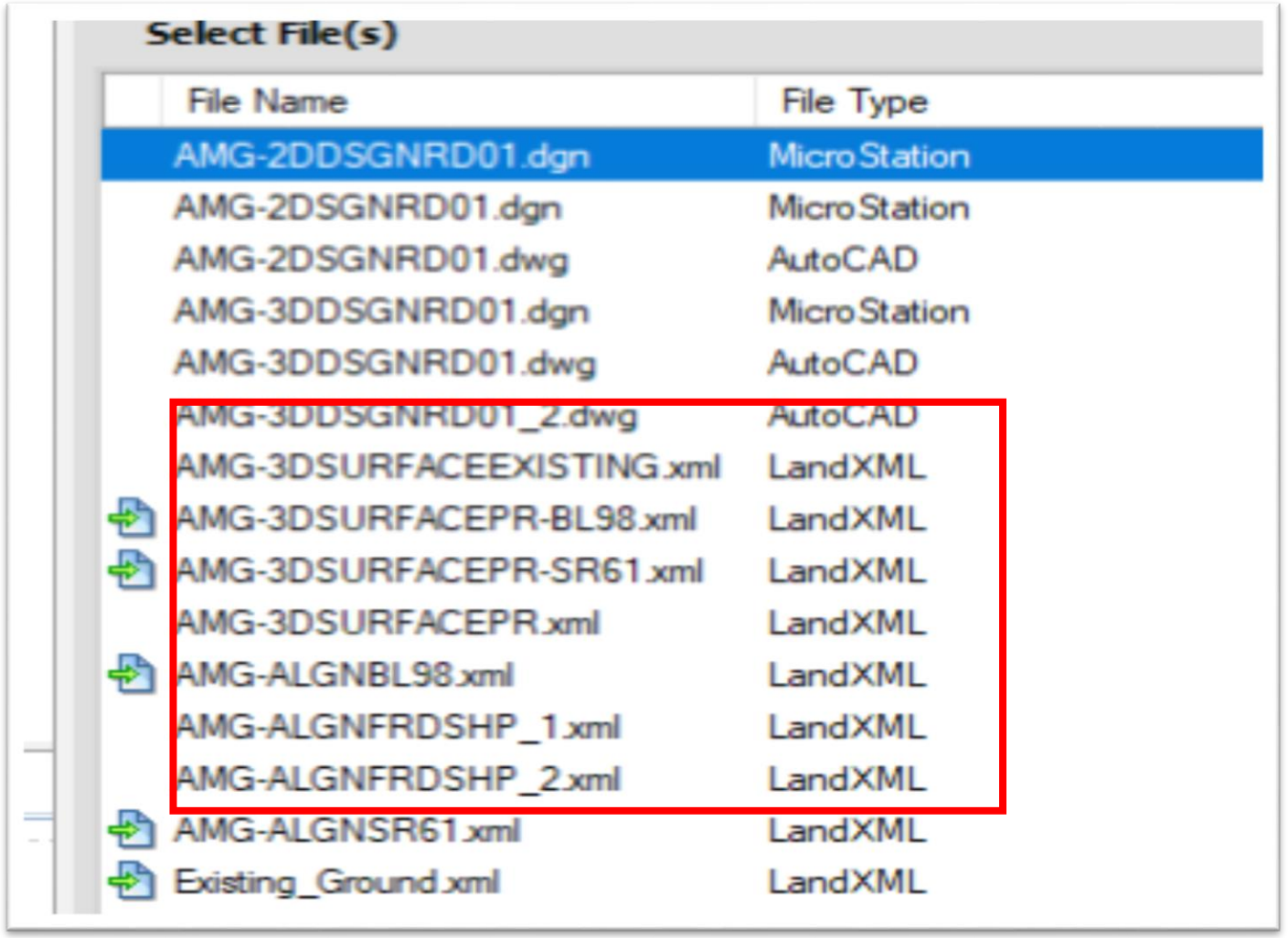
TRIMBLE
Template files based on Florida Datum





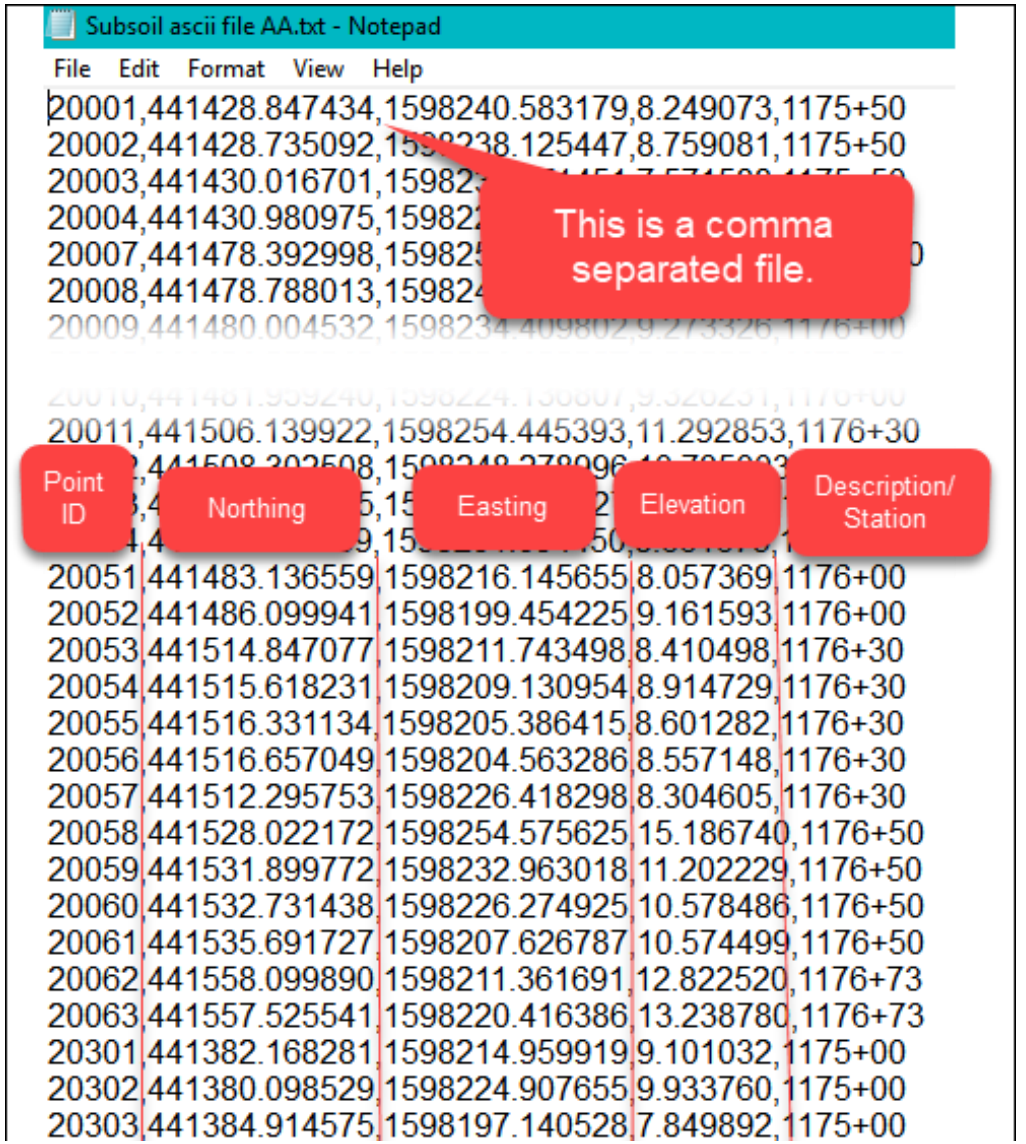
TRIMBLE – Requirements

- WHAT DOES Construction Need from the Designer?
  - ➢Existing Surface
  - ➢Proposed Surface
  - ➢Alignment

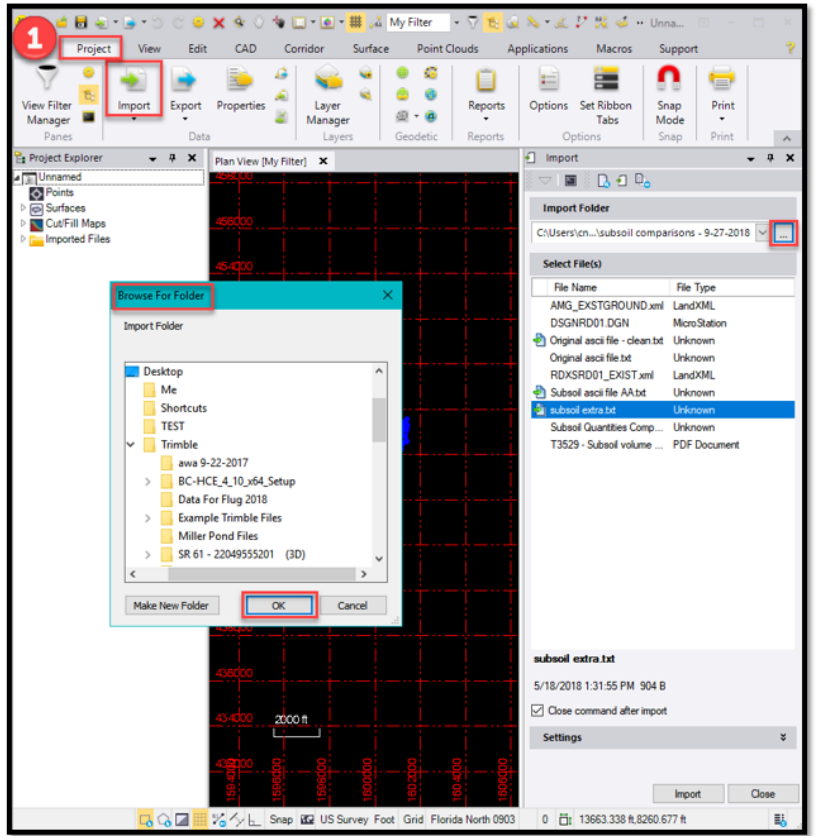


TRIMBLE – Requirements

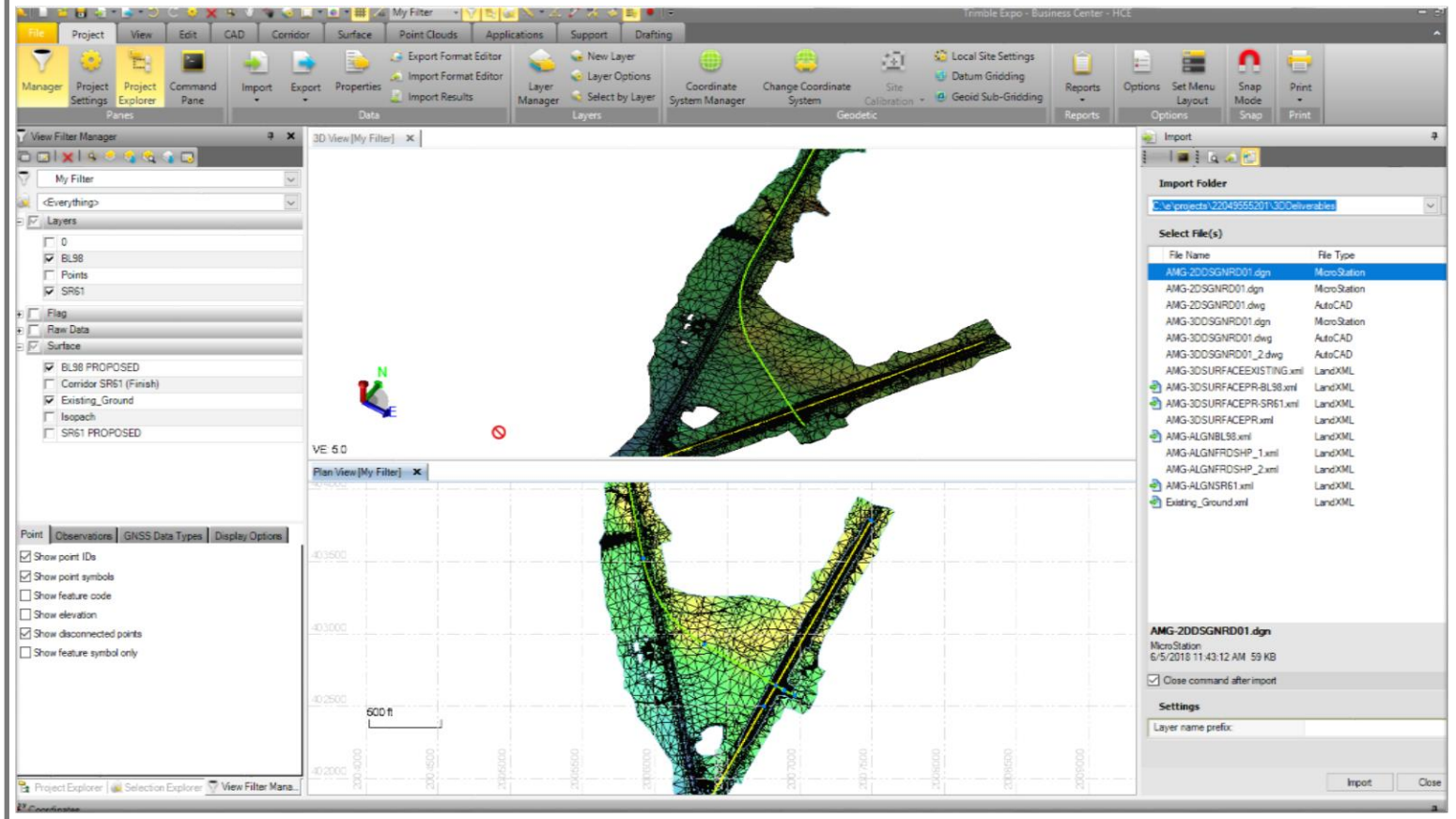
- What Does Construction Need from Department Personnel in the Field?
  - Survey
    - LandXML file (most universal)
  - Survey TXT file
    - Point ID, Northing, Easting, Elevation, and Station



TRIMBLE
Importing Data

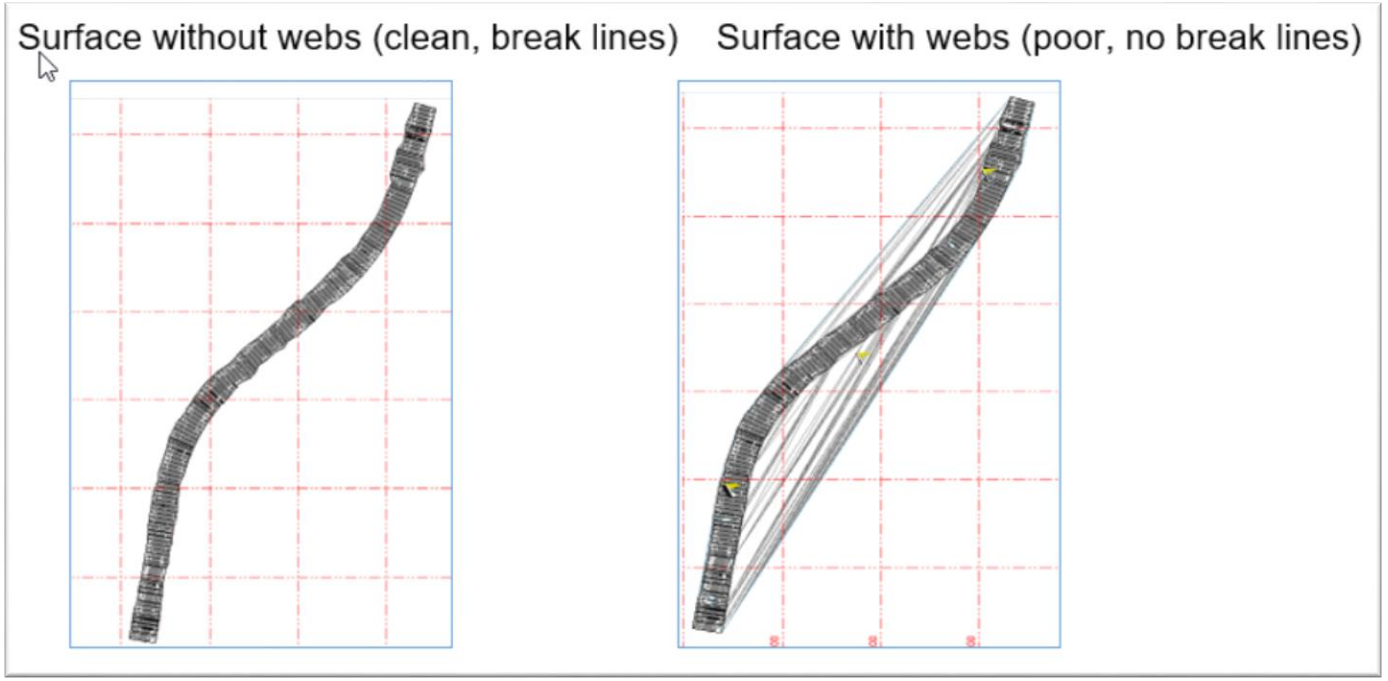


TRIMBLE
Importing the surfaces

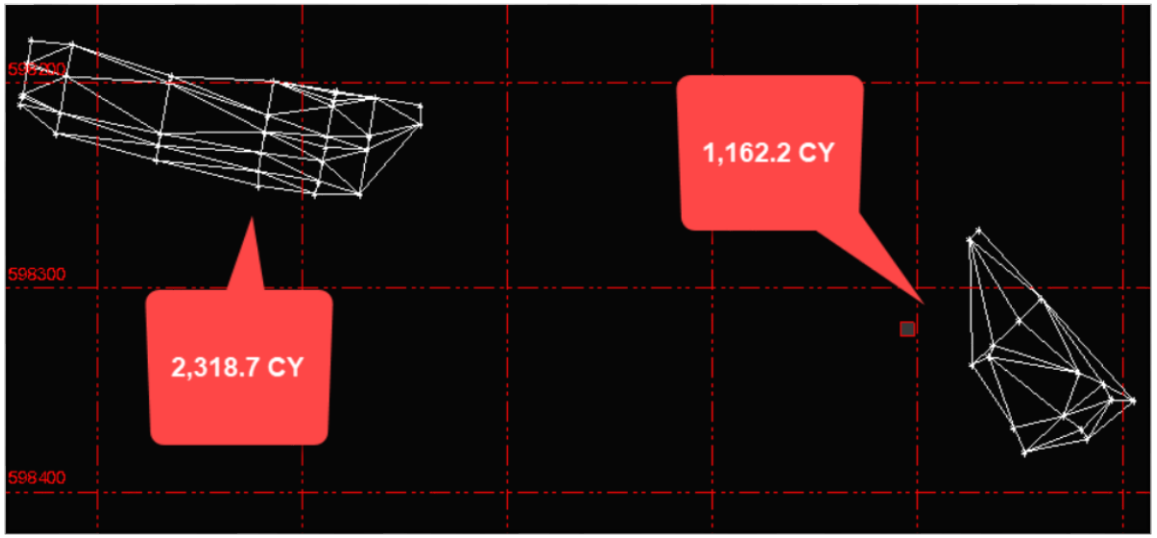


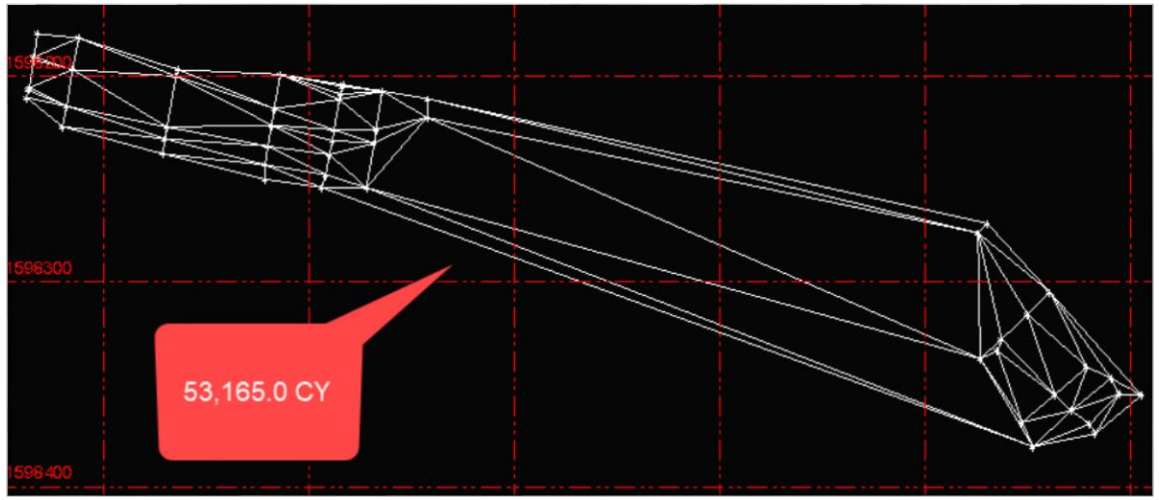
FDOT TRANSPORTATION SYMPOSIUM

TRIMBLE Validating Data



TRIMBLE
Validating Data





TRIMBLE
Running the Report

Corridor Earthwork Report

Corridor name:	corridor
Native material:	<Undefined>
Fill material:	<Undefined>

Start station:	4+00.00
End station:	6+50.00
Account for curve adjustment:	Yes
Account for shrinkage/bulkage:	Yes

Mass Earthwork

	Volume (yd³)
Total available bank cut	1,839.0
Total fill supplied	1,839.0
Total fill required	0.0
Total excess (yd³)	**1,839.0**

Cut Quantities

Material	Volume (yd³)
<Undefined>	1,839.0
Total	1,839.0

Station	Area (ft²)		Volume (yd³)				Accumulated Volume (yd³)
	Available Bank Cut	Fill Required	Available Bank Cut	Fill Supplied	Fill Required	Excess/Deficit	Excess/Deficit
4+00.00	156.9						
			503.9	503.9		503.9	503.9
4+50.00	387.3						
			693.8	693.8		693.8	1,197.6
5+00.00	362.0						
			641.4	641.4		641.4	1,839.0
5+50.00	330.7						
						0.0	1,839.0
6+00.00							
						0.0	1,839.0
6+50.00							

Density State Color Legend		
Bank density		A Shrinkage
Loose density		B Hauling Bulkage
Compacted density		C Hauling Compaction

QUESTIONS AND COMMENTS
THANK YOU FOR ATTENDING!

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