

BUILDING PROJECTS WITH SDD



Goals for Presentation

- Bring awareness to some possible uses for technology in construction
- Encourage teamwork throughout the process
- Help designers and construction staff understand each others needs and limitations
- Show a few tips and tricks
- Encourage innovative thinking in the field



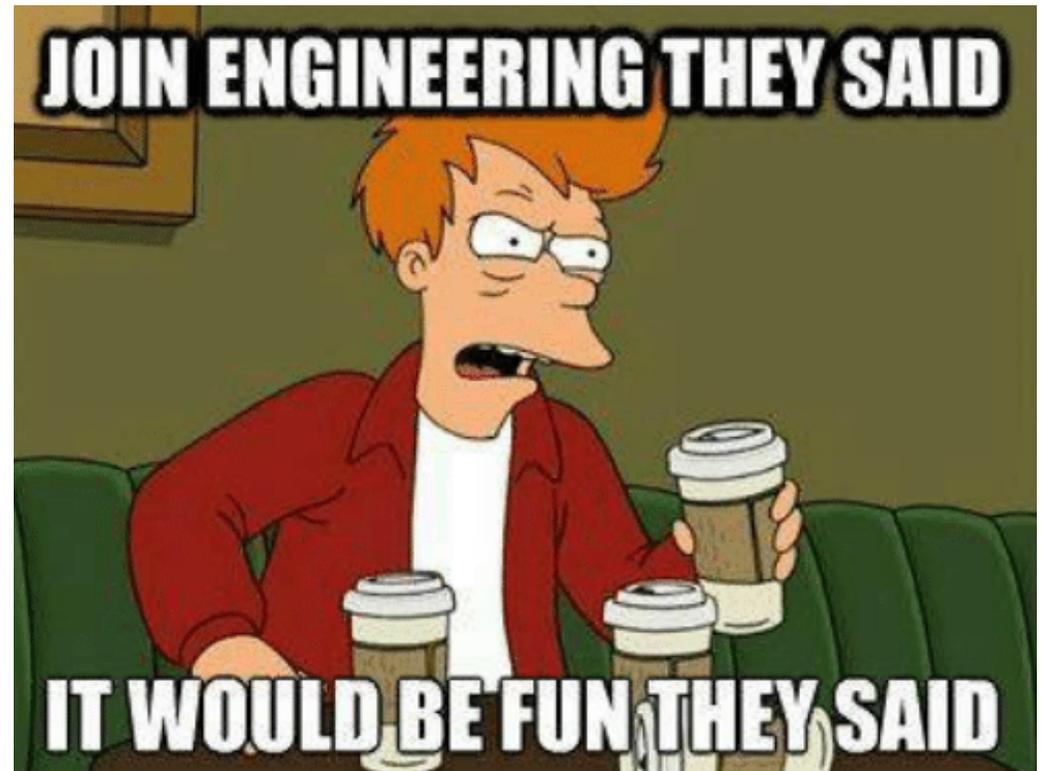
Today's Topics

- **Deliverables from Design**
- **Use of Deliverables in Construction**
- **Construction Survey Equipment**
- **Efficient Accurate Techniques**
- **Working with Trimble and Bentley**
- **Construction Staking**
- **AMG – Use and Limitations**
- **Field Verification**
- **Survey Committee and Training**

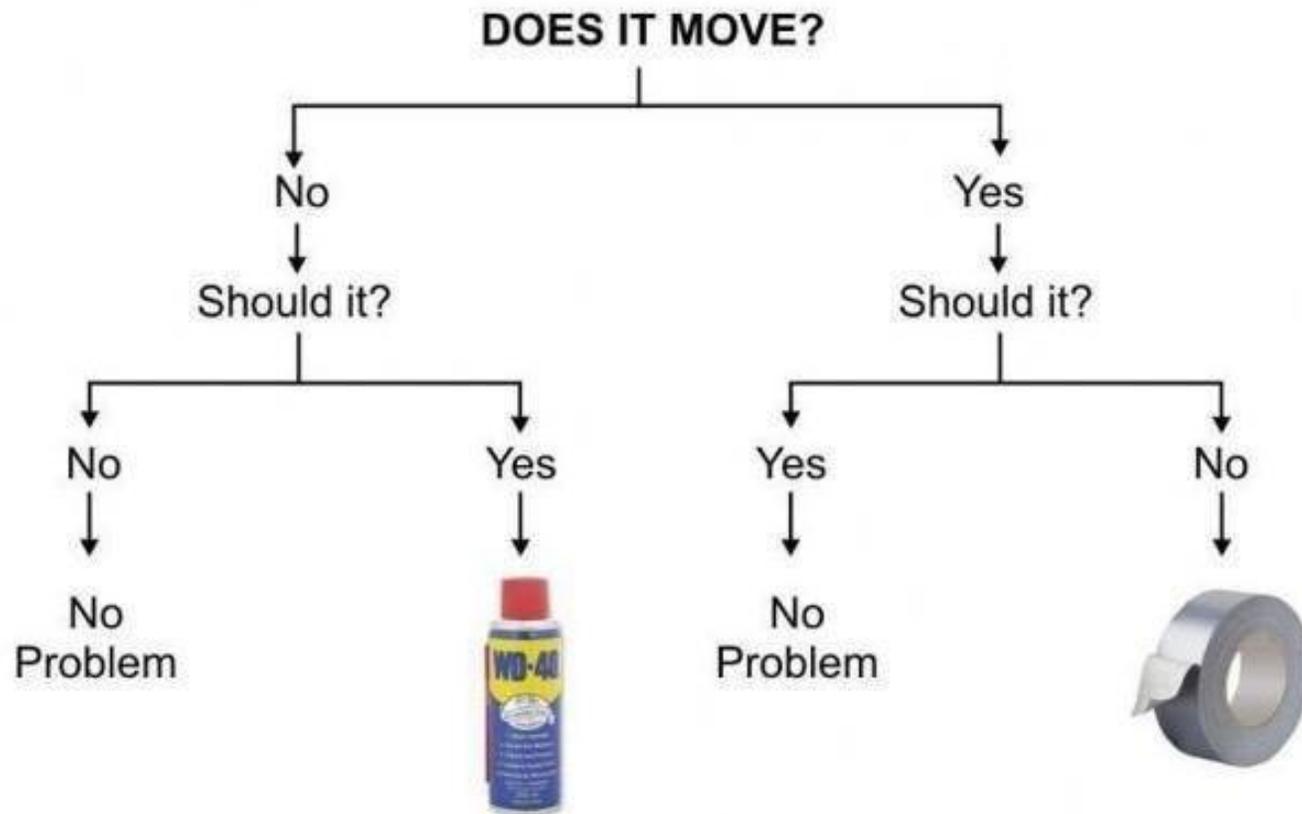


What This Presentation is Not

- Intended to be all inclusive
- Intended to be a training
- Necessary the most current technology
- The only way to do the job

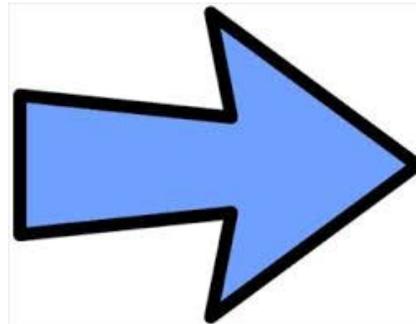


Engineering Flowchart



Plan Production

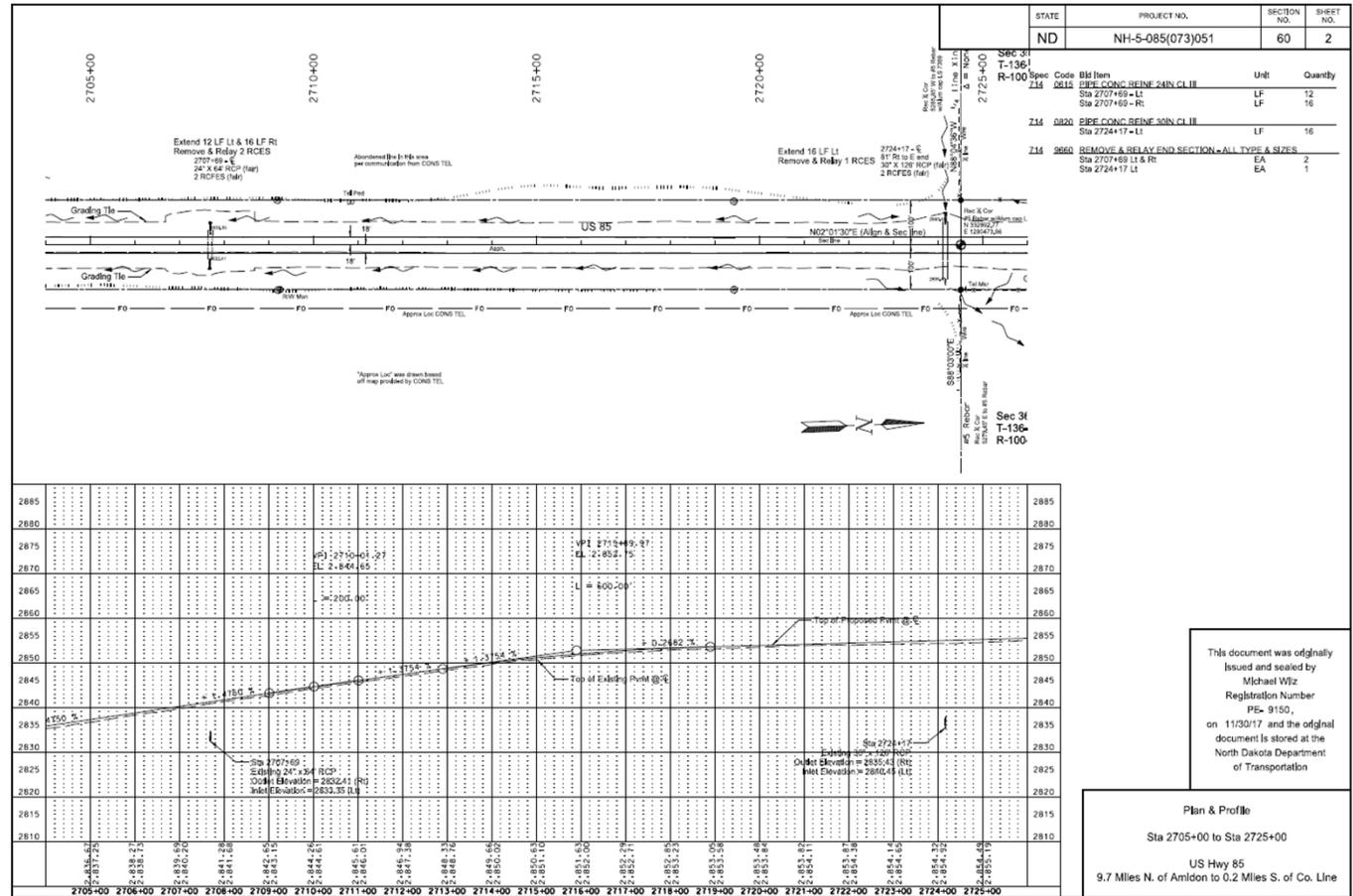
- **Preliminary Survey**
- **Existing Alignment & Right of Way**
- **Existing Ground Surface**
- **Proposed Alignment and Profile**
- **Proposed Surface Model**
- **Drainage**



- **Plan & Profile Sheets**
- **Cross Sections**

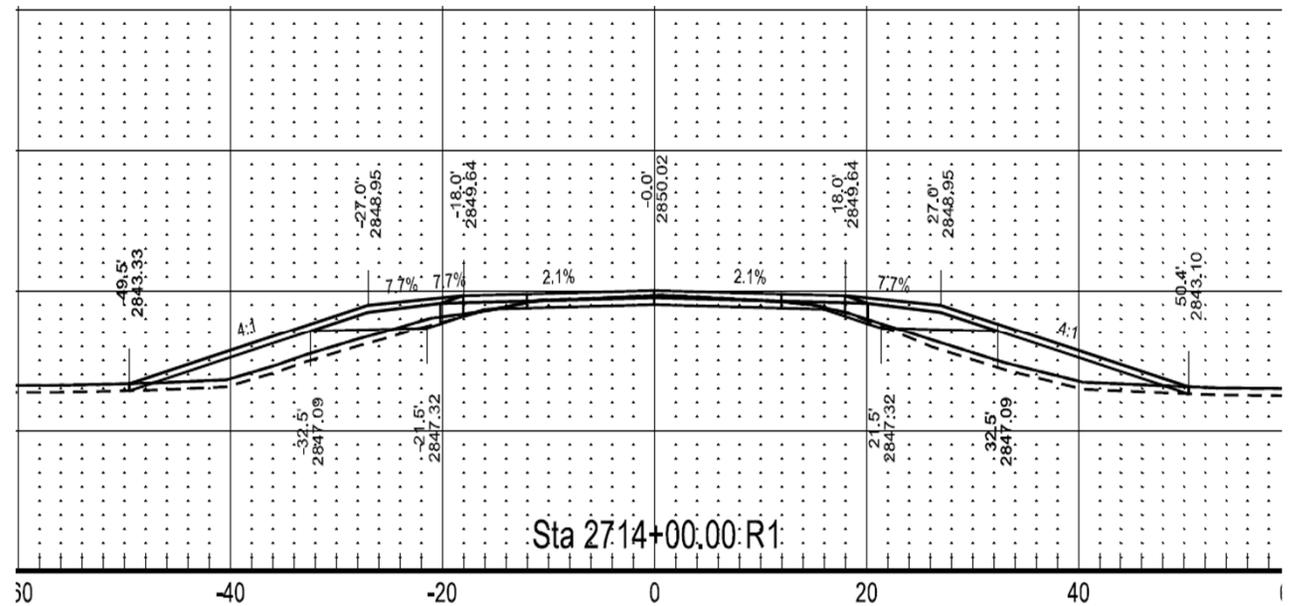
P&P Sheets

- Finish Profile of Top of Pavement
- Existing topography
- Pipe Elevation
- Stationing
- Quantities
- Right of Way
- Construction Limits



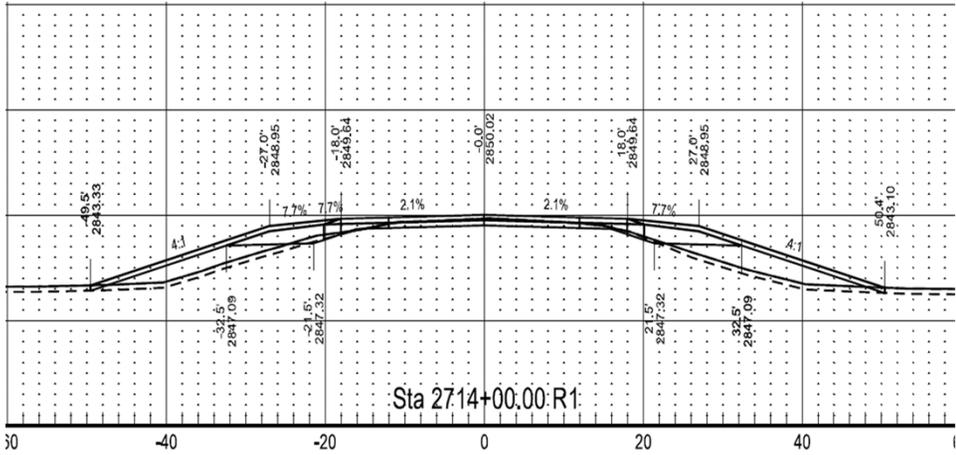
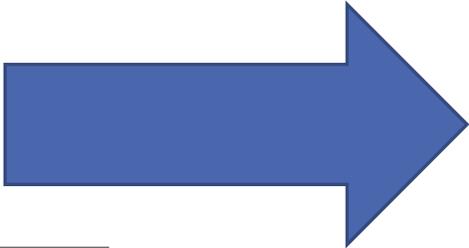
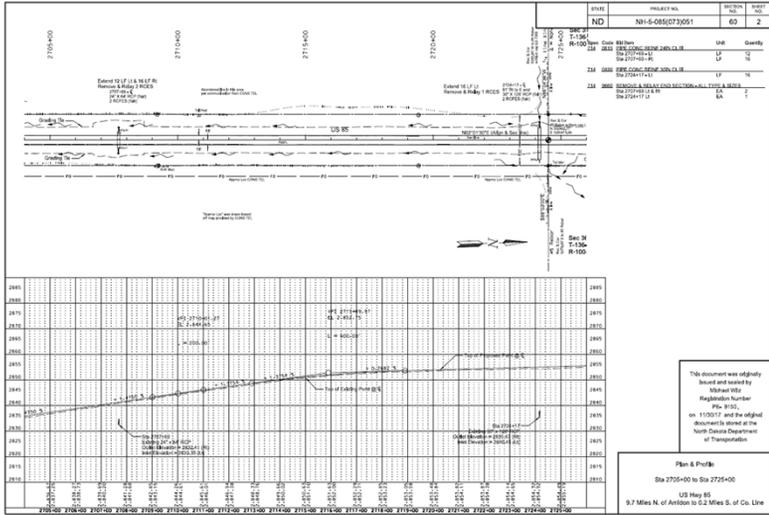
Cross Section Sheets

- Break point elevations
- Stationing
- Cross Slopes



How Do We Do It





Supplemental Design Data!!

North Dakota nd.gov Official Portal for North Dakota State Government




[Home](#) | [About](#) | [Careers](#)

Proposal Package

Document
Addendum 3 - Job 19 PDF
Addendum 2 - Job 19 PDF
Addendum 1 - Job 19 PDF
Job 19 Request for Proposal PDF
NH-5-085(073)051 Final Plans 1 of 2 ED PDF
NH-5-085(073)051 Final Plans 2 of 2 XSEC ED PDF
NH-5-085(073)051 Standard Drawings PDF

Supplemental Information

Document
NH-5-085(073)051 Supplemental Design Data PDF

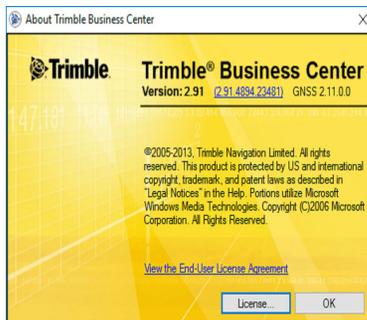
- [AAReadme.docx](#) ✓
- [B1_US85.tin](#) ✓
- [B1_US85.xml](#) ✓
- [CONTROL.dgn](#) ✓
- [Design.dgn](#) ✓
- [DG_US85.tin](#) ✓
- [DG_US85.xml](#) ✓
- [DS_Align.dgn](#) ✓
- [G1_US85.tin](#) ✓
- [G1_US85.tin](#) ✓
- [G1_US85.xml](#) ✓
- [profile.dgn](#) ✓
- [RDM_US85.dgn](#) ✓
- [RW_bndy.dgn](#) ✓
- [Terrain_Exst.dgn](#) ✓
- [TOPOG.dgn](#) ✓
- [T_US85.tin](#) ✓
- [T_US85.xml](#) ✓

SDD to Field Survey

SDD



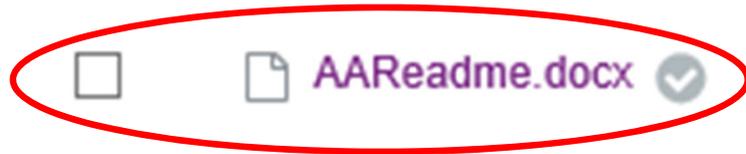
Alignment & Profile.xml
Subgrade, Base, Finish Surfaces.xml
Background Images.dxf



Alignment & Profile.rxl
Subgrade, Base, Finish Surfaces.ttm
Cross Section Templates

First Things First

AAReadme



This aareadme file does not list all limitations with the model. It is only provided as a place to start your review. The contractor is responsible for reviewing model information and determining if and where it may be applicable.

Multiple alignments in design file

Alignments

Chain – EX 85

Profile - PRPUS85

Multiple surfaces created

Surfaces

Proposed Top (T)

Proposed Base (B1)

Proposed Dirt Grade (DG)

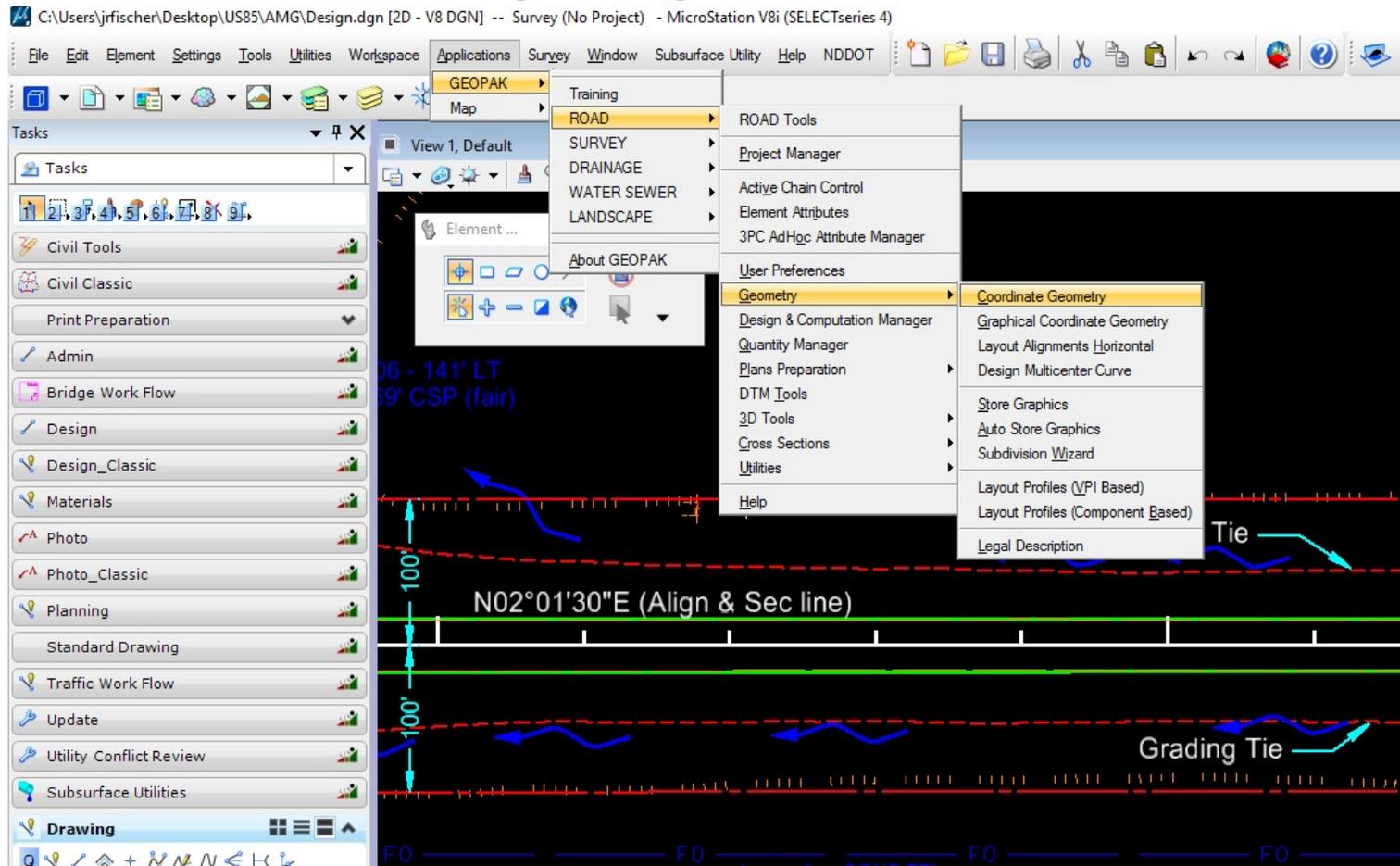
Proposed Geogrid Fabric (G1)

Need to understand limitations

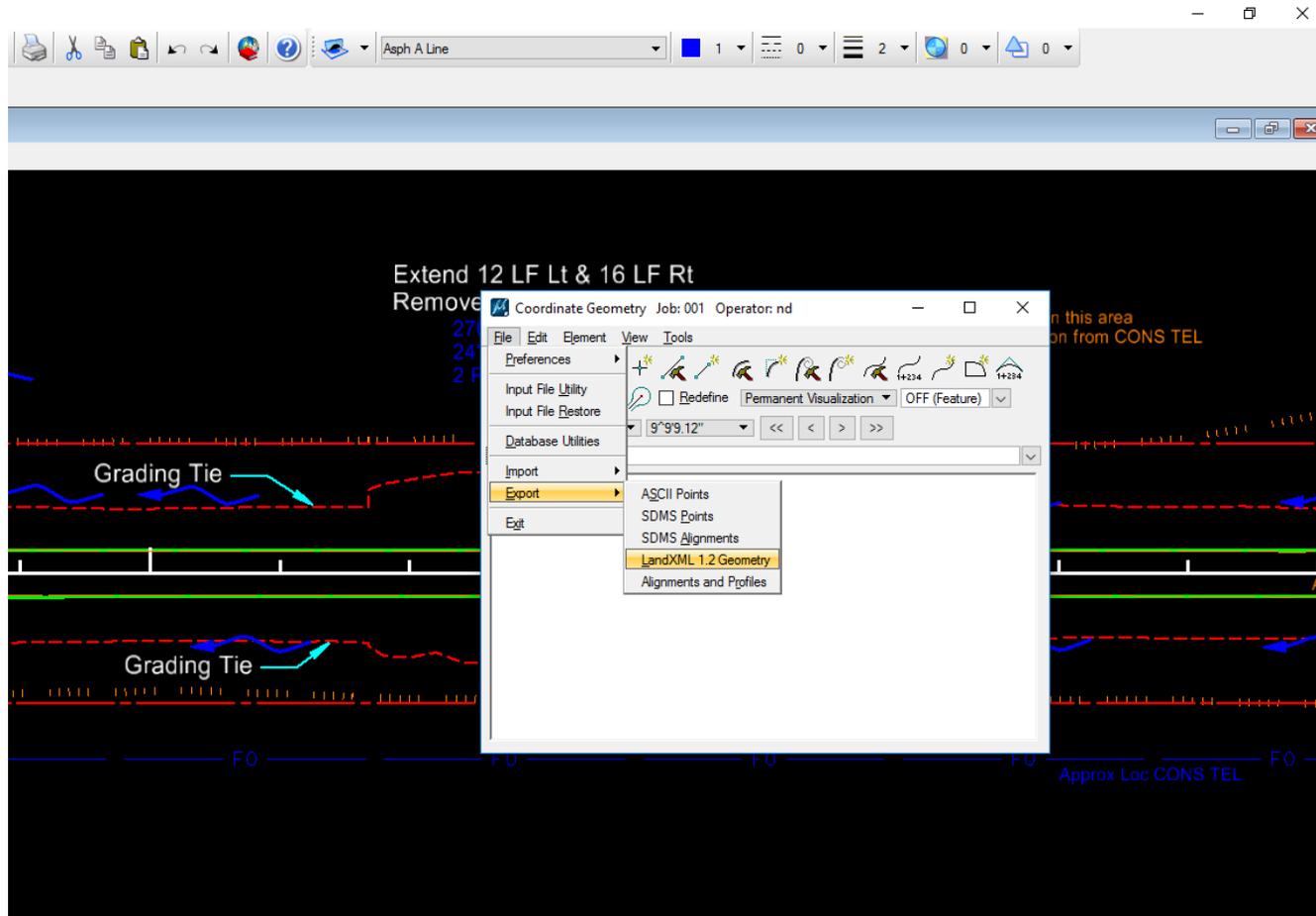
Model Limitations

Approach radii were not modeled. Any information shown at the location of an approach radius is not accurate.

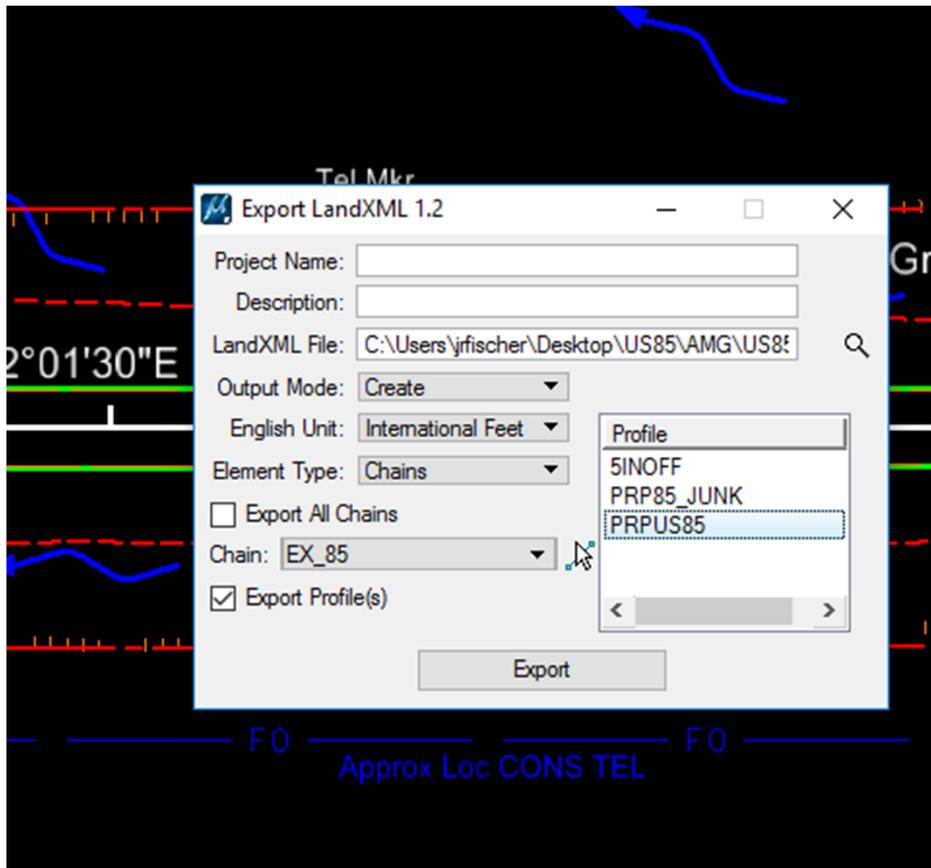
Exporting Alignment & Profile



Exporting Alignment & Profile



Exporting Alignment & Profile



 **US85A&P.xml**

US85A&P.xml



US85A&P.xml

Drag and drop the .xml alignment and profile into TBC

5000 ft



Unnamed - Trimble Business Center

Point Clouds Machine Control Support

Georeference Place Georeference Vector PDF Boundaries Change Coordinate System Datum Gridding Geoid Sub-Gridding Measure Distance Reports Print

Plan 3D Points My Filter Import Vector PDF Data Capture Coordinate System Manager Geodetic Measure Distance Reports Print

Export

File Format

Point Cloud Mobile Mapping

Corridor Custom GIS

Survey CAD Construction

DC road exporter from coridor
DC road exporter from surface
RXL road exporter from alignment
RXL road exporter from surface
Trimble Access road RXL templates
Trimble Access road strings

Data

Road name: US 85

Horizontal alignment: EX_85

Vertical alignment: PRPUS85

Begin station: 2695+53.05

End station: 3012+21.00

File Name

Unnamed.rxl

Close command after export

Settings

File version: 6.4

Horizontal alignment stati 65.617

Save As

This PC > Desktop > US85

Organize New folder

This PC Desktop Documents Downloads Music

AMG US85.rxl

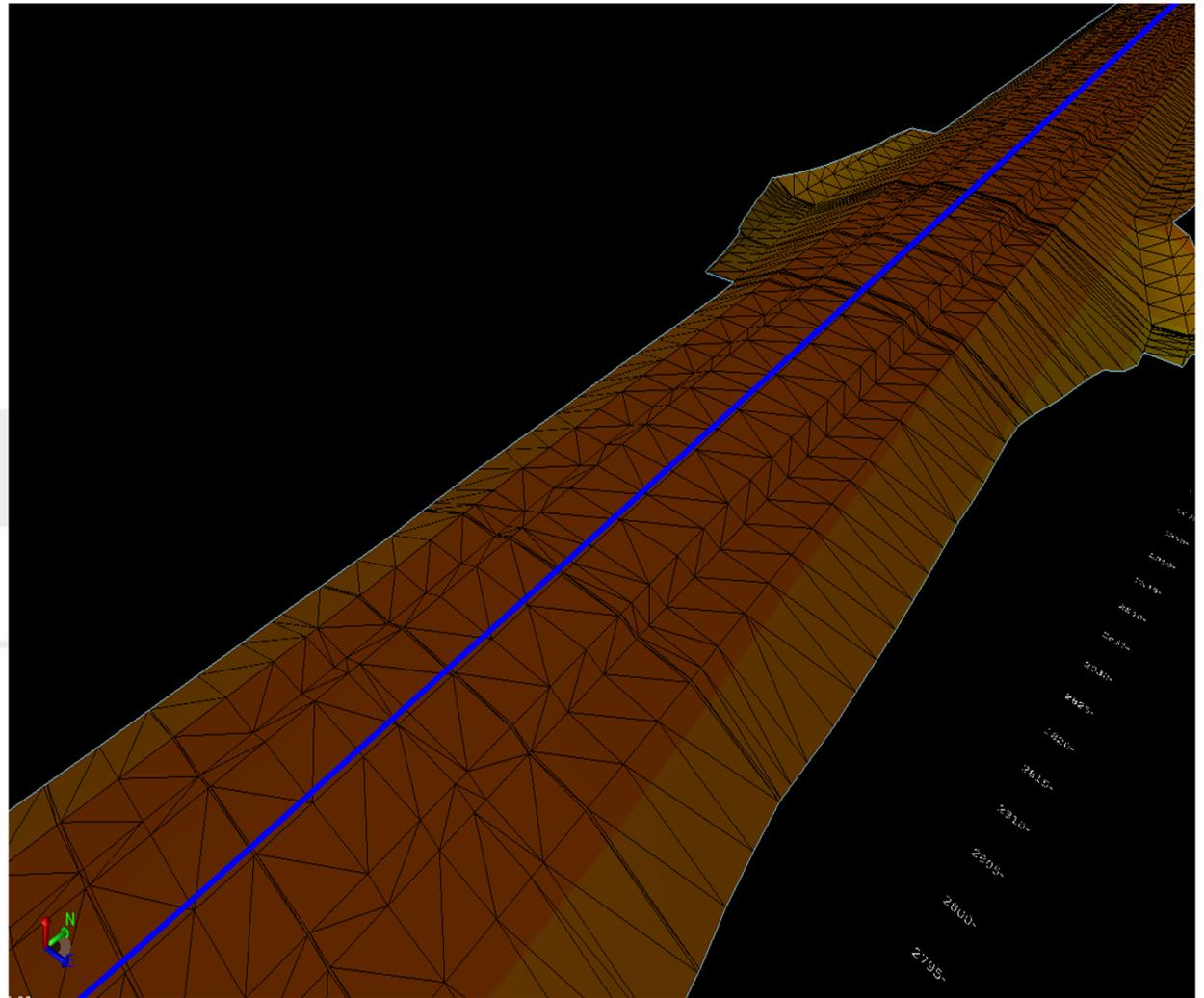
File name: US85.rxl

Save as type: RXL road exporter from alignment files (*.rxl)

Hide Folders Save Cancel

.xml Surfaces

- DG_US85.xml ✓
- G1_US85.xml ✓
- B1_US85.xml ✓
- T_US85.xml ✓



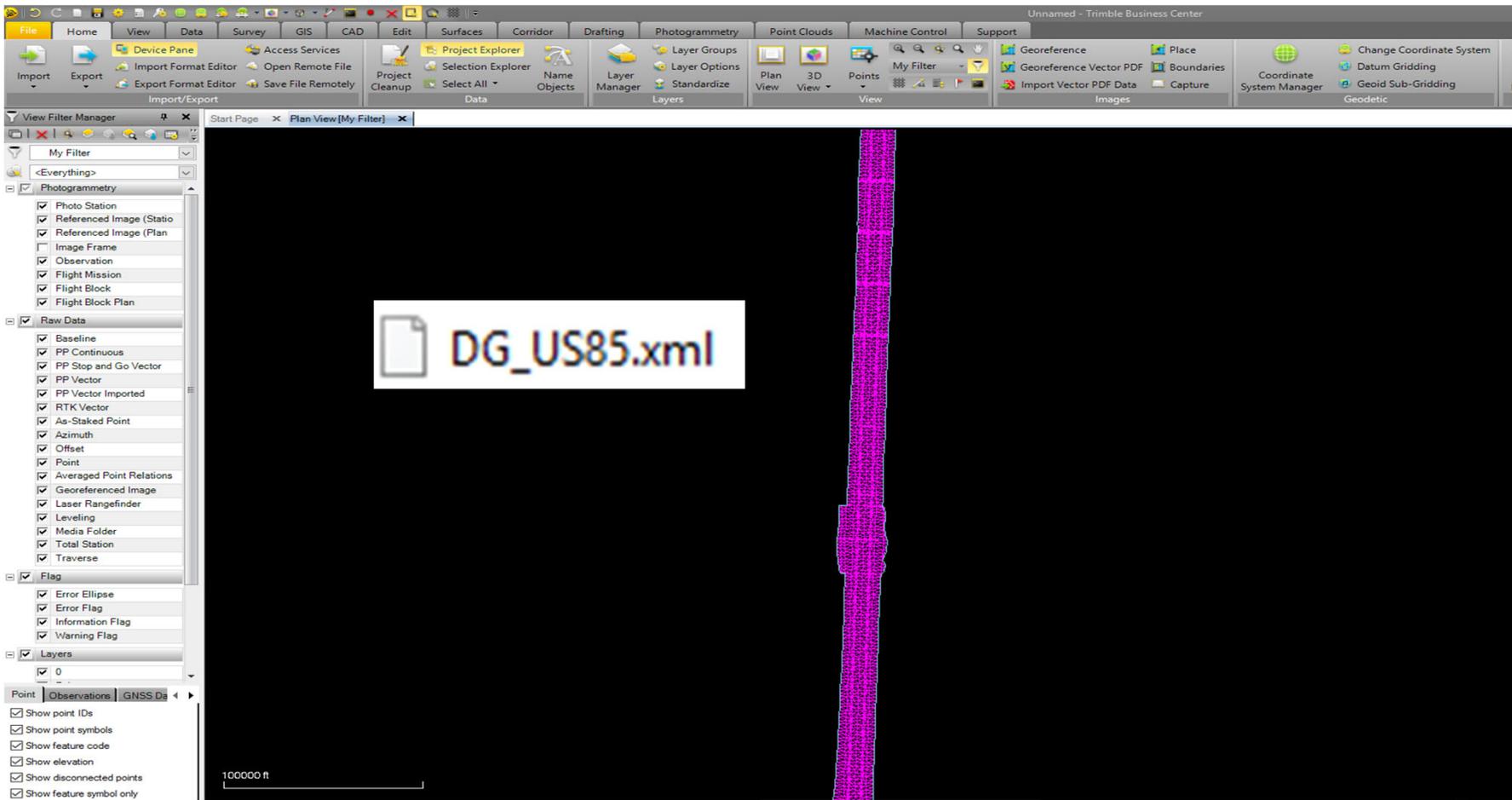
Use of the Surface Model



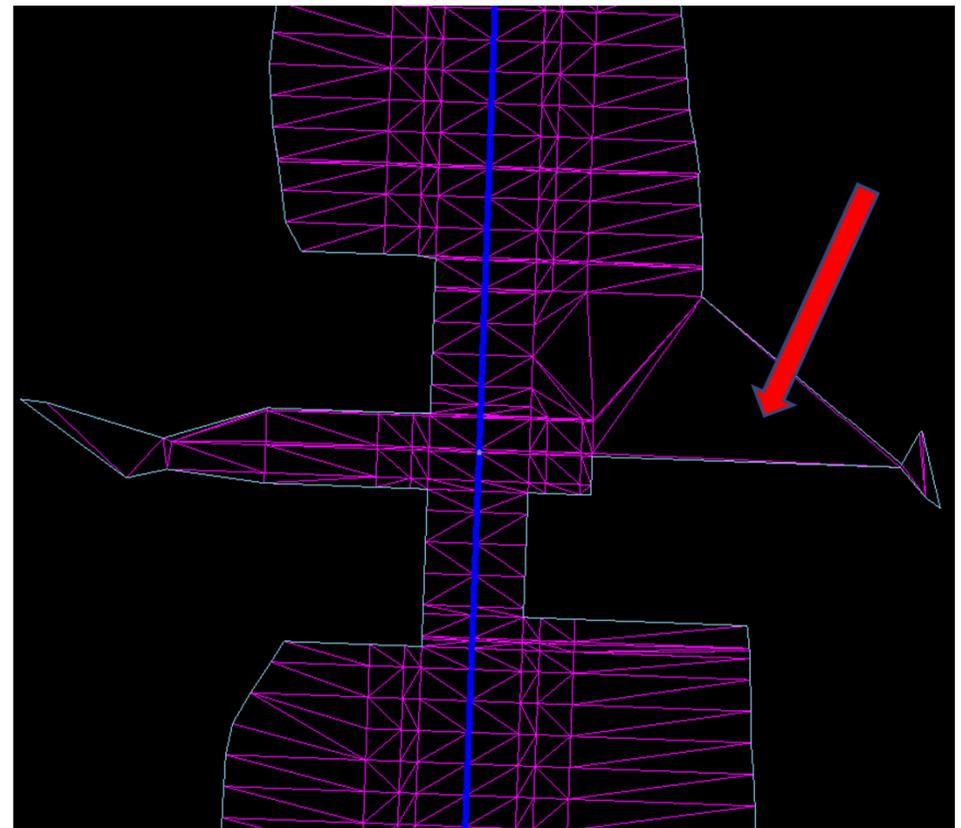
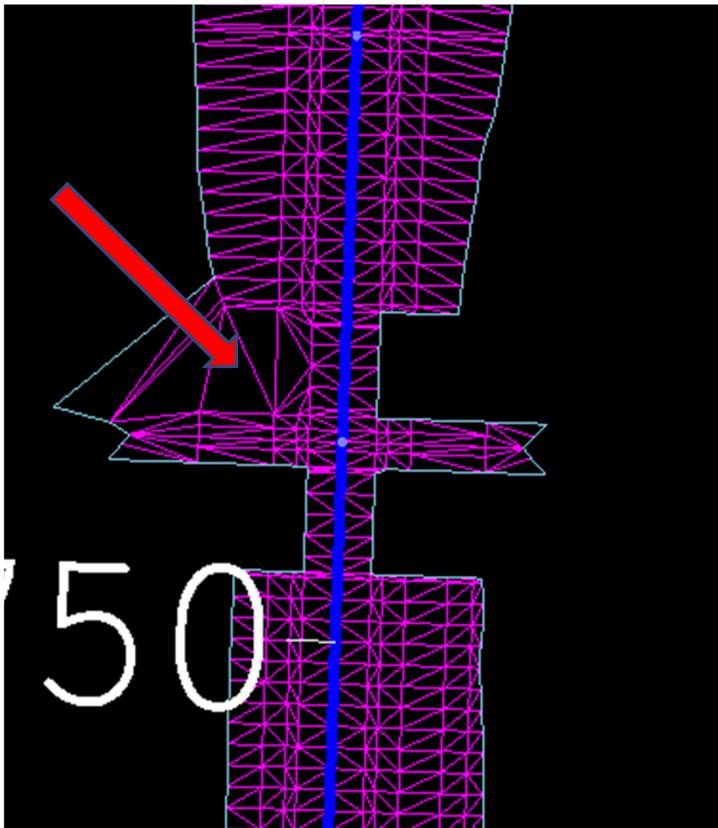
Use of the Surface Model



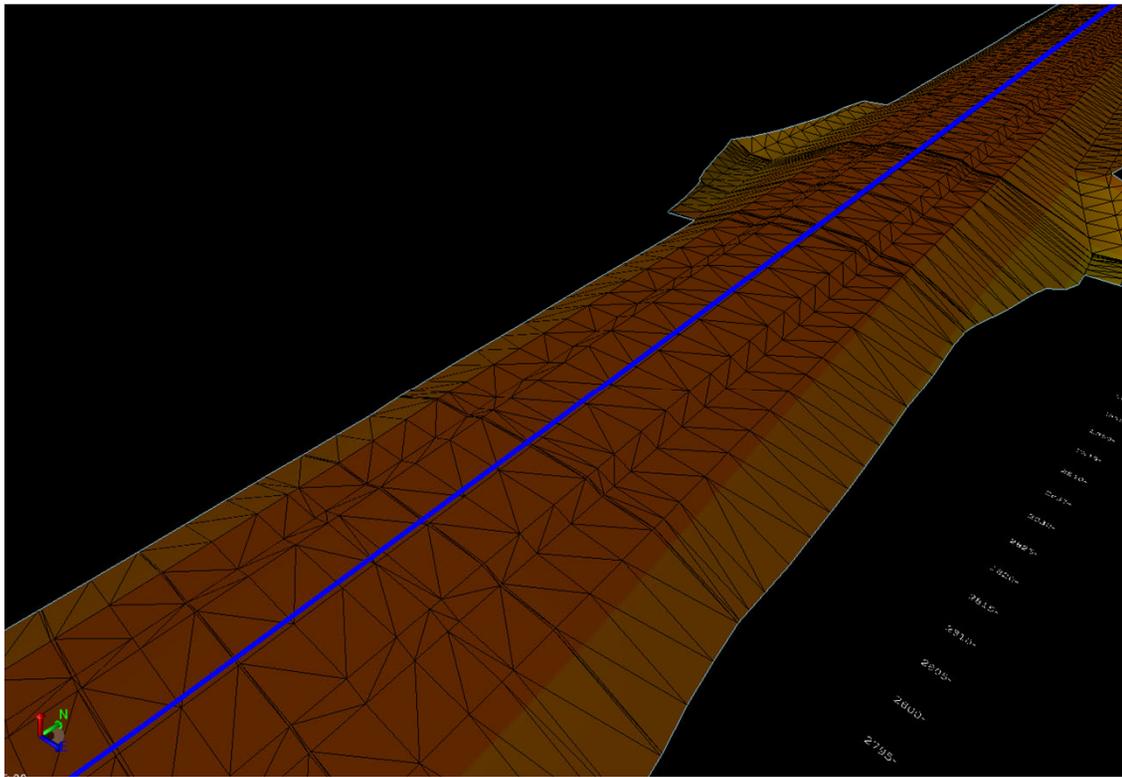
Use of the Surface Model

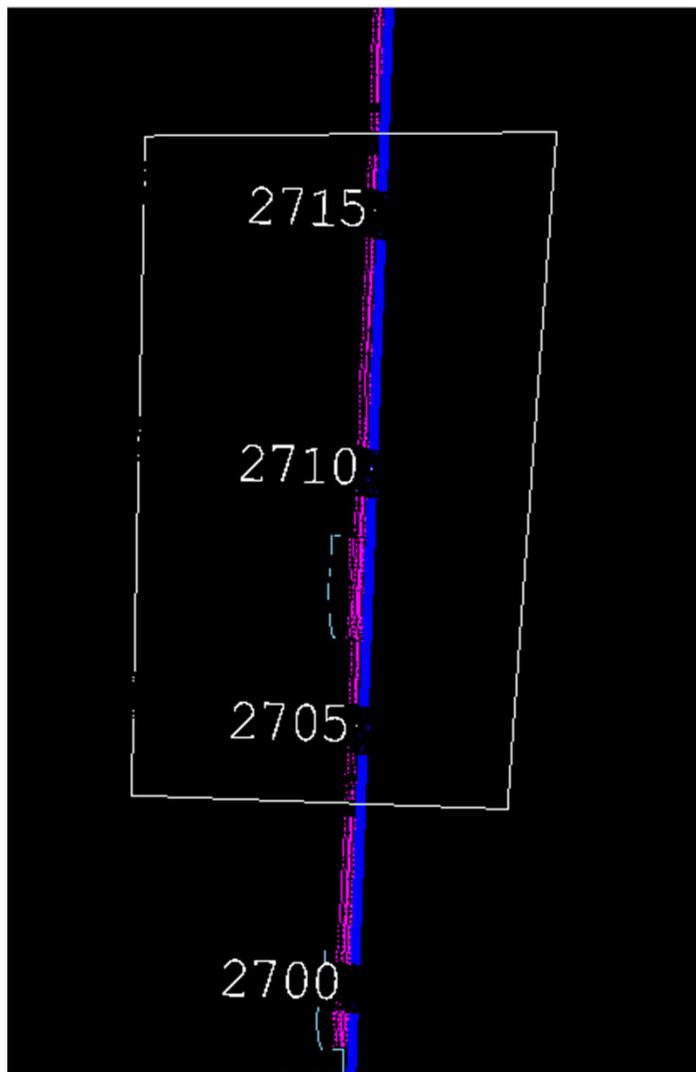


Review and Understand Limitations



Exporting the Model to Data Collector





Export

File Format

Point Cloud | Mobile Mapping | **GIS**

Corridor | Custom | Survey | CAD | Construction

Machine Site Map exporter
Mass Haul Plan exporter
SCS900 Tunnel XML exporter
Site Mass Haul VCL exporter
SOSI Vector Data Exporter
TTM exporter
VCL Project Link exporter

Data

Surface:
Triangles_DG

Surface clipping boundary:
surface clip

File Name

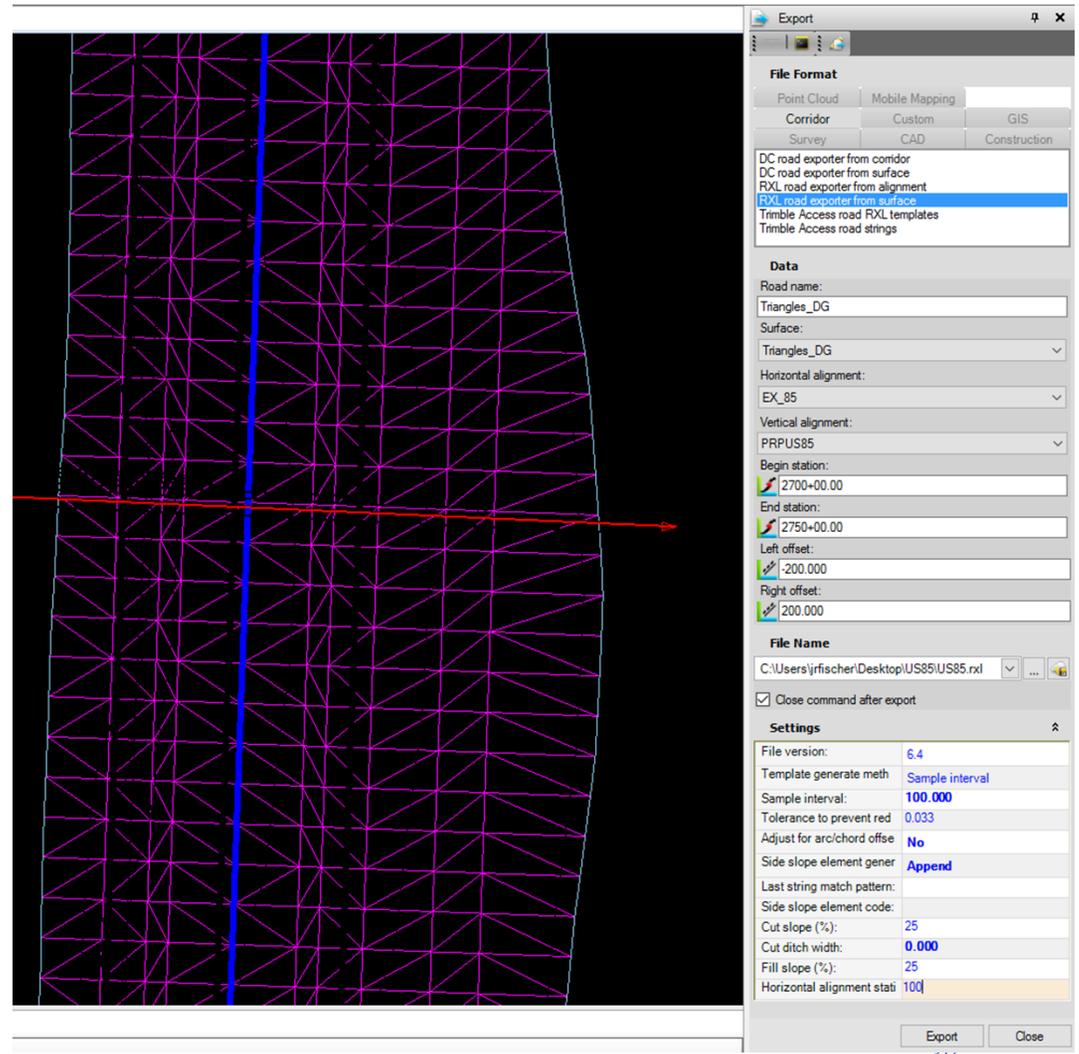
C:\Users\jrfischer\Desktop\U...US85_DG.ttm

Close command after export

Settings

Internal Name: [Object Name]

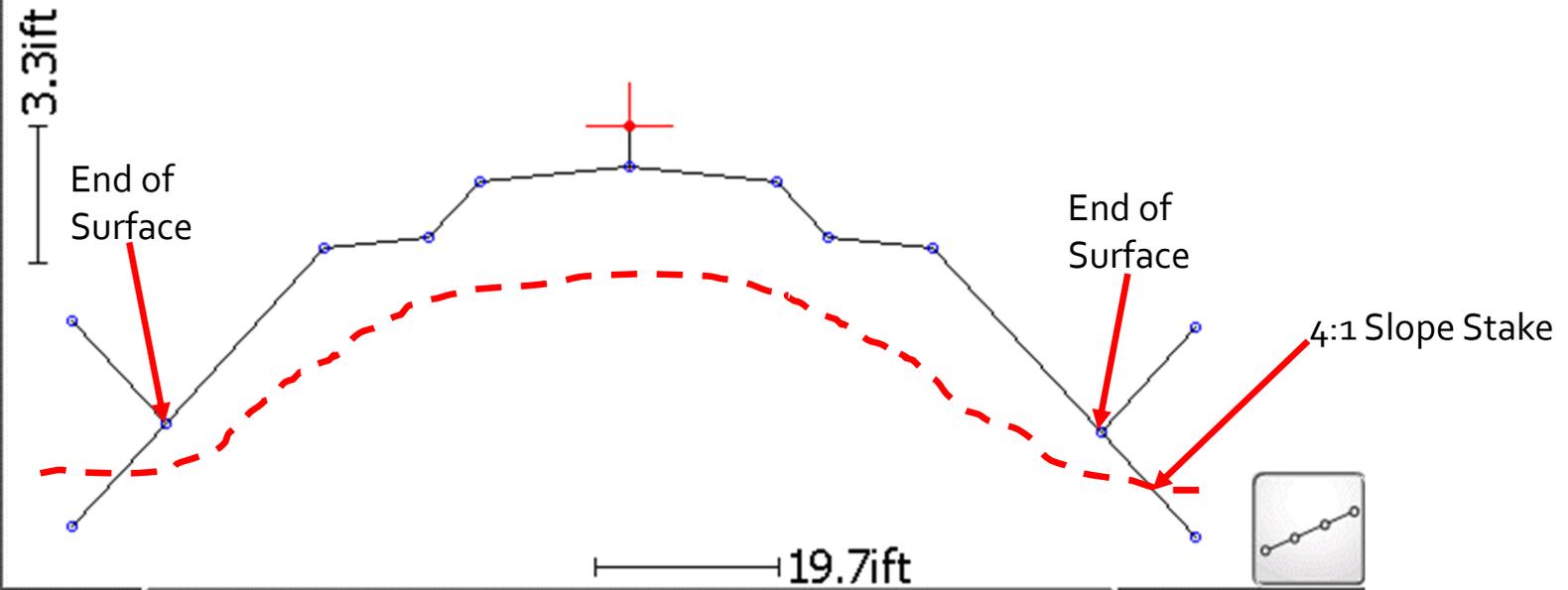
Cutting Cross Section Templates from surfaces for staking



Stn: 2714+00.000ift (XS,T)

String: CL Offset: 0.000ift

North: 331941.669ift East: 1290436.798ift Elev: 2850.021ift



Export

File Format

Point Cloud | Mobile Mapping

Corridor | Custom | GIS

Survey | CAD | Construction

DC road exporter from coridor
 DC road exporter from surface
 RXL road exporter from alignment
RXL road exporter from surface
 Trimble Access road RXL templates
 Trimble Access road strings

Data

Road name:
 Triangles_DG

Surface:
 Triangles_DG

Horizontal alignment:
 EX_85

Vertical alignment:
 PRPUS85

Begin station:
 2700+00.00

End station:
 2750+00.00

Left offset:
 -200.000

Right offset:
 200.000

File Name

C:\Users\jrfischer\Desktop\US85\US85.rxl

Close command after export

Settings

File version:	6.4
Template generate meth	Sample interval
Sample interval:	100.000
Tolerance to prevent red	0.033
Adjust for arc/chord offse	No
Side slope element gener	Append
Last string match pattern:	
Side slope element code:	
Cut slope (%):	25
Cut ditch width:	0.000
Fill slope (%):	25
Horizontal alignment stati	100

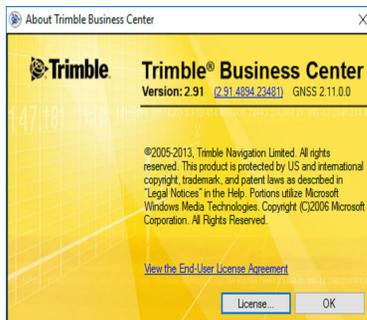
Export Close

SDD to Field Survey

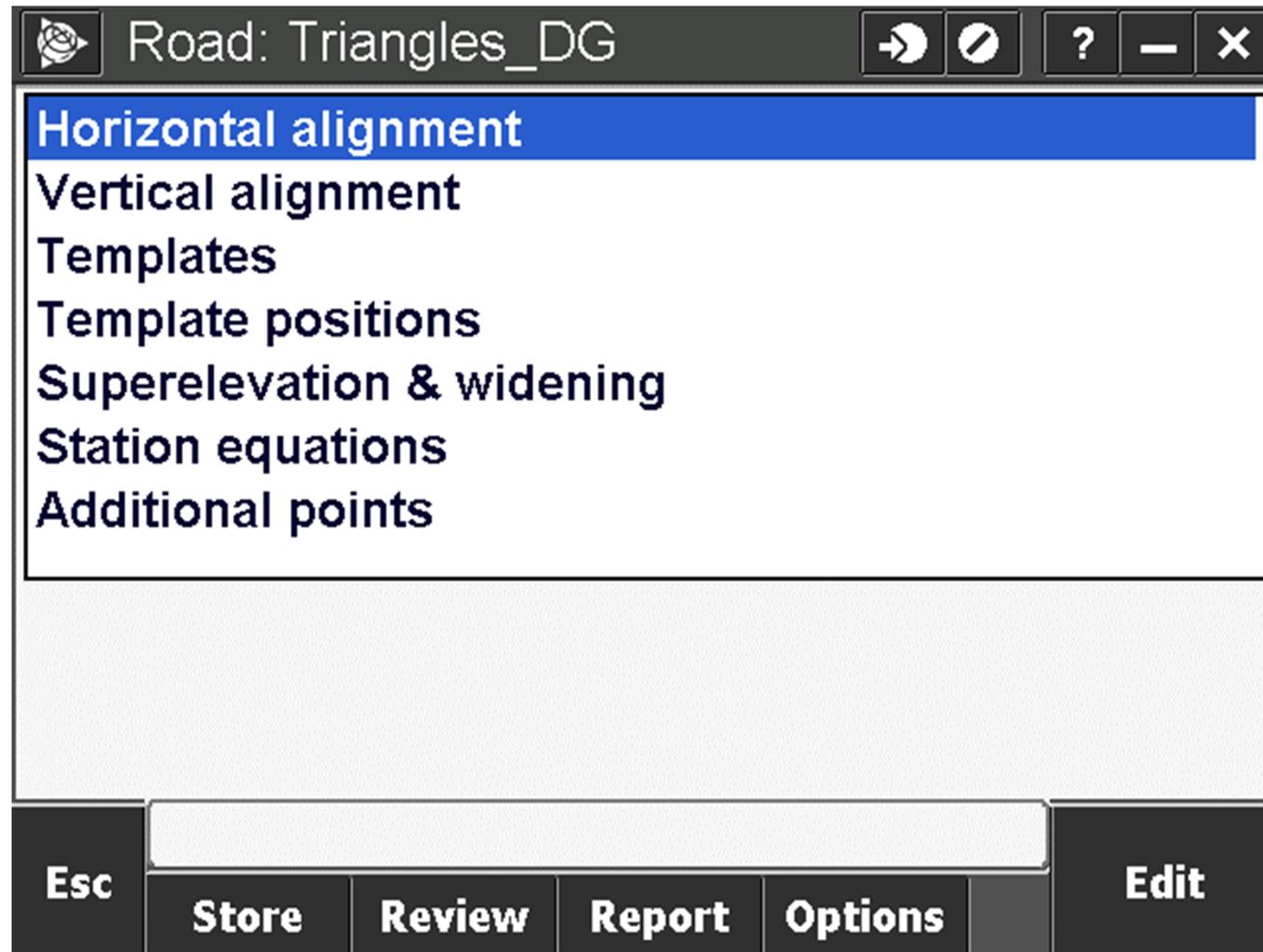
SDD

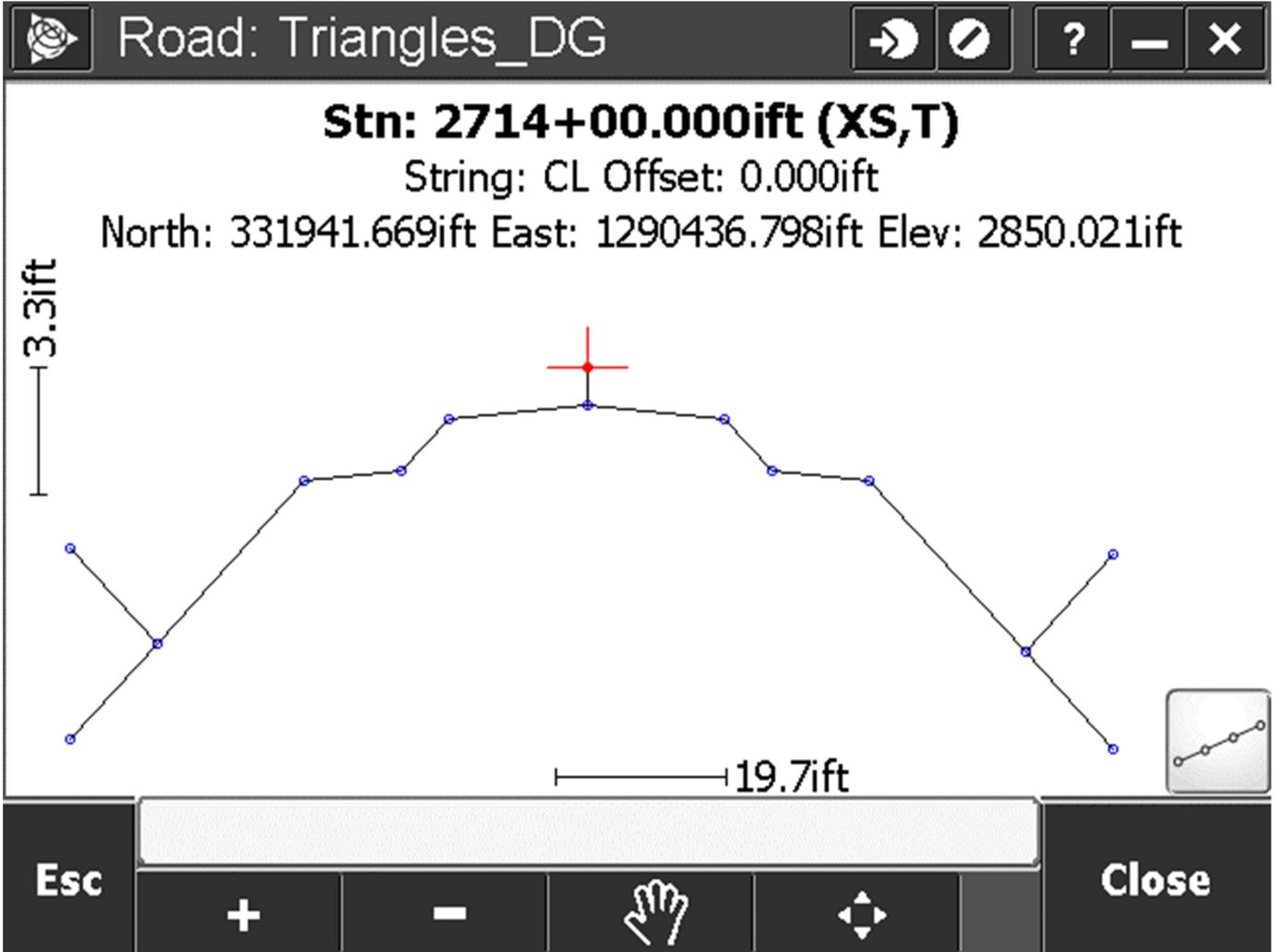


Alignment & Profile.xml
Subgrade, Base, Finish Surfaces.xml



Alignment & Profile.rxl
Subgrade, Base, Finish Surfaces.ttm
Cross Section Templates

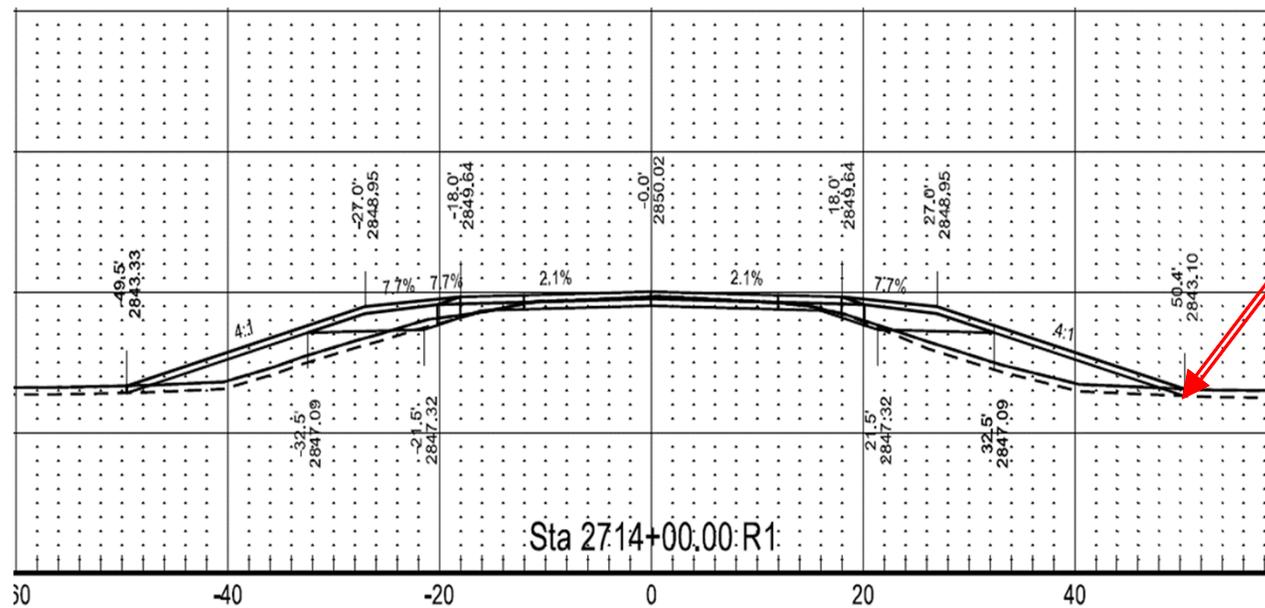






Slope Staking

- Using Template Created from Surface
- Using Side Slope Definition and Cross Sections



4:1
F
4.5
@
50.4

Slope Staking with Side Slope Definition

Road: Triangles_DG

Road name: Triangles_DG String name: Catch

Stake: Side slope from alignment

Target height: 5.000ift

Station: 2714+00.000ift (T)

Station interval: 100.000ift

1/3

Esc Sta- Sta+ Options Start

Map
Menu
Favorites
Switch to

99%

Slope Staking with Side Slope Definition

Road: Triangles_DG

Hinge point definition

Hinge derivation method:
Offset and elevation

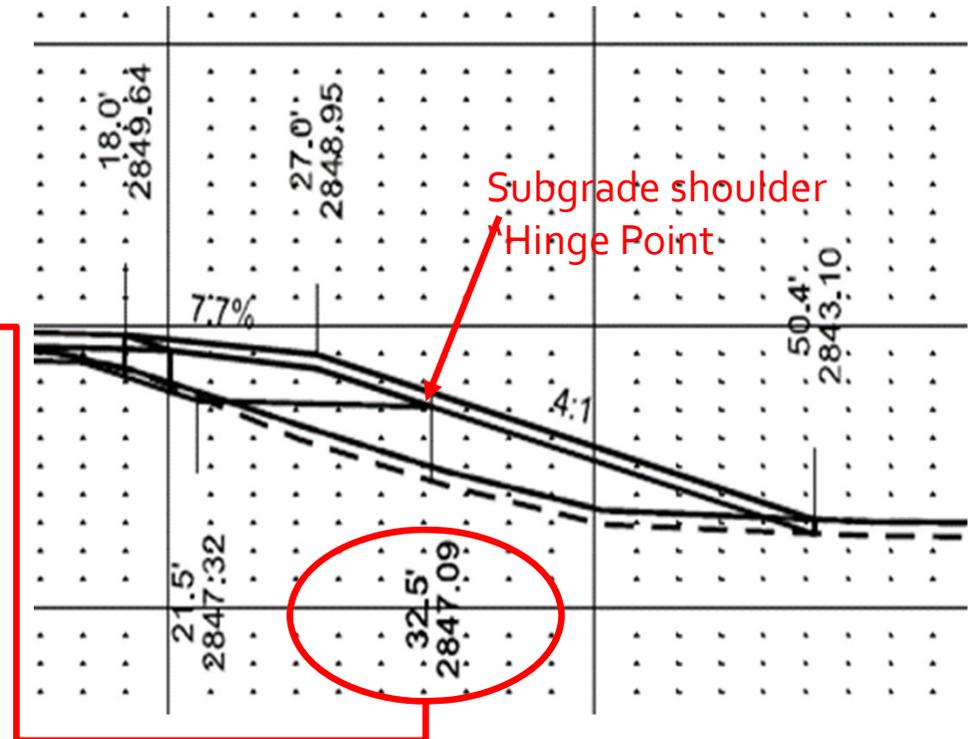
H.Offset: **32.500ft Right** | Elevation: **2847.090ft**

Side slope definition

Cut slope: **25.0000%**

Map
Menu
Favorites
Switch to

Esc | Sta- | Sta+ | Options | Start



Slope Staking with Side Slope Definition

Road: Triangles_DG

Fill slope: Cut ditch width: 99%

Construction offsets

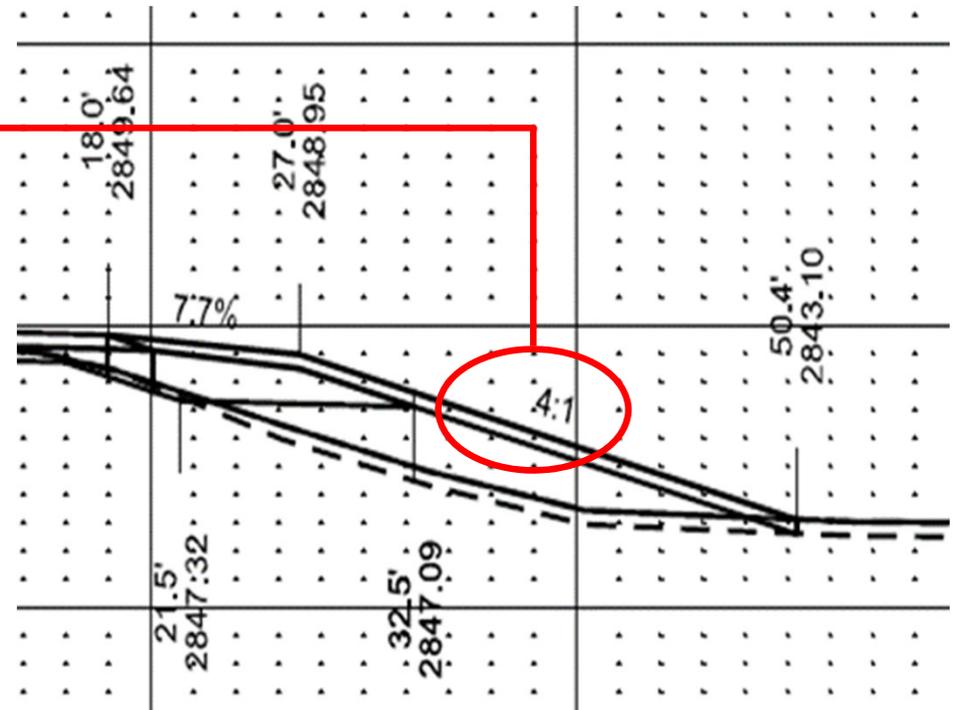
Horizontal offset: Vertical offset:

Store both catch and construction offset:

Map
Menu
Favorites
Switch to

3/3

Esc Sta- Sta+ Options Start



Slope Staking with Template

Select station

Road name:	2704+00.000ift (T)
Triangles	2705+00.000ift (T)
Stake:	2706+00.000ift (T)
Station an	2707+00.000ift (T)
Target height	2708+00.000ift (T)
5.000ift	2709+00.000ift (T)
Station:	2710+00.000ift (T)
2700+00.0	2711+00.000ift (T)
	2712+00.000ift (T)
Offset:	2713+00.000ift (T)
0.000ift	2714+00.000ift (T)
	2715+00.000ift (T)

91%
5.000
+0
5.000
Map
Menu
Favorites
Switch to

1/2

Esc Enter

Select offset

Road name:	(Left side slope)
Triangles	49.497ift Left
Stake:	32.460ift Left
Station an	21.460ift Left
Target height	16.000ift Left
5.000ift	0.000ift Left
Station:	0.000ift CL
2714+00.0	0.000ift Right
	16.000ift Right
Offset:	21.460ift Right
0.000ift	32.460ift Right
	50.404ift Right

91%
5.000
+0
5.000
Map
Menu
Favorites
Switch to

1/2

Esc Enter

Blue Topping Methods

- Templates
- TTM Surface
- Creating Report
- Cross Section Labels



Blue Topping with Template

Select offset

Road name: (Left side slope) Triangles_49.497ft Left

Stake: 32.460ft Left

Station and Target height: 21.460ft Left

5.000ft 16.000ft Left

0.000ft Left

Station: 0.000ft Right

2714+00.0 16.000ft Right

Offset: 21.460ft Right

(Left side) 32.460ft Right

50.404ft Right

98%

Map

Menu

Favorites

Switch to

1/2

Esc Enter

Road: Triangles_DG

Stn: 2714+00.000ft (XS,T)

String: Offset: -32.460ft

North: 331942.816ft East: 1290404.358ft Elev: 2847.089ft

Slope: -2.10% Delta offset: 11.000ft Delta elev: -0.231ft

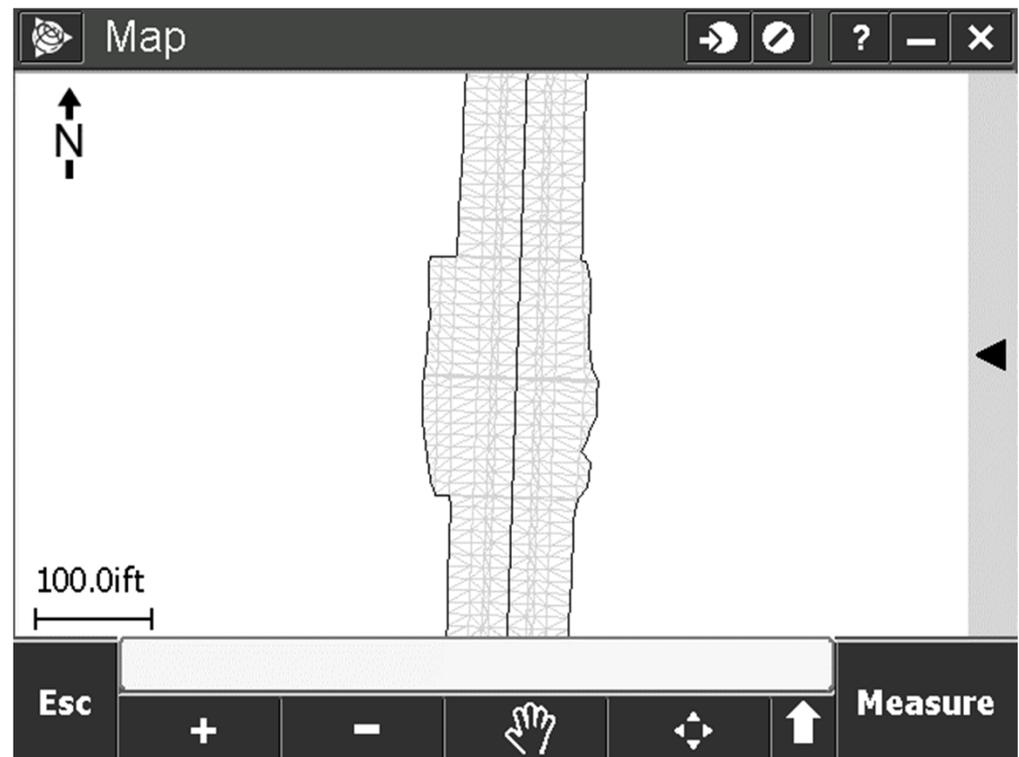
3.3ft

19.7ft

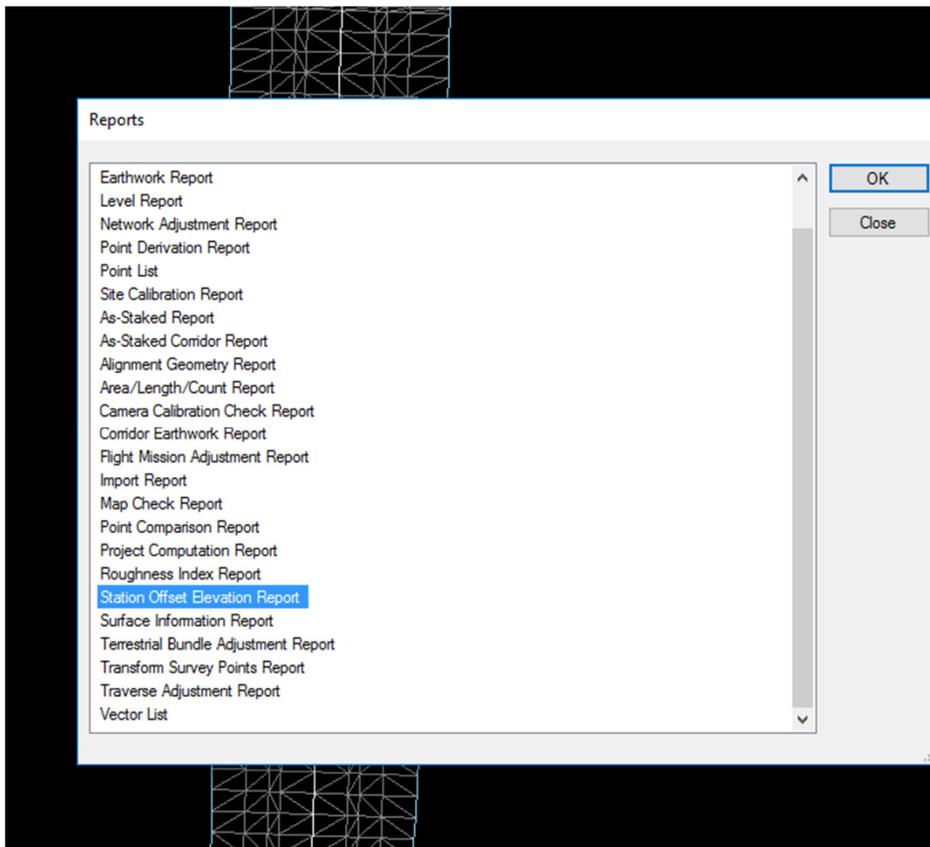
Esc + - Close

Blue Topping with Surface

- Difficult to pinpoint the breakpoint
- Offset isn't readily available
- Works great for grade verification

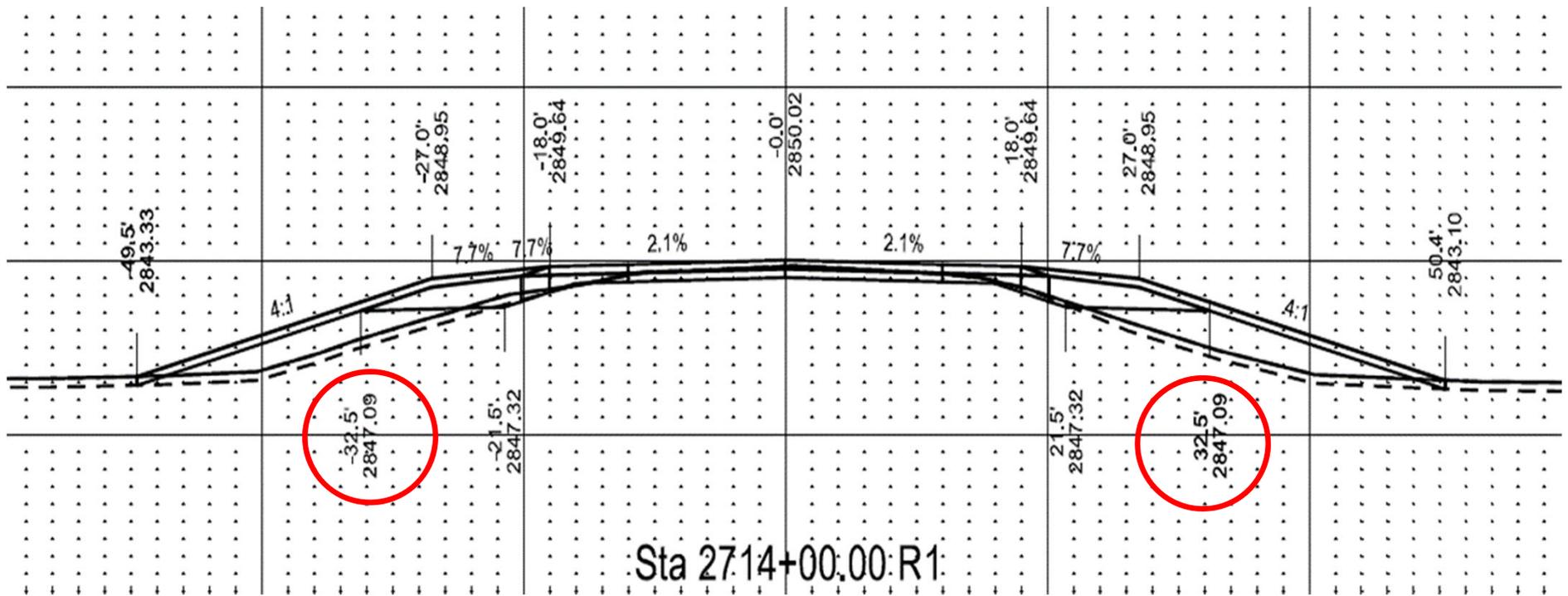


Blue Top Report from TBC



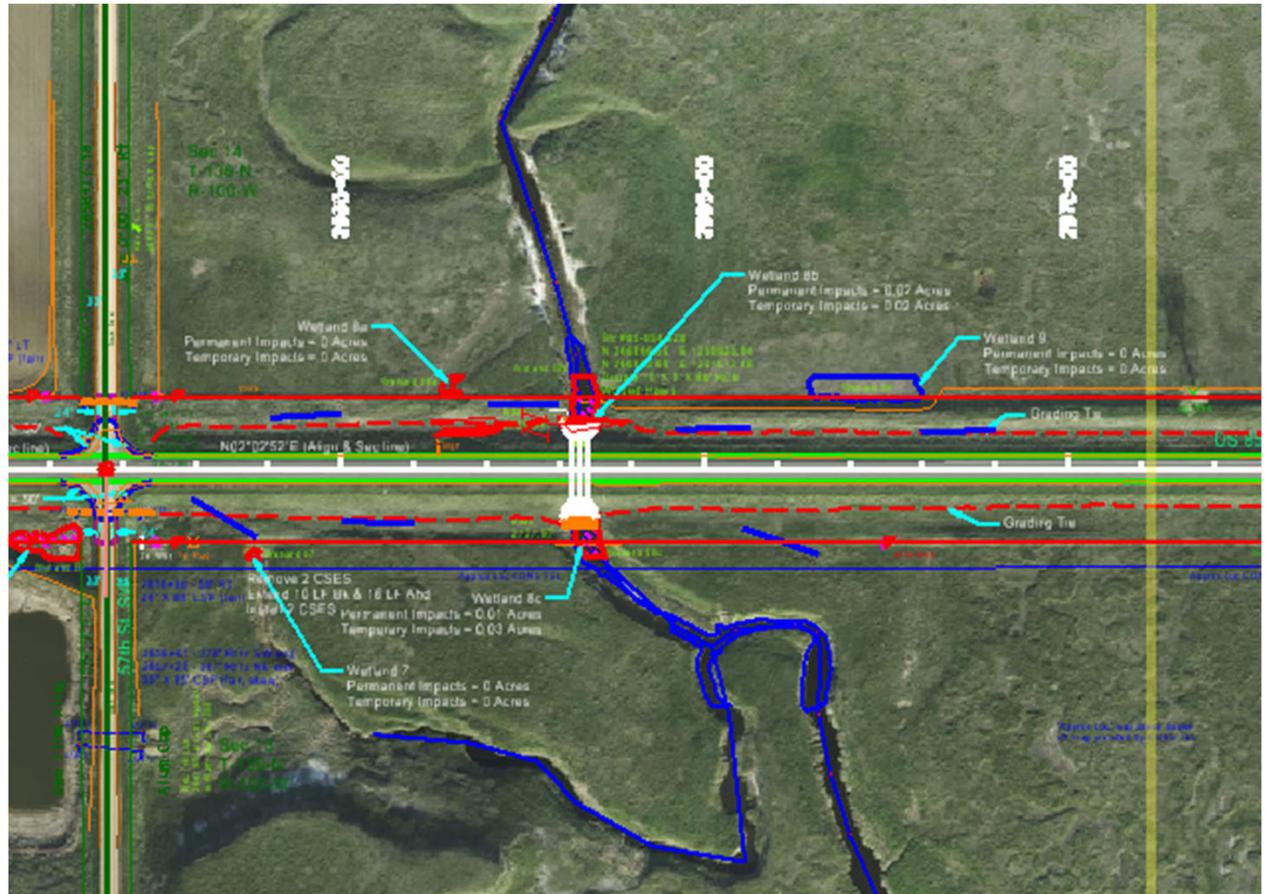
Station (ft)	Point ID	Offset (ft)	Elevation (ft)	Slope
2713+00.00	Triangles_DG	-50.725	2841.2577	
	Triangles_DG	-32.460	2845.8240	-1:4.0000
	Triangles_DG	-21.460	2846.0550	-2.10%
	Triangles_DG	-16.000	2847.4199	-1:4.0000
	Triangles_DG	0.000	2847.7559	-2.10%
	Triangles_DG	16.000	2847.4199	-2.10%
	Triangles_DG	21.460	2846.0550	-1:4.0000
	Triangles_DG	32.460	2845.8240	-2.10%
	Triangles_DG	49.918	2841.4595	-1:4.0000
2714+00.00	Triangles_DG	48.487	2842.8293	
	Triangles_DG	-32.460	2847.0886	-1:4.0000
	Triangles_DG	-21.460	2847.3196	-2.10%
	Triangles_DG	-16.000	2848.6845	-1:4.0000
	Triangles_DG	0.000	2849.0205	-2.10%
	Triangles_DG	16.000	2848.6845	-2.10%
	Triangles_DG	21.460	2847.3196	-1:4.0000
	Triangles_DG	32.460	2847.0886	-2.10%
	Triangles_DG	50.403	2842.6027	-1:4.0000
2715+00.00	Triangles_DG	-49.255	2843.9698	
	Triangles_DG	-32.460	2848.1687	-1:4.0000
	Triangles_DG	-21.460	2848.3997	-2.10%
	Triangles_DG	-16.000	2849.7646	-1:4.0000
	Triangles_DG	0.000	2850.1006	-2.10%
	Triangles_DG	16.000	2849.7646	-2.10%
	Triangles_DG	21.460	2848.3997	-1:4.0000
	Triangles_DG	32.460	2848.1687	-2.10%
	Triangles_DG	51.421	2843.4283	-1:4.0000

Cross Section Labels

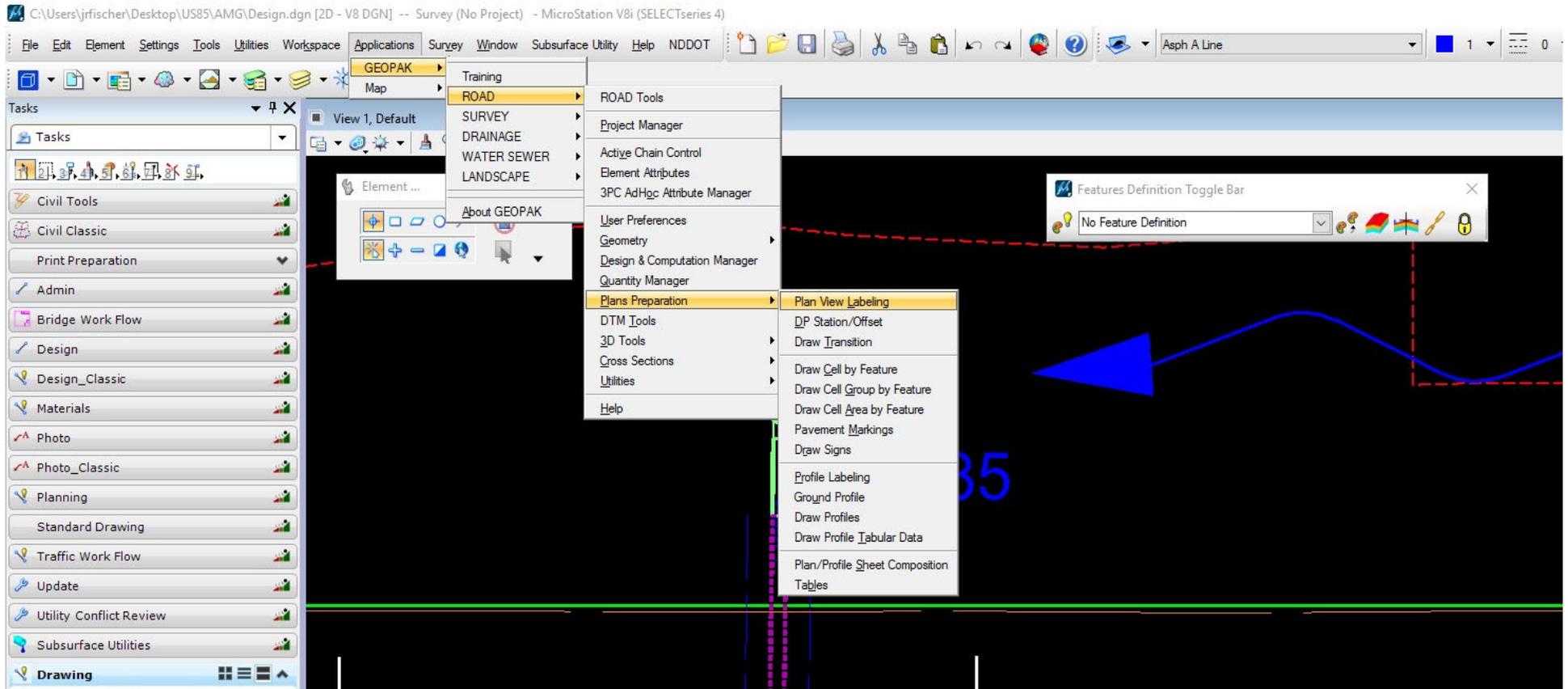


.dgn Files

- CONTROL.dgn
- Design.dgn
- DS_Align.dgn
- profile.dgn
- RDM_US85.dgn
- RW_bndy.dgn
- Terrain_Exst.dgn
- TOPOG.dgn

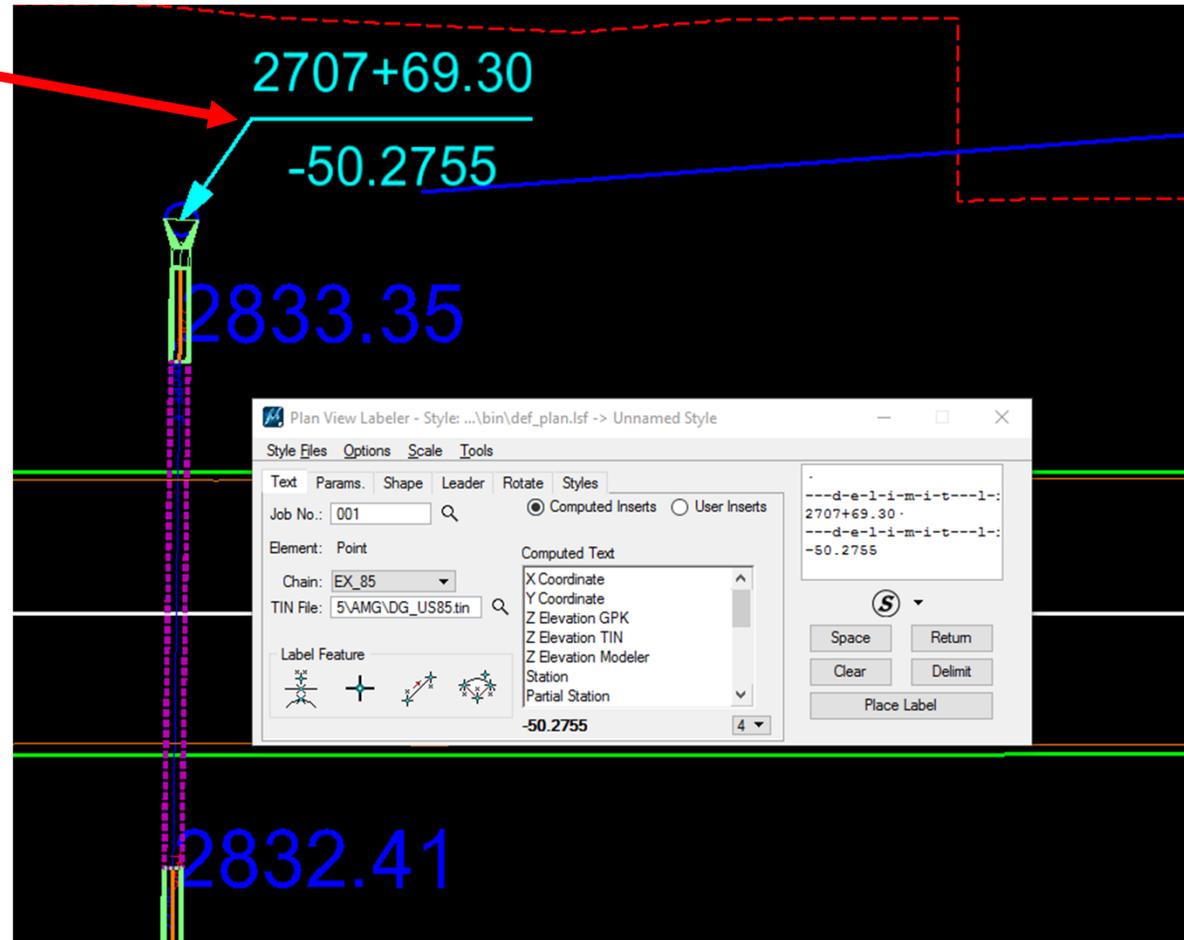


Plan View Labeling



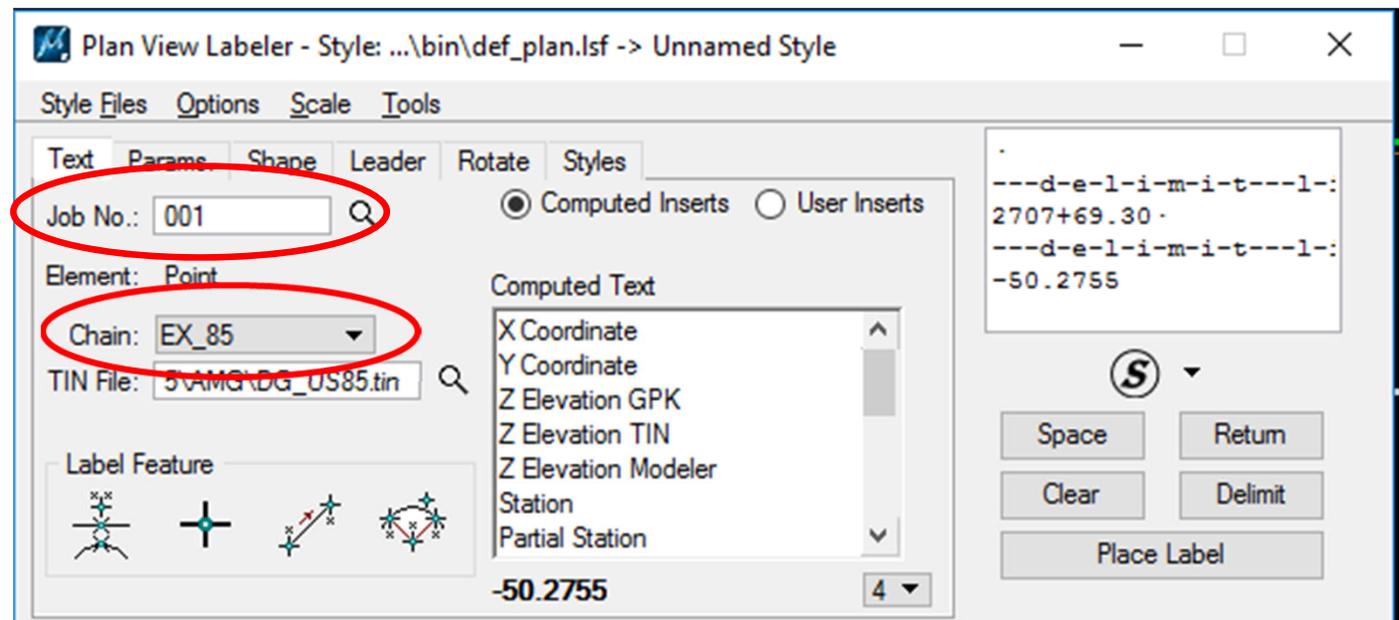
Plan View Labeling

Station and Offset of pipe end

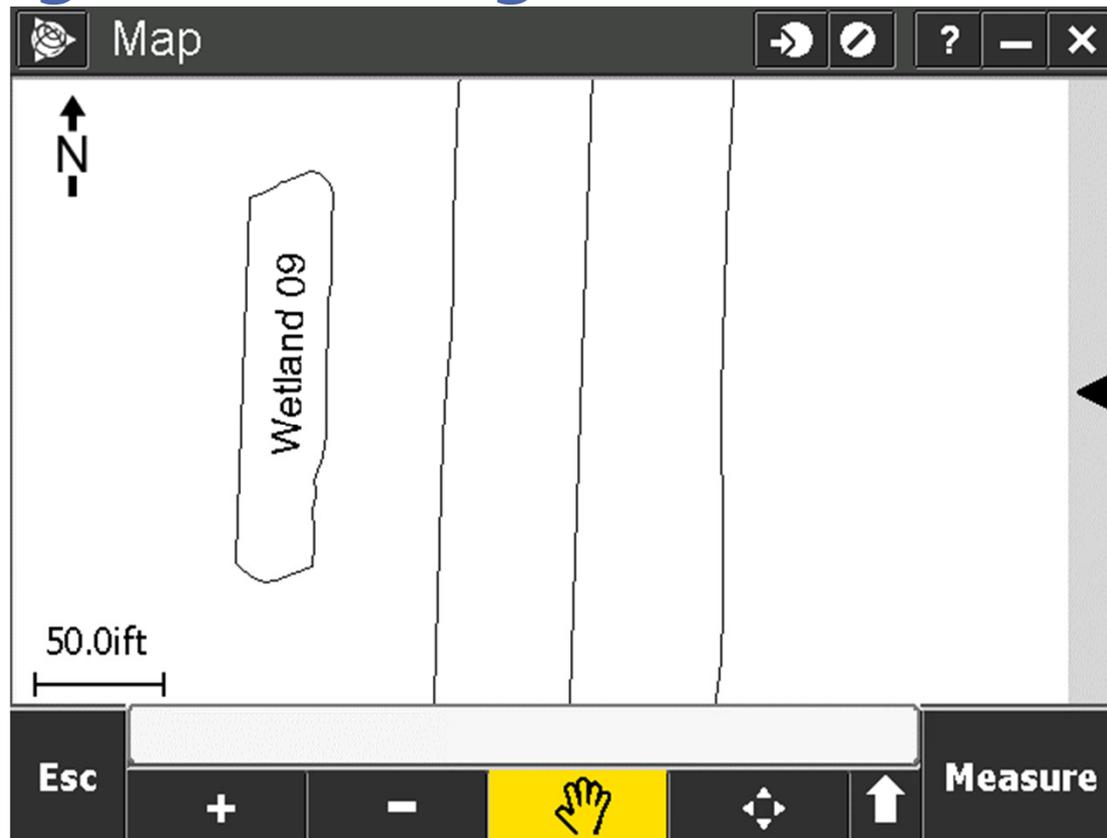


- Need the .gpk file which contains alignment
- Need to select chain that has the stationing you want to reference
- If you want elevation you can load one of the .tin files provide in the SDD

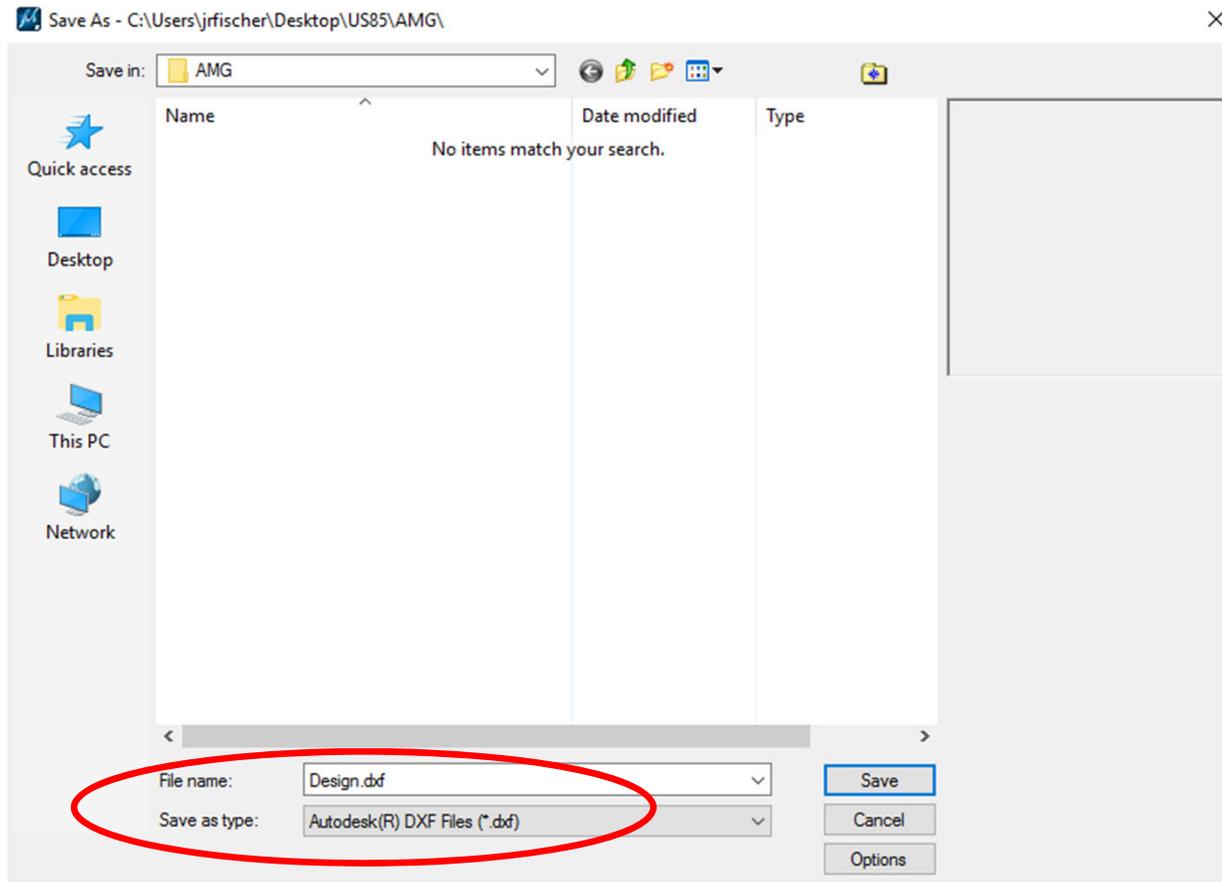
Plan View Labeling



Background Images for Data Collector



Background Images



Automated Machine Guidance (AMG)



Contractor Benefits

- Increased Productivity
- Reduction in labor
- Material savings
- Safety
- Reduction in survey cost
- Increased Accuracy
- Reduction in Fuel
- Daily As-Builts



Changing Role of Surveyor

- Establishes horizontal and vertical project control
- Data management
- Acquires and validates DTM
- Set Fewer Stakes
- Performs and Documents Check Shot
- Verifies Grades

Changing Role of the Inspector

- Performs field work with less support from surveyors
- Checks constructed elements for grade, alignment, or width with fewer stakes available
- Needs additional technology to check stake-less construction



Field Verification is Key

- Discuss what you want done
- Check shots – Contractor and Engineer
- Final Documentation
- GPS Signal During Finishing
- Work together
- A few stakes doesn't hurt



Survey Committee & Training

- Survey committee meetings and topics
- Help guides and survey guidance in O:\22 Committees Meetings\Survey Committee
- Talk to each other
- Submit topics and request training to survey committee
- Don't be afraid to ask questions and try things
- Share the information you have with others

- Jason Fischer, P.E.
- Dickinson District
- jrfischer@nd.gov

LOONEY TUNES



"That's all Folks!"