



# TRANSPORTATION SYMPOSIUM

2019

## Automated Machine Guidance (AMG) 3D Pilot Projects

Steven Buck and Jason Christopher

# AMG

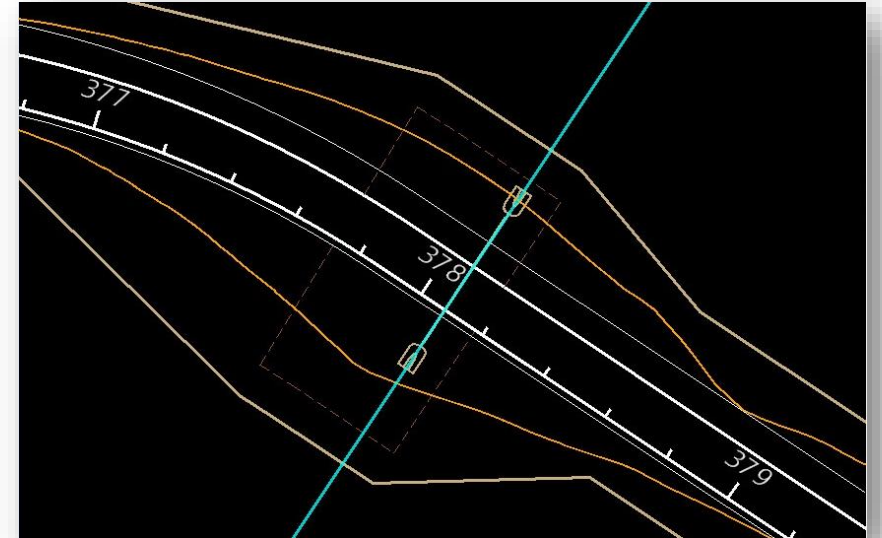
## CONSTRUCTION



Photo Courtesy of FHWA

VS.

## DESIGN

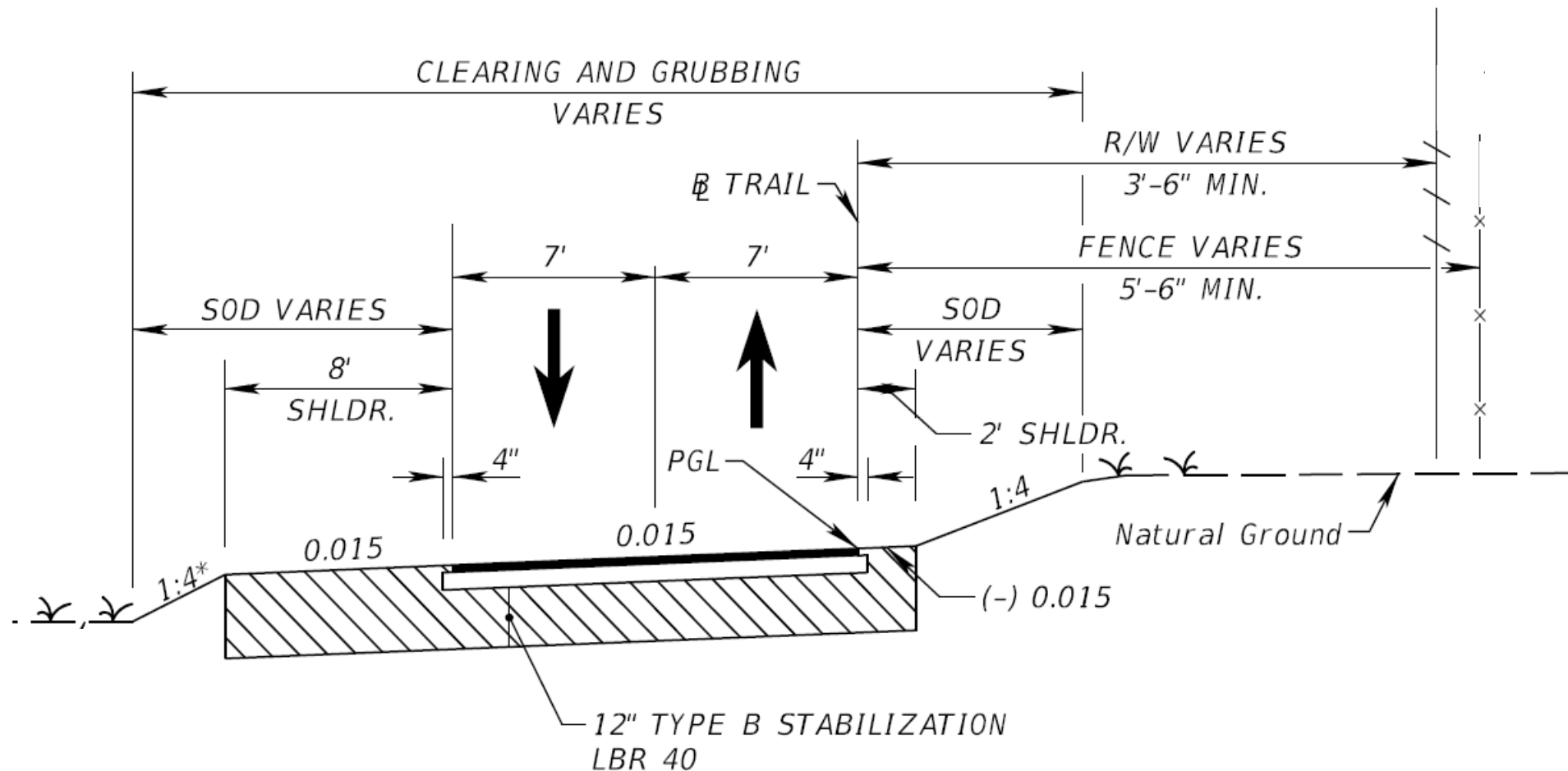


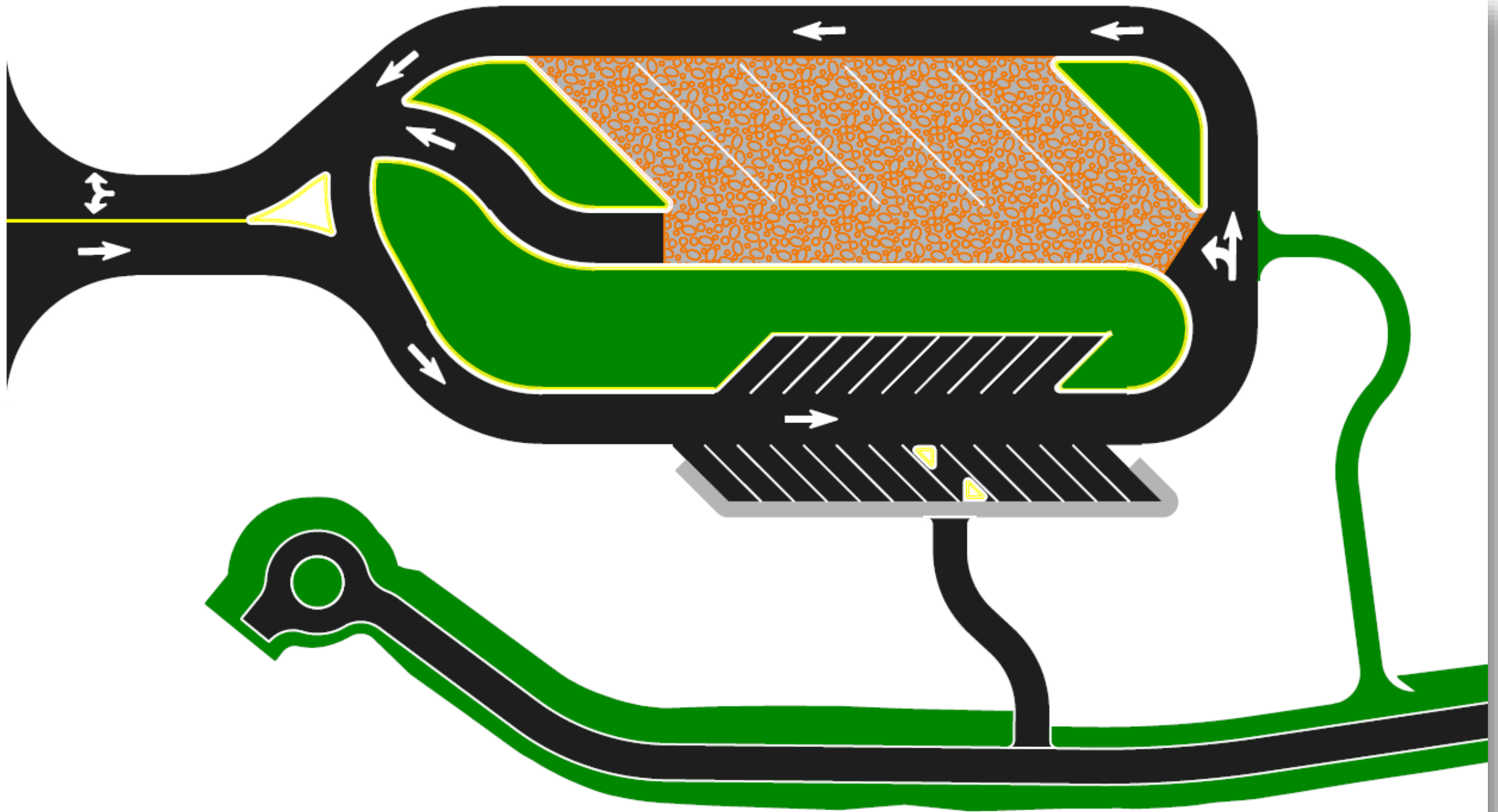
# CHANGING THE MINDSET

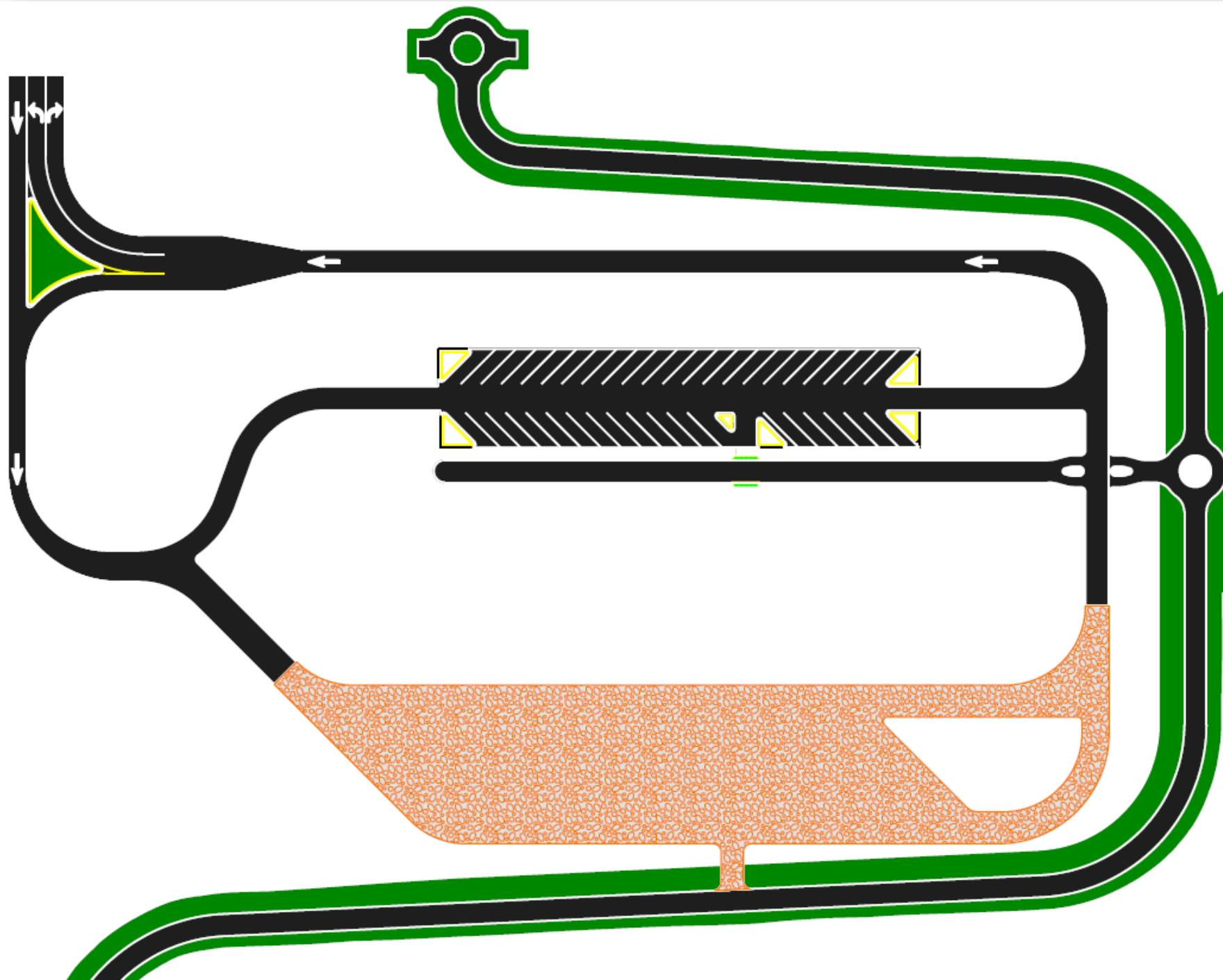
PLANS PRODUCTION  
=  
DATA PRODUCTION

# D5 Pilot Project

- New construction of a 3.5 mile long trail







# Goal #1

SIGNED & SEALED  
3D MODEL FOR AMG  
CONSTRUCTION

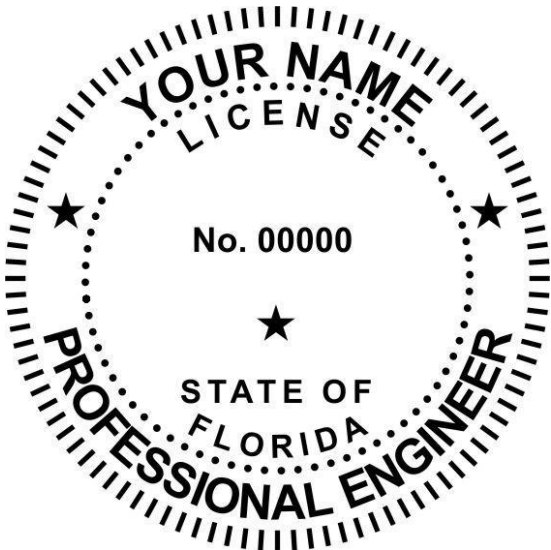
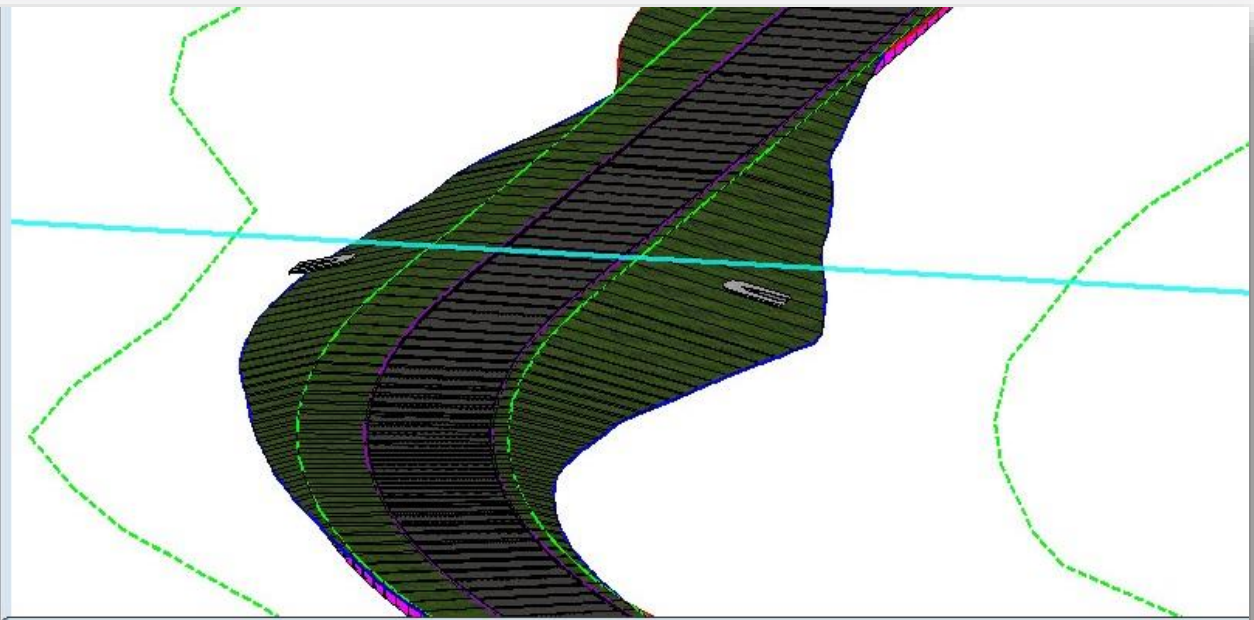
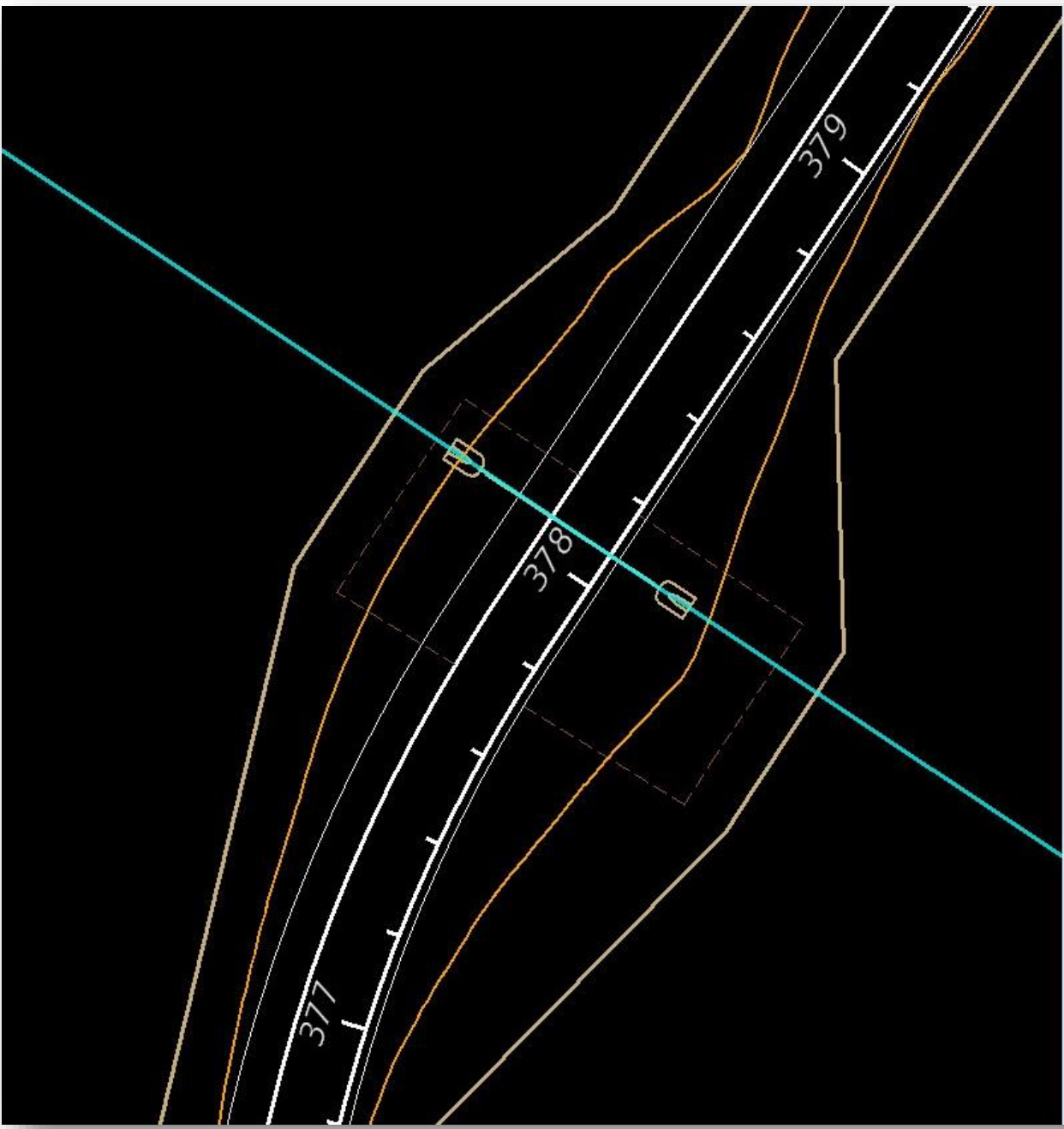


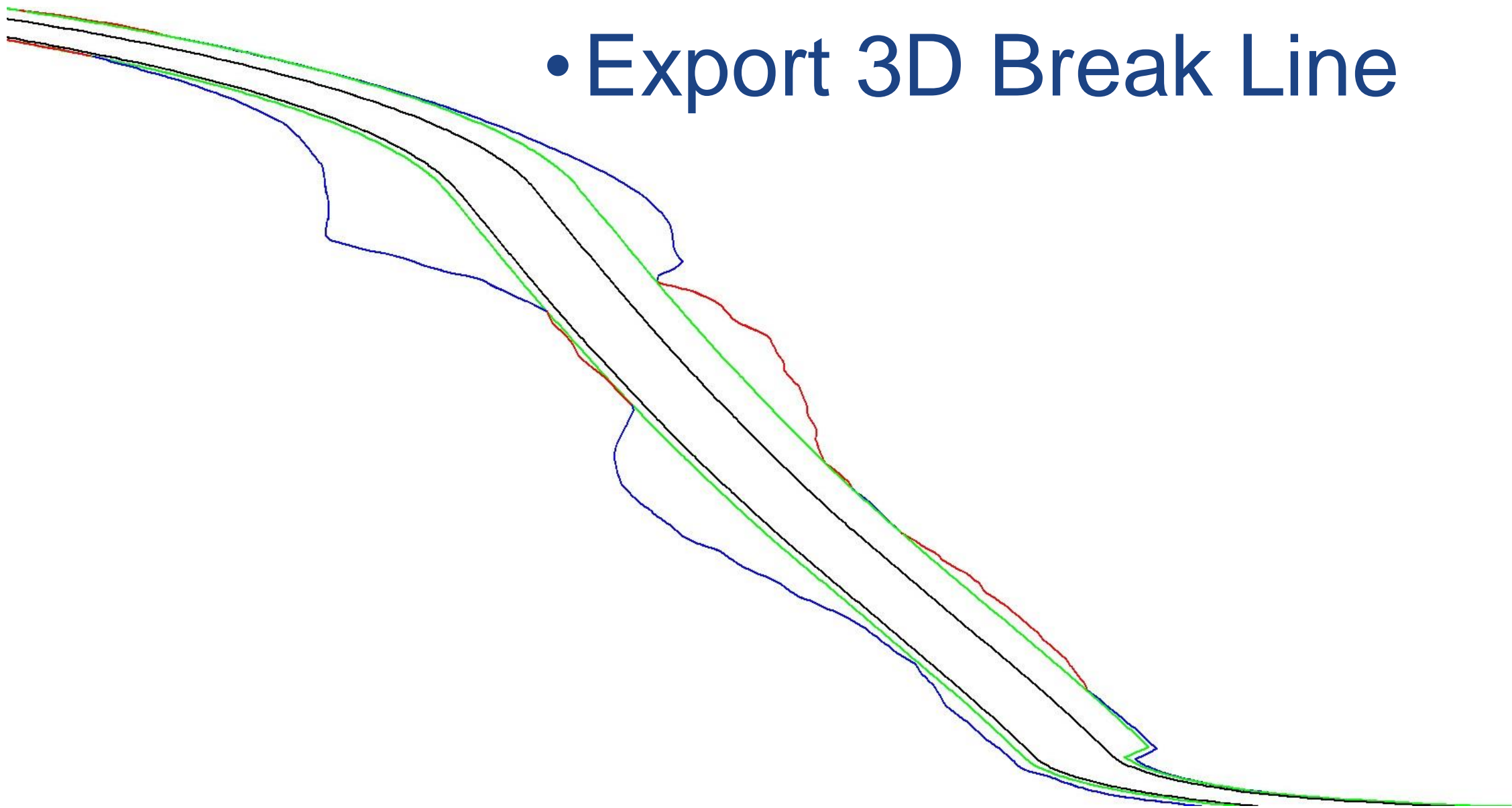
Photo Courtesy of ProStamps



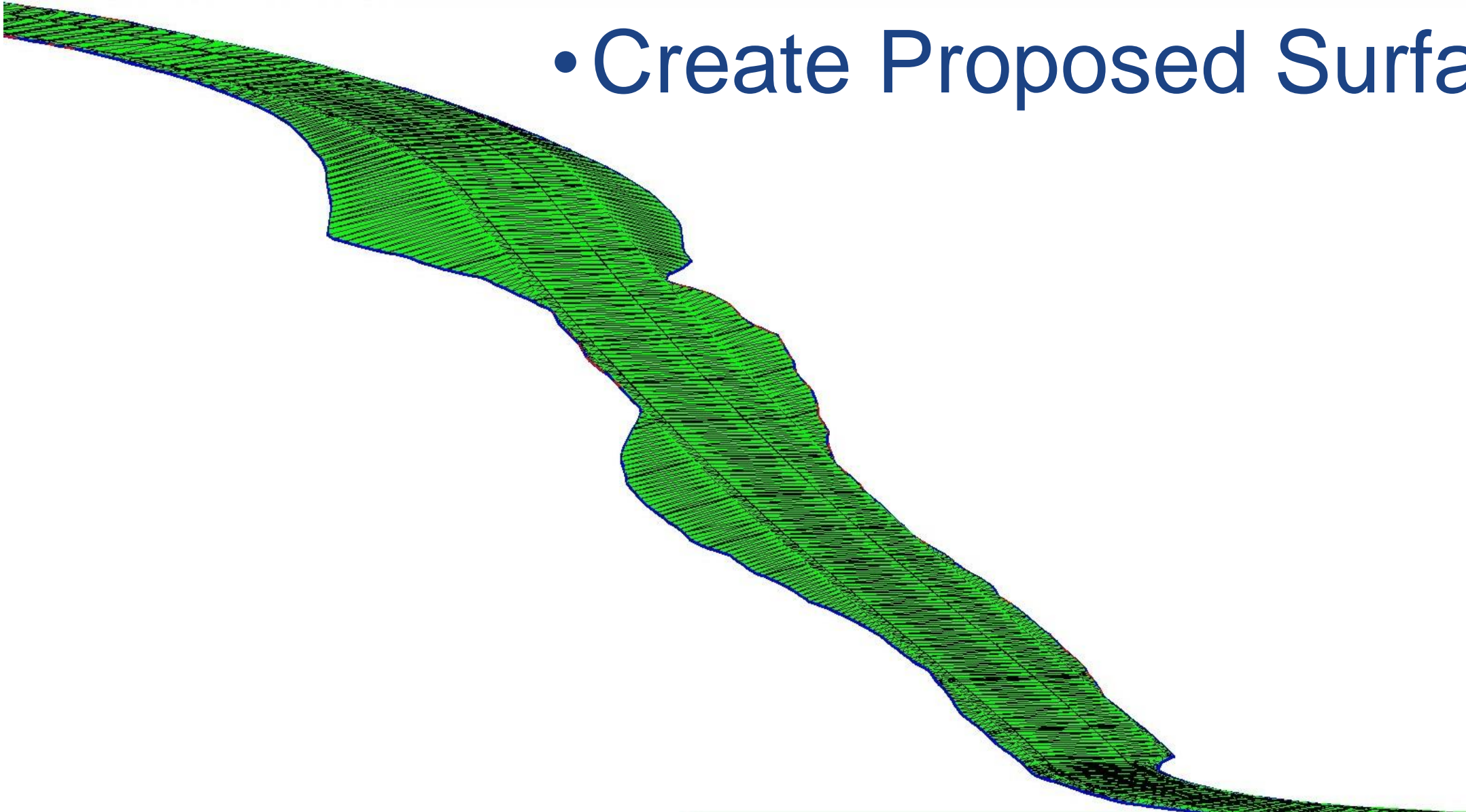




- Export 3D Break Line

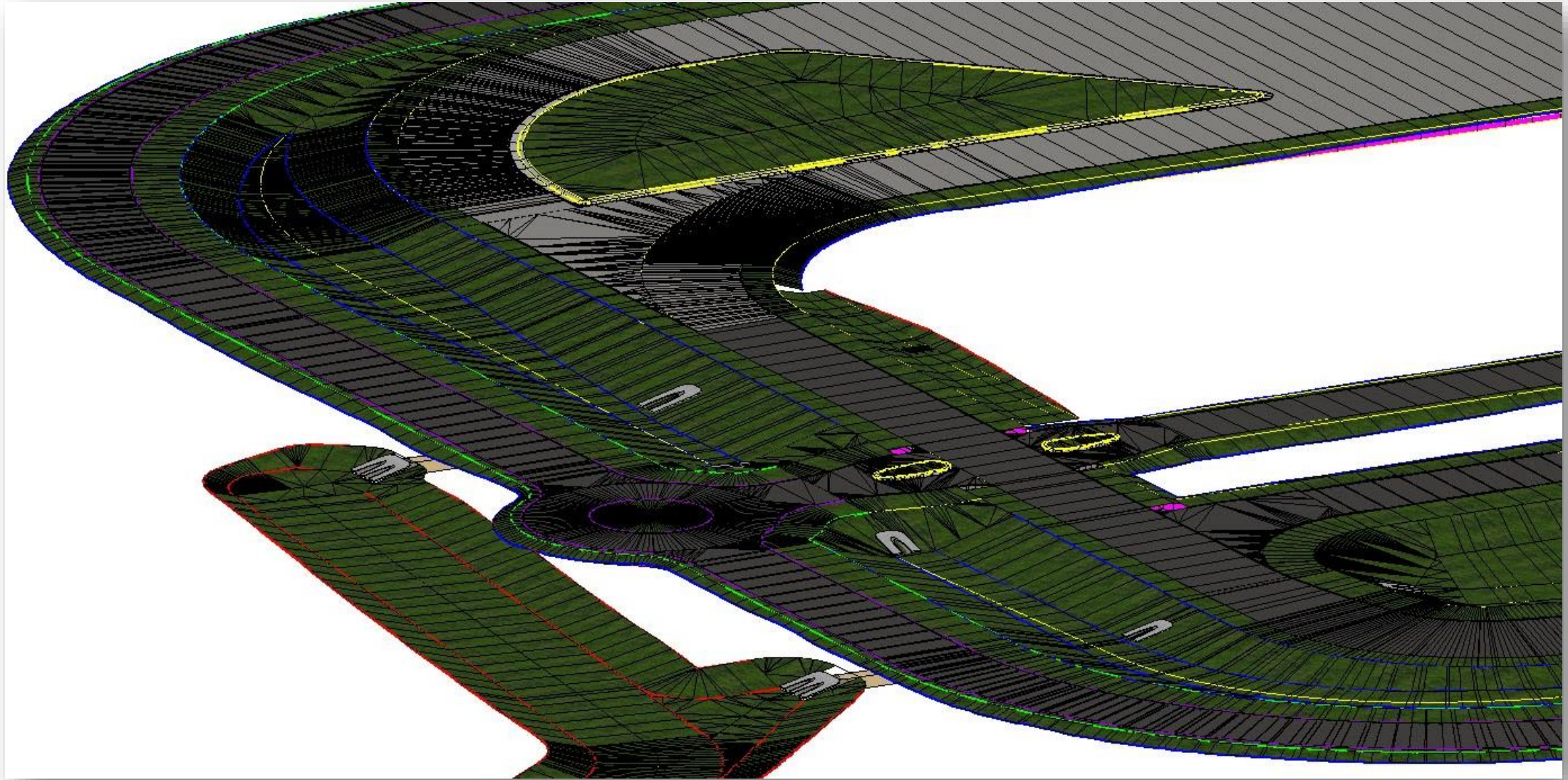


- Create Proposed Surface





# Contractor Input



# Contractor Input

- Gaps in the model = problems
- Need enough detail to construct

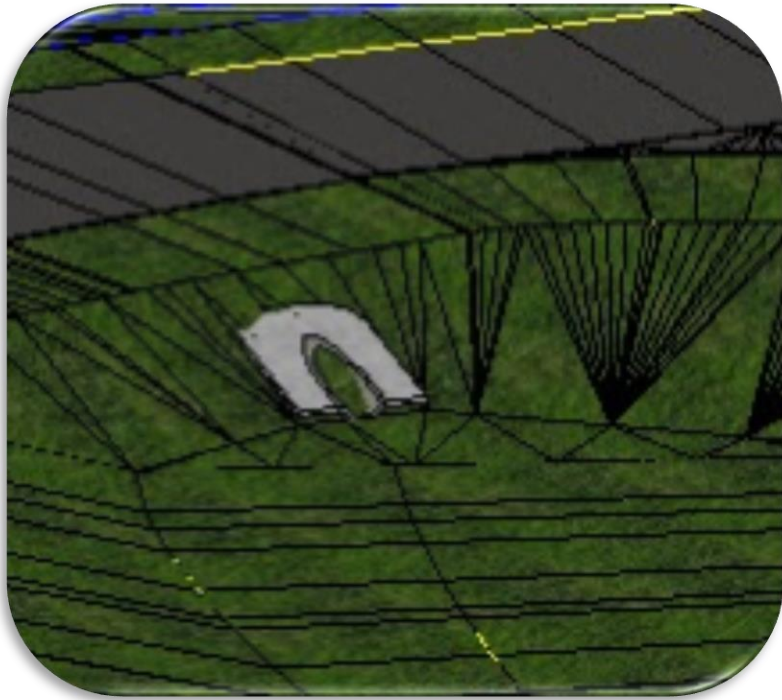
# Goal #1

## HOW IS THIS DIFFERENT?

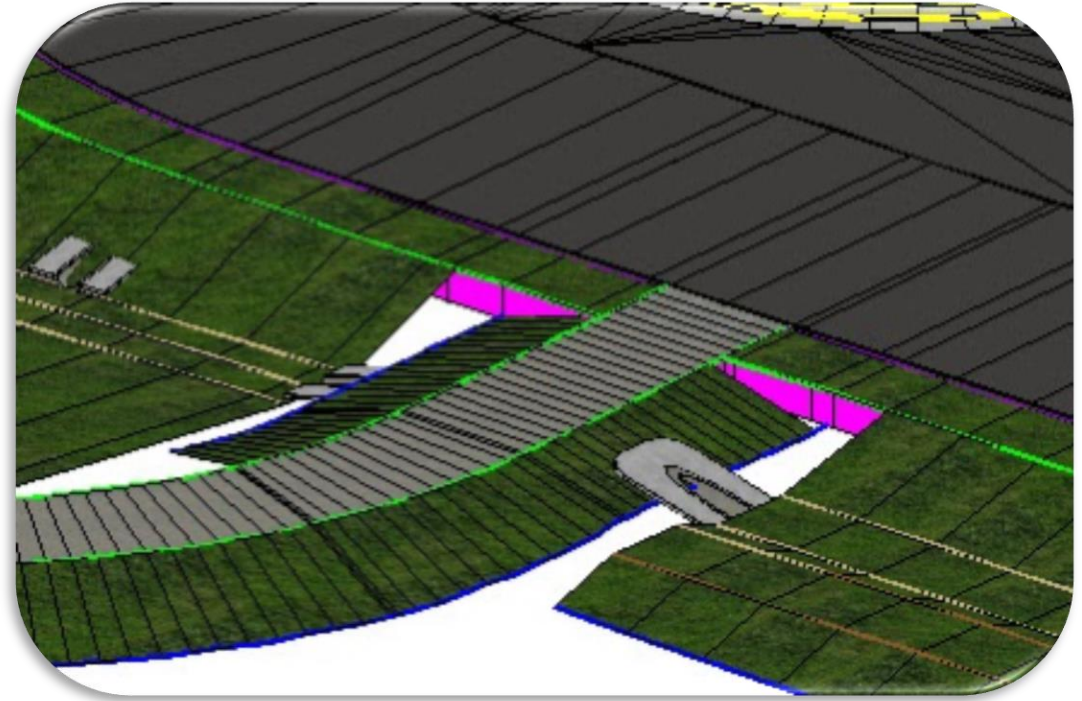
- More detail modeling
- Additional QC of model
- Locking the model file
  - 3D sign and seal



# How much detail?



OR



# Goal #2

## NexGen PLANS DATA PRODUCTION

# INDEX OF ROADWAY PLANS

SHEET NO.	SHEET DESCRIPTION
1	KEY SHEET
2	SIGNATURE SHEET
<del>3</del>	<del>SUMMARY OF PAY ITEMS</del>
4-7	TYPICAL SECTIONS
8	OPTIONAL MATERIALS TABULATION
9	SUMMARY OF DRAINAGE STRUCTURES
<del>10</del>	<del>PROJECT LAYOUT</del>
<del>11</del>	<del>CURVE AND COORDINATE DATA SHEET</del>
12	GENERAL NOTES
<del>13-24</del>	<del>TRAIL PLAN PROFILE SHEETS</del>
<del>25-30</del>	<del>DETAIL SHEETS</del>
<del>31-36</del>	<del>GRADING SHEETS</del>
37-38	DRAINAGE STRUCTURES
<del>39</del>	<del>SOUTH TRAILHEAD CROSS SECTION PATTERN SHEET</del>
<del>40-46</del>	<del>SOUTH TRAILHEAD CROSS SECTIONS</del>
<del>47</del>	<del>NORTH TRAILHEAD CROSS SECTION PATTERN SHEET</del>
<del>48-66</del>	<del>NORTH TRAILHEAD CROSS SECTIONS</del>
<del>67</del>	<del>TRAIL CROSS SECTION PATTERN SHEET</del>
<del>68-89</del>	<del>TRAIL CROSS SECTIONS</del>
90-92	STORMWATER POLLUTION PREVENTION PLAN
<del>93</del>	<del>TRAFFIC CONTROL PLAN GENERAL NOTES</del>
CTL-1	PROJECT NETWORK CONTROL SHEET
GR-1	AUGER BORING RESULTS
GR-2	TRAIL SOIL SURVEY
SQ-1 - SQ-8	SUMMARY OF QUANTITIES

# NexGen Plans

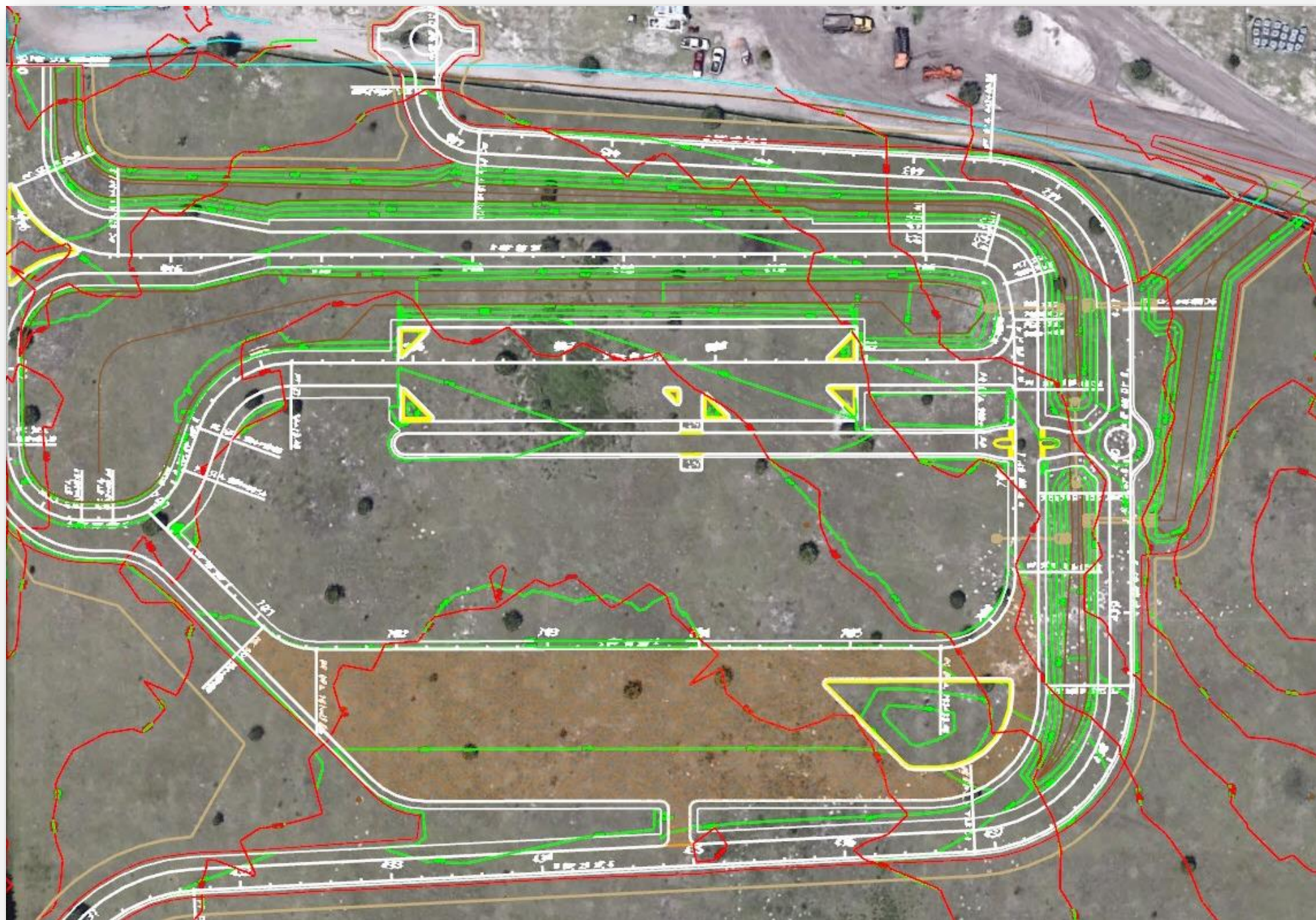
104 PLAN SHEETS  
VS.  
31 PLAN SHEETS

# NexGen Plans

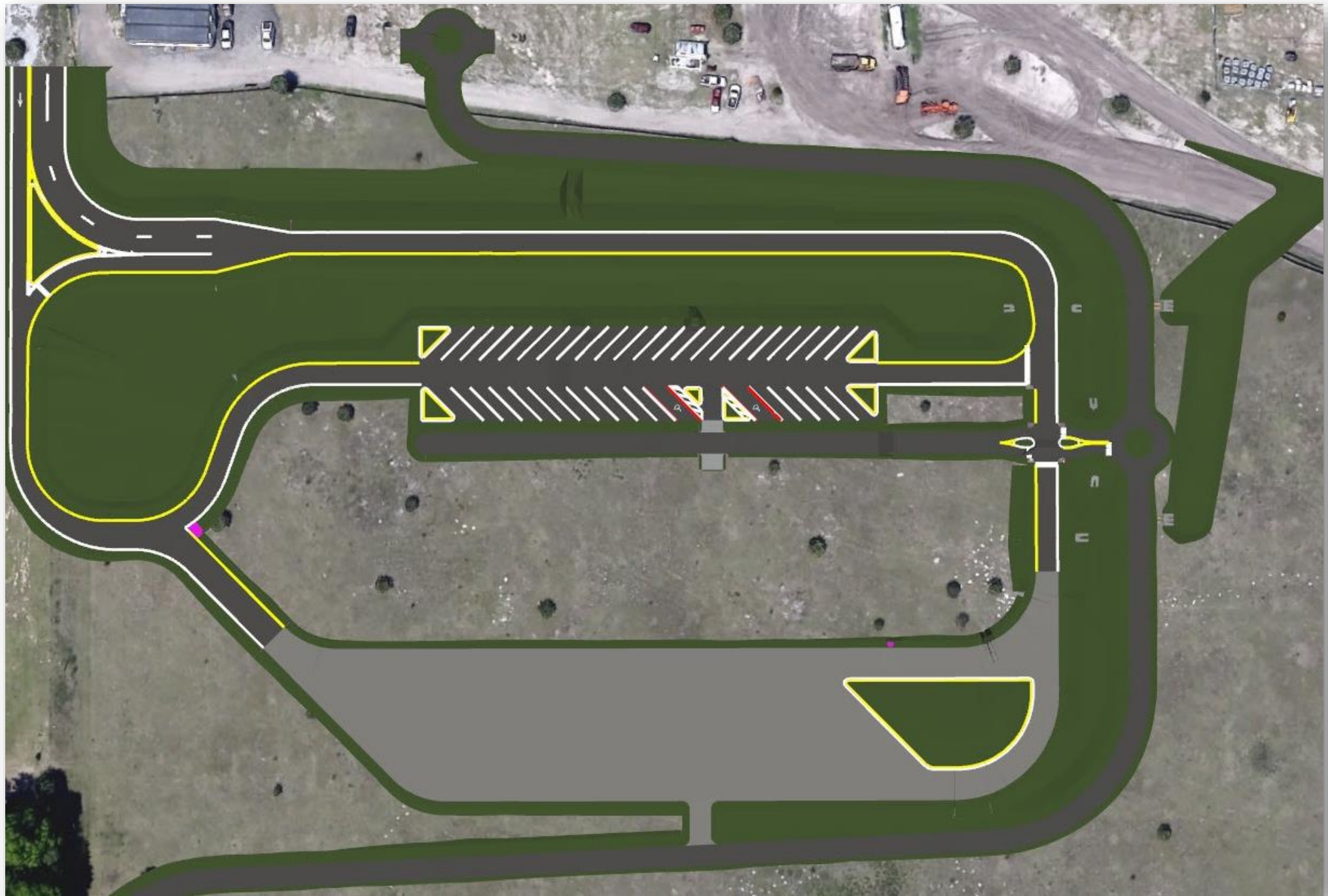
## HOW DO YOU REVIEW???

- Internal Stakeholders
- External Stakeholders













**DISTRICT FIVE - DESIGN**

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STATE OF FLORIDA  
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
TRAIL	LAKE	430975-5

**LAKE WEKIVA TRAIL**

SHEET  
NO.

01/25/2019

1:14:24 PM

C:\PenInks\430975\5203\roadans\RI\_PTRD11.DWG



# Internal Stakeholders

One on One Interviews  
Interactive Review Meetings

# External Stakeholders

FDEP



SJRWMD



St. Johns River  
Water Management District

Orange County



Lake County

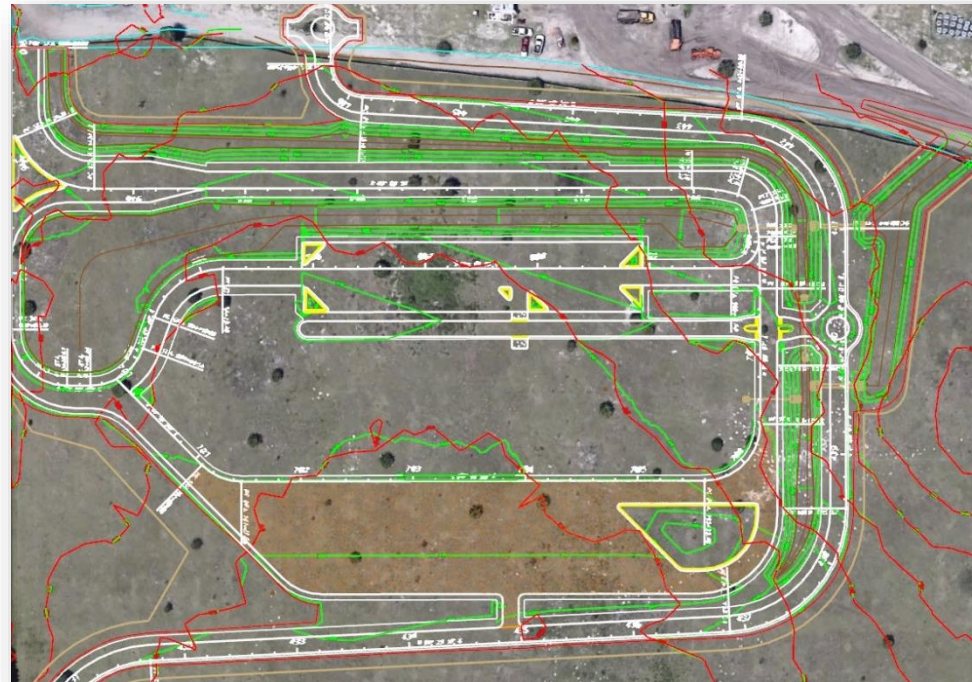


Utilities



# Permit Review

## Drainage Report NexGen Plans 2D KMZ with Contours



# Utility Review

Provided 2D CADD Files  
Received CADD/Shape Files

# Major Challenges

Changing the Mindset  
Reviews  
CEI  
Bidding

# Next Steps

DECEMBER 4<sup>TH</sup> LETTING  
CEI SOP

# Polk Parkway Resurfacing MP 0-8 (3D/AMG)

## Project Overview & Objectives



### General

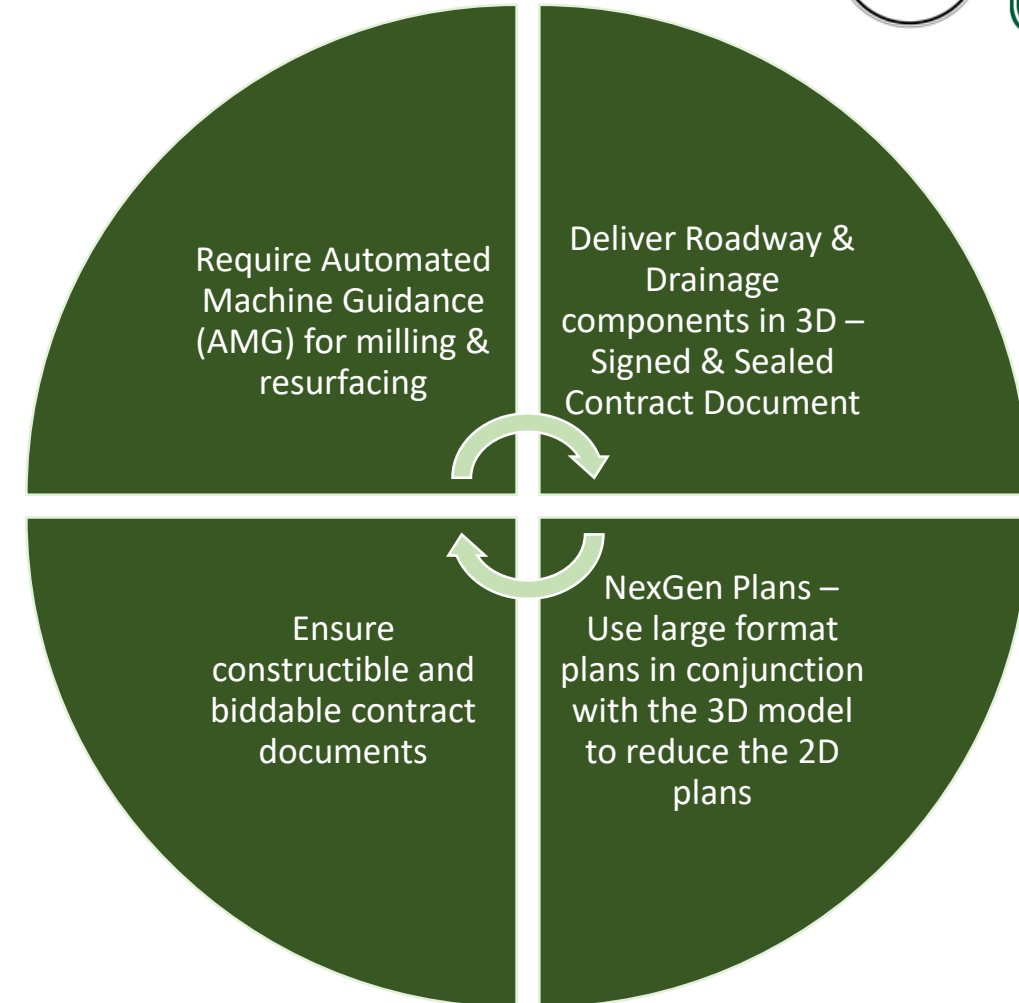
- 8 Miles of 4-lane divided urban limited access toll facility
- Multiple Interchanges
- Moderately complex geometry

### Milling & Resurfacing

- Full Depth Crack Repairs
- Cross Slope Correction

### Roadside & Safety Improvements

- Misc. Barrier
- Minor Drainage
- Traffic (S&PM, Lighting, Signals)





# Polk Parkway Resurfacing MP 0-8 (3D/AMG)

## Contract & Information Only Documents



### Sign & Seal 3D Model

- Roadway & Drainage only
- CADD/Model Files (\*.DGN)
- LandXML files (AMG Paving)

### Modified Special Provisions

- MSP 001 – Definition of “Plans”
- MSP 327 – Milling
- MSP 330 – Superpave (Resurfacing)

### Sign & Seal 2D Plans

- Temporary Traffic Control
- Structures
- Signalization
- S&PM/Lighting (Large Format)

### 2D “For Information Only” Plans

- Roadway Large Format
  - Project Layout
  - Roadway/Drainage
  - Cross Sections (Review Only)
- S&PM/Lighting Large Format
  - Combined S&PM & Lighting

### Removed from 2D Plans

- Summary of Pay Items
- Curve & Coordinate Data Sheets
- Roadway/Drainage Plan Sheets
- Roadway Cross Sections
- Drainage Structures Sheets

# Polk Parkway Resurfacing MP 0-8 (3D/AMG)

## Approach to Managing Risk



Obtained approval for objectives from Central Office and Turnpike Leadership

Held multiple Construction and CEI Industry Forums

Created a "Plans-Data Production Cross-Walk" to track changes

Created traditional drainage structure sheets for UAO coordination only

Held multiple Project Delivery Workshops with Department & Consultant Stakeholders

Held multiple 3D Model Review Workshops for Phase Submittal ERC Reviews

Created NexGen Plans – Large Format Plans where practical

Coordinated with Central Office for Modified Special Provisions, NexGen Plans, 3D model technical support and state of the practice inquiries

# Polk Parkway Resurfacing MP 0-8 (3D/AMG)

## Plan-Data Cross Walk



Item Description	Traditional Format	S&S?	Proposed Format	S&S?	Comments
<b>Roadway Plans</b>					
Key Sheet	11x17	Y	11x17	Y	Follows FDM and TDH
Signature Sheet	11X17	Y	11x17	Y	Follows FDM and TDH, with "FIO" sheets noted
Summary of Pay Items	11X17	Y	Letter	N	Include in bid package separate from plans
Typical Sections	11X17	Y	11x17	Y	These will be S&S since no useful solution could be found to include the information in the 3D model.
Typical Section Details	11X17	Y	11x17	Y	These will be S&S since no useful solution could be found to include the information in the 3D model.
Summary of Drainage Structures	11X17	Y	11x17	Y	Follows FDM and TDH, with the addition of invert and top elevations in the table.
Optional Materials Tabulation	11X17	Y	11x17	Y	Follows FDM and TDH
General Notes	11X17	Y	11x17	Y	Follows FDM and TDH
Project Layout	11X17	Y	Roll plot	N	Only information provided is stationing, PC/PT/PI locations, bearings, begin/end project, and identification of roadway roll plot limits; station equations and curve data will not be provided since this information can be pulled from the S&S 3D model.
Coordinate & Curve Data	11X17	Y	None	N/A	Information traditionally provided on these sheets can be pulled directly from S&S 3D model
Roadway Plan	11X17	Y	Roll plots	N	All proposed design elements are shown and labeled. For bidding assistance, begin/end station labels and other proposed geometry will be included on the roll plot.
Plan Labels	On the sheet	Y	Model metadata	Y	Information traditionally provided in plan labels will be provided within the intelligence of the 3D design elements, in the form of metadata that can be read from the 3D model
Drainage Structures	11X17	Y	In 3D model	Y	All information needed for construction (grate/top/inlet elevations, invert elevations, pipe size, etc.) provided as metadata in the 3D model. The same information is also provided in the Summary of Drainage Structures.
Cross Section Pattern	11X17	Y	None	N/A	Not needed
Cross Sections	11X17	Y	Roll plots	N	Include in reviews through design, remove from contract set
SWPPP	11X17	Y	11x17	Y	Follows FDM and TDH
Erosion Control Details	11X17	Y	11x17	Y	Follows FDM and TDH
TTC General Notes	11X17	Y	11x17	Y	Follows FDM and TDH
TTC Phase Typical	11X17	Y	11x17	Y	Follows FDM and TDH
TTC Details	11X17	Y	11x17	Y	Follows FDM and TDH
TTC Detours	11X17	Y	11x17	Y	Follows FDM and TDH
Utility Adjustments	11X17	Y	Roll plots	N	Follows FDM and TDH, provided on roadway roll plots
Structures Details	11X17	Y	11x17	Y	Follows FDM and TDH
Summary of Quantities	11X17	Y	11x17	Y	Follows FDM and TDH
3D Model	DGN/XML	N	DGN/XML	Y	

Item Description	Traditional Format	S&S?	Proposed Format	S&S?	Comments
<b>SAPM Plans</b>					
Key Sheet	11x17	Y	11x17	Y	Follows FDM and TDH
Signature Sheet	11X17	Y	11x17	Y	Follows FDM and TDH
Tabulation of Quantities	11X17	Y	11x17	Y	Follows FDM and TDH
General Notes	11X17	Y	11x17	Y	Follows FDM and TDH
Plan Sheets	11X17	Y	Roll plots	Y	Other than being laid out on roll plots, the information provided will follow FDM and TDH requirements
Guide Sign Worksheets	11X17	Y	11x17	Y	Follows FDM and TDH
Cross Sections	11X17	Y	11x17	Y	Follows FDM and TDH
Special Details	11X17	Y	11x17	Y	Follows FDM and TDH
<b>Signalization Plans</b>					
Key Sheet	11x17	Y	11x17	Y	Follows FDM and TDH
Signature Sheet	11X17	Y	11x17	Y	Follows FDM and TDH
Tabulation of Quantities	11X17	Y	11x17	Y	Follows FDM and TDH
General Notes	11X17	Y	11x17	Y	Follows FDM and TDH
Plan Sheets	11X17	Y	11x17	Y	Follows FDM and TDH
Guide Sign Worksheets	11X17	Y	11x17	Y	Follows FDM and TDH
Cross Sections	11X17	Y	11x17	Y	Follows FDM and TDH
Special Details	11X17	Y	11x17	Y	Follows FDM and TDH
Mast Arm Tabulation Sheet	11X17	Y	11x17	Y	Follows FDM and TDH
<b>Lighting Plans (included in SAPM set)</b>					
Tabulation of Quantities	11X17	Y	11x17	Y	Follows FDM and TDH
General Notes	11X17	Y	11x17	Y	Follows FDM and TDH
Pole Data	11X17	Y	11x17	Y	Follows FDM and TDH
Service Point Details	11X17	Y	11x17	Y	Follows FDM and TDH
Plan Sheets	11X17	Y	Roll plots	Y	Other than being laid out on roll plots, the information provided will follow FDM and TDH requirements
Special Details	11X17	Y	11x17	Y	Follows FDM and TDH

# Polk Parkway Resurfacing MP 0-8 (3D/AMG)

## Project Management Considerations



Identify & define pilot project objectives and stake holders prior to selecting a candidate project. Ensure stakeholders are on board or that their issues/concerns can be mitigated.

Engage team members that are curious, interested, and passionate about 3D design delivery. Select trusted partners to come along for the ride.

Broadly scope & negotiate the staff hours – anticipate and account for unknowns and stakeholder needs to avoid adverse impacts to your Production & Letting commitments.

Schedule accordingly and anticipate additional time needed to resolve pilot project's technical issues and stake holder coordination.

3D delivery requires a significant change in work flow for Department ERC reviews and WMD/Utility coordination & reviews.

3D delivery is new and challenging. It is also exciting and manageable – Try it!

# 3D Model, AMG, and NexGen Plans

- 3D Model – Signed & Sealed Contract Document
- NexGen Plans – Large format plans with the 3D model
- Plans – Data Production Cross Walk
- Phase Submittal Reviews (different approaches)
- 3D Model Level of Detail
- CEI Scope Development (different approaches)
- Modified Special Provisions

# Challenges for Further Exploration

- 3D Model Revisions
- 3D Model As-Builts
- Data Storage and Archiving of Files
- Florida Board of Professional Engineers Rules Changes
- External Stake Holder Coordination & Acceptance
- Evolution of design and CEI scopes
- Department Phases Reviews and Reviewer Training
- Updates to Standard Specifications and Basis Estimates



# THANK YOU



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