Supporting AMG on site for QA

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U.S. Department of Transportation
Federal Highway Administration

Learning Objectives

- Discuss how a contractor's work plan can manage use of 3D models on site
- Discuss the training needs for Construction Engineers and Inspectors
- Describe the two approaches to procuring equipment and training for the owner's representatives

Overview

- General Comments
- Equipment & Training
  - Procurement Options
  - Building Competency
- Contractor’s Work Plan / Intent
- Verifying Construction Accuracy / QA
- Measurement

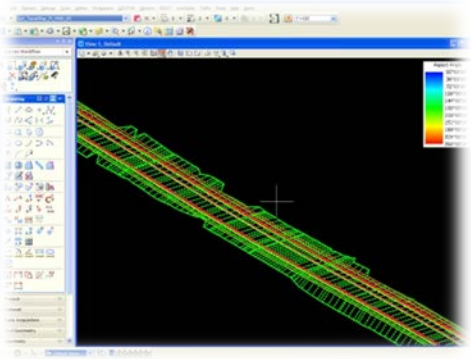
General Comments

- Enable AMG
  - Catch up
- Focus on Quality Assurance
- Utilize Modern Technology

**Look Mom,
No Strings!**

Equipment

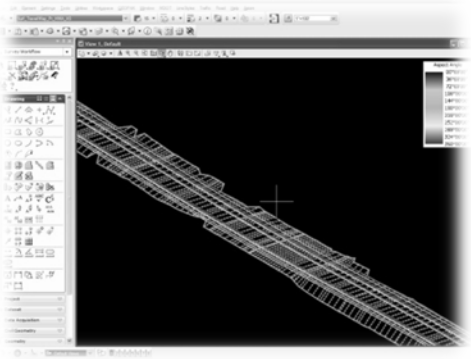
OLD



NEW

Equipment

OLD



NEW

Equipment

Equipment Considerations

- Cost vs. Benefit
- Support
- Procurement
- Training

Equipment Considerations : Cost vs. Benefit

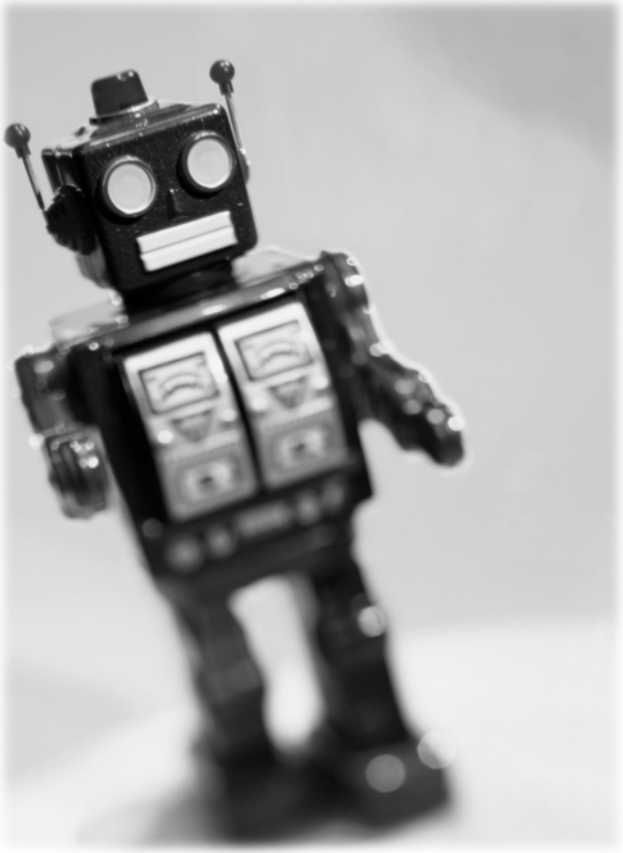
- Robotic Total Station
  - ~$20 k
- GPS Receiver / Antenna
  - ~$20k
- Controller
  - ~$4k
- Digital Level
  - ~$6k

Equipment Considerations : Support

- Hardware
- Software
- Firmware
- Connectivity

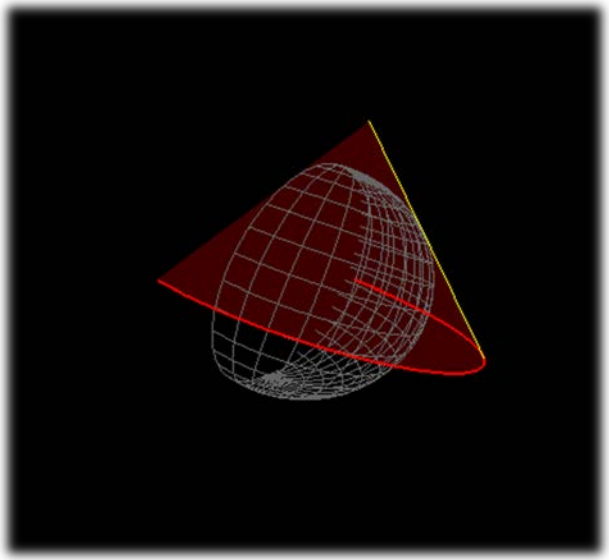
Equipment Considerations : Training

- Survey Concepts
- Plan Reading & Data
- Device Specific Concepts
- When to employ which tool
- Troubleshooting



Equipment Considerations : Training – Survey Concepts

- Fundamental Concepts
  - Train Control Freaks!
  - GPS & TPS Do's & Don'ts
  - Units of Measure
  - Coordinate Systems
  - Grid vs. Ground
  - Calculations
  - Data Use
  - Data Collection
  - Field Practices



Equipment : Procurement Options

- Agency Procured
- Contractor Procured
- Consultant

- Pros & Cons

Agency Procured Pros vs. Cons

PROS	CONS
Potential easier to standardize.	Expensive investment
Flexibility on use of equipment.	Need to manage the assets
Don’t need contract language developed.	
Implies independence & competency.	

Contractor Procured Pros vs. Cons

PROS	CONS
Less investment pain	Harder to standardize across a dept.
Contractor provided training	Stipulations on use being project related
Uniformity on a per project basis	Perception of dependence

Consultant Services Pros vs. Cons

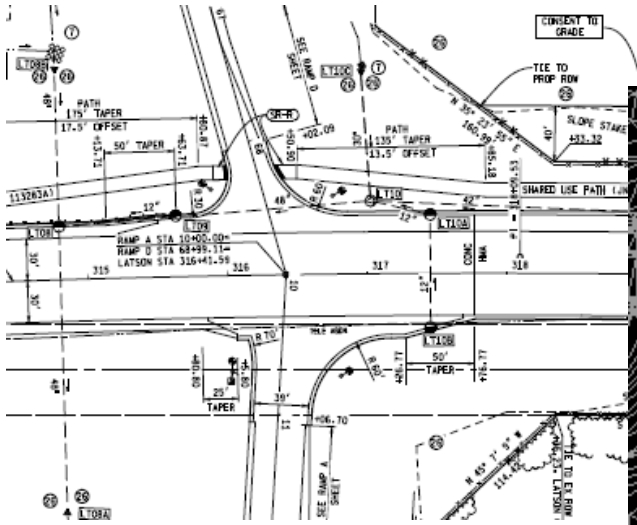
PROS	CONS
Equipped, knowledgeable provider	Does not build internal competency
Absorbed into project CE costs	Scheduling / administration burdensome
Delegation & division of tasks optimal for some projects	Costly

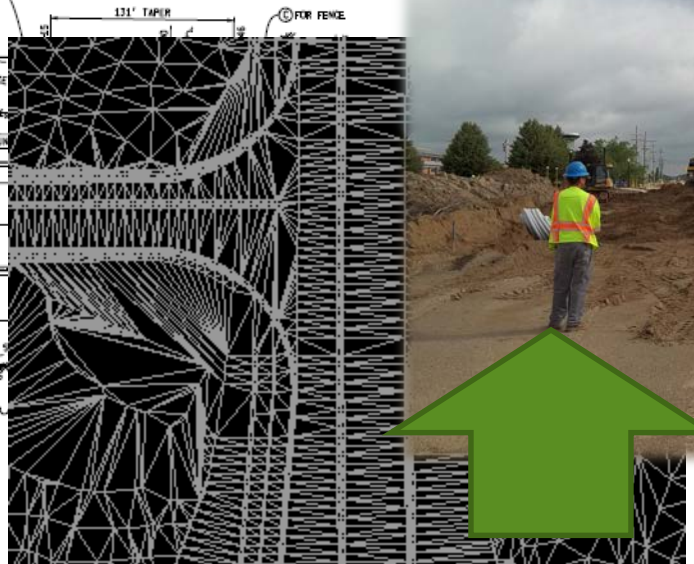
Contractor's Work Plan / Intent

- Work with Contractor's Trade Organization to develop.
- Contractor determines means & methods
- Promote Innovation
- Define Interactions
- Path to problem solving
- Provisions for revisions

Verifying Construction Accuracy / Q.A.
Office Preparations

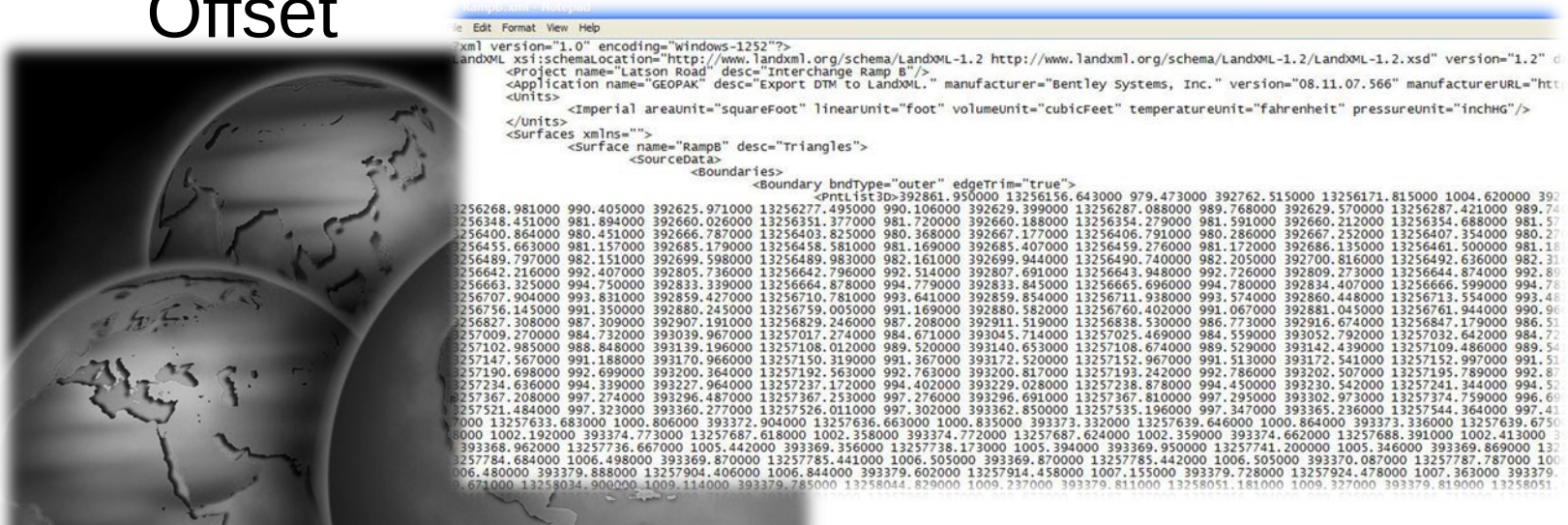
- Standardize Deliverables
- Make them accessible
- Explore opportunities for data streamlining





Core Information

- A model contains information to answer : Where do we put this project and the proposed design features contained within it?
  - Foundation : NSRS Language : Station Offset



Which enables :

- A direct import of all project alignments to roading software on a survey device (MS Field Genius) in seconds!

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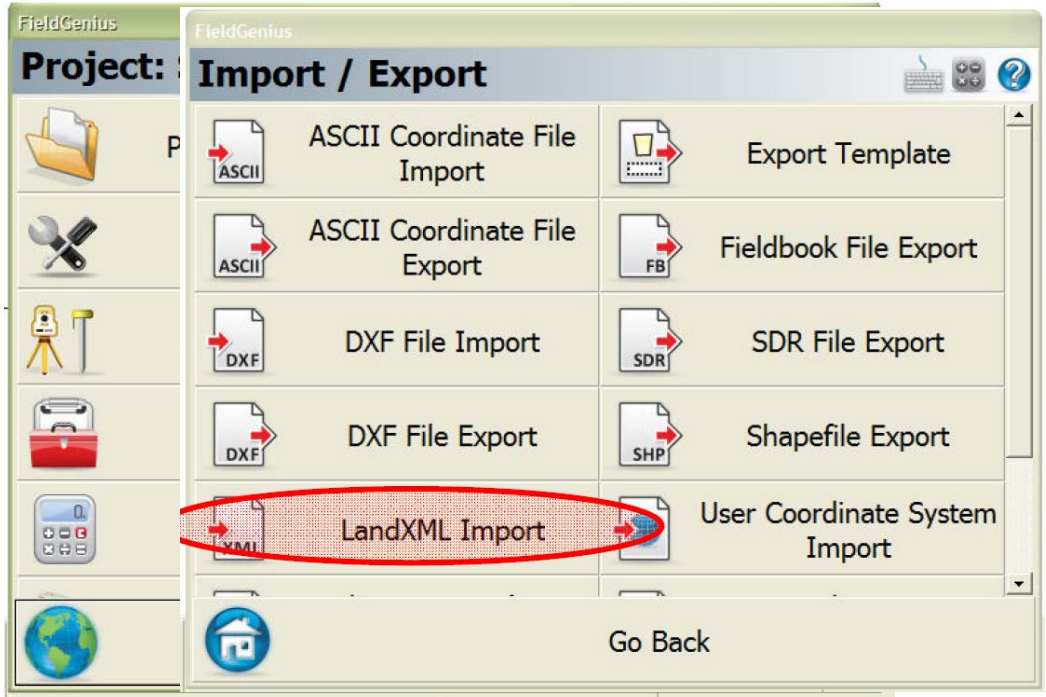

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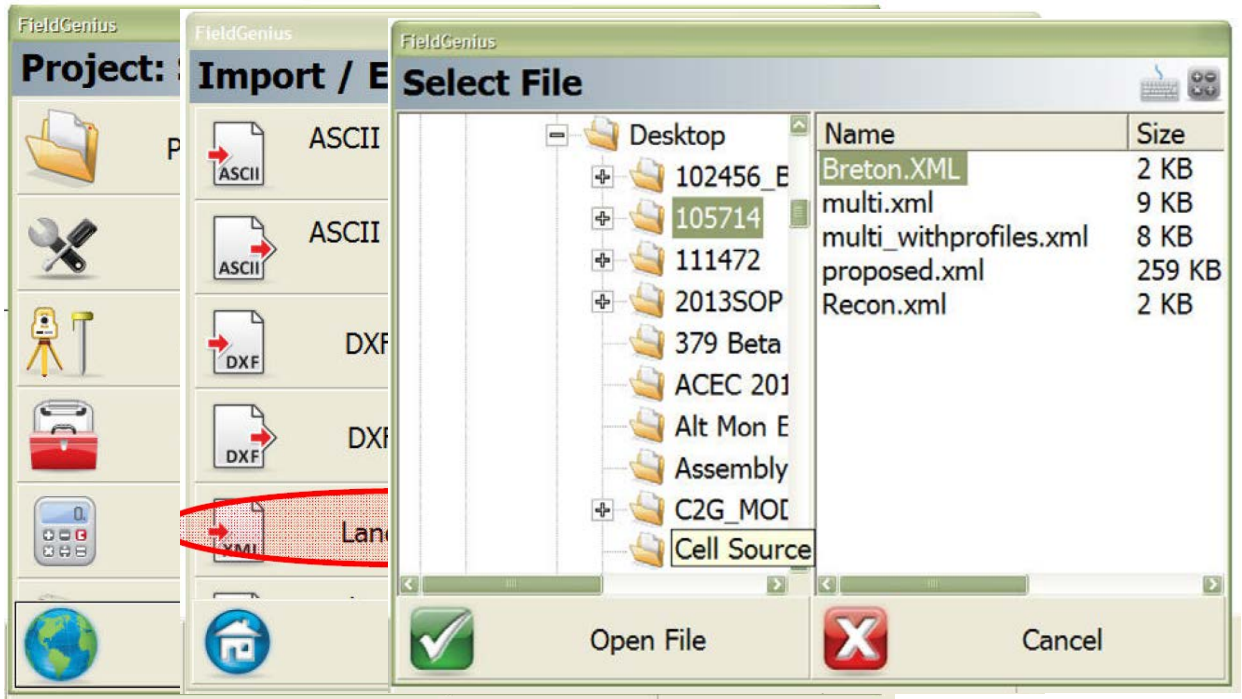

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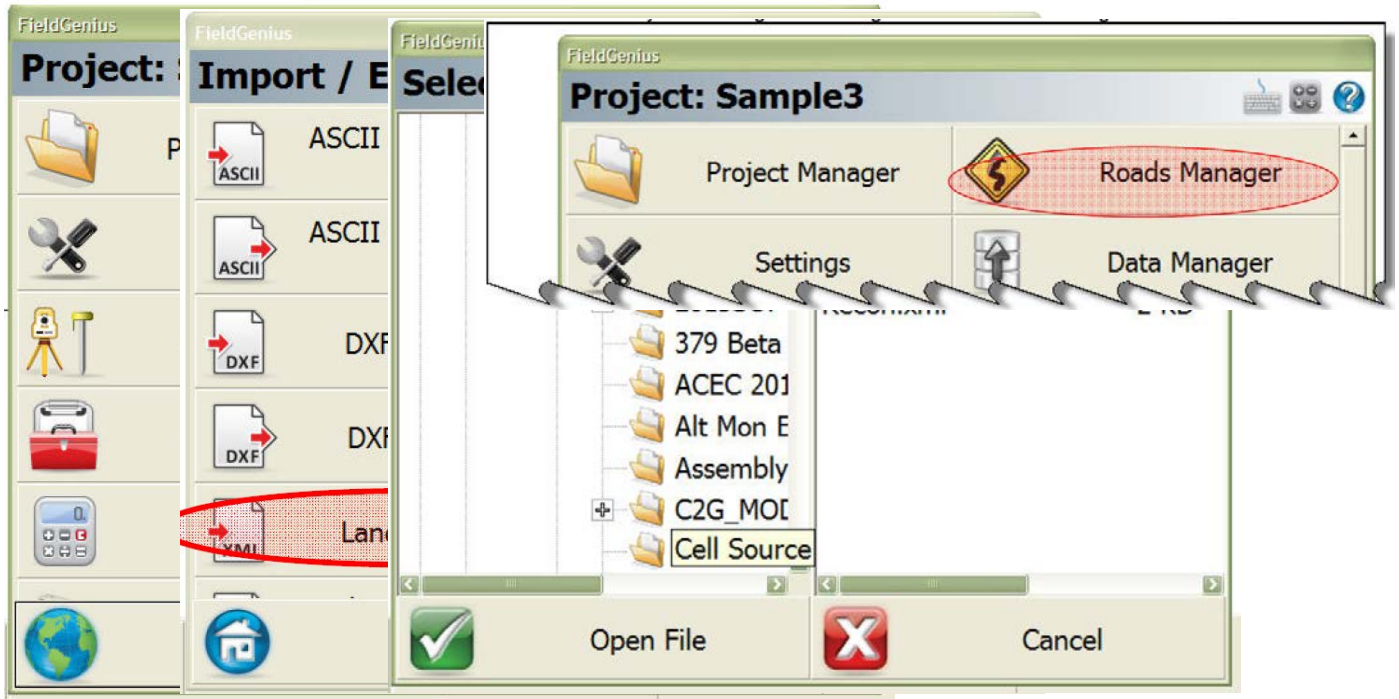

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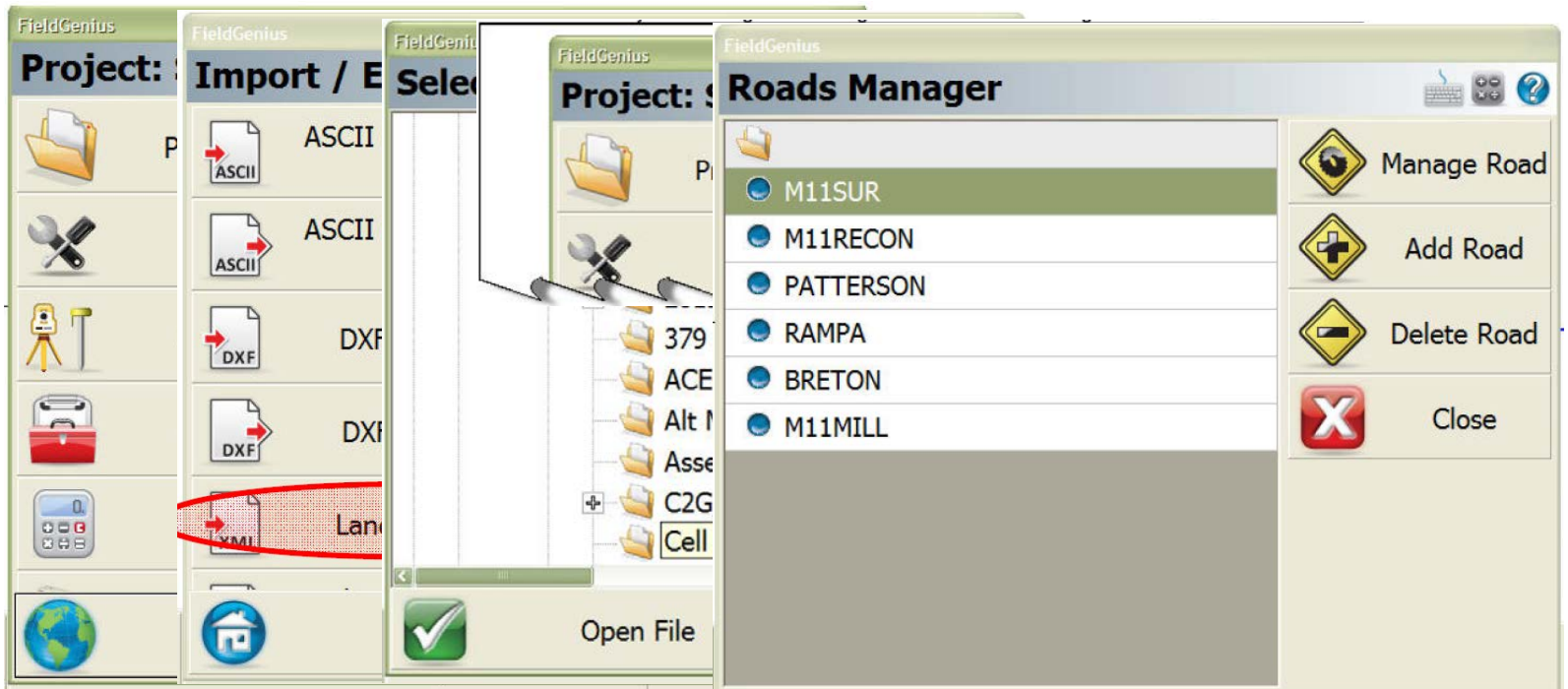
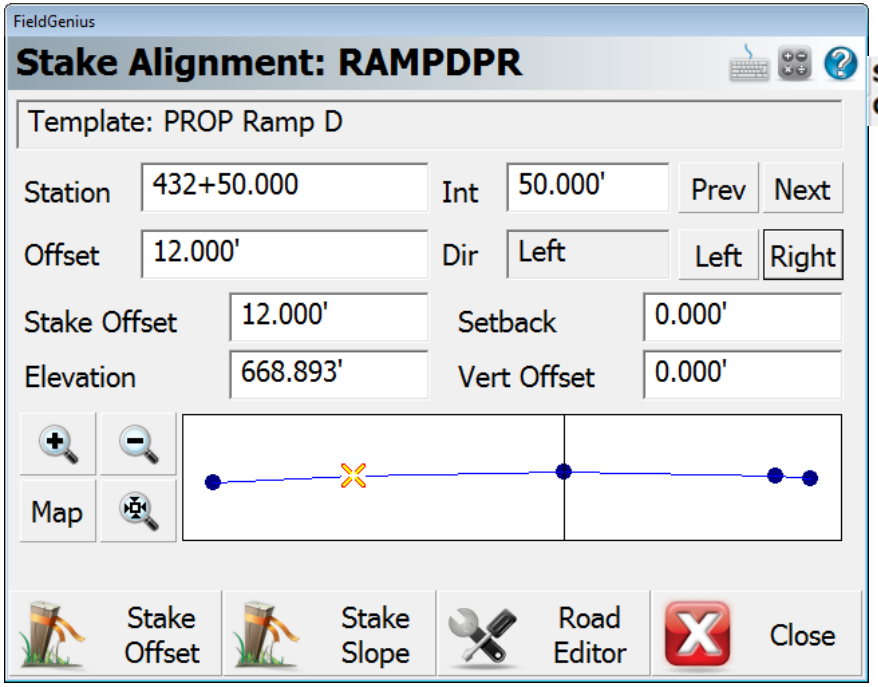
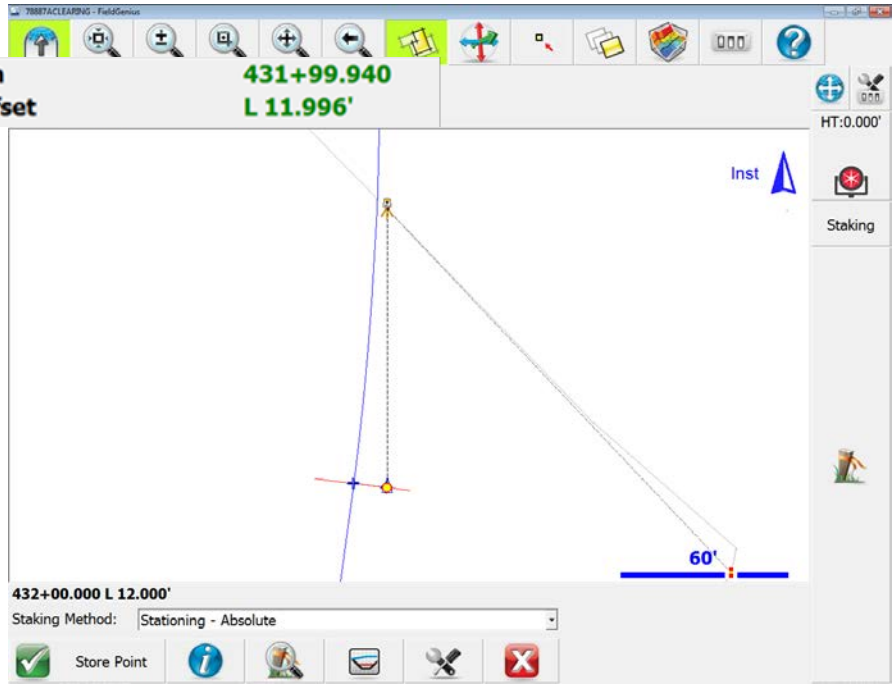


This allows the user to :

- See x,y position relative to station – offset & record observations in automated reports relative to same.





Without it…

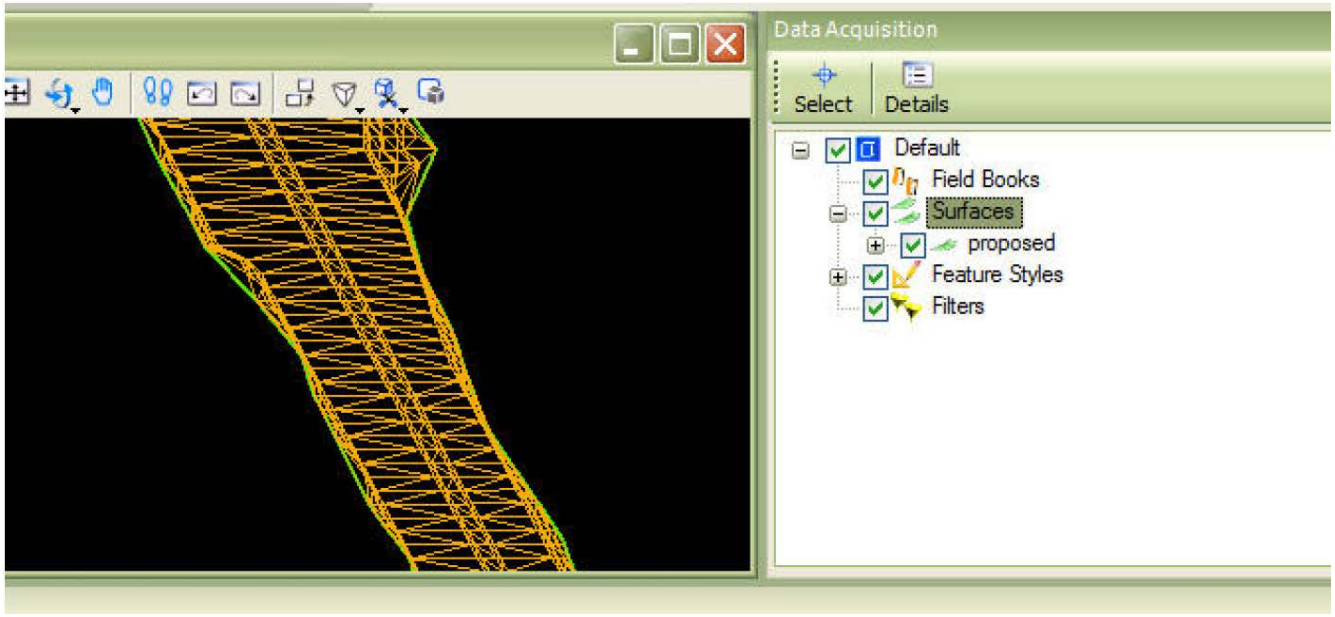
1. Un-roll paper plan set
2. Manually key in each tangent and curve section
3. Assign stationing

- Subject to entry errors.
- On complex jobs with multi alignments – TIME CONSUMING.
- Multiply this tedious function by many users and you have – UNECESSARY TIME LOSS.

- A model contains information to answer : Where is the proposed grade?

Which enables :

- Which enables a direct import of surface .xml into roading software on a survey device in minutes!



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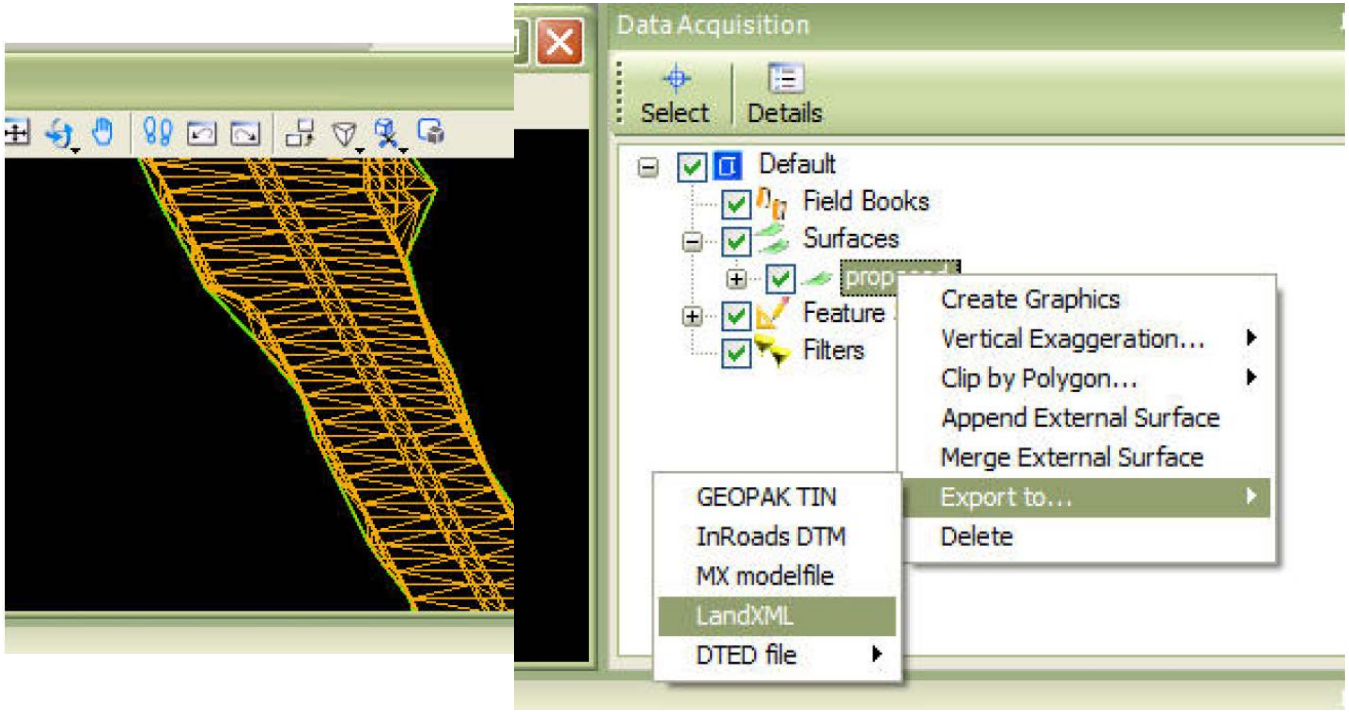

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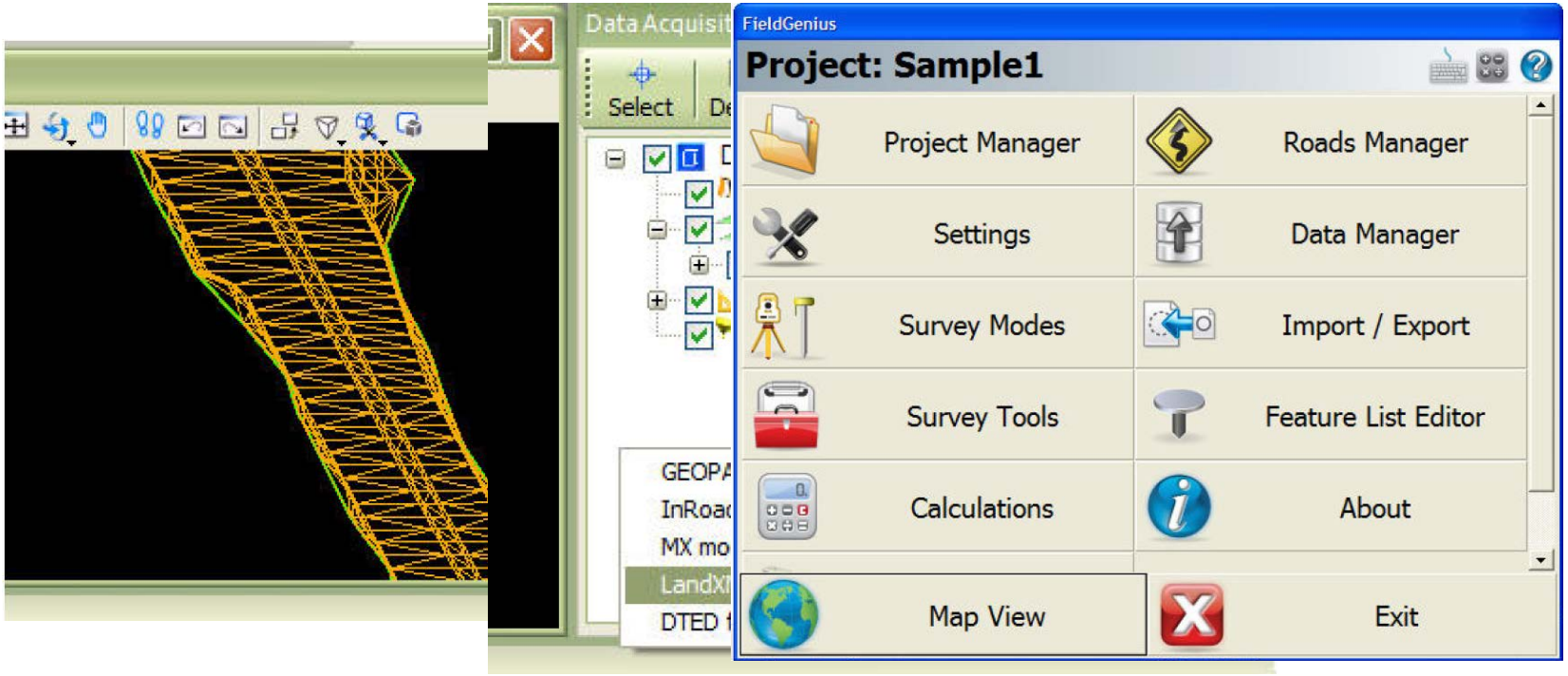

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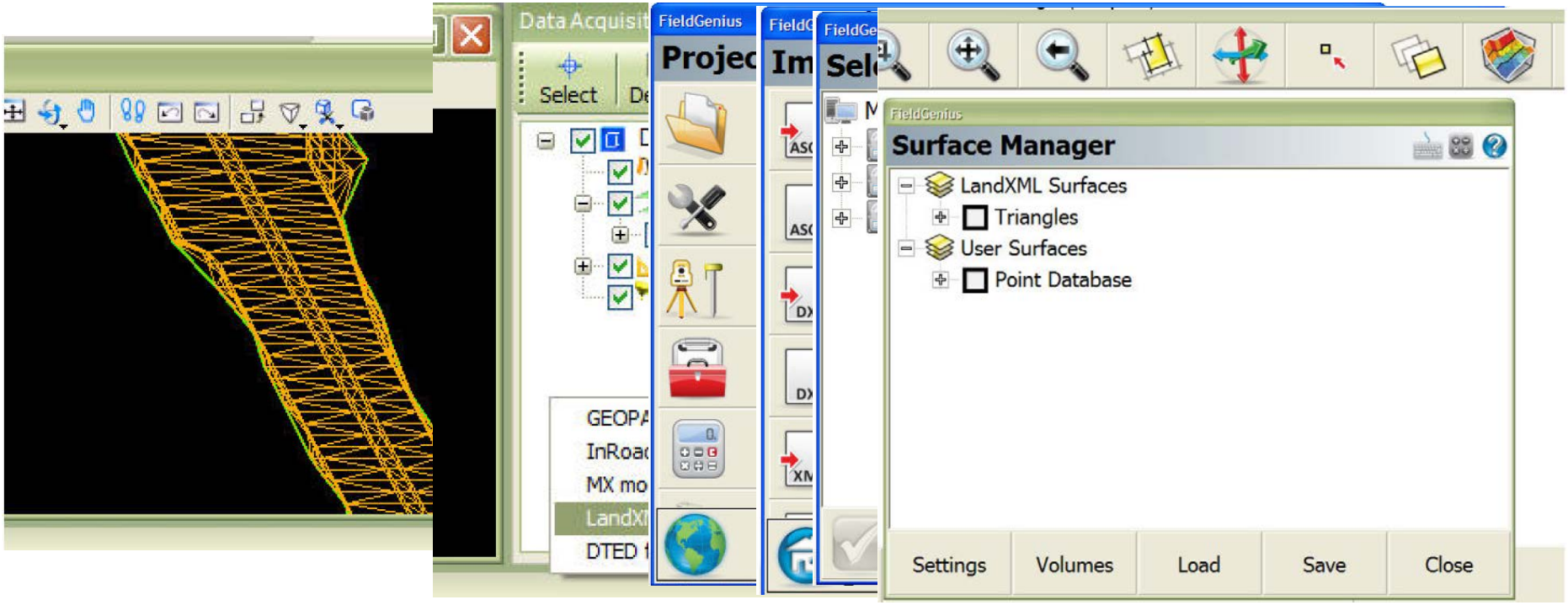
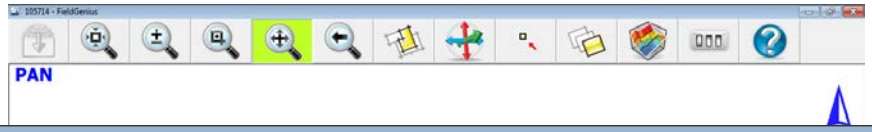


This allows the user to :

- See x,y,z position relative to proposed grade anywhere on the site & record observations in automated reports relative to same.



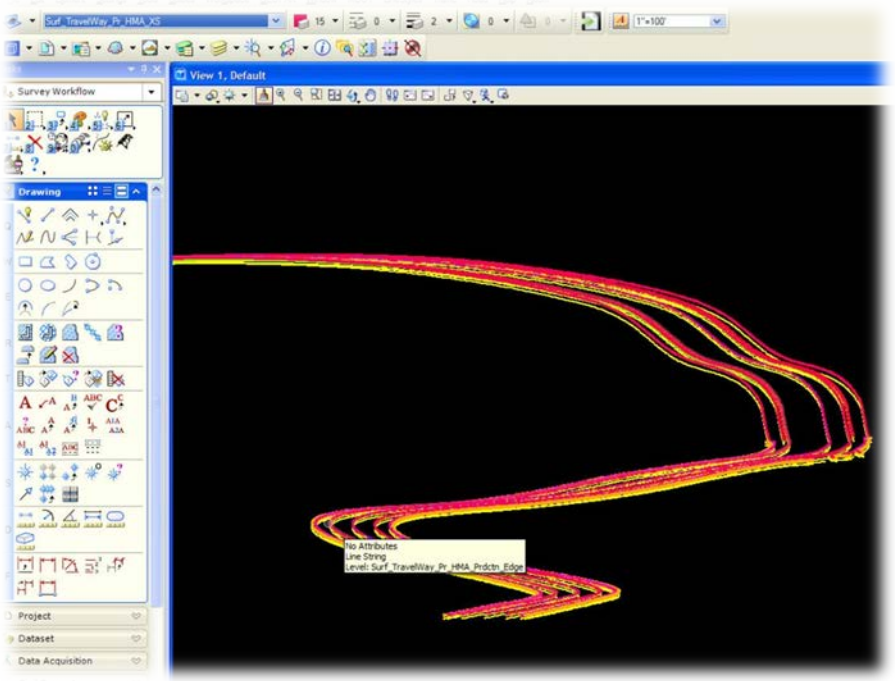
FieldGenius

File Viewer - RAMPDSTAKEOUT.csv

Station	Offset	Offset Length	As Built Pt	Design N	Design E	Design El	As Built El	Cut(-)/Fill(+)	Delta N	Delta E
43200.000	Left	11.996	5022	542095.914	13625583.048	669.884	669.892	-0.008	-0.046	0.039
43250.000	Left	12.007	5023	542054.784	13625612.297	668.893	668.912	-0.018	-0.075	0.043
43300.000	Left	12.031	5024	542012.535	13625639.903	667.743	667.767	-0.024	-0.053	-0.004
43350.000	Left	12.001	5025	541969.231	13625665.825	666.433	666.429	0.004	-0.039	0.021

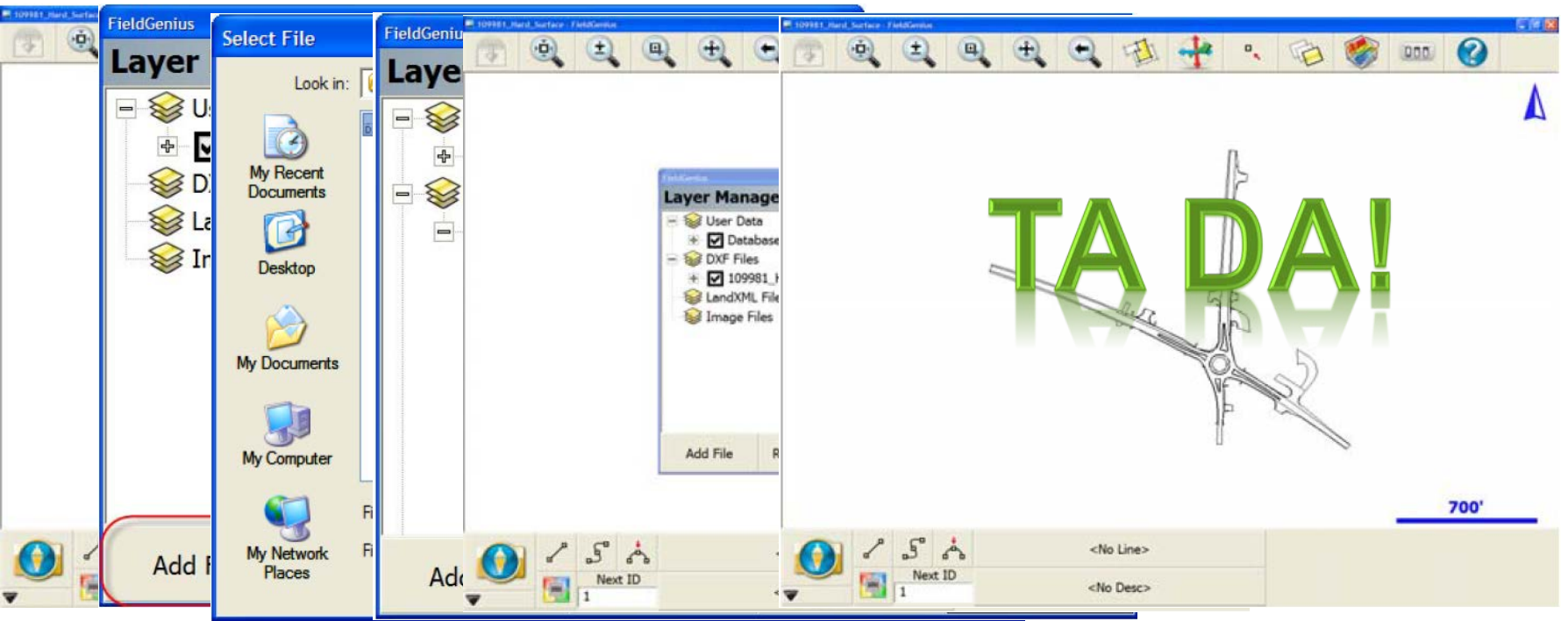
3D Elements

- A model contains information to represent : The true 3D location of proposed objects critical to design.

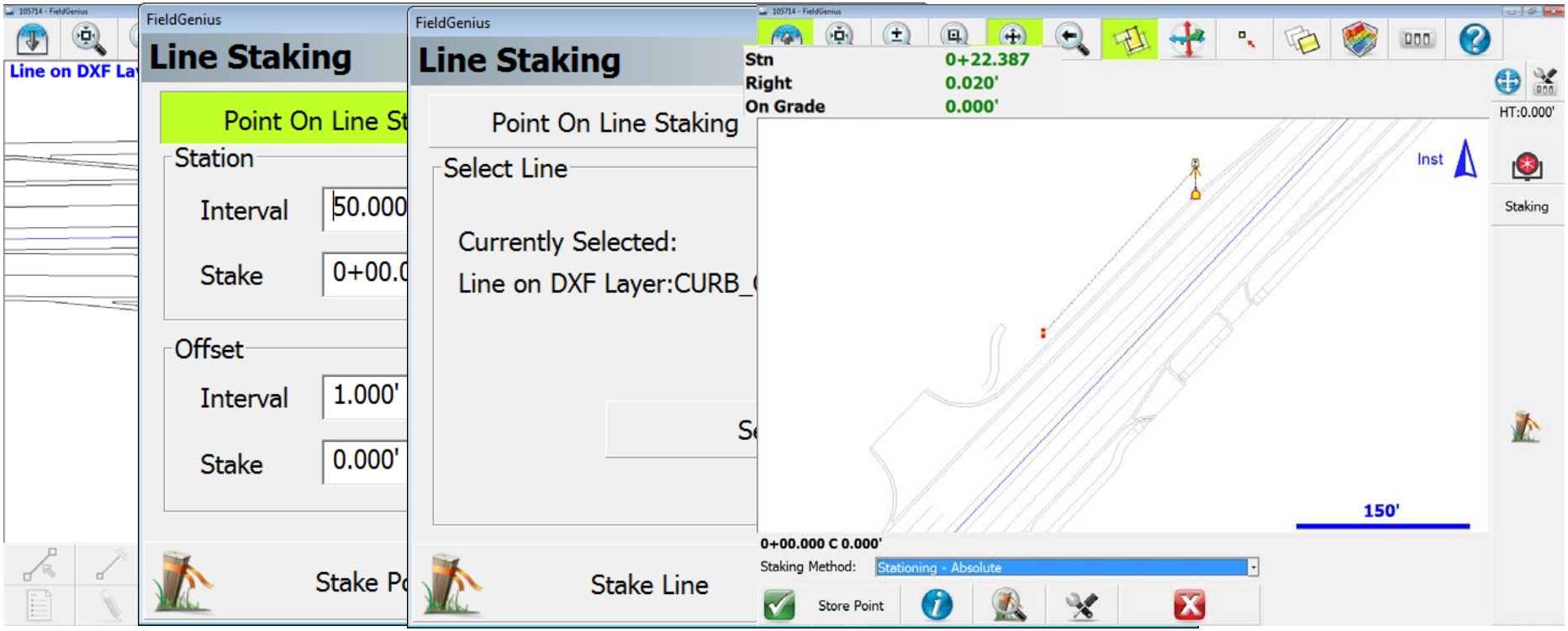


Which enables :

- Which enables a direct import of 3D .dxf into roading software on a survey device in minutes!



- Position relative to a 3D design faster than ever before with little pre-computation of design features!

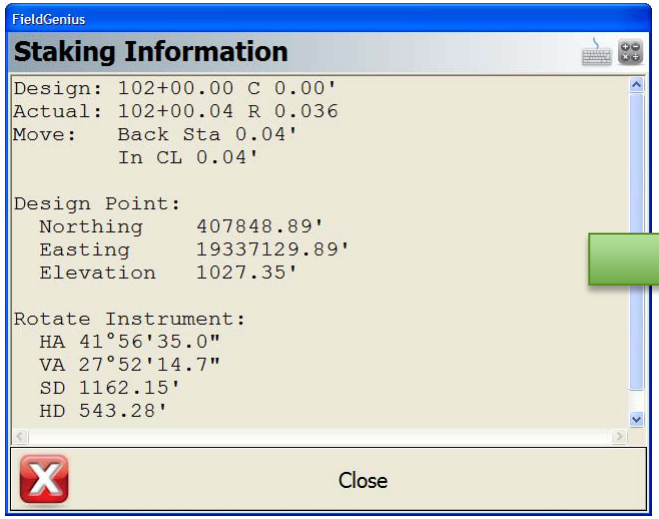


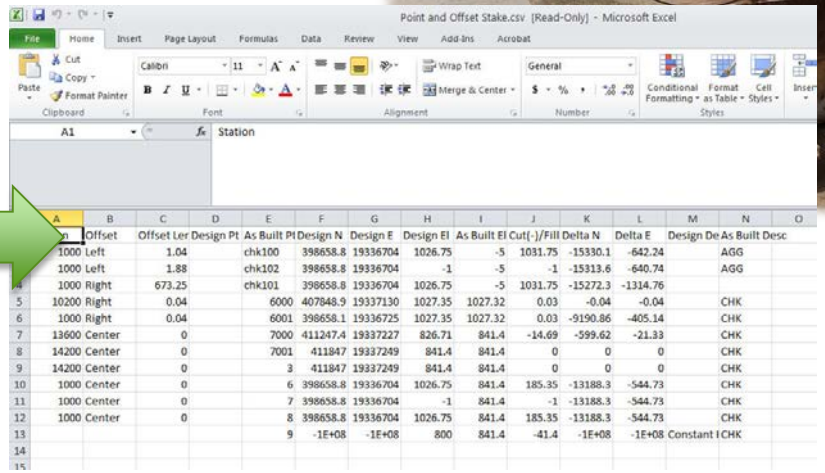
Verifying Construction Accuracy / Q.A.
Pre-Construction Steps - Field

- Recover and check control!
- Protect it!
- Plan approach and tools needed
- Compute scale factor(s) if design on grid.
- Calibrate to the site – lock down!

Verifying Construction Accuracy / Q.A. During Construction - Field

- Build comfort
- Spot check often
- Utilize automated reports
- Right tool for the job!





Measurement

Verizon LTE 8:36 AM 97%

Notes

Abutment b wall bearings

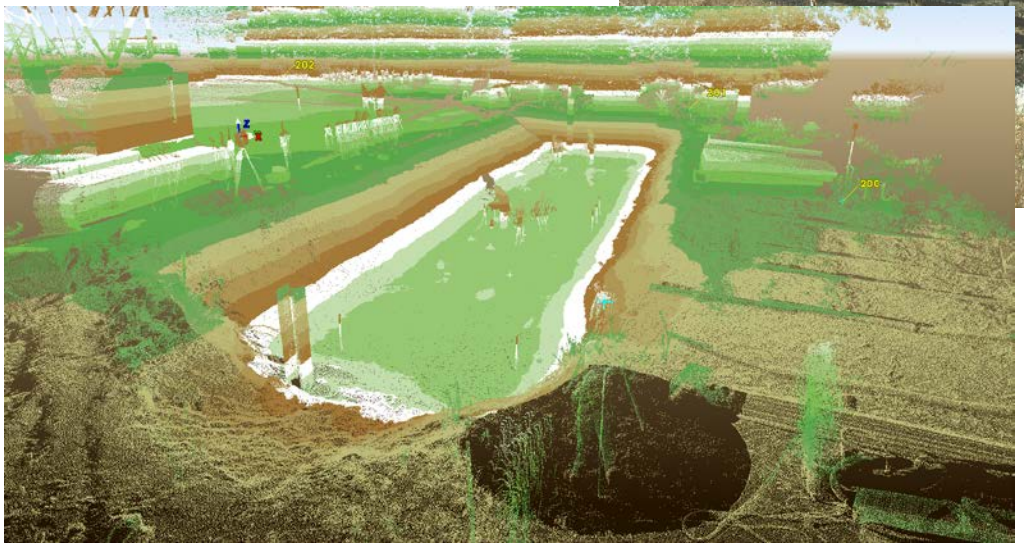
Yesterday Jul 8 4:09 PM

Abutment b wall bearings
1000.77 BM 584 on EB I-96 outside shoulder / NCI = 1000.75
+11.805
1012.575 HI
-0.57
1012.005 BM 589 on S.W. corner of abutment a footing / NCI = 1011.97
+10.569
1022.574 HI
-5.429 A = 1017.145 / plan = 1017.12 / diff = 0.025
-5.263 B = 1017.311 / plan = 1017.29 / diff = 0.021
-5.093 C = 1017.481 / plan = 1017.45 / diff = 0.031
-4.924 D = 1017.650 / plan = 1017.62 / diff = 0.030
-4.766 E = 1017.808 / plan = 1017.78 / diff = 0.028
-4.599 F = 1017.975 / plan = 1017.95 / diff = 0.025
-4.505 G = 1018.069 / plan = 1018.03 / diff = 0.039
-4.680 H = 1017.894 / plan = 1017.86 / diff = 0.034
-4.848 J = 1017.726 / plan = 1017.69 / diff = 0.036
-5.018 K = 1017.556 / plan = 1017.52 / diff = 0.036
-5.188 L = 1017.386 / plan = 1017.35 / diff = 0.036
-5.364 M = 1017.210 / plan = 1017.18 / diff = 0.030

7/2/2013

1012.005 BM 589
+10.643
1022.648 HI
-5.512 A = 1017.136 / plan = 1017.12 / diff = 0.016
-5.350 B = 1017.298 / plan = 1017.29 / diff = 0.008
-5.185 C = 1017.463 / plan = 1017.45 / diff = 0.013
-5.008 D = 1017.640 / plan = 1017.62 / diff = 0.02
-4.862 E = 1017.786 / plan = 1017.78 / diff = 0.006
-4.691 F = 1017.957 / plan = 1017.95 / diff = 0.007
-4.615 G = 1018.033 / plan = 1018.03 / diff = 0.003
-4.774 H = 1017.874 / plan = 1017.86 / diff = 0.014
-4.941 J = 1017.707 / plan = 1017.69 / diff = 0.017


CP5
CP603



Questions?

Questions / Comments

Contact Information

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lobbestaelj@michigan.gov