Oregon Department of Transportation

Inspector Positioning Tablets

Brett Murphy
Engineering Automation Specialist
Oregon Department of Transportation

ODOT ENGINEERING AUTOMATION

Who am I?

- “New-ish guy” to Engineering Automation
- BS in GIS & Remote Sensing
- Imposter!

Inspecting Digital Construction

PROBLEM:

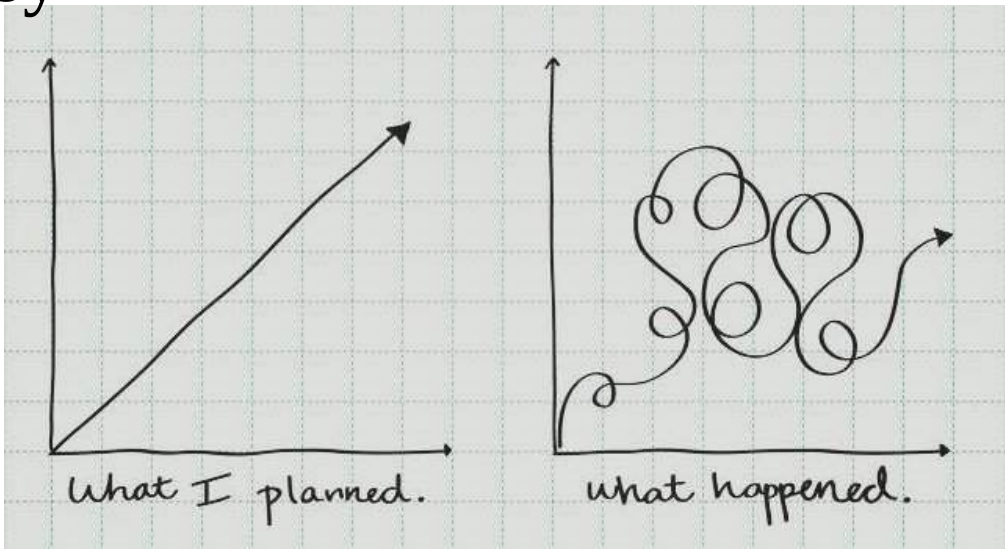
- Less stakes to reference
- AMG is fast, hard to keep up
- Survey crew too costly, can be weeks out

ANSWER: Precision GNSS For All!

(turns out it helps for a million other things too)

How did we get here?

- Oregon DOT's path to Digital Construction Inspection
  - It didn't happen over night
  - It wasn't always easy
  - It isn't finished
  - It's worth it!

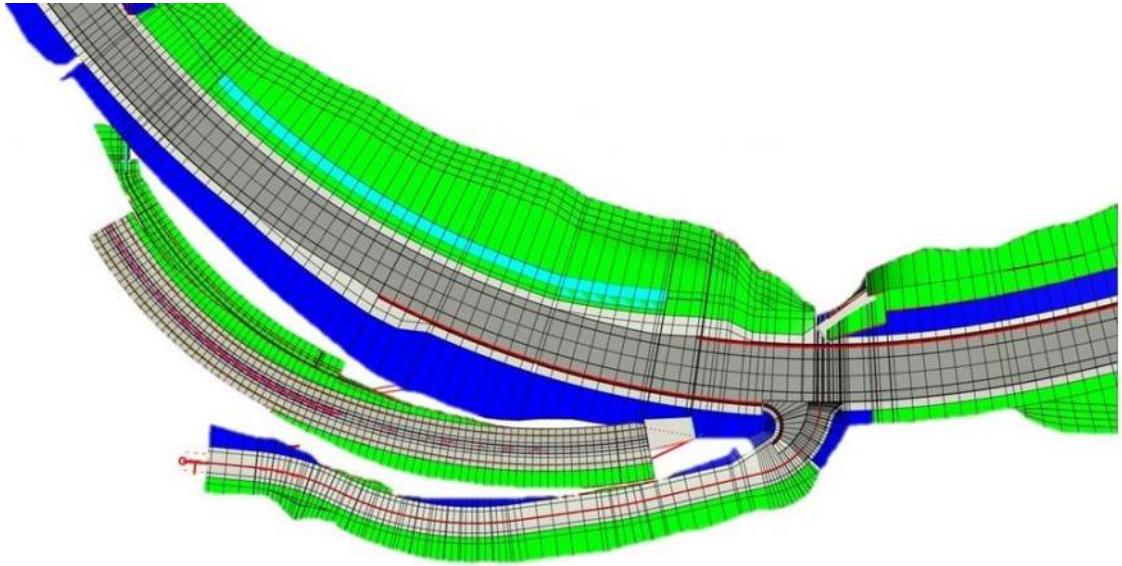


Fully Committed to 3D Design

Have delivered over 100 3D Design projects since 2014

Required on DOT and Consultant designed projects

But the Design side got ahead of the Construction Administration side...

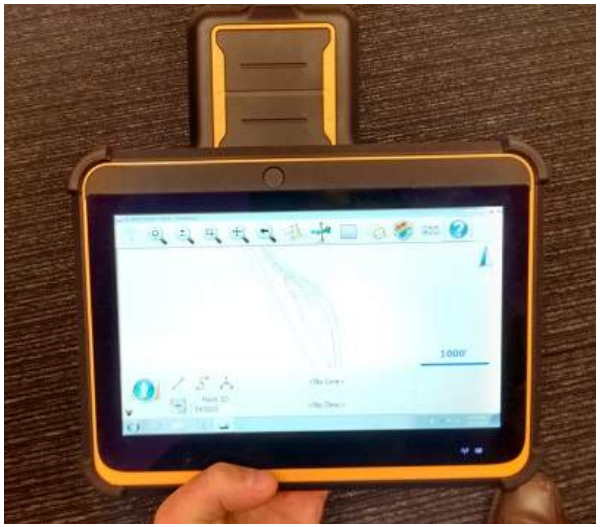


Program Foundations

- GNSS tablet for inspectors
- Real-Time Network & standardized projections
- Training: initial, advanced, recurrent
- Support
- Feedback loops: internal & external
  - Users & Super-Users
  - Hardware
  - Software

Inspector Tablets

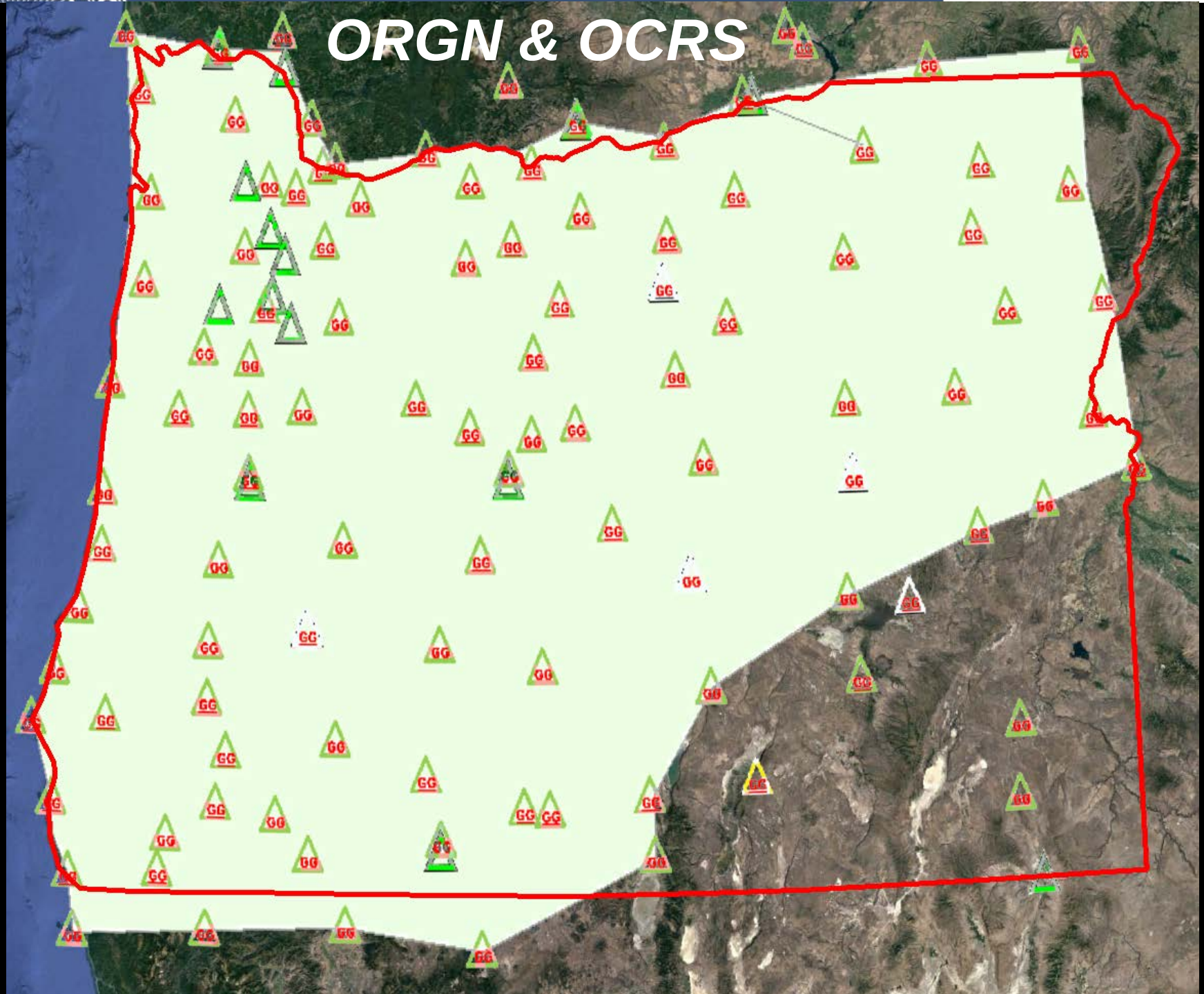
- Rugged Tablet with built in Hemisphere GNSS antenna
- Can be used “handheld” or a rod
- Touch screen
- Windows 10
- Cell modem
- +/- $8200



Software

- MicroSurvey FieldGenius Software
  - Easy to use
  - Intuitive touchscreen based interface
  - Connects to RTN's
  - Import/Export options
  - Demo outside at lunch

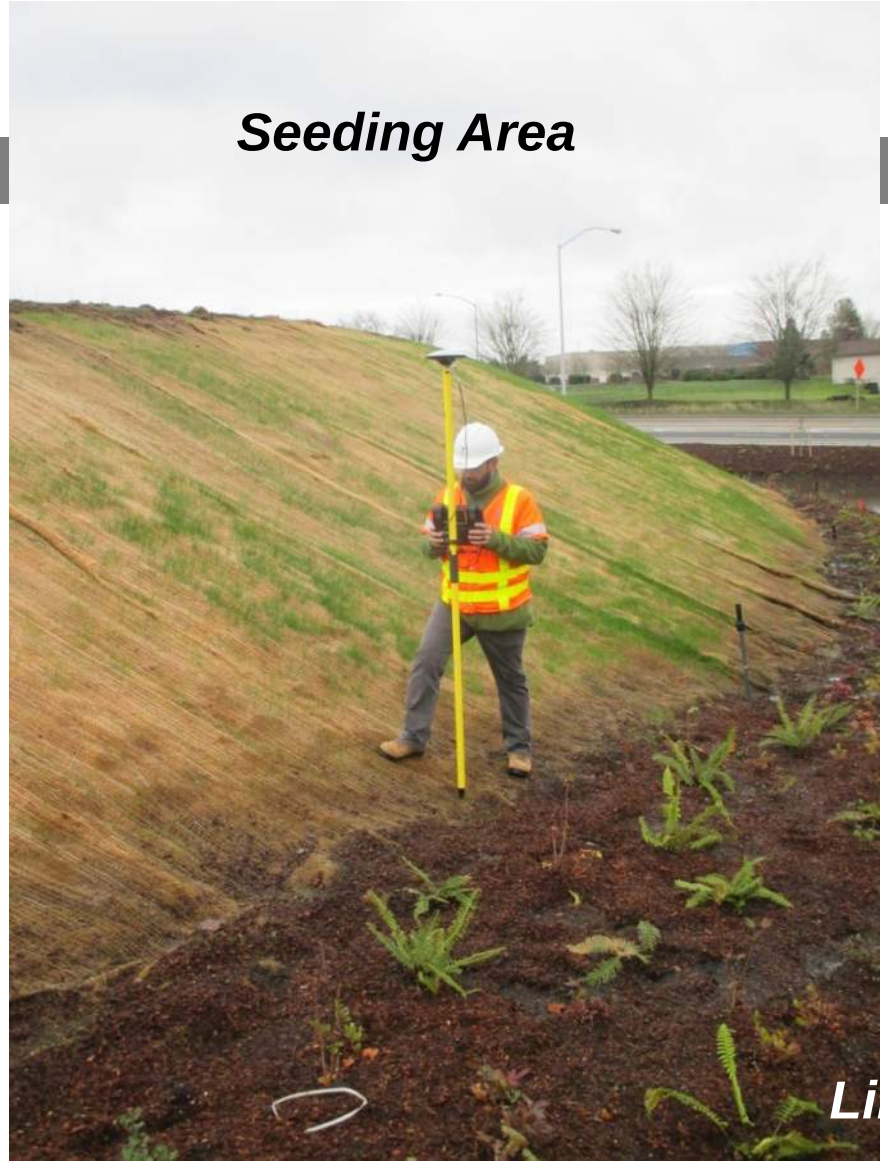
ORGN & OCRS



Accuracy

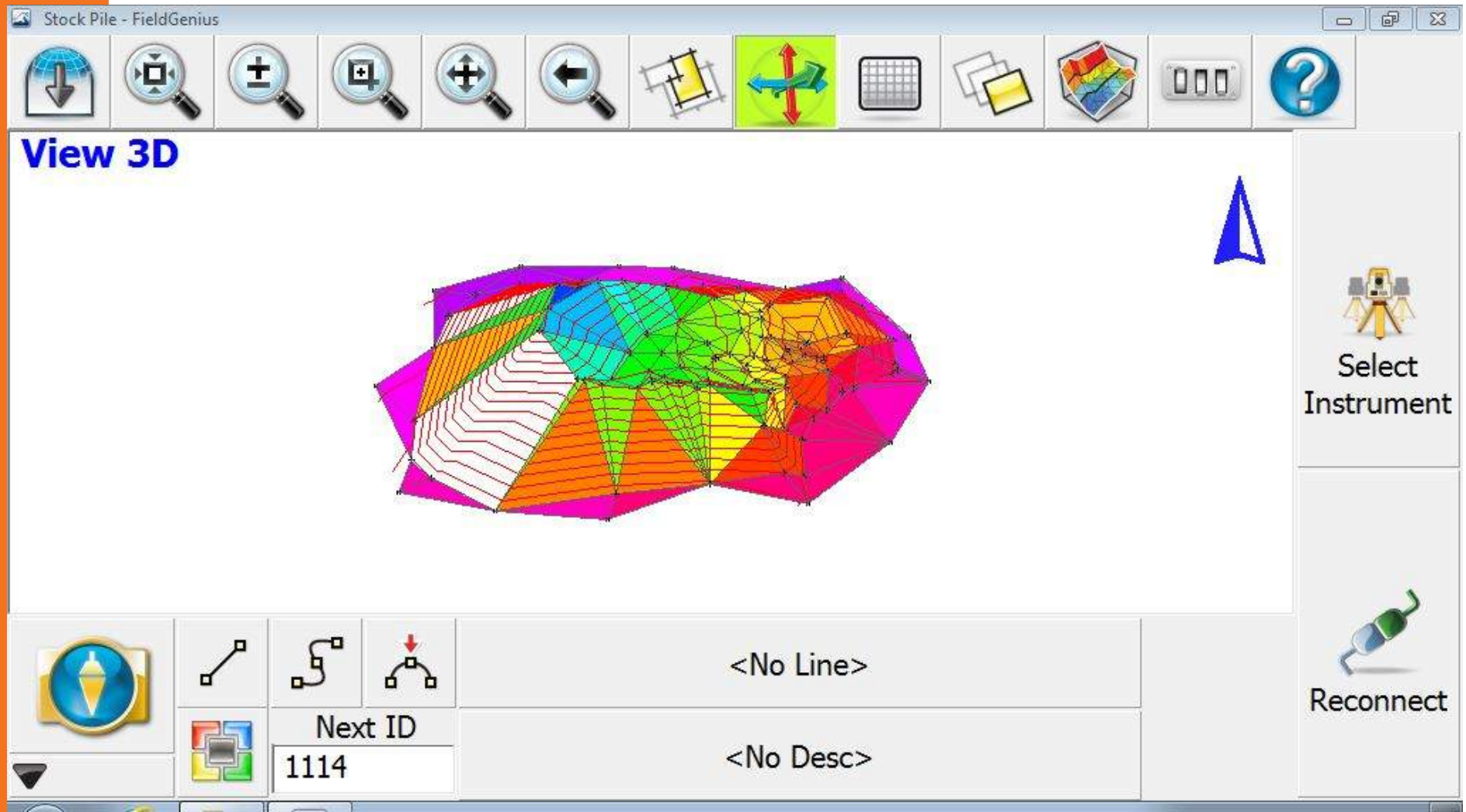
- 3-5 second RTK observations (or longer)
- +/- 0.04’ horizontal & +/- 0.07 vertical
- Exact same as surveyors’ GNSS tools

Capabilities: Measurement

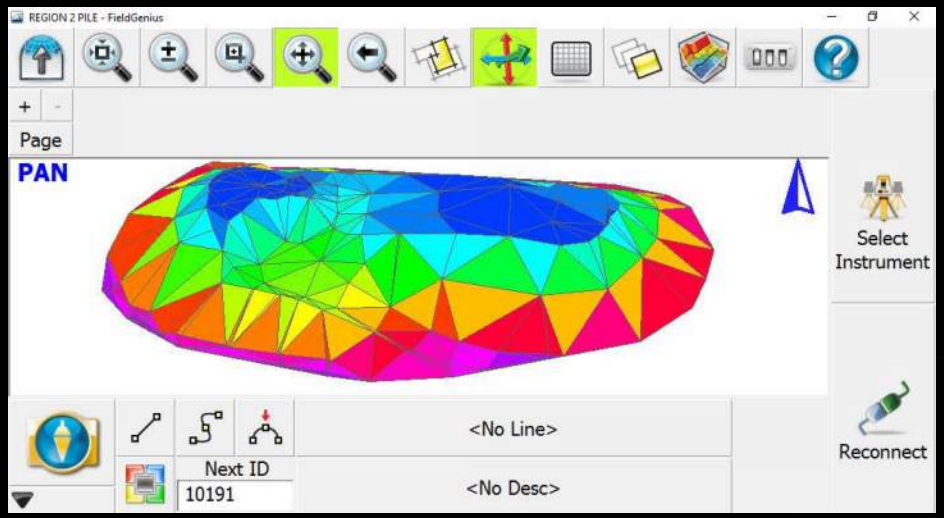


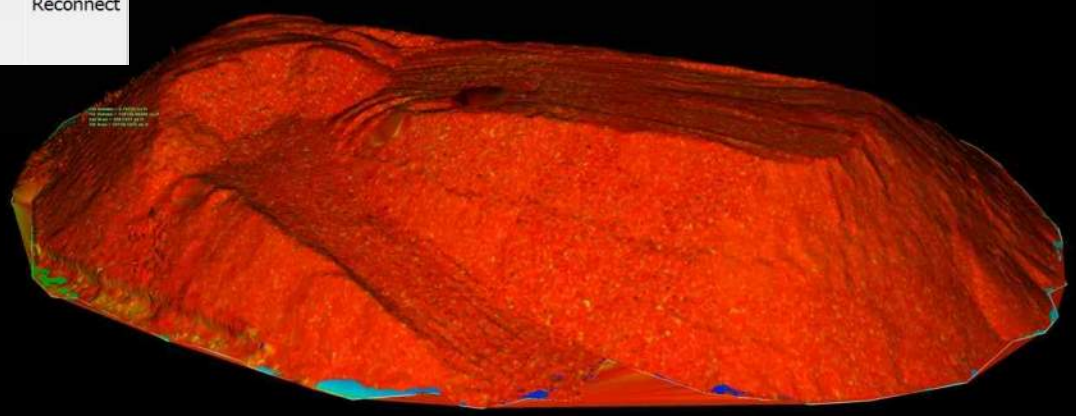
Capabilities: Measurement

Capabilities: Measurement



That's great, but how accurate is it really?

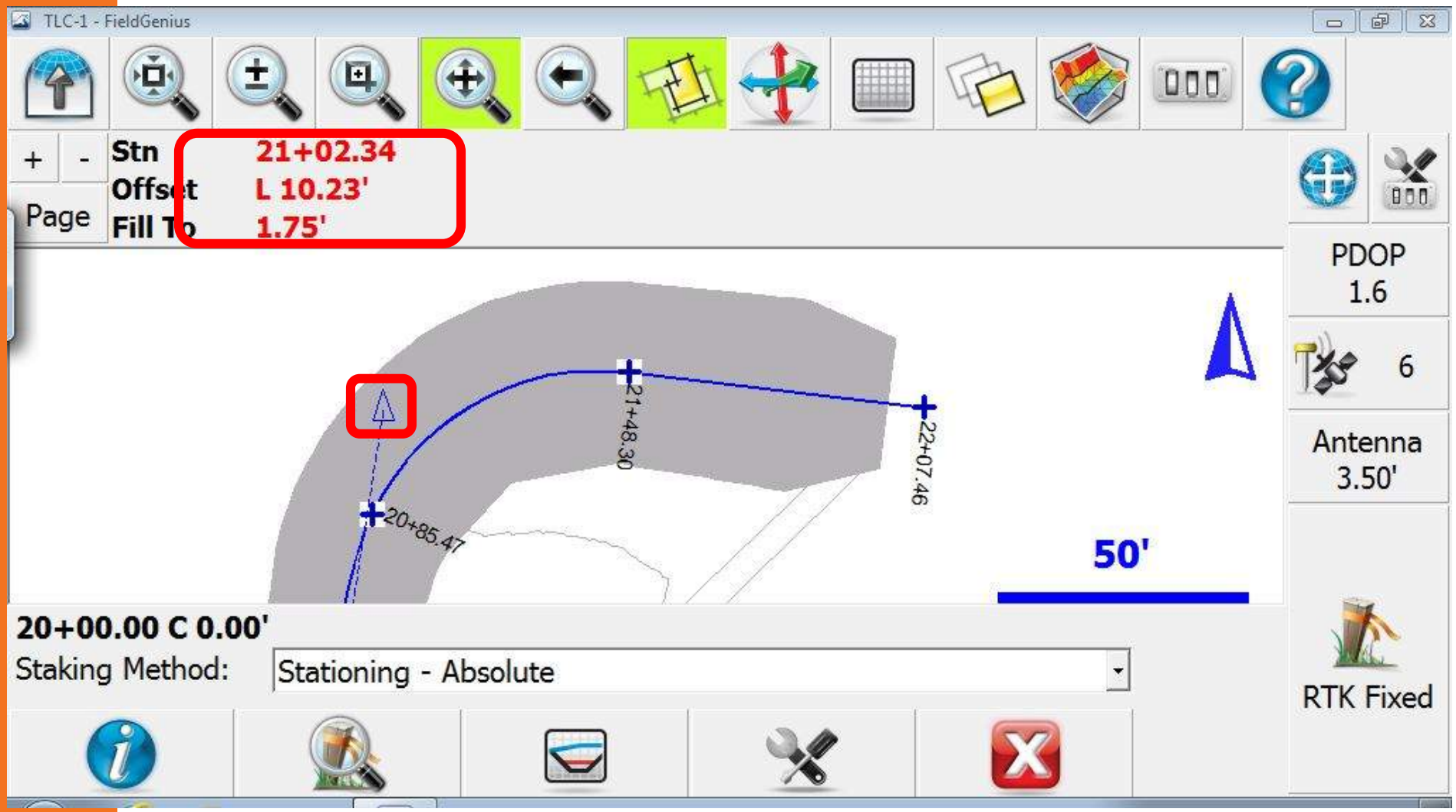




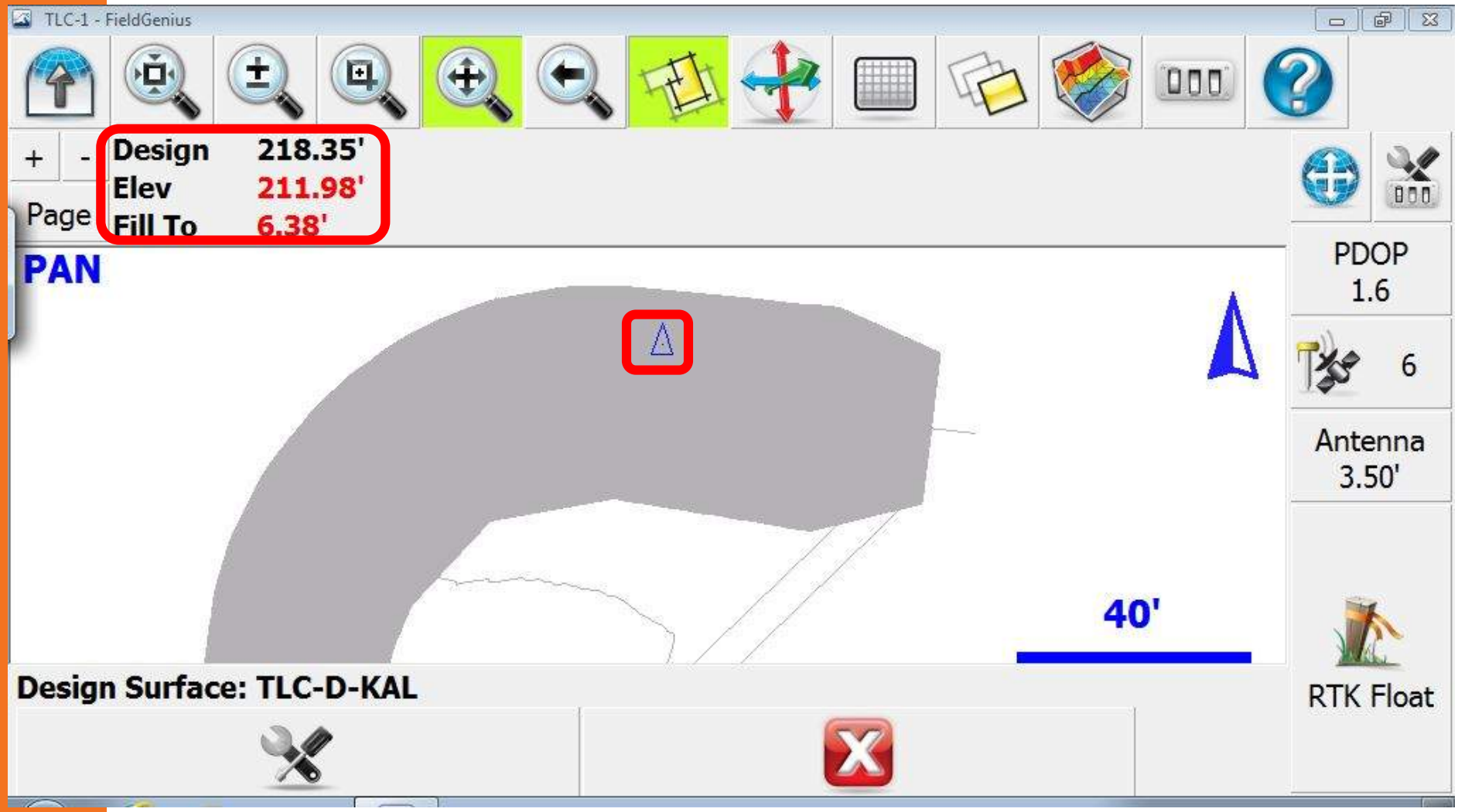
Method	Collection Time	Analysis Time	# of Staff	Volume (cu. yard)	% Difference from Scanner
Static Scanner	2 hours	2 hours	2	4079	-
GPS Tablet	40 mins.	5 mins.	1	4013	-1.6%
Stockpile Reports	4 mins.	5 hours	1	3899	-4.4%

Capabilities: Positioning

Capabilities: Positioning



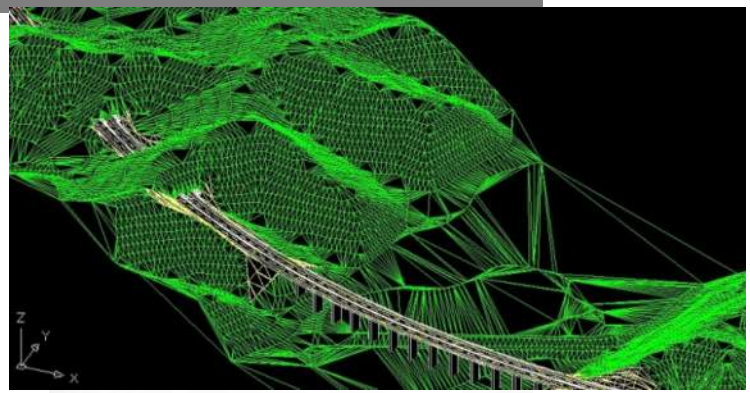
Capabilities: Surfaces



What are we NOT measuring?

- Staking contractor work
- Setting control or benchmarks
- Locating/defining property lines, right of way, easements, ownership, etc.
- Locating items closer than ½” horizontally or ¾” vertically
- Disagreeing with a contractor measurement closer than a 0.10 ft

Program Development

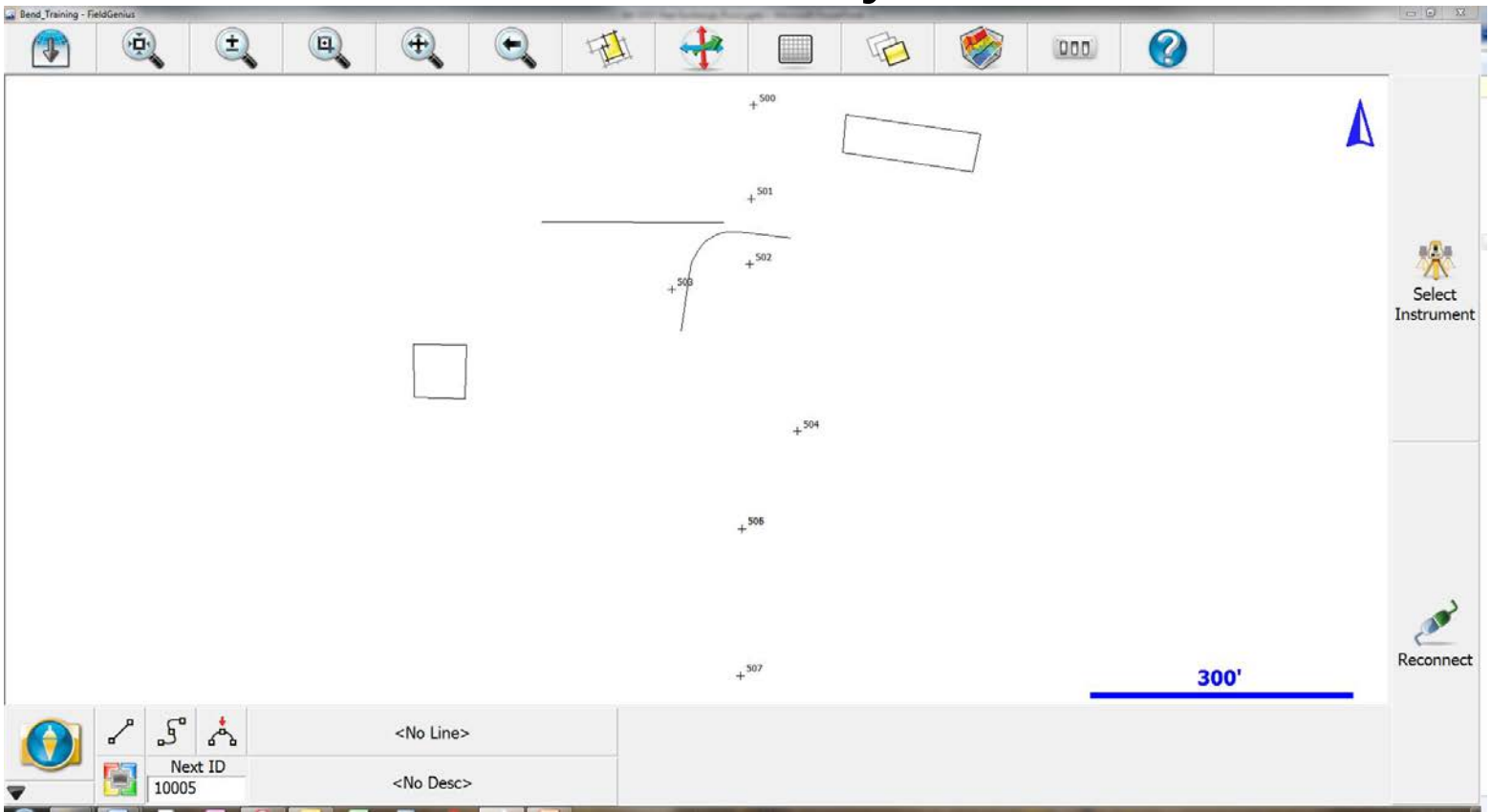


Training

- GNSS Tablet 101 @ construction offices
- Survey Fundamentals for Construction Inspection

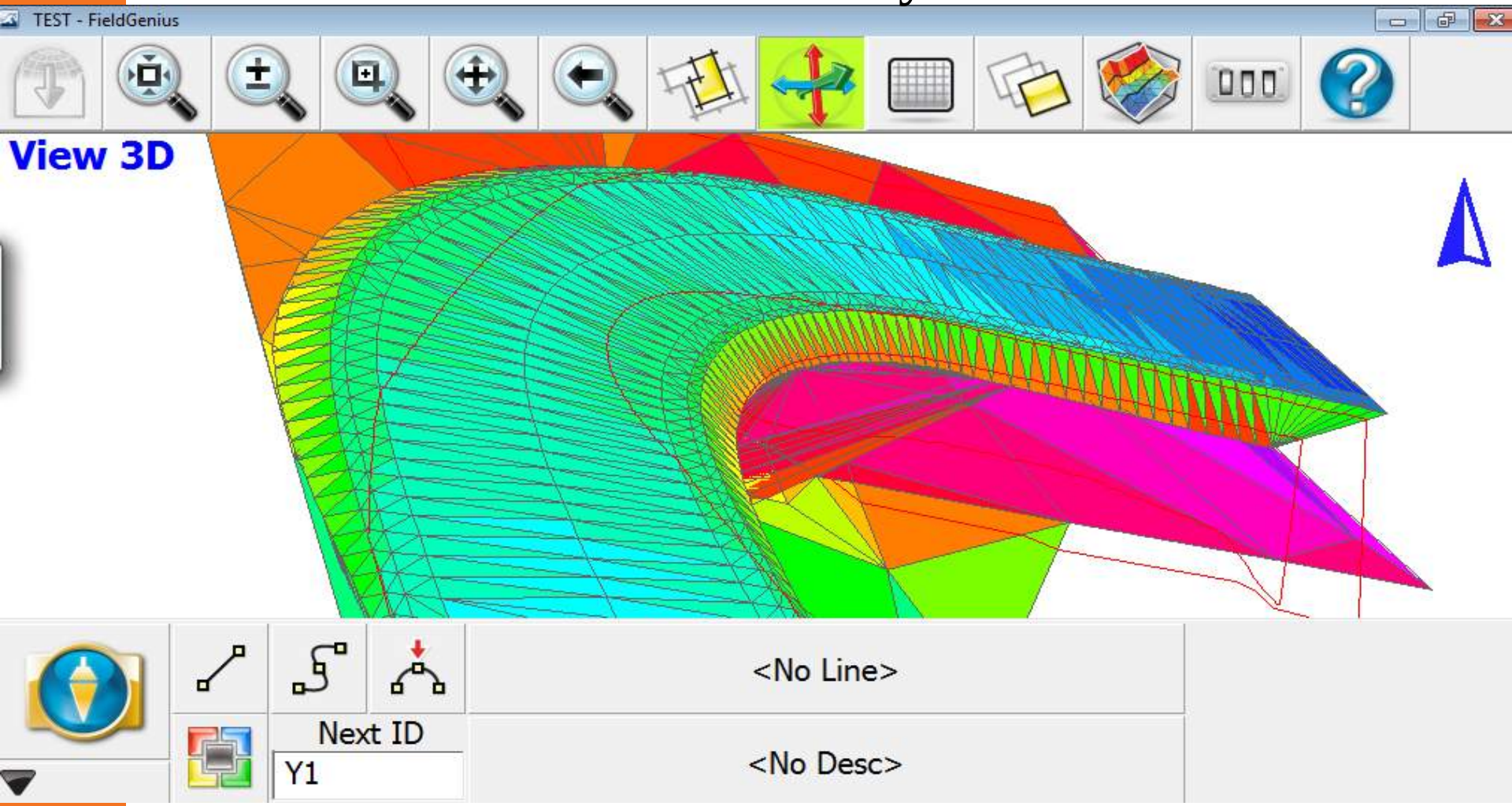
GNSS Tablet 101

- Outdoor classroom at every office

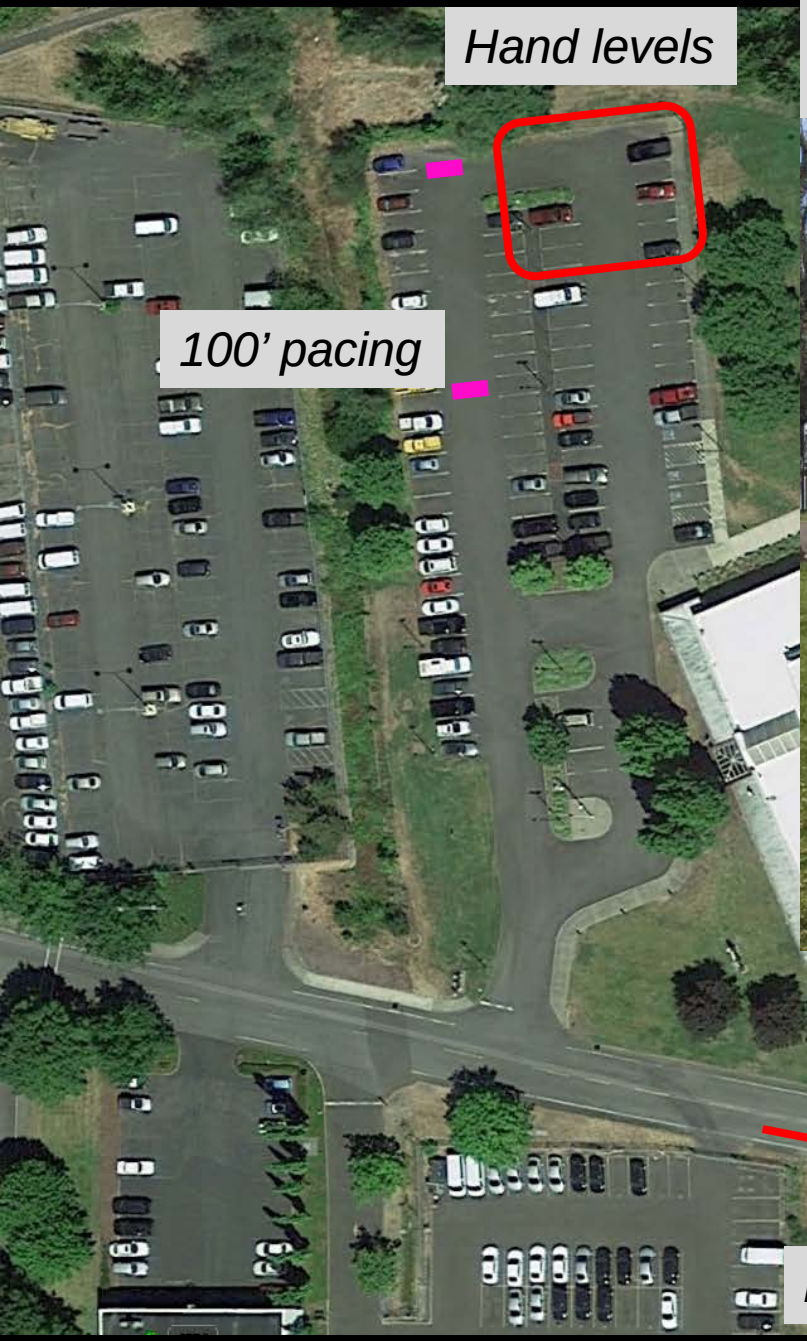


GNSS Tablet 101

- Outdoor classroom at every office



Survey Fundamentals for Construction Inspection

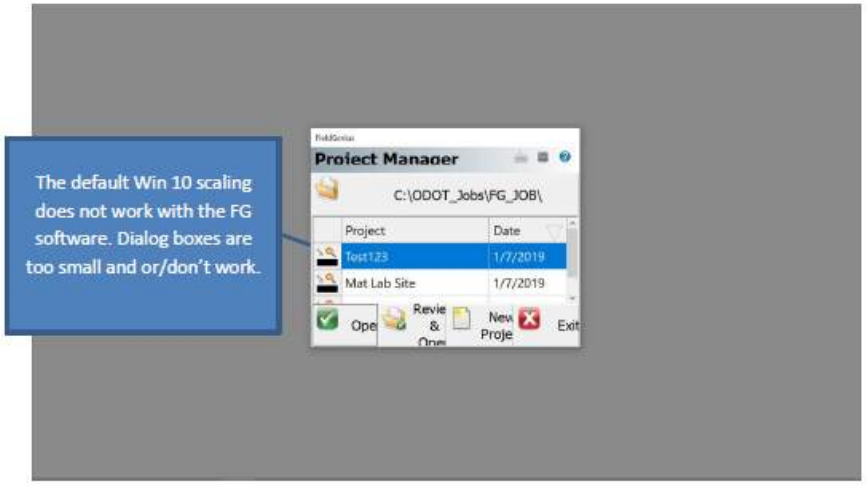


Support

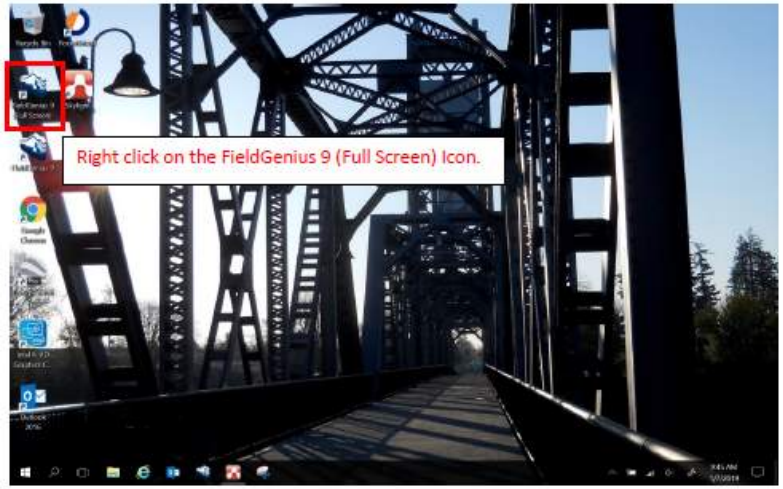
- On-call, in-field technical and managerial support
- SUPER – USERS!!!

Field Genius Tech Tip

Windows 10 – Scaling Issue



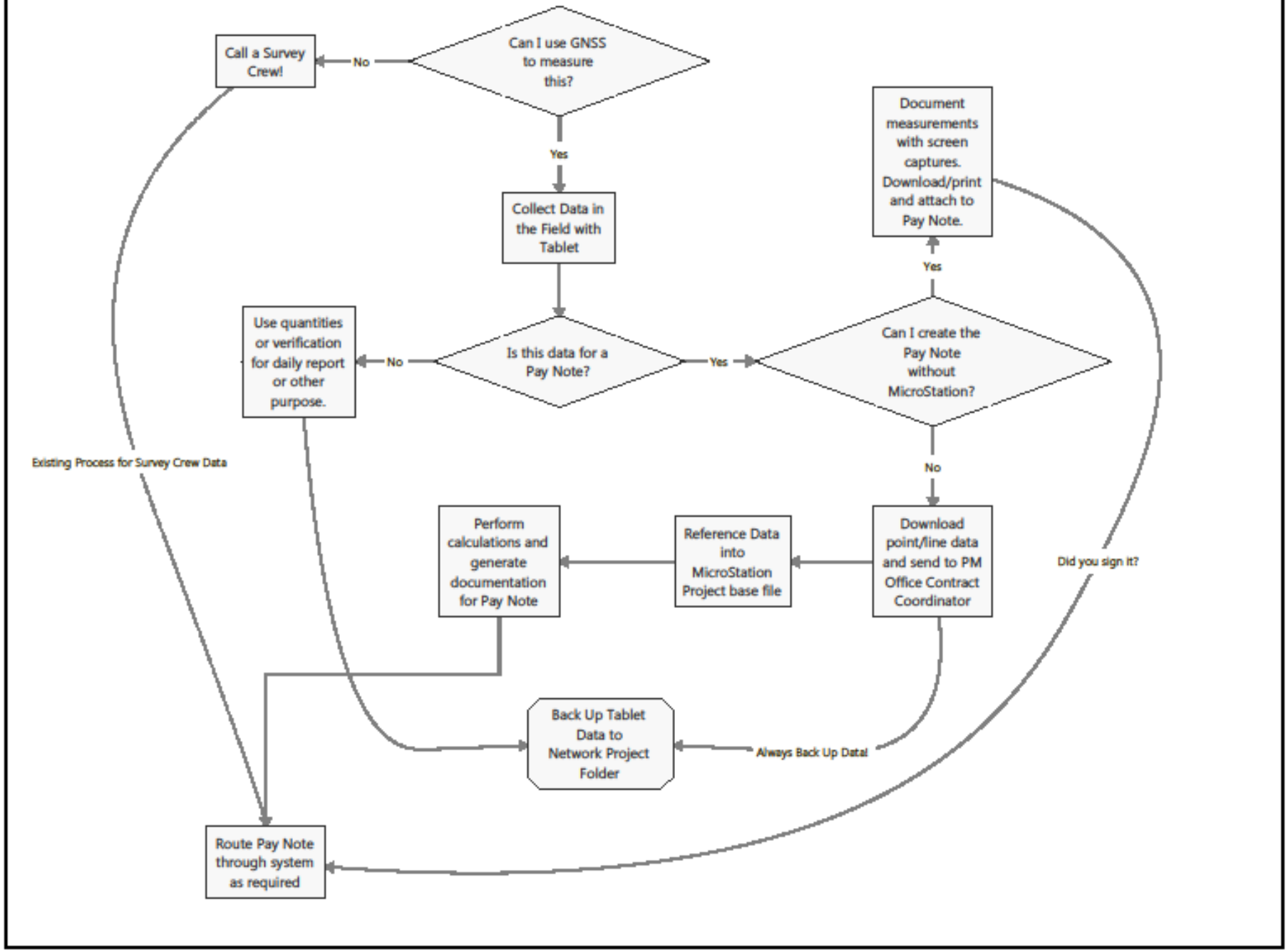
To correct this issue, you need to change the 'compatibility' settings of the FieldGenius program in the properties menu under the FieldGenius Icon.



Feedback Loops

- Internal:
  - Super-users develop use cases & test processes
  - Discover bugs, problems, ask questions, etc
  - Const Offices: how can we make the whole process better?
- External:
  - Hardware: fixed battery terminals
  - Software: fixed JPEG related crash

GNSS Tablet Basic Workflow



Pay Note (Standard)

Project Information

Big Pave and Fill — Project Name (Section)
C16999 — Contract No.
CON05678 — EA

Concrete slope paving — Item Description
0790 — Item No.
11 — Group No.

Method of Quality Assurance

Supporting Data:

- ☐ T – Test Certs
- ☒ O – CMO
- ☒ Q – Compliance Certs
- ☐ E – Equipment List & Drawing
- ☐ SQ – Small Quantity
- ☐ BG – Blue & Green Sheets

79-2 — F – FIR #
ODOT Lab Report No.

- ○ No QPL
- ○ QPL – Approved
- ◉ QPL – Qualified

1234 — QPL Product No.

- ☐ No Quality Documentation Required
- ☐ Quality Documents Submitted with Pay Note
- ☐ Warranty

Quantity Data

		Unit
Previous Quantity:	192.278	SqFt
Installed This Note:	295.167	SqFt
Total to Date:	487.445	SqFt

- ☐ Re-measure
- ☒ Measured In Place Method
- ☐ Partial Payment
- ☐ Installation Complete

06 May, 2019 — Installation Date
06 May, 2019 — Completion Date

Plans Information

As Per Plans: ☒ Yes ☐ No — If No, why?

Near 38+00 — Location/Station
2A-6 — Plan Sheet No.

Calculations / Verification Statement / Remarks:

See Area map attached

☐ Arrow Instructions
North Arrow

☒ See Attached Drawing

Pay Quantity = _____

Phil Dirt — Inspector Signature
42699 — Cert#
5/9/2019 — Date
Bid Item Complete: ☐ Yes ☒ No

For Office Use Only

☒ Quality Checked — Star Claymaker, CAS — Reviewed by — 5/13/2019 — Date — 295.2 — Quantity This Note — SqFt — Unit

☒ Quality Checked — Duane Johnson, QCCS — Reviewed by — 5/13/2019 — Date — 4 — Estimate No. — 2 — Note No.

Pay Note (Standard)

Project Information

Big Pave and Fill — Project Name (Section)
C16999 — Contract No.
CON05678 — EA

Concrete slope paving — Item Description
0530 — Item No.
11 — Group No.

Method of Quality Assurance

Supporting Data:

- ☐ T – Test Certs
- ☐ O – CMO
- ☒ Q – Compliance Certs
- ☐ E – Equipment List & Drawing
- ☐ SQ – Small Quantity
- ☐ BG – Blue & Green Sheets

53-1 — F – FIR #
ODOT Lab Report No.

- ◉ No QPL
- ○ QPL – Approved
- ○ QPL – Qualified

QPL Product No.

- ☐ No Quality Documentation Required
- ☐ Quality Documents Submitted with Pay Note
- ☐ Warranty

Quantity Data

		Unit
Previous Quantity:	0.000	Foot
Installed This Note:	256.718	Foot
Total to Date:	256.718	Foot

- ☐ Re-measure
- ☒ Measured In Place Method
- ☐ Partial Payment
- ☐ Installation Complete

19 April, 2019 — Installation Date
19 April, 2019 — Completion Date

Plans Information

As Per Plans: ☒ Yes ☐ No — If No, why?

Near 43+25 — Location/Station
2B-7 — Plan Sheet No.

Calculations / Verification Statement / Remarks:

See Area map attached

☐ Arrow Instructions
North Arrow

☒ See Attached Drawing

Pay Quantity = _____

Phil Dirt — Inspector Signature
42699 — Cert#
4/22/2019 — Date
Bid Item Complete: ☒ Yes ☐ No

For Office Use Only

☒ Quality Checked — Star Claymaker, CAS — Reviewed by — 4/26/2019 — Date — 256.7 — Quantity This Note — Foot — Unit

☒ Quality Checked — Duane Johnson, QCCS — Reviewed by — 4/29/2019 — Date — 3 — Estimate No. — 1 — Note No.

The Pros – so far

- Almost 100% acceptance
- Easy to use and easy to train/support
- Inspectors CAN and will use GPS
- Tons of features – yet simple to do the basics
- Wide user base

The Cons– so far

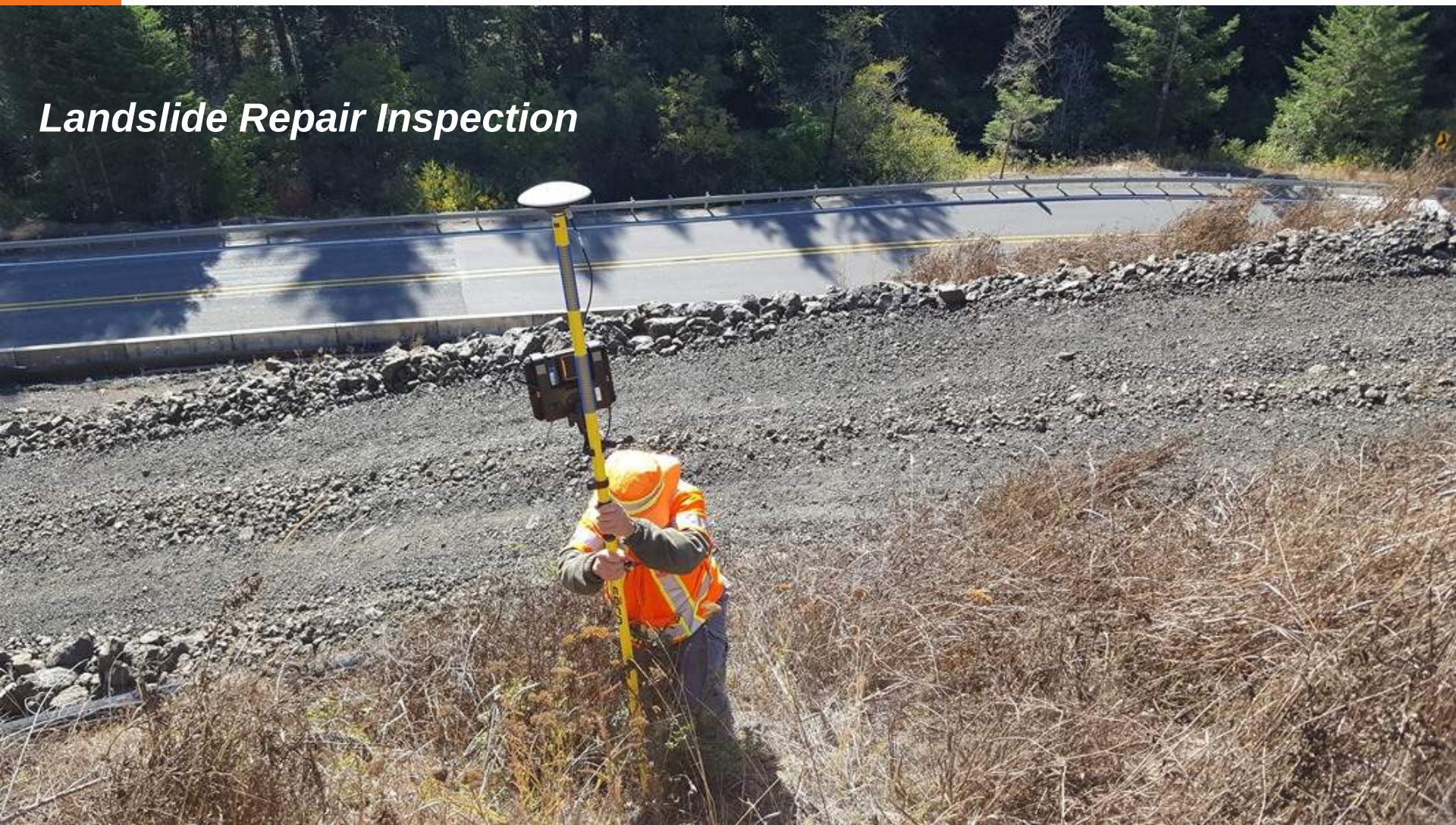
- Initial buy in at all levels
- Backbone/supporting items (Specs)
- IT/IS Computer Support Hurdles
- Fitting new tool/process into old ‘system’
- Greater demand than anticipated
- Initial Funding of the project

Unexpected Uses

Biological Restoration Monitoring

Unexpected Uses

Unexpected Uses



Future Options?

- MicroSurvey about to release android version for any tablet ($ unknown)
- Emlid GNSS rover $1900

```
                    MicroSurvey
                     GNSS Rover
            Basic Android Tablet
+            GIS Collection Apps
-------------------------------
Ultimate field data collector
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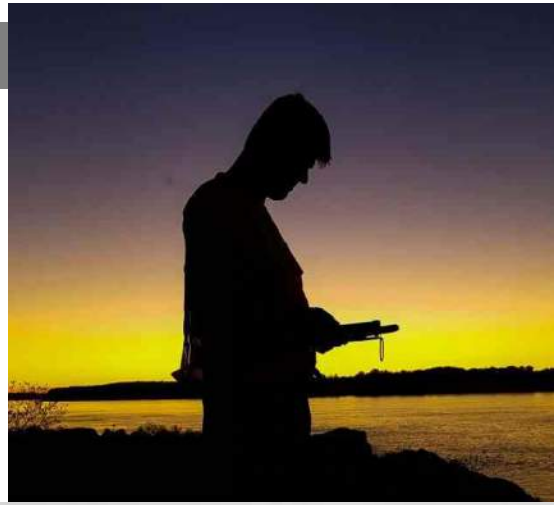
Final Advice

- Get all the BIG pieces set before you start
- Find a tool that works and you can support
- Start small – learn as you go
- Training, training, training!
- Find and leverage your super users
- Do it!

How do I get more info?



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So… we have more time?

- Shameless self-promotion

UAS_Promotional_Video.mp4

UAS Case Study: Minam Curve

- Before:

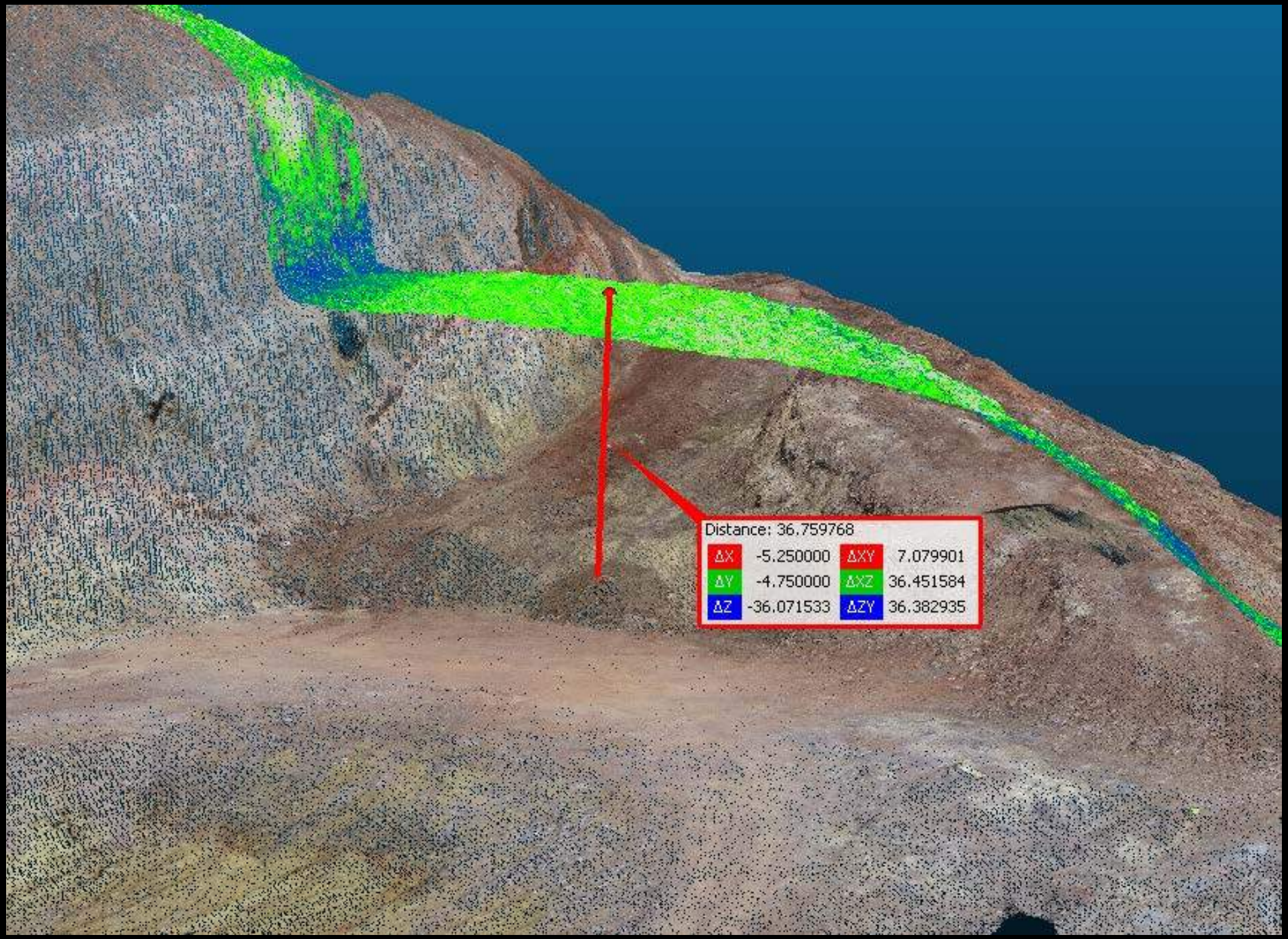
  Overview_Orbirt_Fall_2018.mp4

- After:

  Minam_June_ORBIT.mp4

- Who wants to see stuff blow up?

  Minam Blasting.mp4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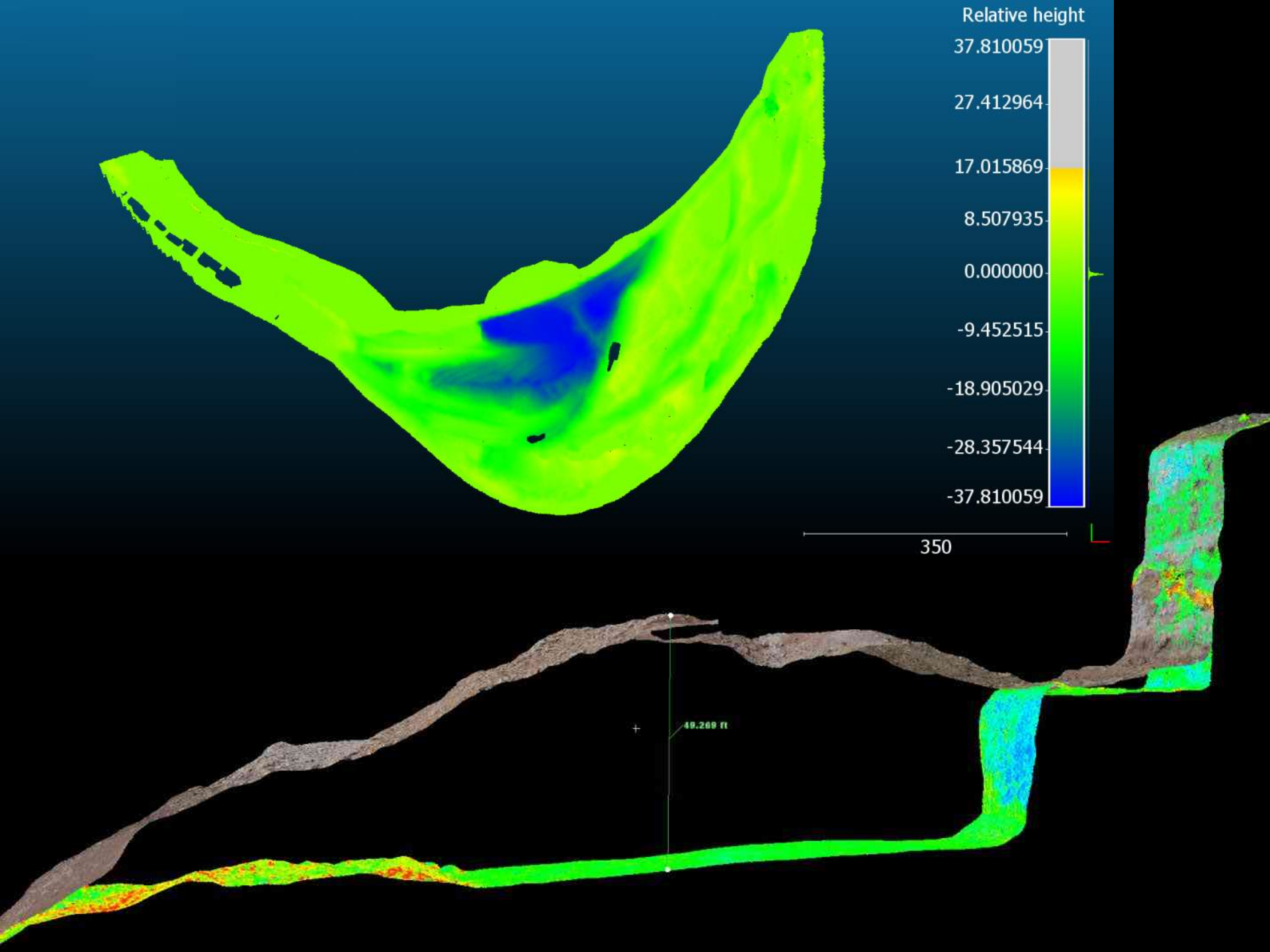
ΔXY 7.079901
ΔY -4.750000
ΔXZ 36.451584
ΔZ -36.071533
ΔZY 36.382935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17.015869
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-28.357544
-37.810059
350
49.269 ft