



Mobile LiDAR

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UTILITY ENGINEERING
& SURVEYING
INSTITUTE
Ontario Chapter



About J.D. Barnes

Our History

- Founded by John Duncan Barnes in 1960
- Establishment of photogrammetric mapping operation in 1972
- Multiple acquisitions over the years to expand services and geographical reach; most recently acquired Survey firms in KW, Windsor & Leamington in 2019
- Expansion of professional services continues to this day and remains a key philosophy embraced by the company
- Presently we have ~450 staff working in 15 offices throughout Ontario and have provided services across North America

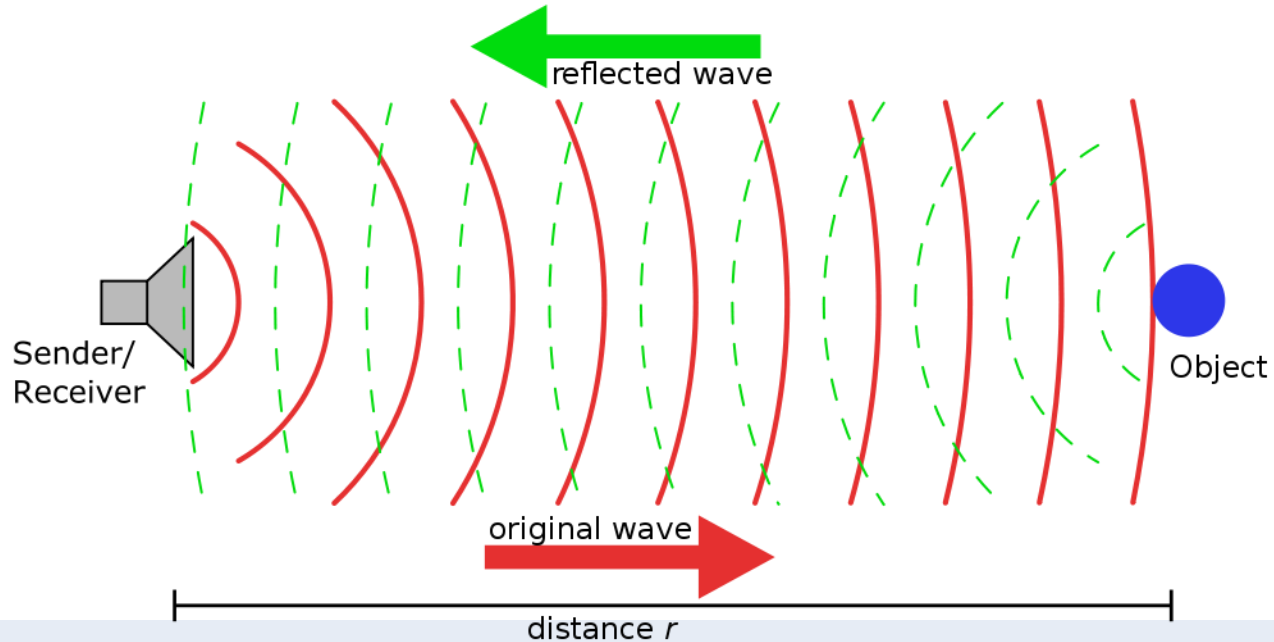


Geodetic & Engineering Surveys

- Geodetic: Design and implementation of horizontal and vertical control networks
- Engineering: Services supporting the design and construction activities of infrastructure and development projects
- Layout and As-Built Surveys: services to support project construction activities
- Bathymetric Surveys for near shore work to depths of 750m
- Monitoring: Providing precise measurements of small movements to detect structural issues
- LIDAR (Laser Scanning): the generation of dense clouds of millions of points, each with a discrete x,y,z value that can be georeferenced. When merged these point clouds provide a complete 3D representation of a site with incredible detail.

What is LiDAR?

Stands for **L**ight **D**etection **A**nd **R**anging (Active Sensor)



LiDAR Applications

- Architecture (BIM)
- Heritage Conservation
- Transportation Infrastructure*
- Plant & Process
- AM/FM*
- Topographic Surveying*
- Deformation analysis
- Quantity surveys*
- Construction (As-builts)*
- Forensic investigations*
- Fabrication
- Digital Twin data*

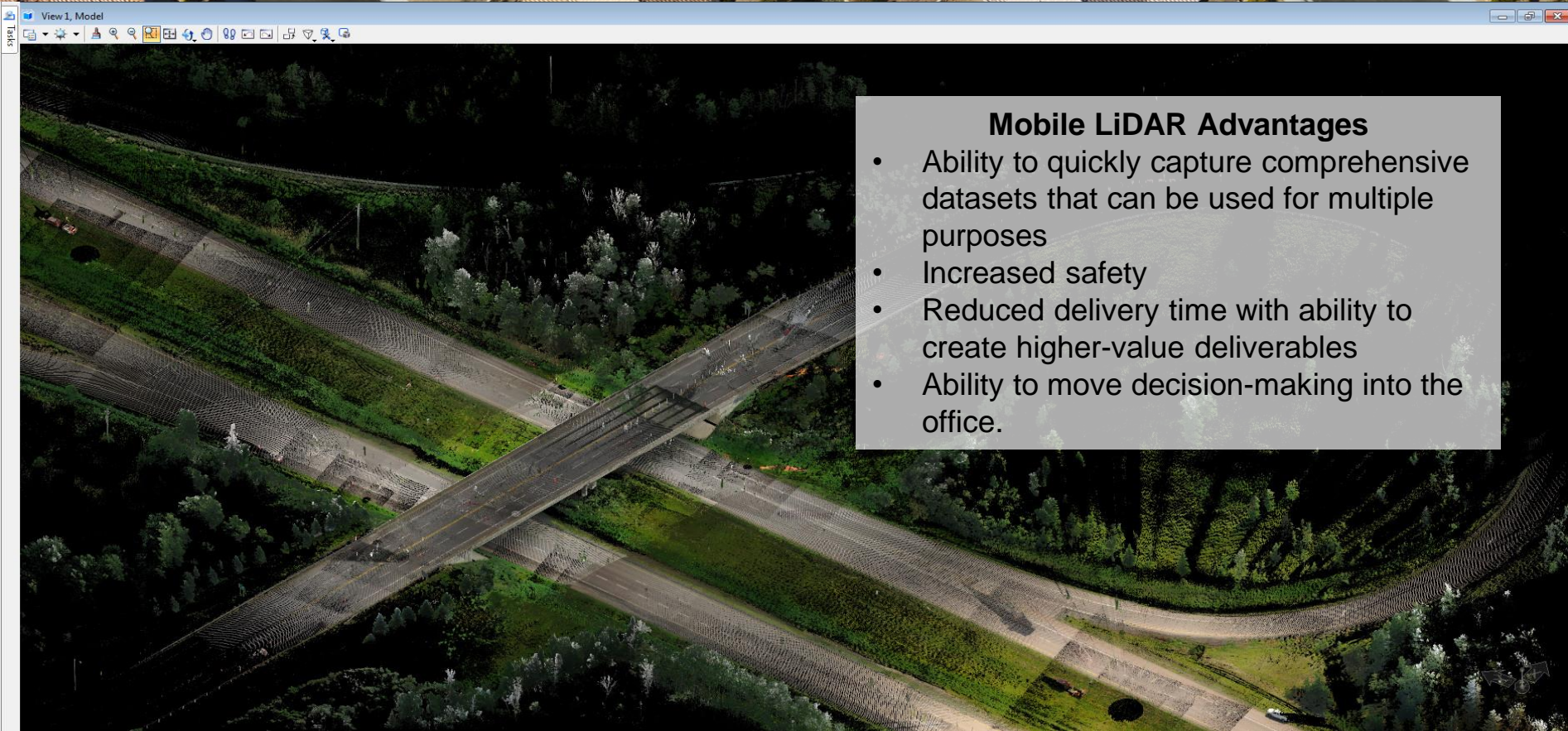
Advantages of Using LIDAR

- 3 dimensional site info (as opposed to a 2D plan) *
- Speed of acquisition *
- Non-contact measurement (safety) *
- Less need for lane closures on street & hwy surveys *
- Completeness of data *
- Unsurpassed level of detail *
- Integration of new design elements into existing infrastructure *
- Compatibility with most CAD & road design s/w (AD, Bentley, etc) *
- Ease of sharing and collaboration amongst stakeholders(web browser bubble viewer allows visualization of the data and precise measurement of features) *
- Lends itself to AR/VR & 3D Printing

What is Mobile LiDAR?

- A process of collecting geospatial data from a mobile vehicle.
- Systems are typically fitted with an integrated array of time synchronized navigation and imaging sensors mounted on a mobile platform.
- GNSS and INS have allowed the rapid and accurate determination of position and attitude of remote sensing equipment, effectively leading to direct mapping of features of interest.





Mobile LiDAR Advantages

- Ability to quickly capture comprehensive datasets that can be used for multiple purposes
- Increased safety
- Reduced delivery time with ability to create higher-value deliverables
- Ability to move decision-making into the office.

Mobile LiDAR Considerations

- Ensured accuracy
- Complexity
- Skill set and man-power needed for data processing
- Sharing of data securely throughout an organization

Pegasus:Two Ultimate

360 Camera

Leica Developed 360 Stitchless

Calibration Sensor

LiDAR Sensor

Z+F 9012 Profiler

Power Supply

One cable connection, 10 hrs

SSD Bay & Sensor Ports

2nd GPS, DMI, Trigger/Sync

Roof Mounting

Standard roof rack mounts, system stores complete in one case



Global GNSS/GPS

Triple Band, All Constellation,
Novatel Propak 6

Light Sensor

Automatic exposure control

Camera System

4 CCD Cameras, 12MP

Integrated PC & SPAN

Industrial Grade High Performance
Multicore PC

IMU Inertial Meas. Unit

200Hz, Tactical Grade iMAR - FSAS



2 Additional Sensor Ports

Industrial Design - Compact

Proven Design from Airborne

Removable 1-TB SSD

USB 3.0 on Drive



Enhanced Side Cameras

4 x 12 Megapixel

On-board Camera Processing

9 Frames per Second

60° x 47° Focused FOV

5X the Quality of Last Gen





New 360° Camera

Leica Developed 360° Spherical

Dual Fish Eye Lens 24 Megapixel

Equal Quality Across Entire Lens

Higher Dynamic Range

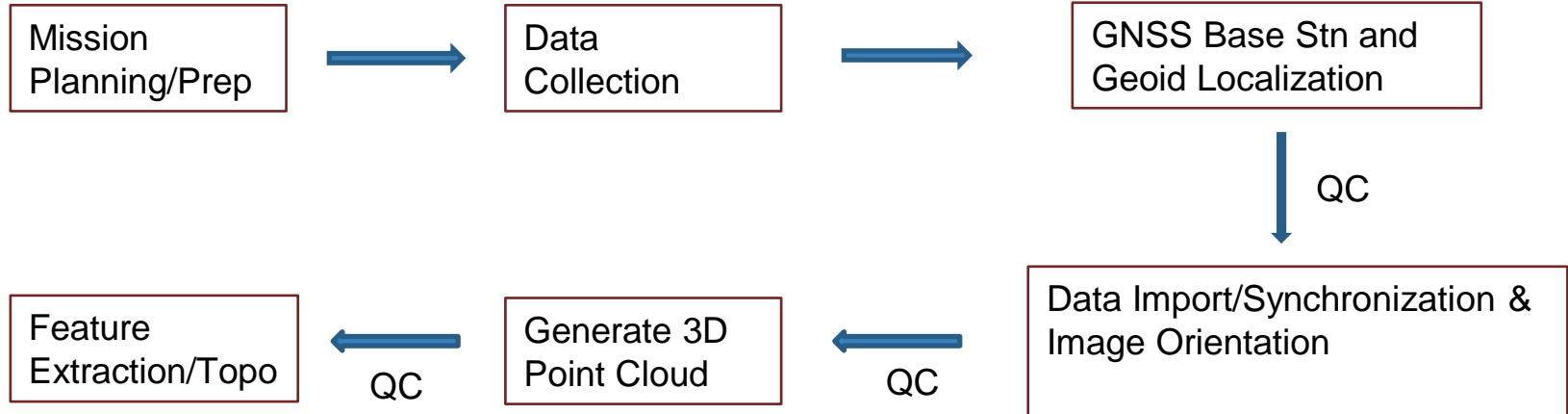
Complete Stitchless Imagery

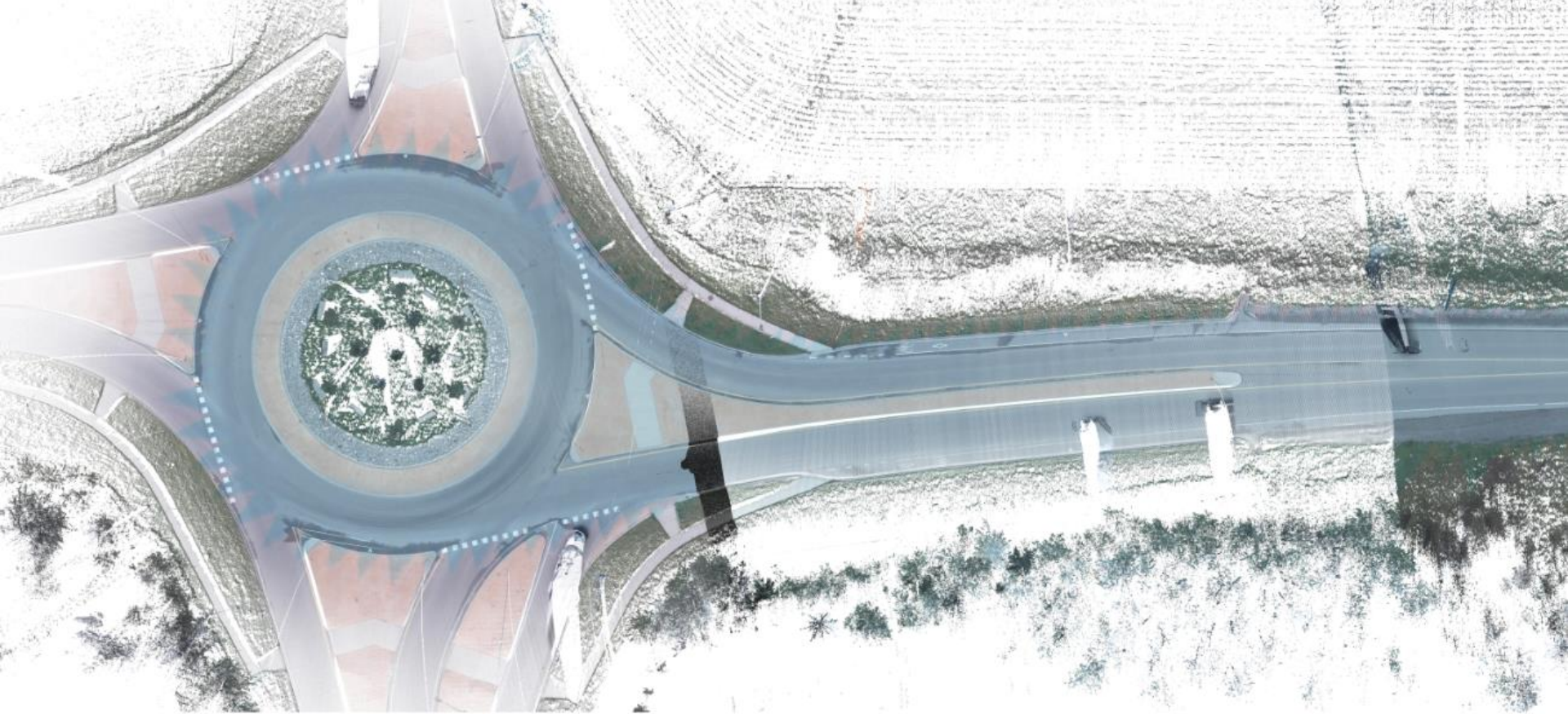


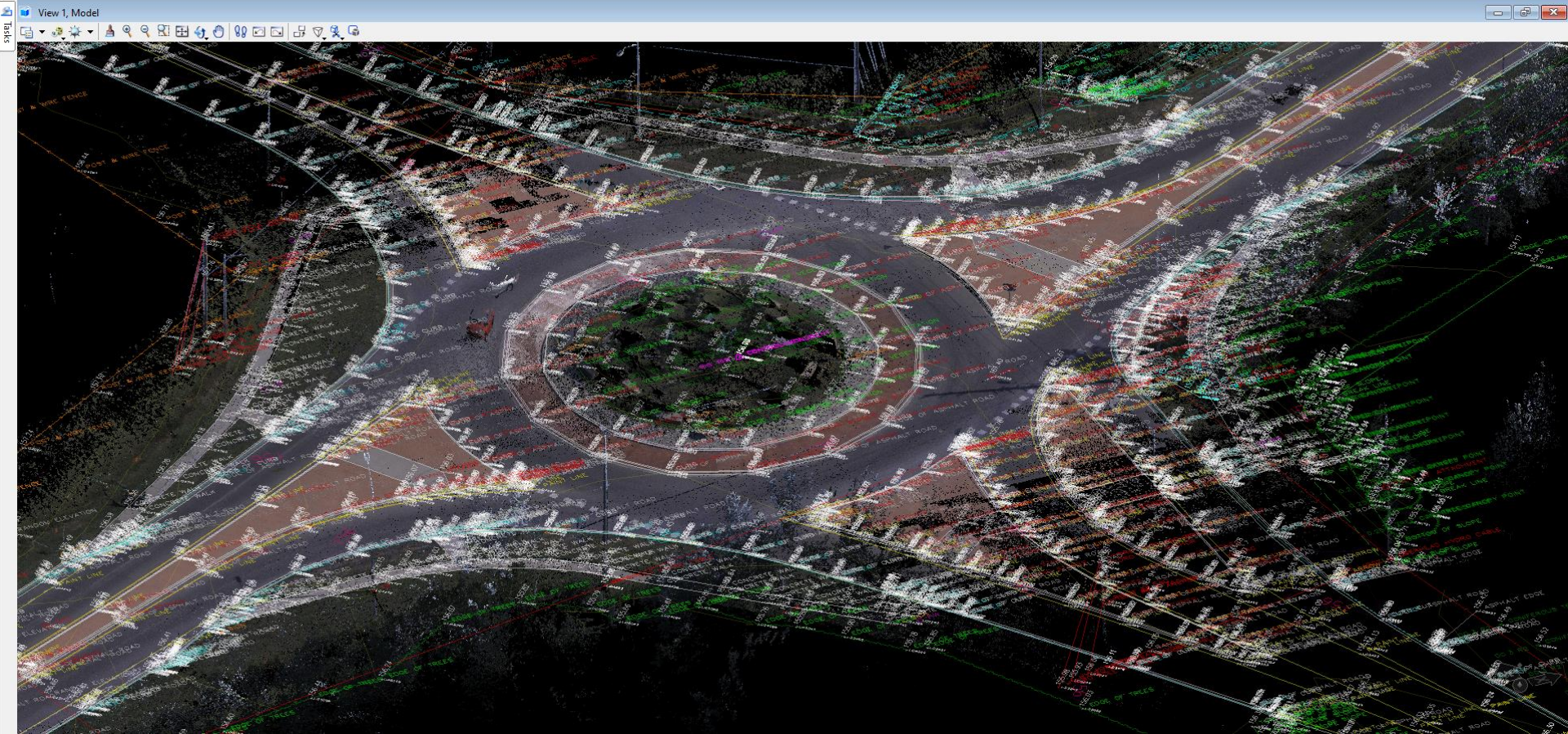
Pegasus: Two – Vehicle Independent



Workflow Process







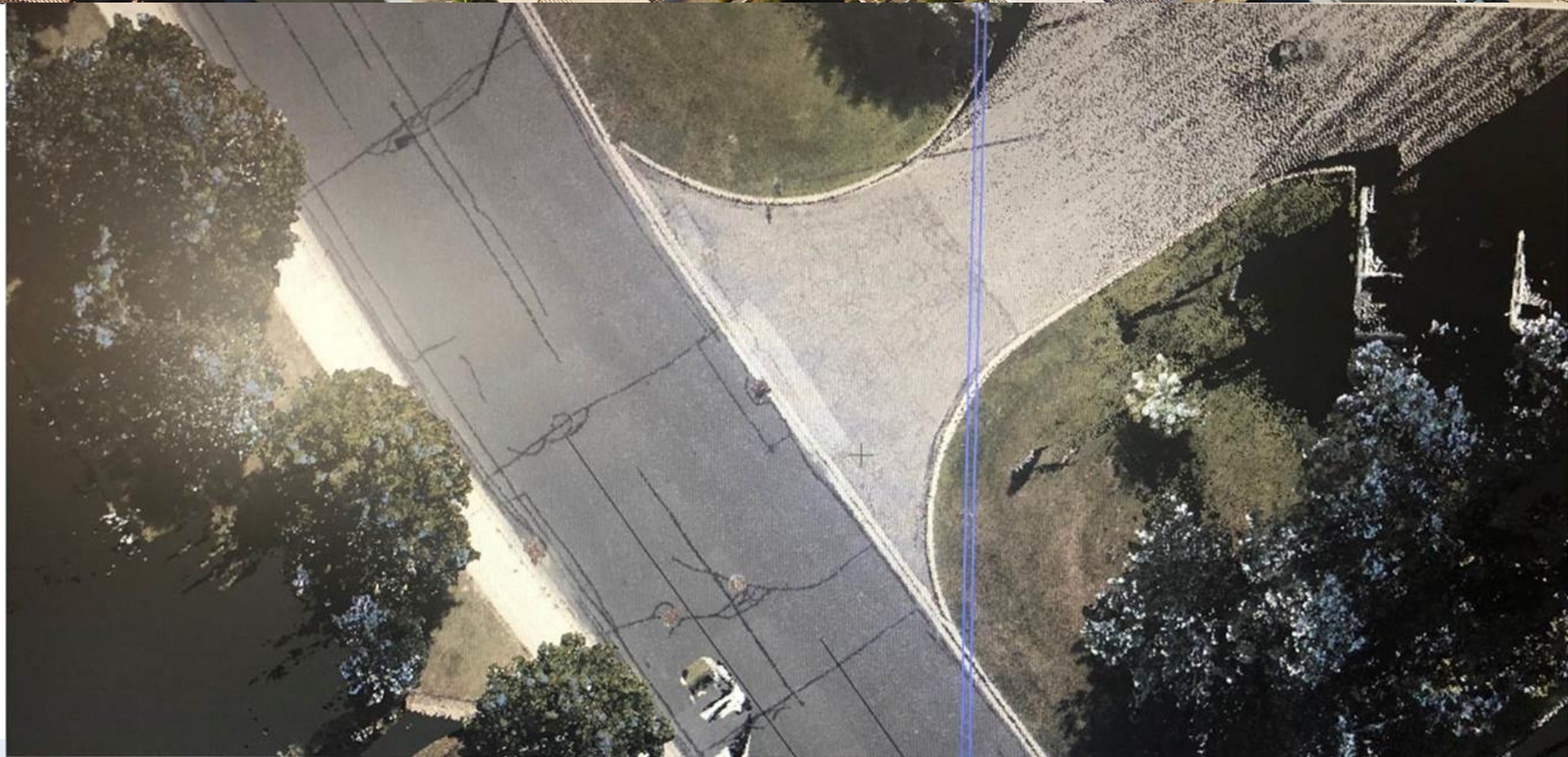
Sample Data-Multi-lane road



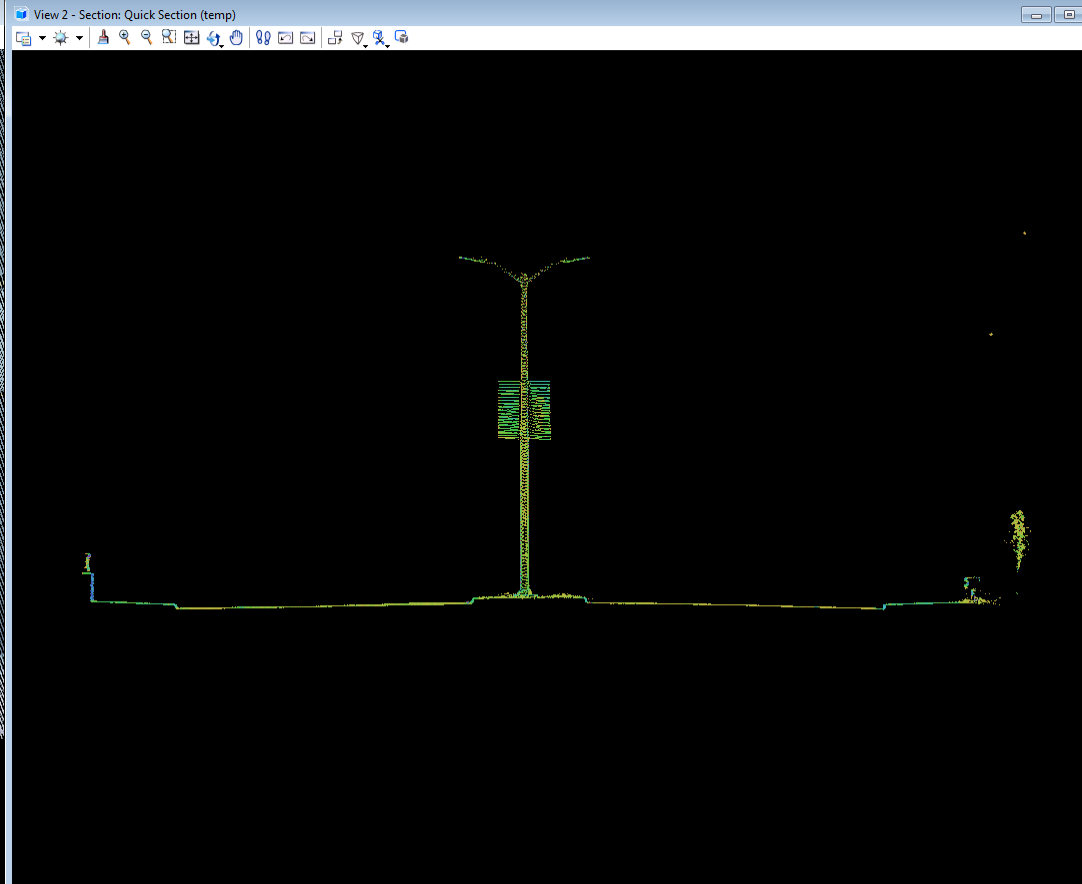
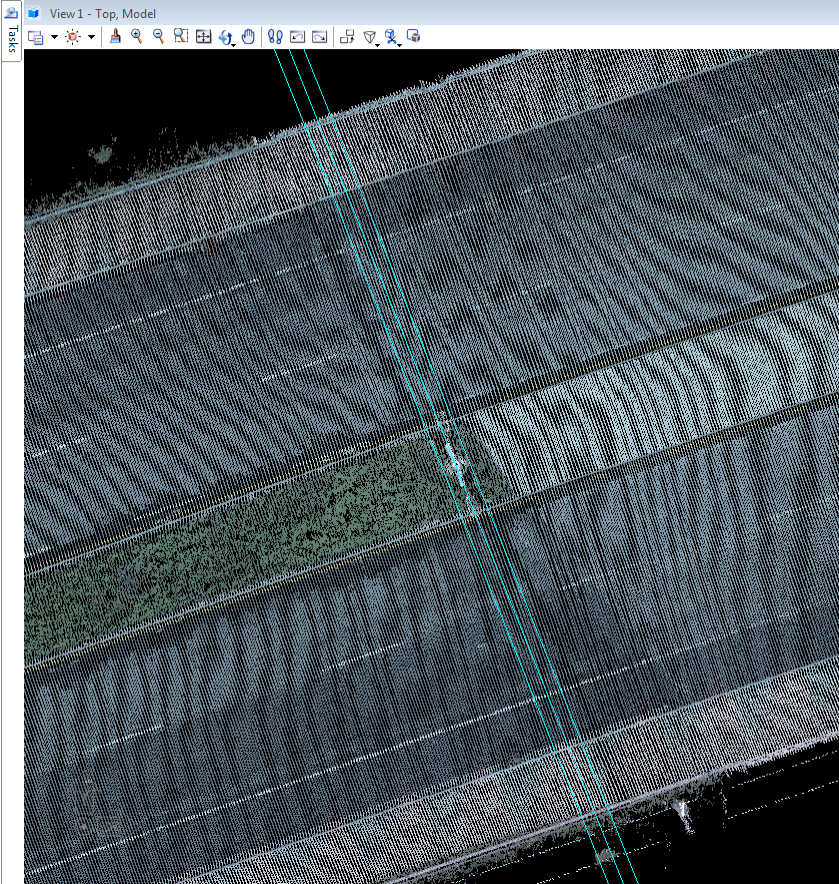
Sample Data – Residential Street



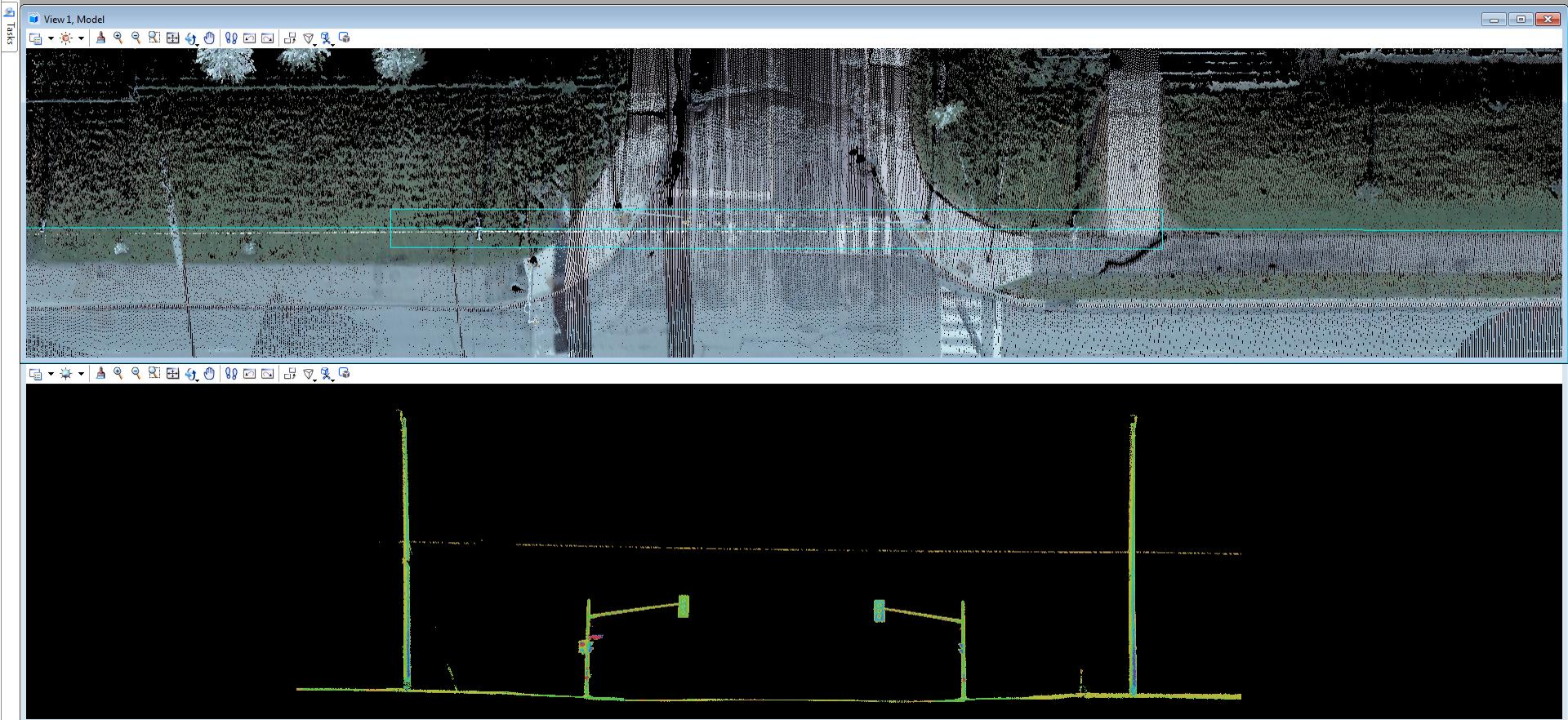
Street Details



tasks



Cross-Sections





1

Accuracy

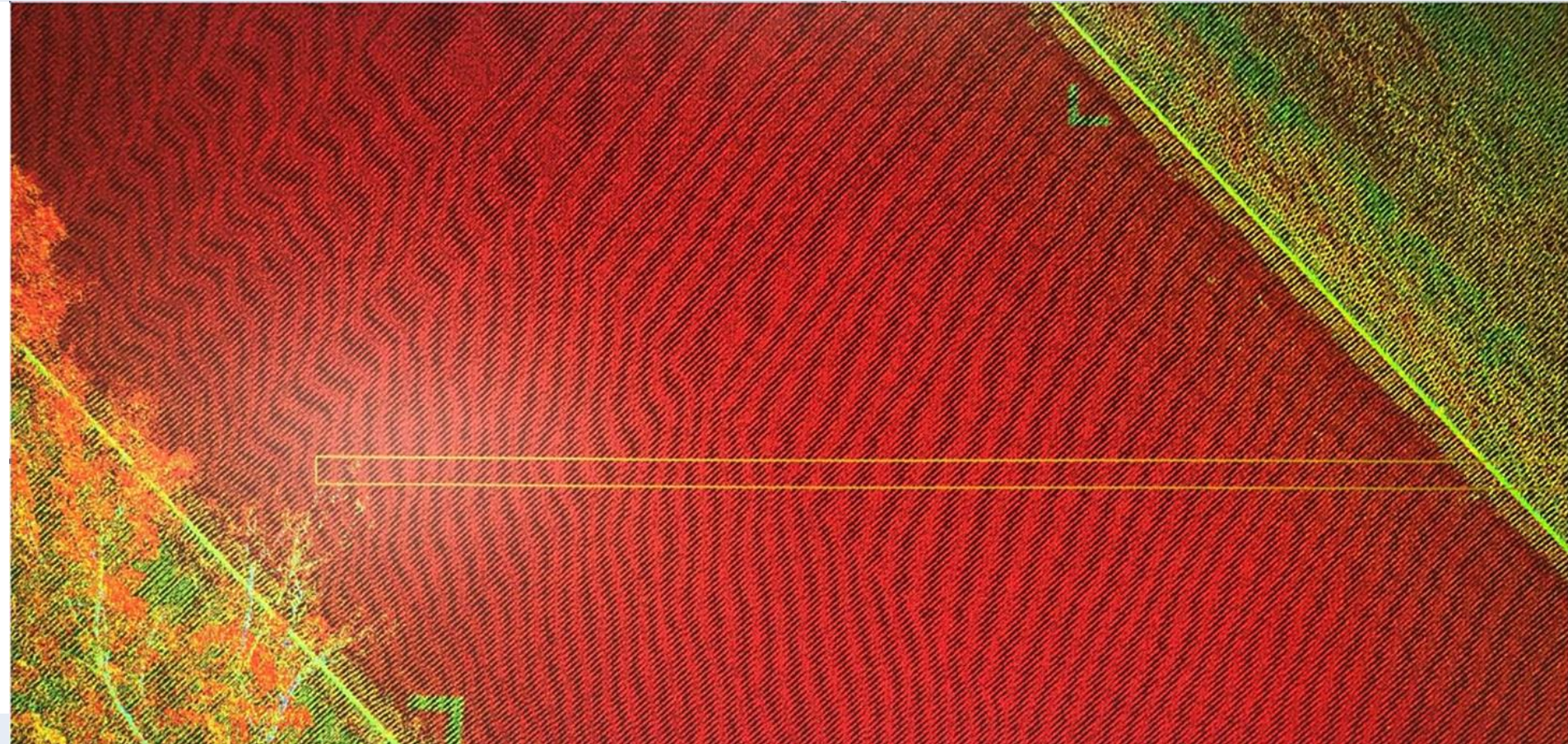
1. Out of the box, we found we could achieve accuracies in the 3-5 cm range in Hz & V
2. With ample GPS Base Stn data, we were able to improve this to 2-3 cm
3. With the use of chevrons or other easily identifiable features as ground control points, we could refine this even further to 1-2 cm
4. To achieve best accuracies, we use both Base stns and Chevrons

Sample QC Analysis

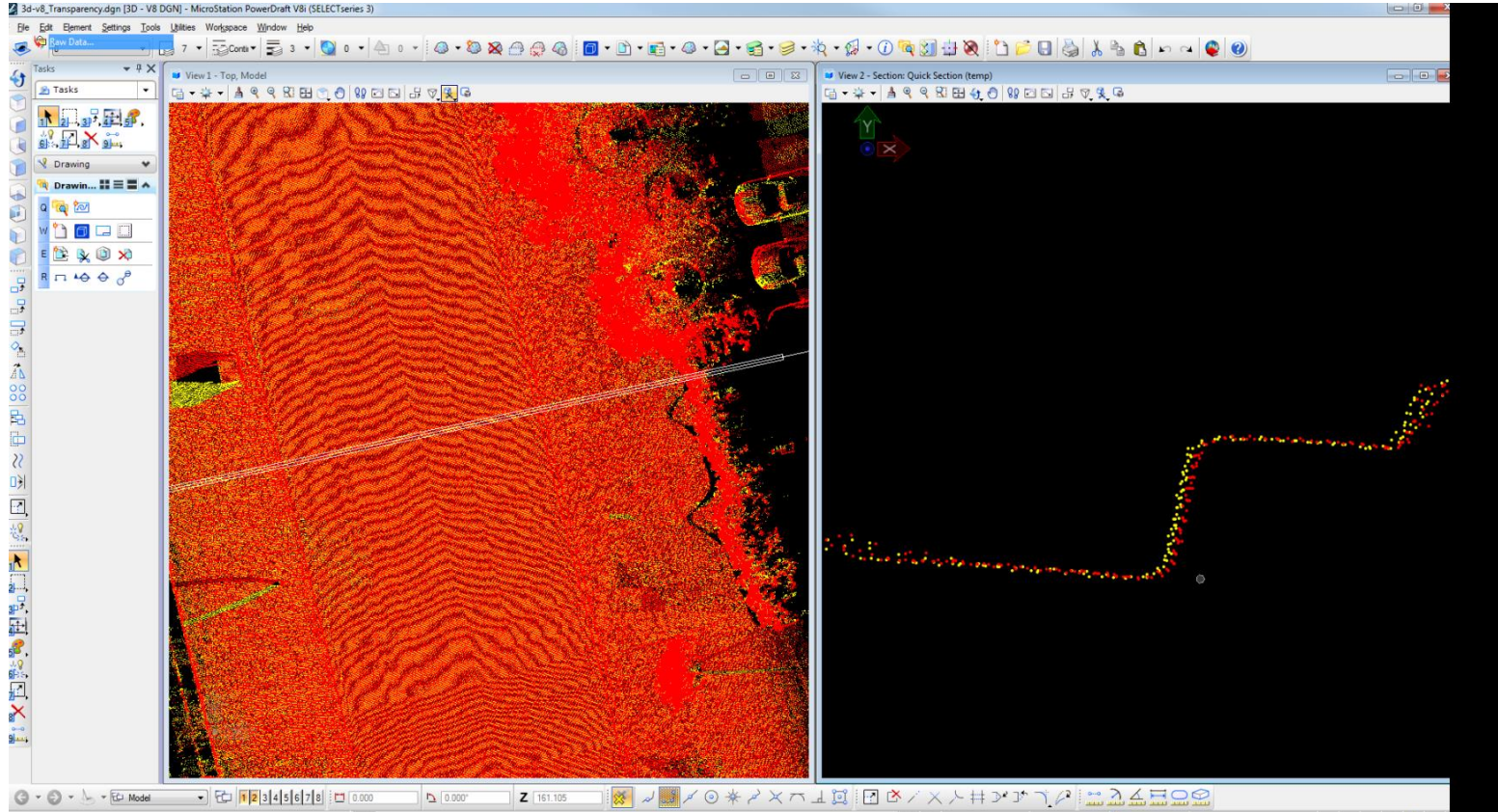
19-23-000-00 JD Barnes Limited Mobile LiDAR R&D / Testing. 1KM run on Renfrew Drive, LP2U @ 150RPS-90°-2 Tracks & 35-40Km/h. Control values based on long RTK x 2 averaged.

No.	Name	Control X (m)	Control Y (m)	Control Z (m)	Used in Adjustment	Final Point Cloud X (m)	Final Point Cloud Y (m)	Final Point Cloud Z (m)	Δ X (m)	Δ Y (m)	Δ Z (m)	Δ Hz (m)	NOTE
1	05AH100	631280.890	4858017.385	197.437	YES	631280.891	4858017.375	197.439	0.001	0.010	0.002	0.010	Control Point
2	05AH101	631290.629	4858019.256	197.500	YES	631290.609	4858019.254	197.506	0.020	0.002	0.006	0.020	Control Point
3	05AH102	631299.443	4857942.002	197.225	NO	631299.417	4857941.982	197.237	0.026	0.020	0.012	0.033	Check Point
4	05AH103	631312.993	4857844.095	195.357	NO	631312.961	4857844.059	195.368	0.032	0.036	0.011	0.048	Check Point
5	05AH104	631321.688	4857848.045	195.448	YES	631321.679	4857848.029	195.446	0.009	0.016	0.002	0.018	Control Point
6	05AH105	631375.740	4857739.899	193.979	NO	631375.718	4857739.882	193.984	0.022	0.017	0.005	0.028	Check Point
7	05AH106	631438.003	4857652.426	194.165	YES	631437.985	4857652.429	194.164	0.018	0.003	0.001	0.018	Control Point
8	05AH107	631443.193	4857660.121	194.169	NO	631443.202	4857660.112	194.175	0.009	0.009	0.006	0.013	Check Point
9	05AH108	631569.337	4857525.160	194.015	YES	631569.361	4857525.164	194.011	0.024	0.004	0.004	0.024	Control Point
10	05AH109	631582.863	4857498.058	193.885	NO	631582.870	4857498.026	193.882	0.007	0.032	0.003	0.033	Check Point
11	05AH110	631639.108	4857369.601	191.920	YES	631639.103	4857369.611	191.920	0.005	0.010	0.000	0.011	Control Point
12	05AH111	631647.736	4857371.741	191.880	YES	631647.756	4857371.721	191.883	0.020	0.020	0.003	0.028	Control Point
13	05AH112	631664.859	4857245.582	189.945	YES	631664.854	4857245.583	189.944	0.005	0.001	0.001	0.005	Control Point
14	05AH113	631674.160	4857247.672	189.940	YES	631674.152	4857247.666	189.939	0.008	0.006	0.001	0.010	Control Point
AVERAGES:									0.006	0.011	0.002	0.021	Prepared by: zh 8/15/2019
AVERAGE OF ABSOLUTE VALUES:									0.015	0.013	0.004	0.021	
MIN:									0.024	0.010	0.012	0.005	
MAX:									0.032	0.036	0.004	0.048	

Chevrons Used as GCP's

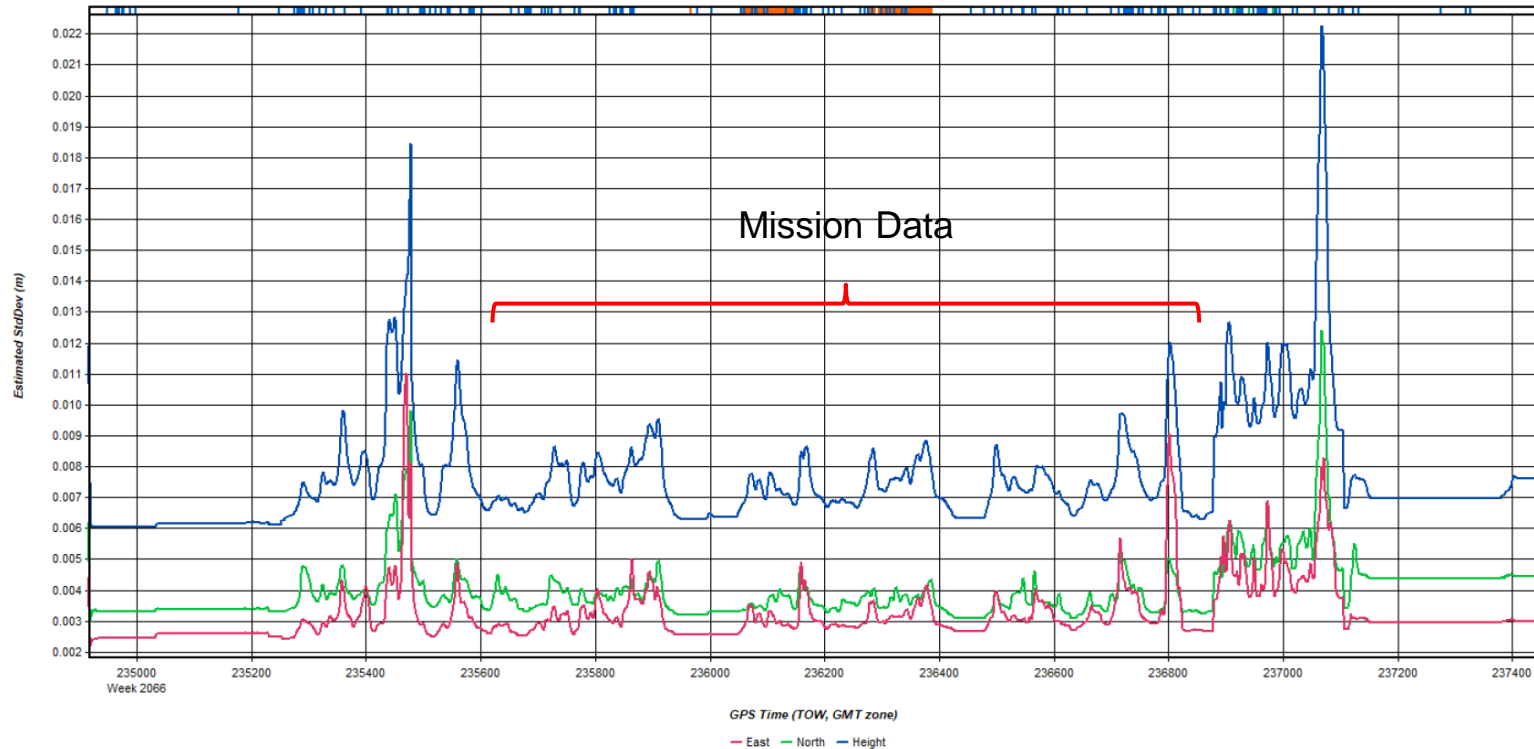


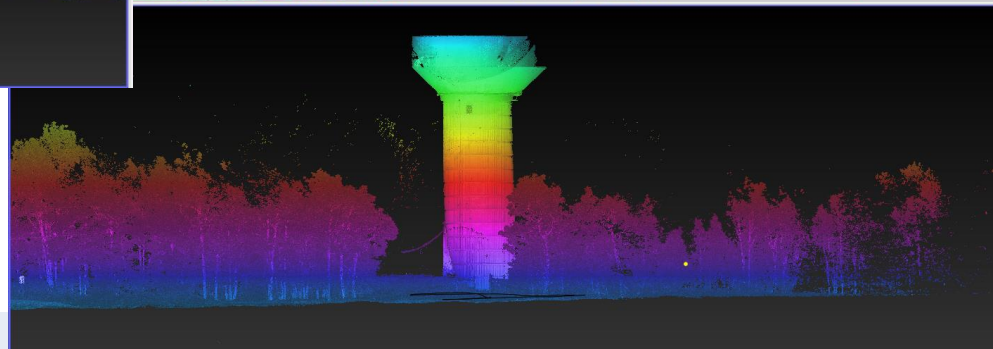
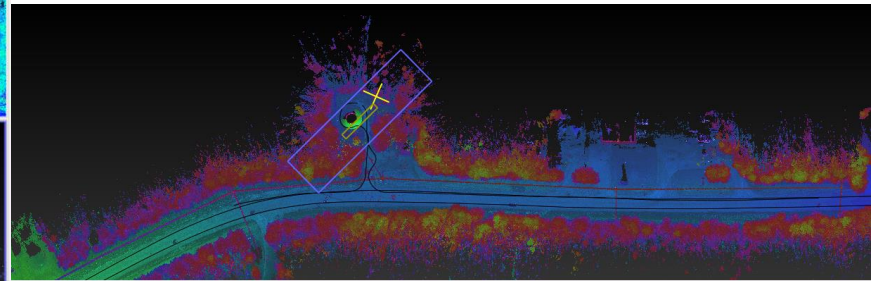
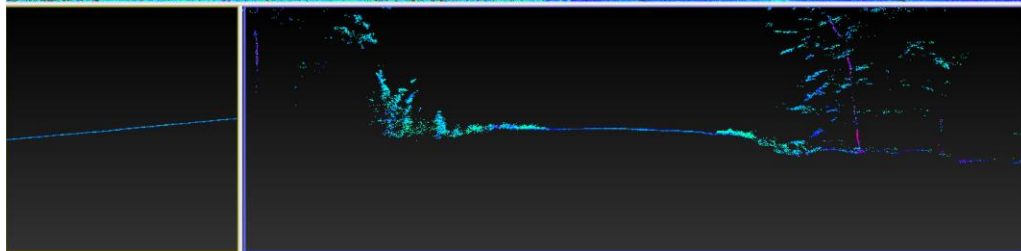
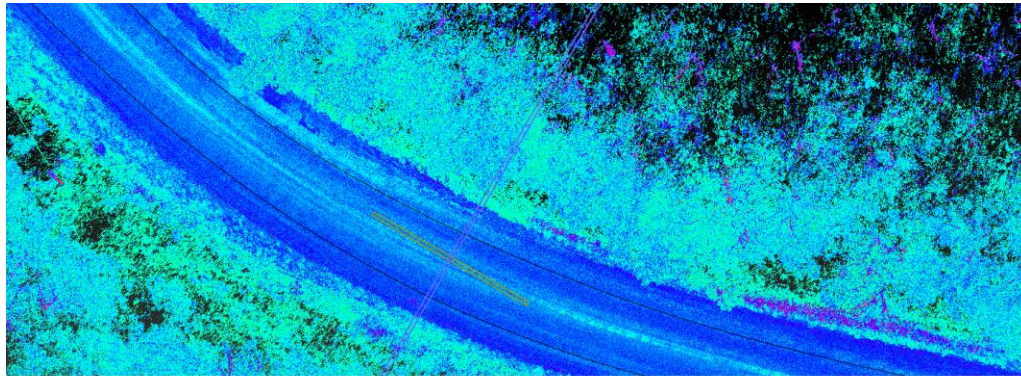
Matching Trajectories

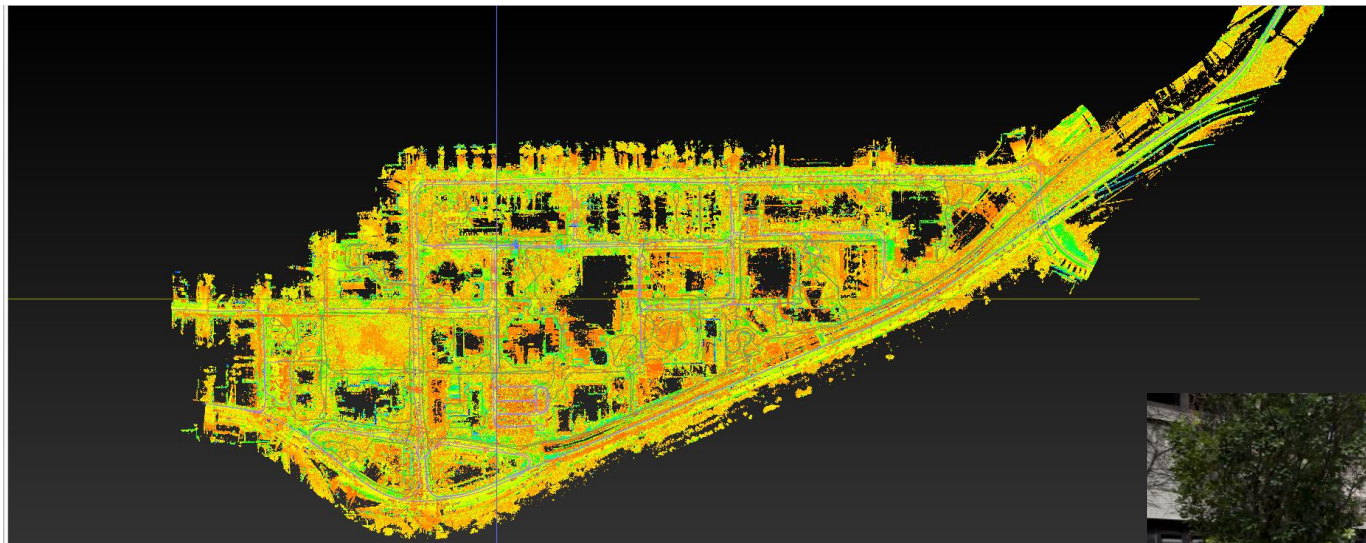


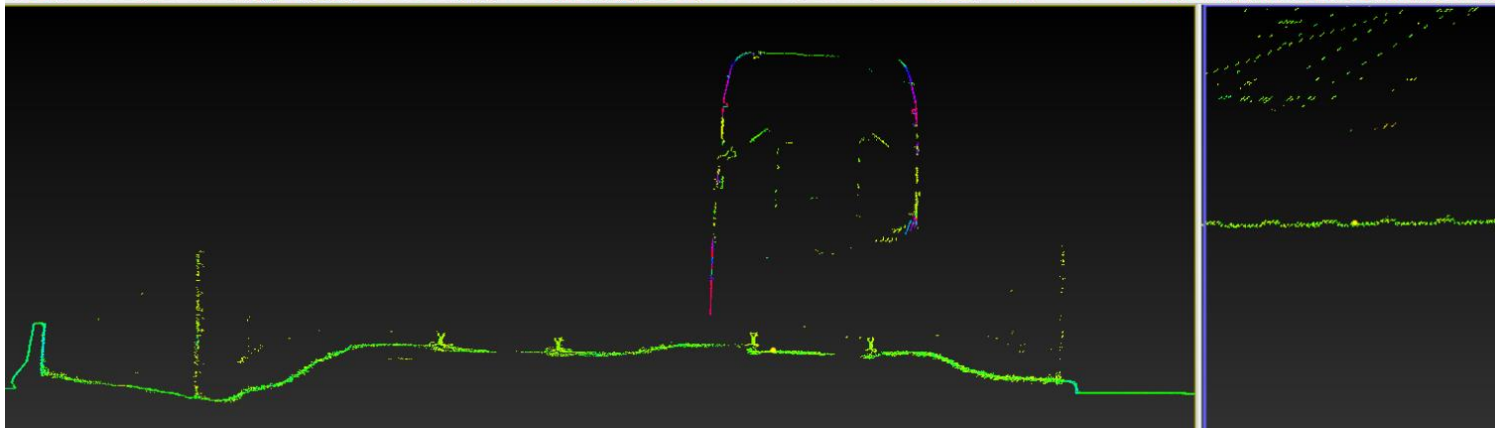
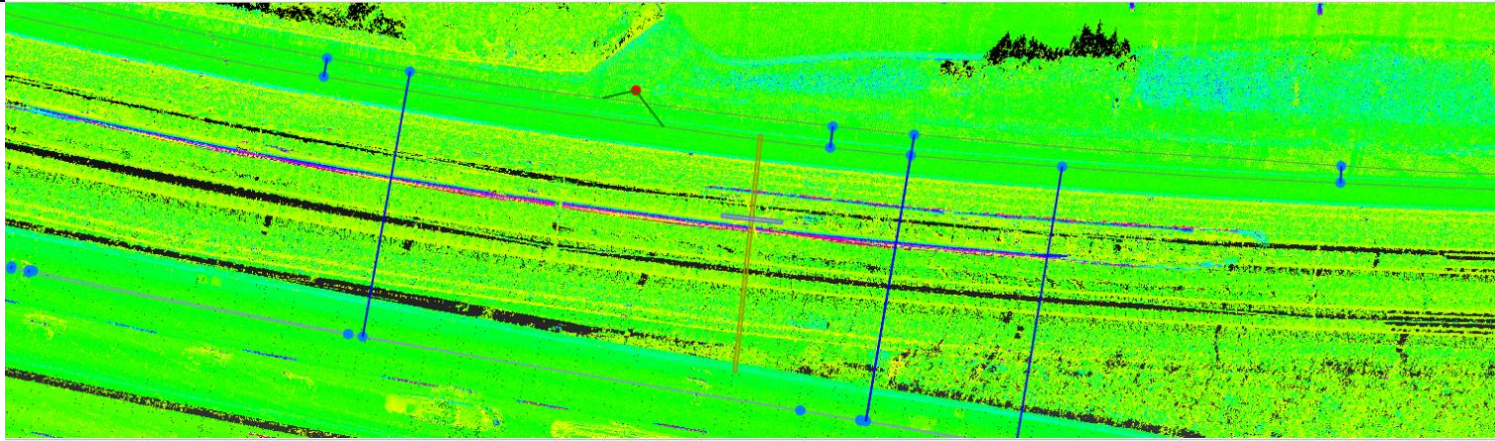
Positional Accuracy Plots

Figure 2: Renfrew4_22562084 [Smoothed TC Combined] - Estimated Position Accuracy Plot









Questions?

I can be reached at...

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Thank You