

A detailed topographic map of Huntington, West Virginia, showing the city's layout, roads, and surrounding terrain. The map is oriented horizontally and serves as the background for the slide.

# **A Case Study from Huntington WV: Collecting, Extracting and Visualizing Assets using a Mobile Mapping Foundation**

**Bradley Adams**

Vice President, Transcend

**Steve Ellis**

Program Manager, LANGAN

**LANGAN**



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Research Board



# Introduction

- Stakeholders

- KYOVA Interstate Planning Commission
- West Virginia DOT
- FHWA

- Data Consumers

- KYOVA Data Holder
- Pilot Project Extended to other MPOs
- DOT Planning Division, Engineering Division
- Engineering Consultants

# Overview

- Products
  - Comprehensive Video Log
  - Accurate, Complete LiDAR Point Cloud
  - Rear Camera Pavement Camera
- Features Extracted
  - Sidewalks
  - Local Signage
  - Traffic Signals
  - Trees in Planting Containers
  - Storm Sewer Inlets
- Data Uses
  - Asset Inventory
  - Sidewalk Assessment
  - As- Is Conditions for Engineering Projects

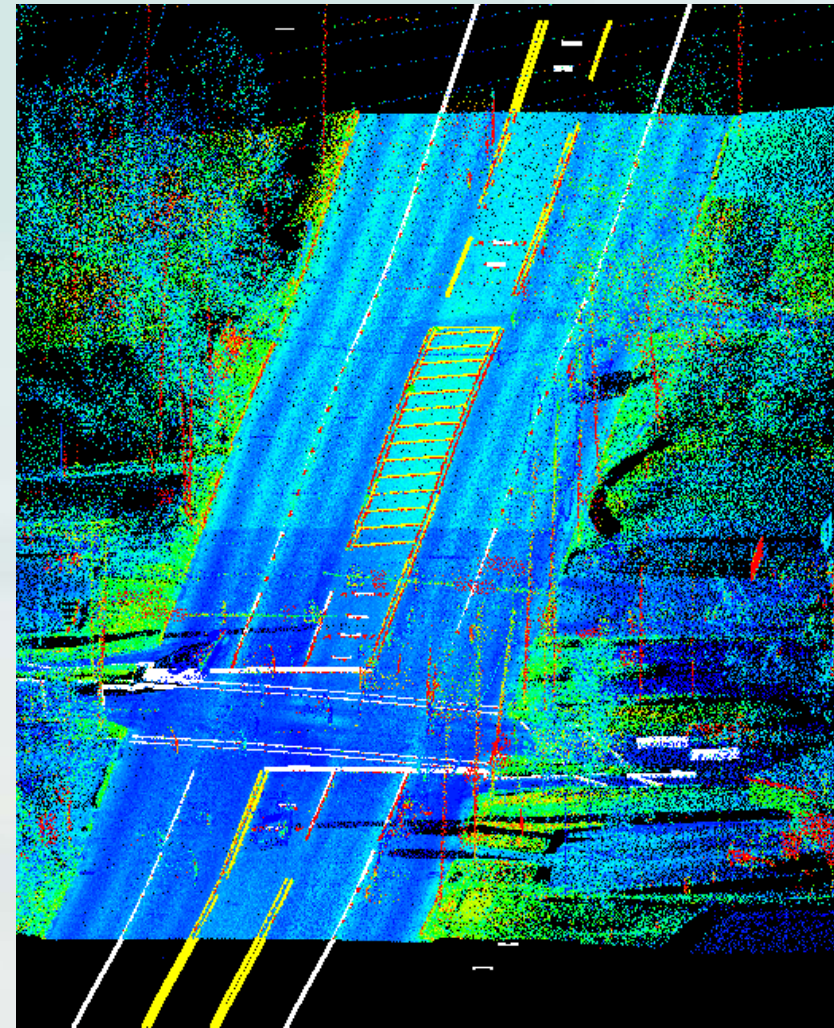


# MIRE Elements 127 out of 202

## I. Roadway Segment Descriptors

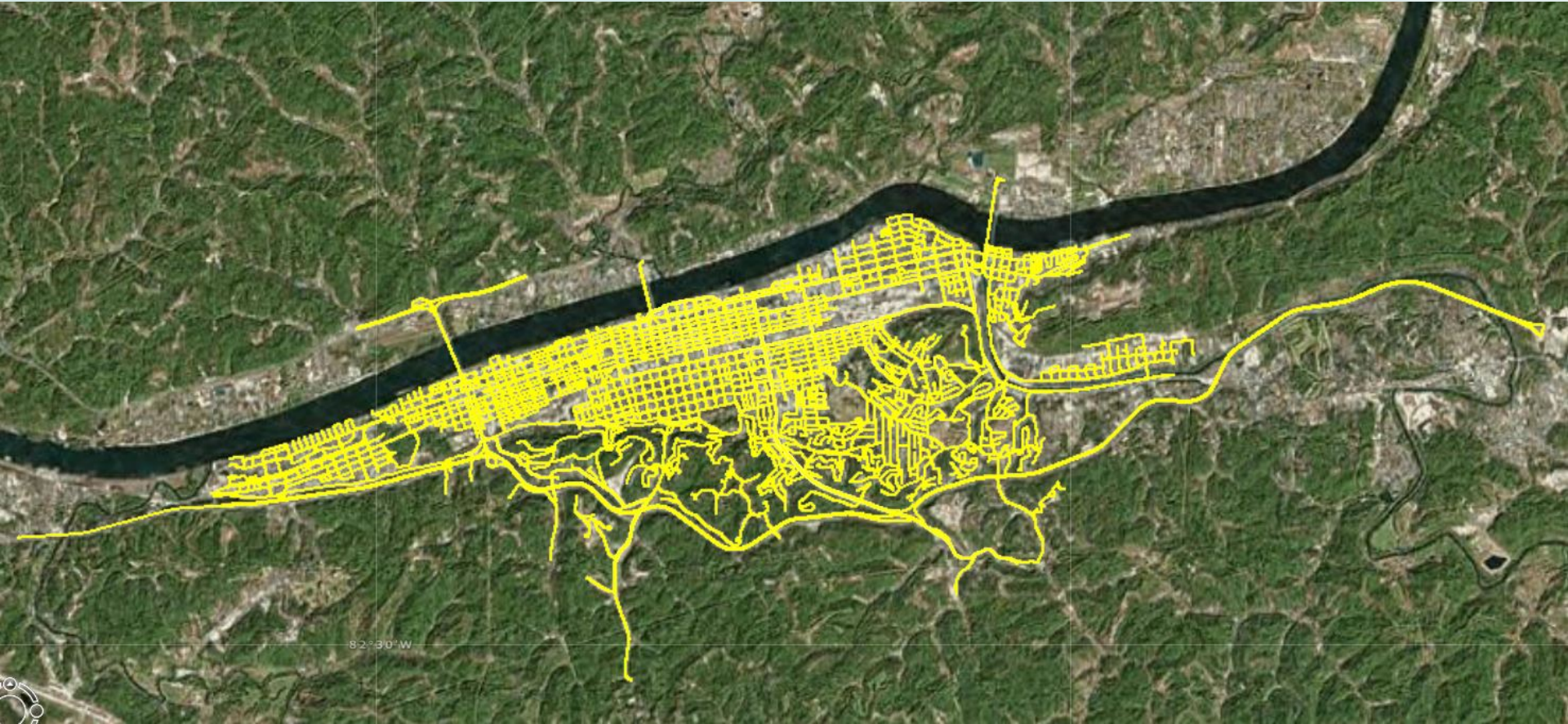
### I.B. Segment Classification

- 23. Surface Type
- 24. Total Paved Surface Width
- 31. Number of Through Lanes
- 32. Outside Through Lane Width
- 33. Inside Through Lane Width
- 34. Cross Slope
- 35. Auxiliary Lane Presence/Type
- 36. Auxiliary Lane Length
- 37. HOV Lane Presence/Type
- 38. HOV Lanes
- 39. Reversible Lanes
- 40. Presence/Type of Bicycle Facility
- 41. Width of Bicycle Facility
- 42. Number of Peak Period Through Lanes
- 43. Right Shoulder Type
- 44. Right Shoulder Total Width





# City of Huntington- Project Scope



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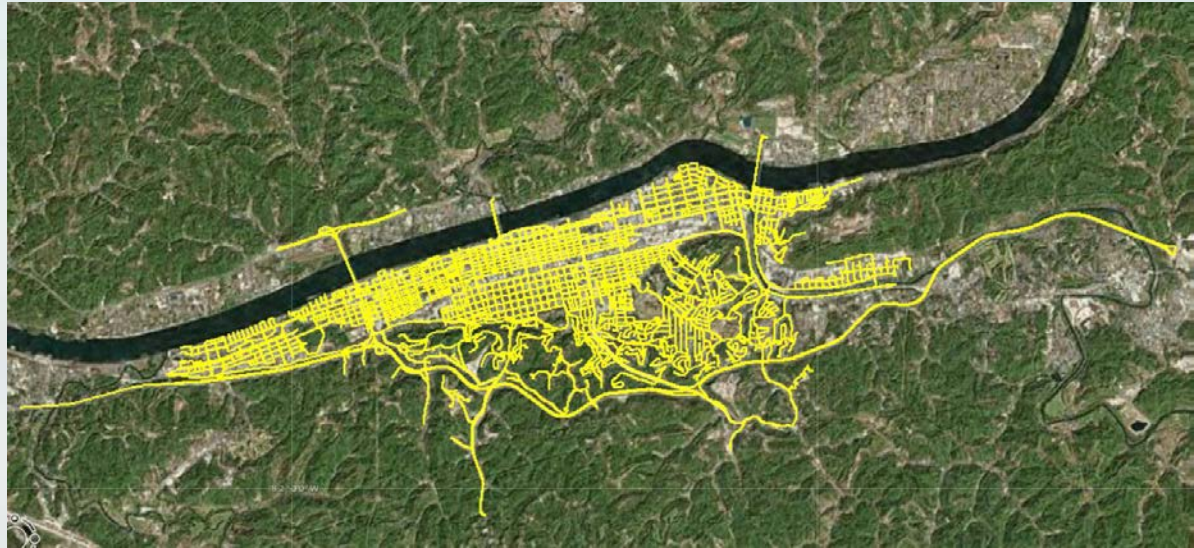
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# City of Huntington- Project Scope

- 281 Linear Miles
- 5 Days of Scanning
- 40 Hours of Post Processing
- 8 Weeks of Extraction



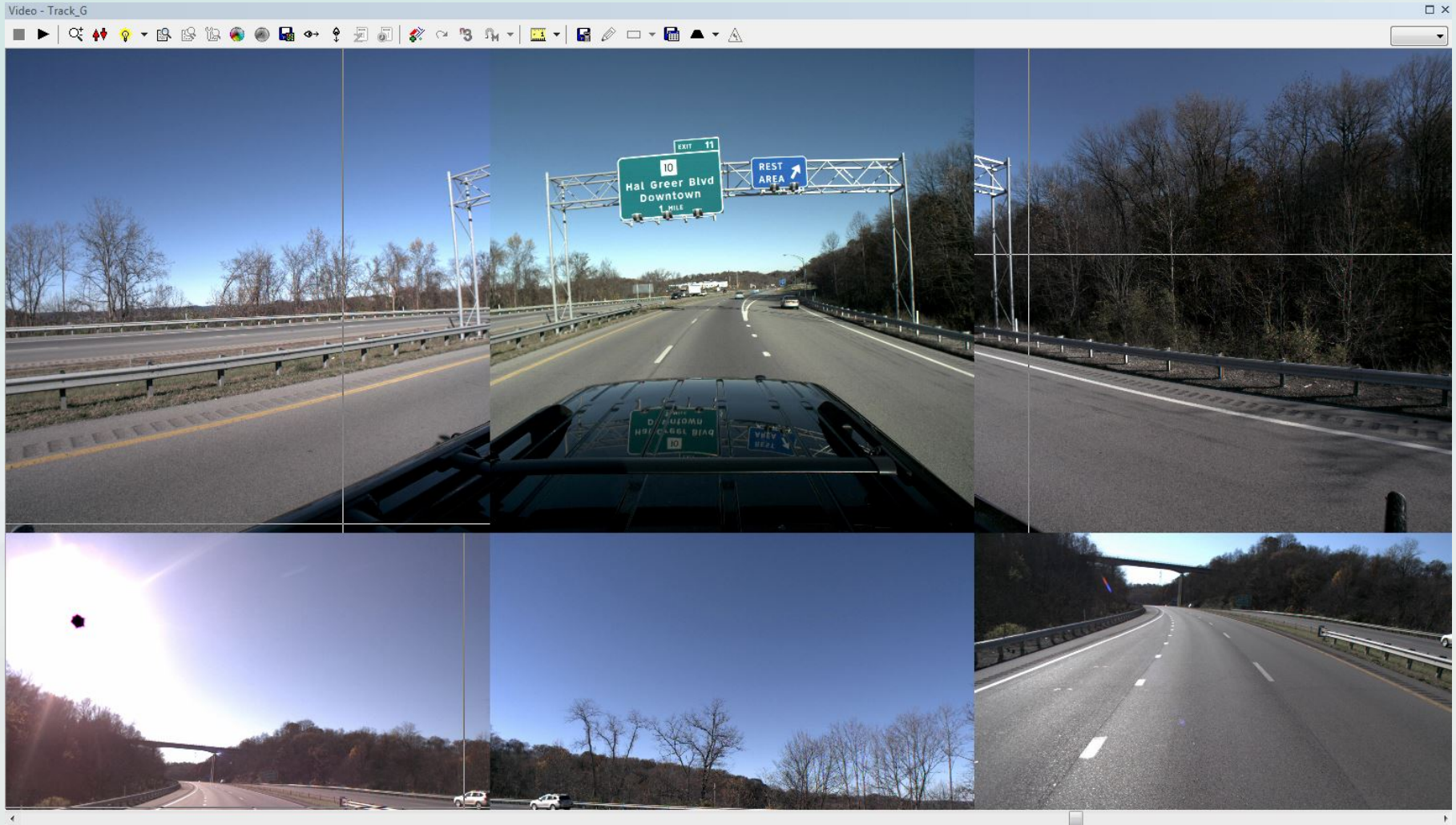
# City of Huntington- Project Scope

- Local Signs 10,336
- Signals 1,064
- Storm Inlets 3,374
- Tree Planters 259
- Sidewalks 964,358.92 feet





# City of Huntington- Results

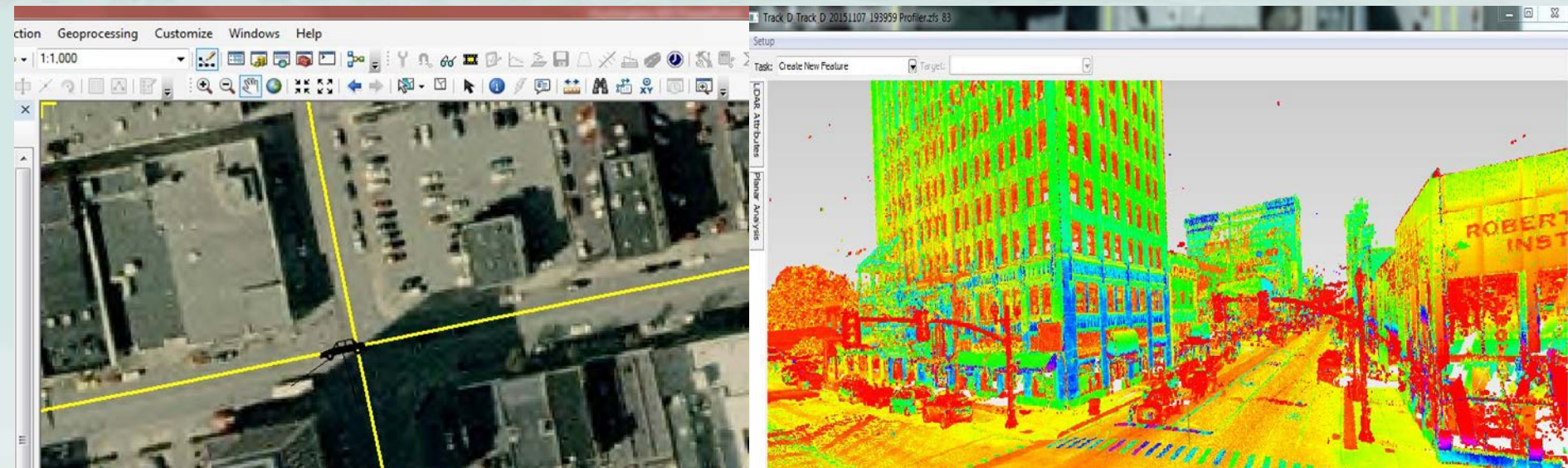


**LANGAN**





# City of Huntington- Results



**LANGAN**

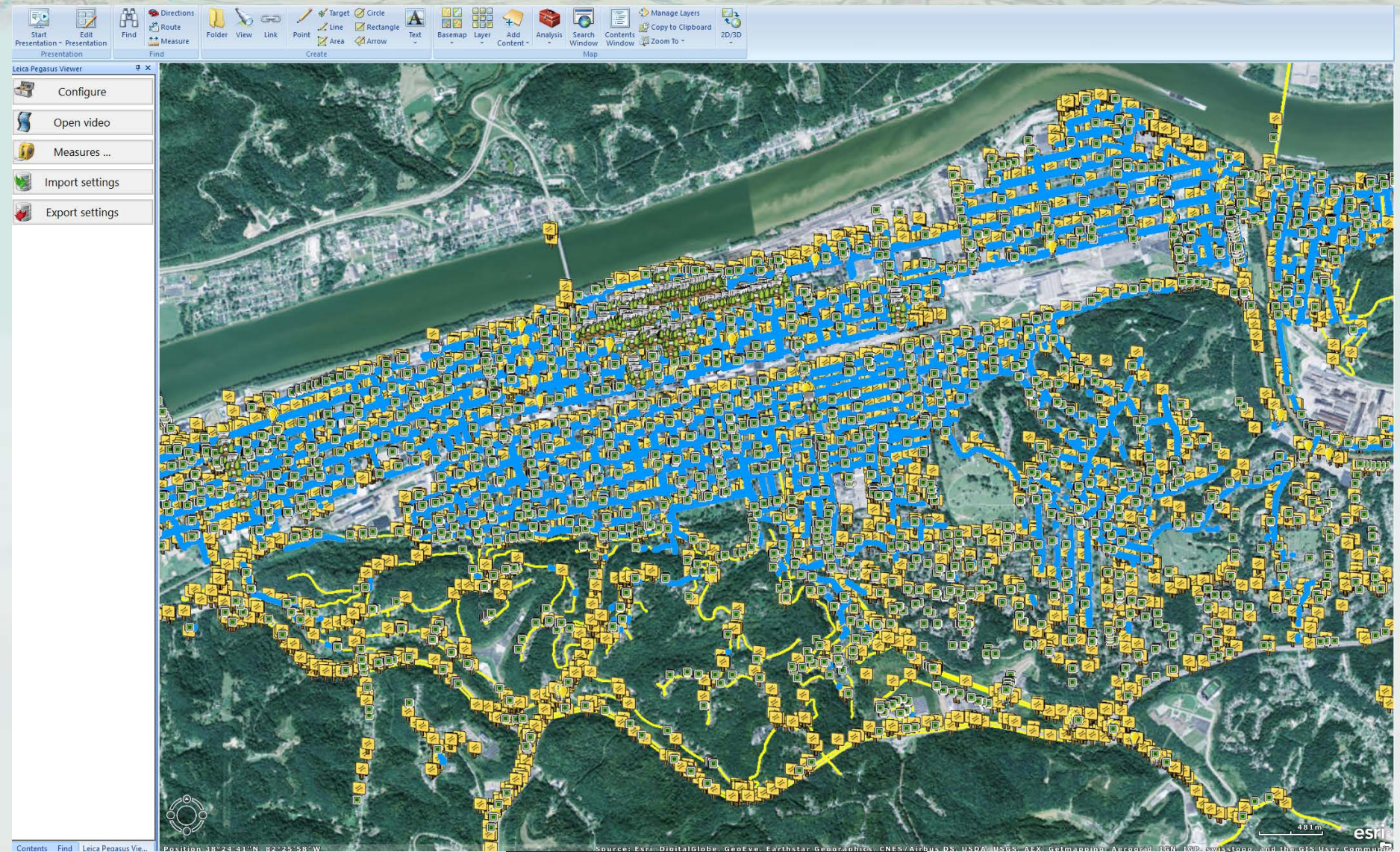
**TRB**

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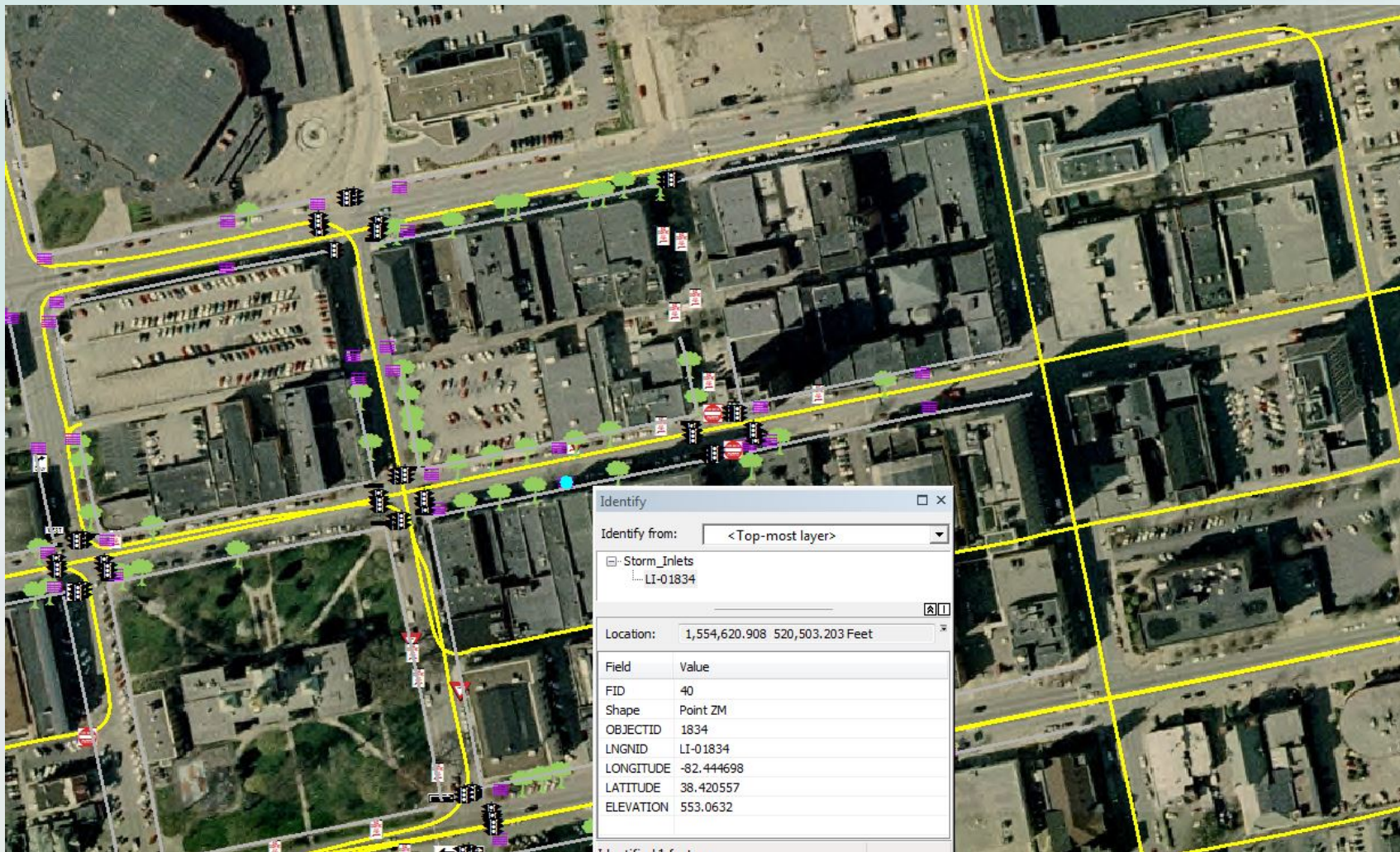


# City of Huntington- Results



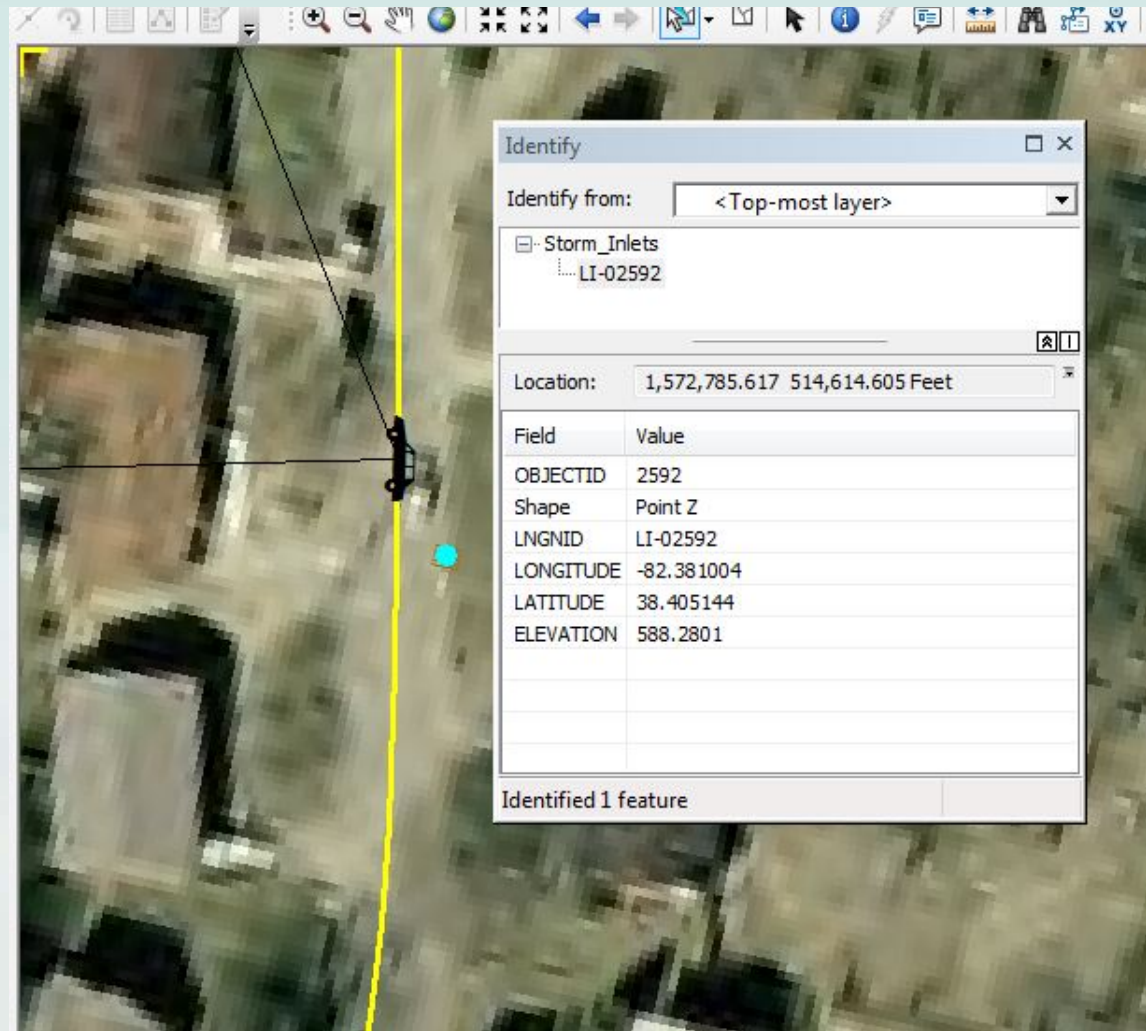


# City of Huntington- Results

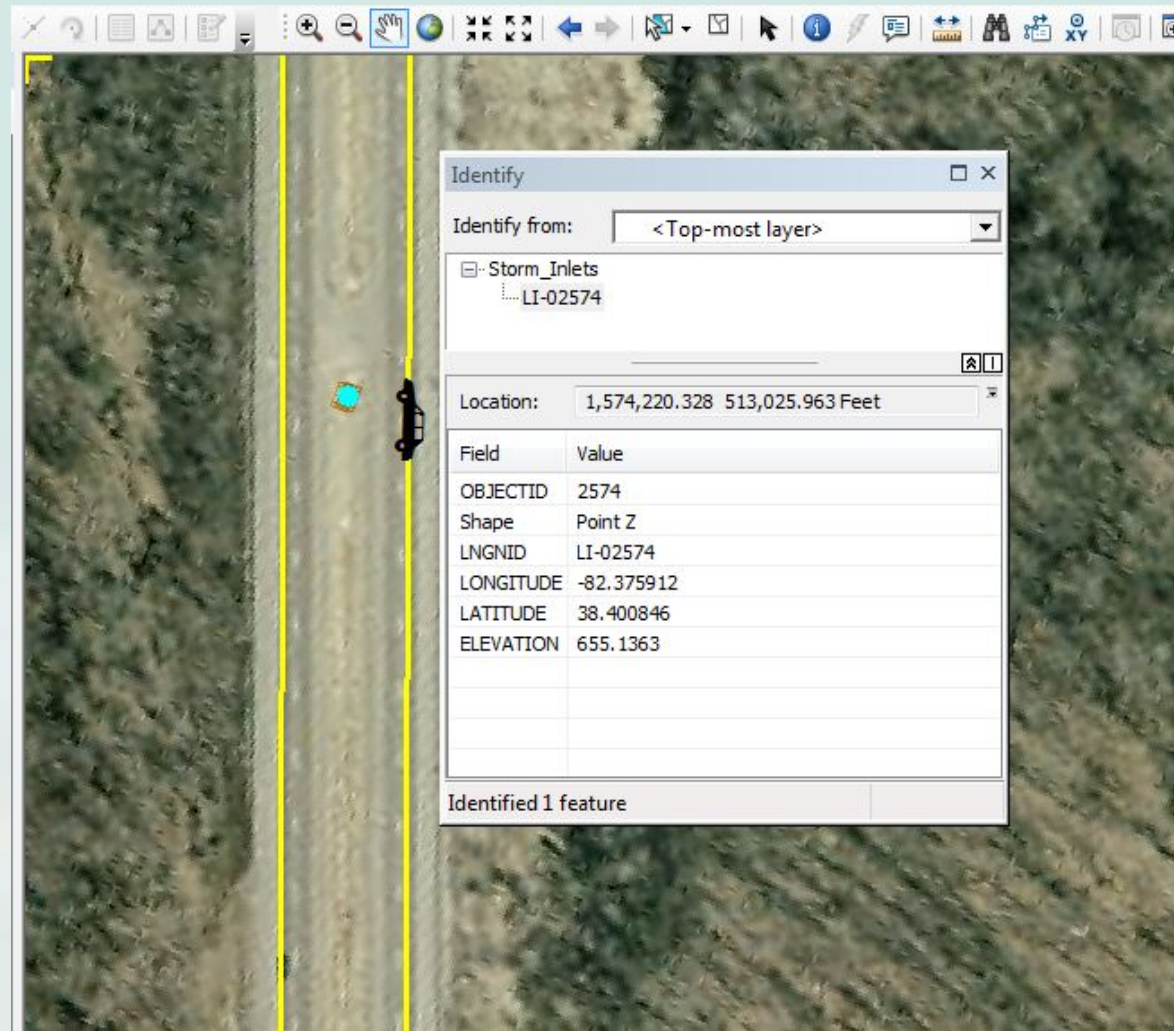




# City of Huntington- Results

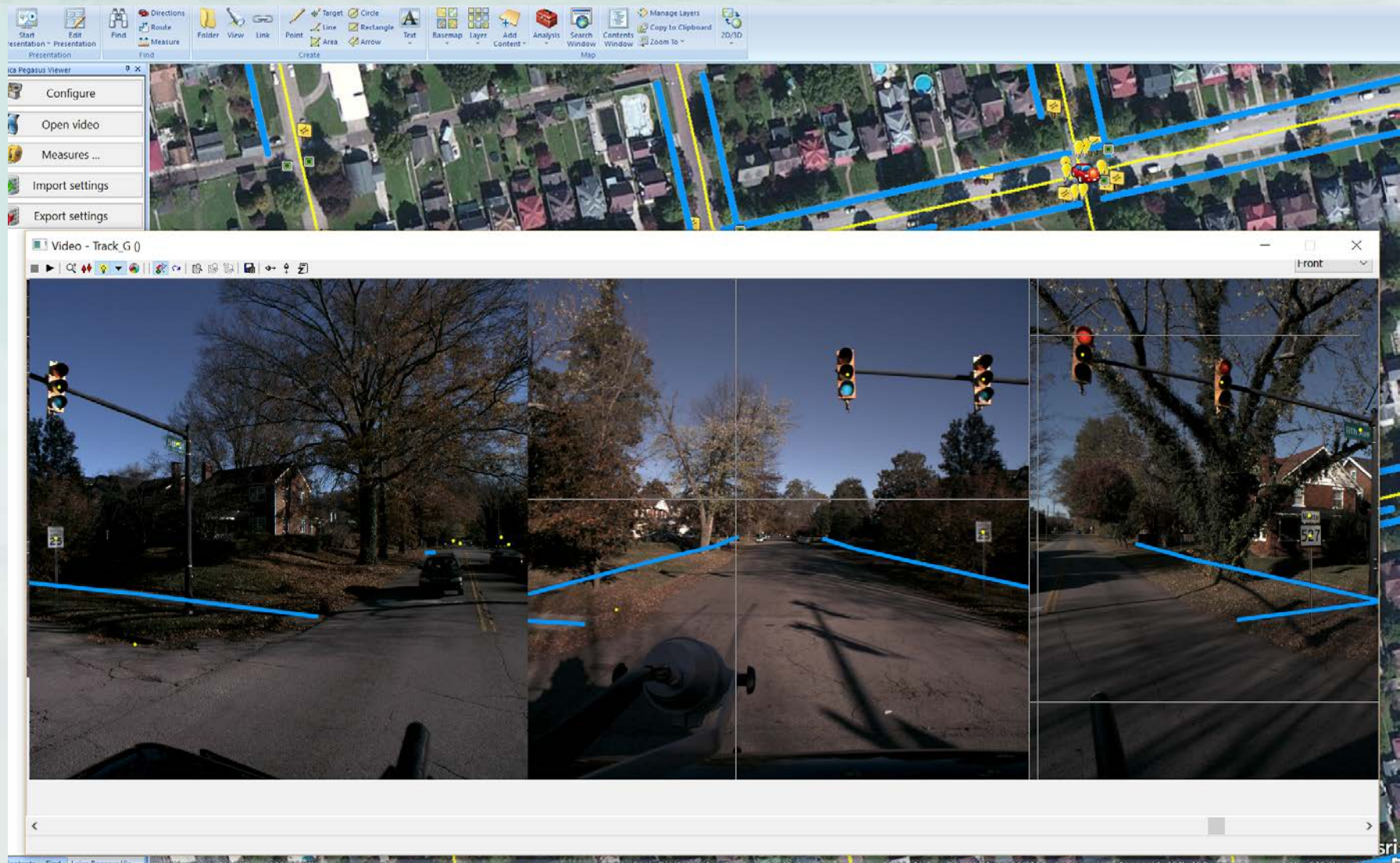


# City of Huntington- Results



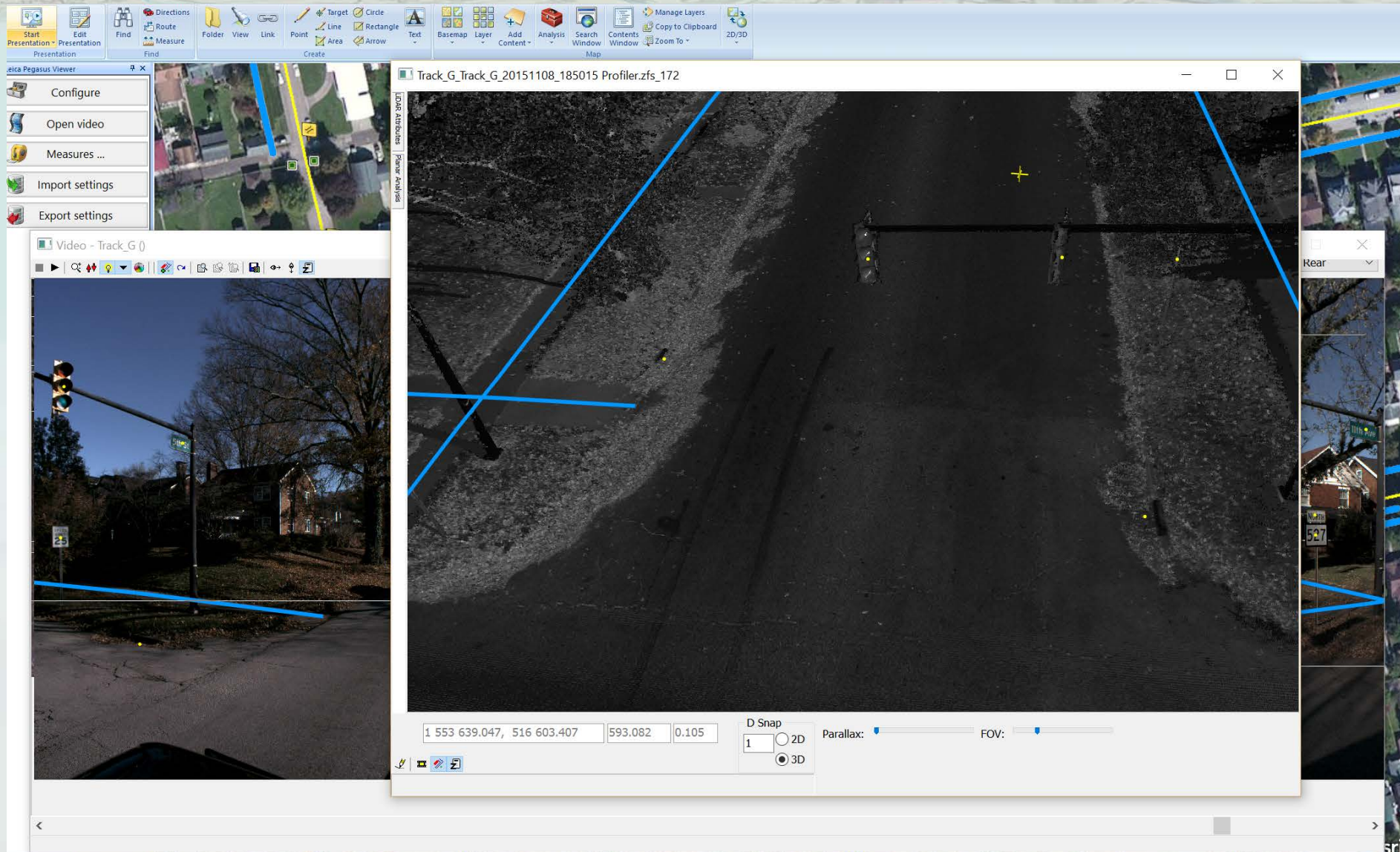


# City of Huntington





# City of Huntington- Results

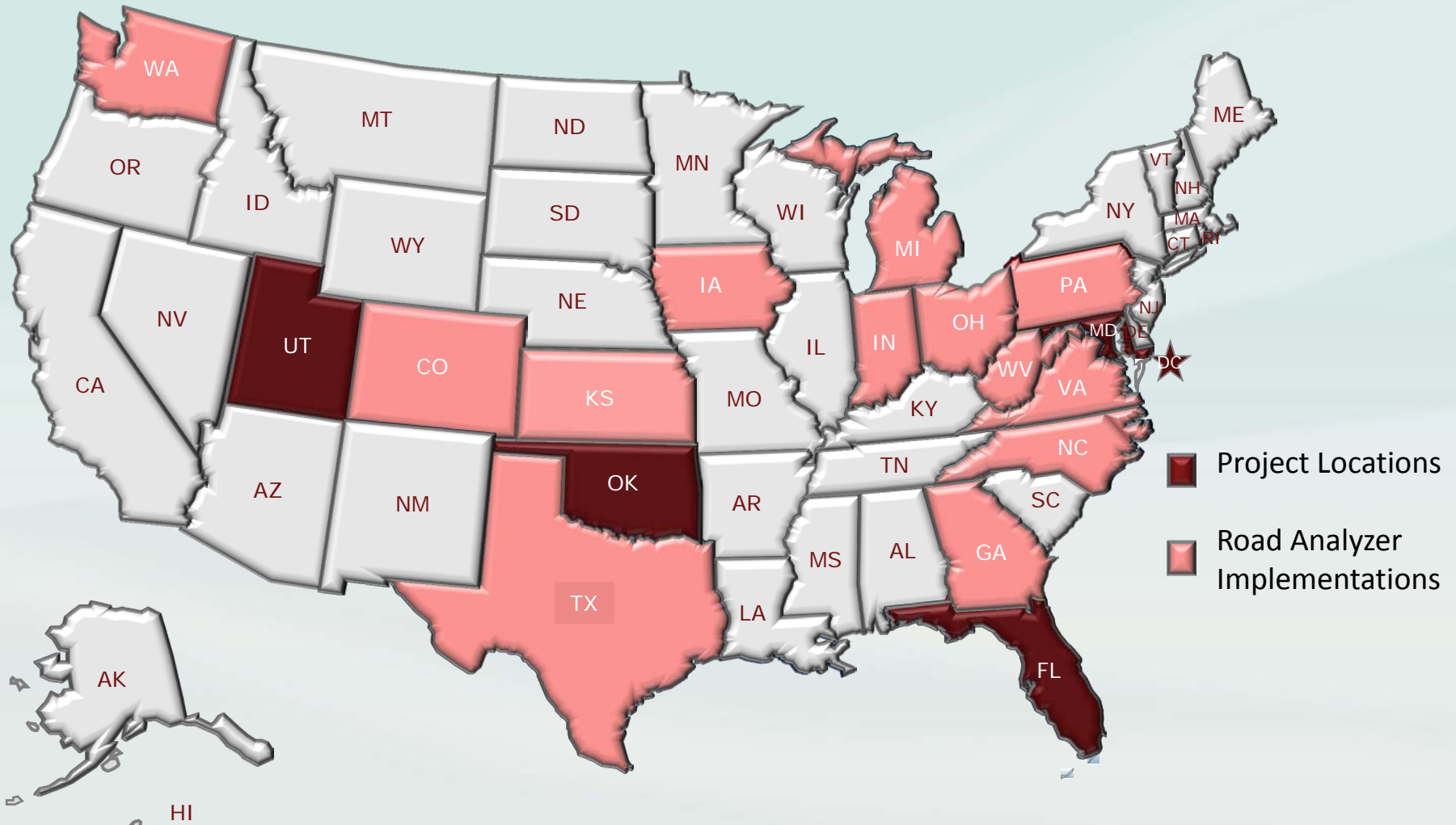


# What is Road Analyzer?

- Road Analyzer is a tool for visualizing and analyzing assets and events that occur along a route.
- It's a web browser application.
- It does not require GIS or DB expertise to use it.
- Connect to your data source via ArcGIS Server map services, and get started.



# Transcend Road Analyzer Locations



# Road Analyzer

Road Analyzer™

Route ▾

Show ▾

Styling ▾

Draw ▾

+ More ▾

Help ▾

Welcome Brad!

ACCOUNT ▾



Scale: 0.1

From: 5.87

To: 10

Guide: 6.592

« BACK

NEXT »

× **F System 100% Coverage** view data | view stick

11 - Principal Arterial - Interstate - Urban

11 - Principal Arterial - Interstate - Urban

× **County 100% Coverage** view data | view stick

06 - Cabell

06 - Cabell

× **District 100% Coverage** view data | view stick

02-District 2

02-District 2

× **Guardrails 94% Coverage** view data | hide stick | hide overlaps

GOOD GOOD GOOD GOOD GOOD  
GOOD GOOD G GOOD

GOOD GOOD  
GOOD

× **AADT 100% Coverage** view data | view stick

29163

40345

× **Facility 100% Coverage** view data | view stick

2 - Two-Way Roadway

2 - Two-Way Roadway

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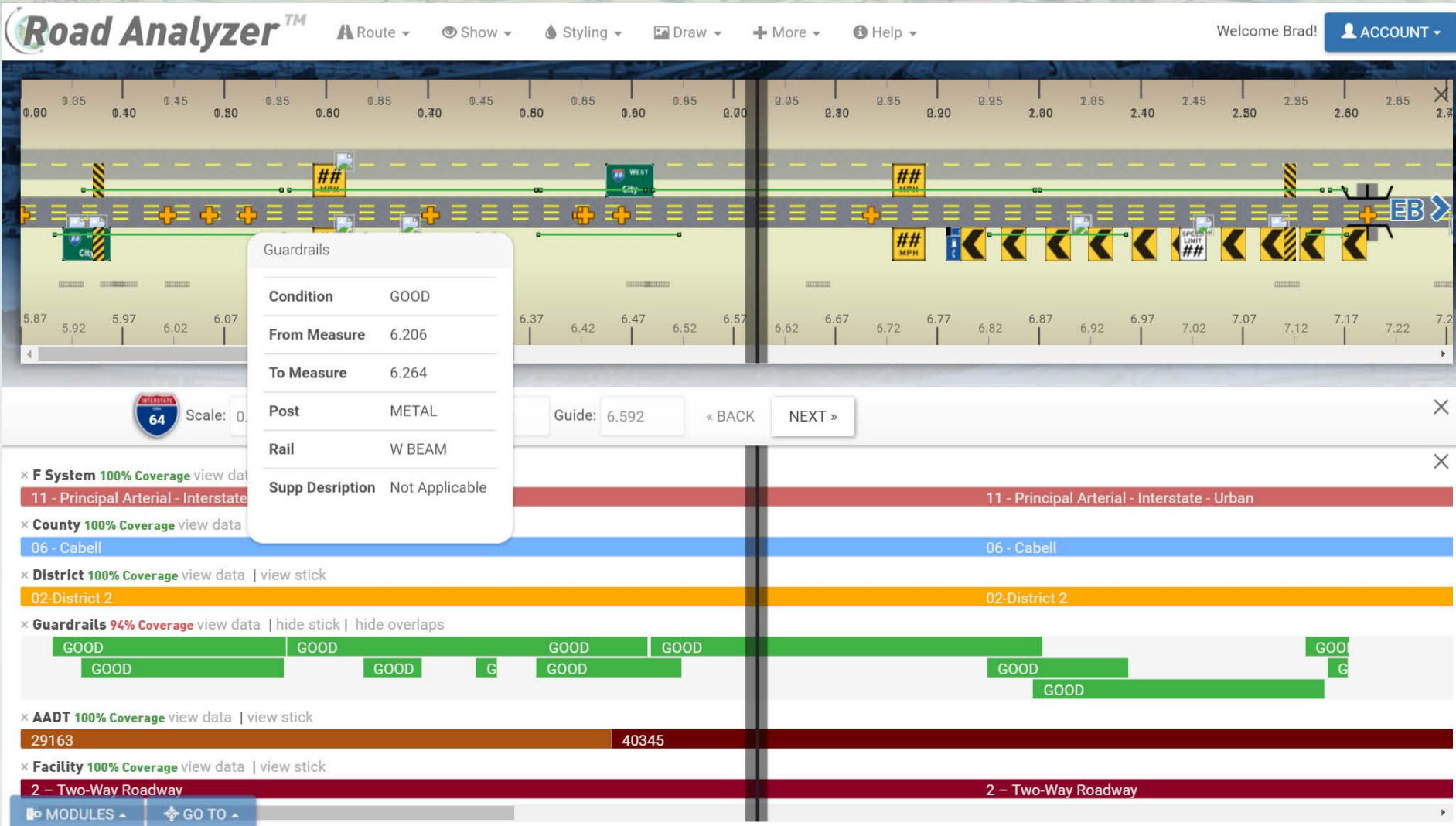
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# Road Analyzer



# Road Analyzer

**Road Analyzer™** Route Show Styling Draw More Help Welcome Brad! ACCOUNT

## Guardrails

Details Feature Grid Statistics Categories Coverage

Condition	GOOD
From Measure	5.901
To Measure	6.13
Post	METAL
Rail	W BEAM
Supp Description	Not Applicable
I Dc Guardrail	0
F Key	1376
Element I D	CABE-IS-064-00-00NA
County Code	CABE
Route	064
Sub- Route	00
Sys	IS
Supp Code	000NA

View Layer Data Query CLOSE

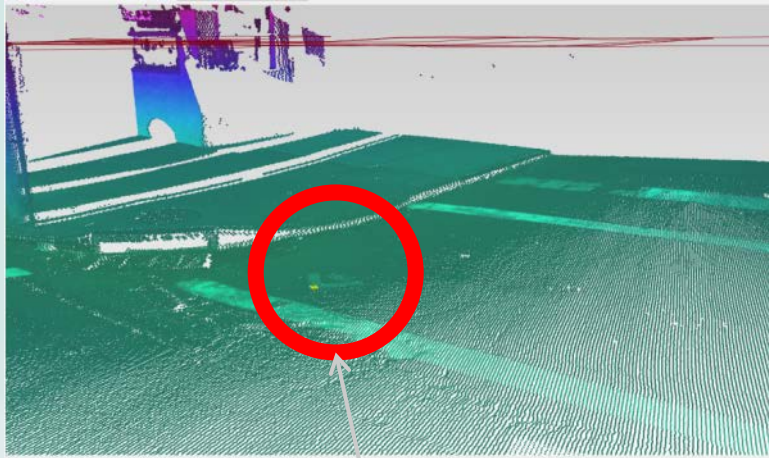




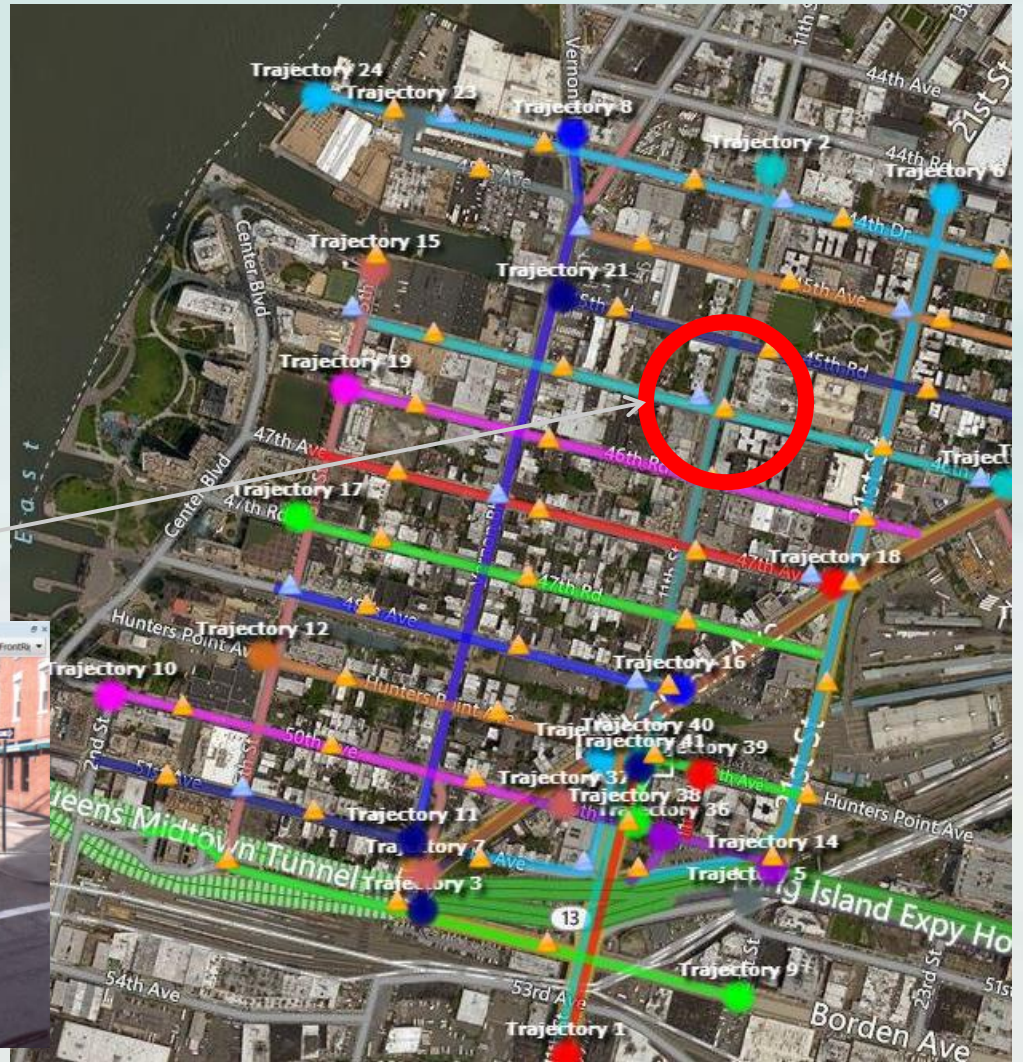
# Survey Grade Accuracy Process



# Acquisition Pre/Post Planning

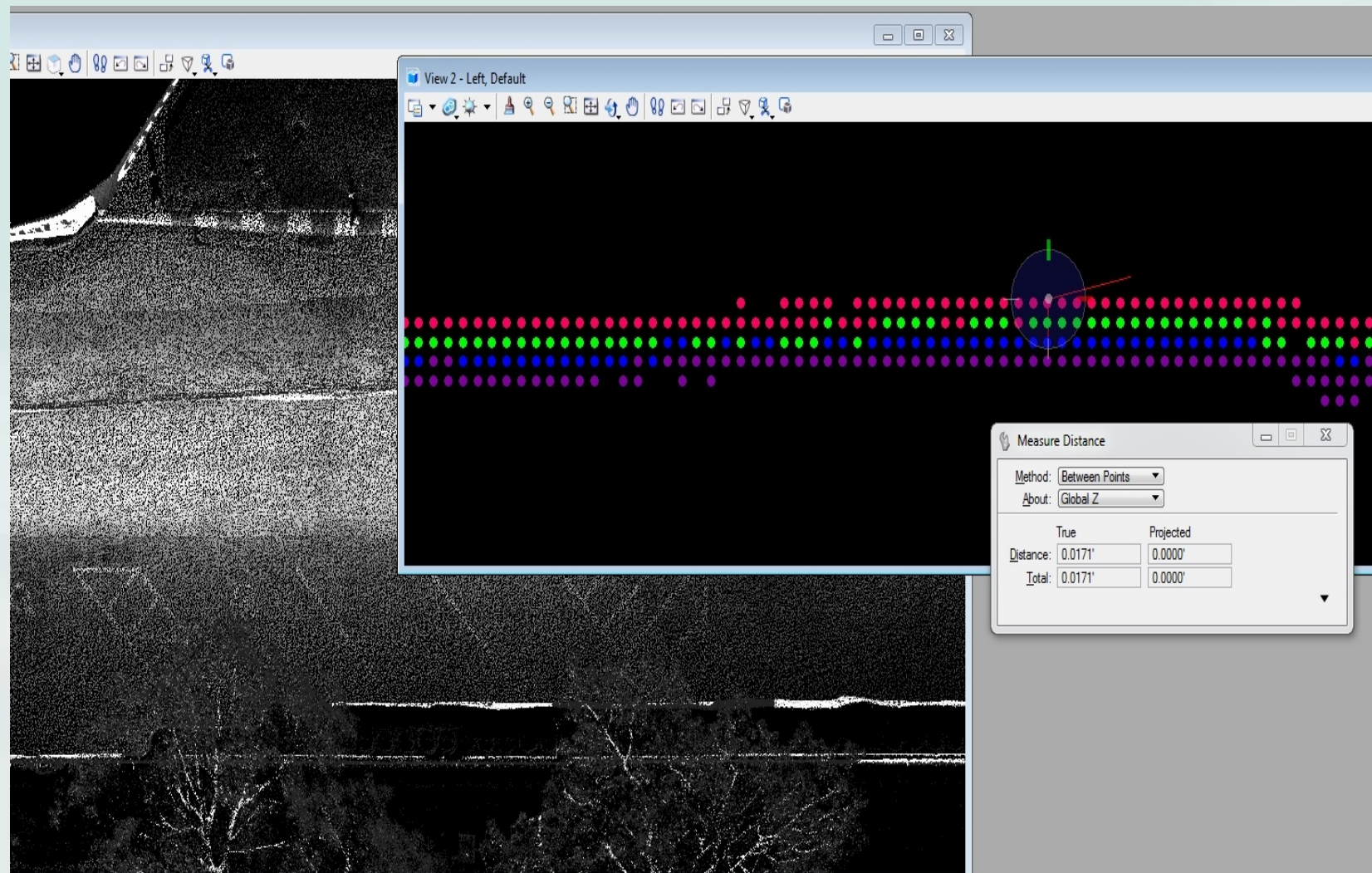


Survey Control  
Points



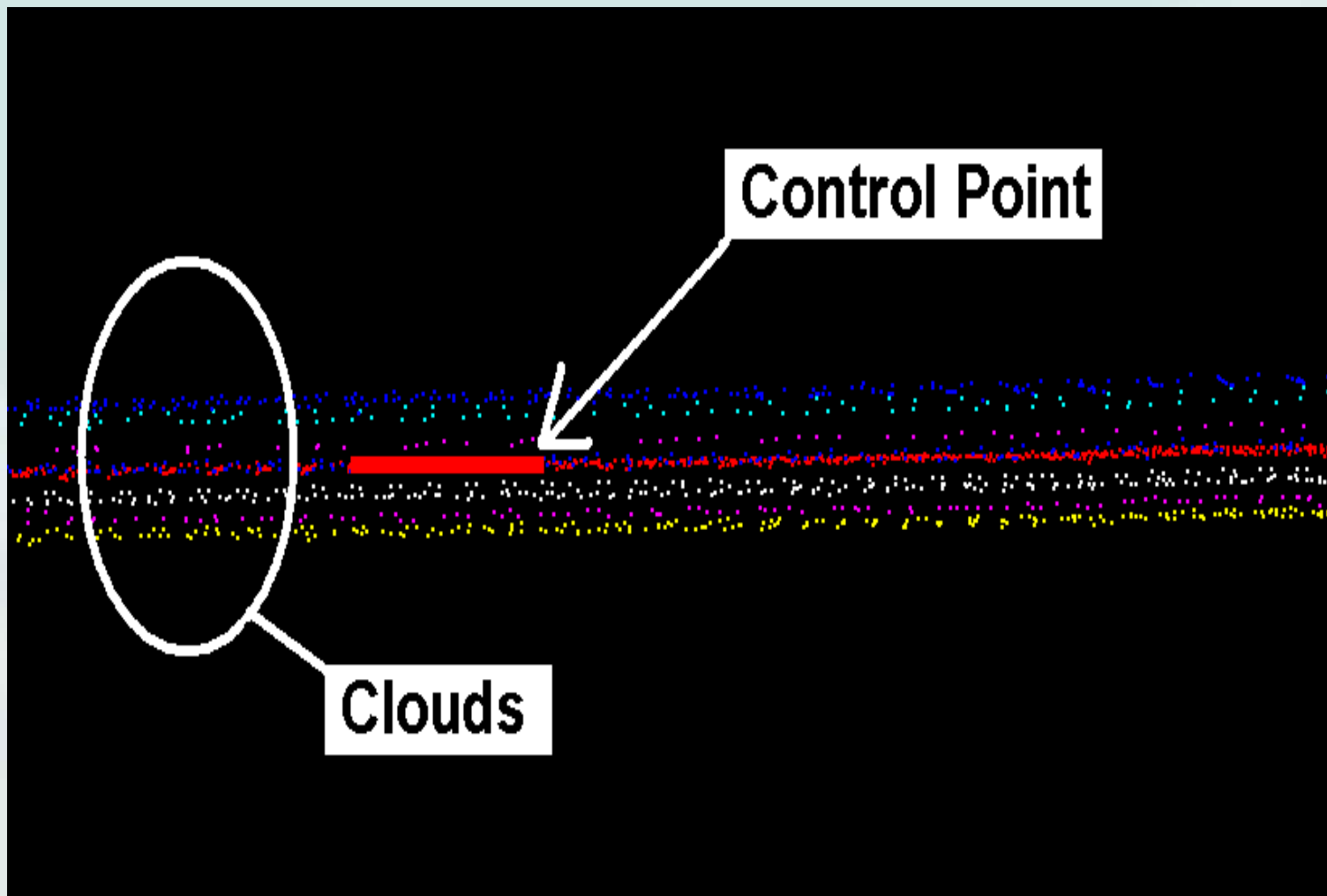


# Initial Results

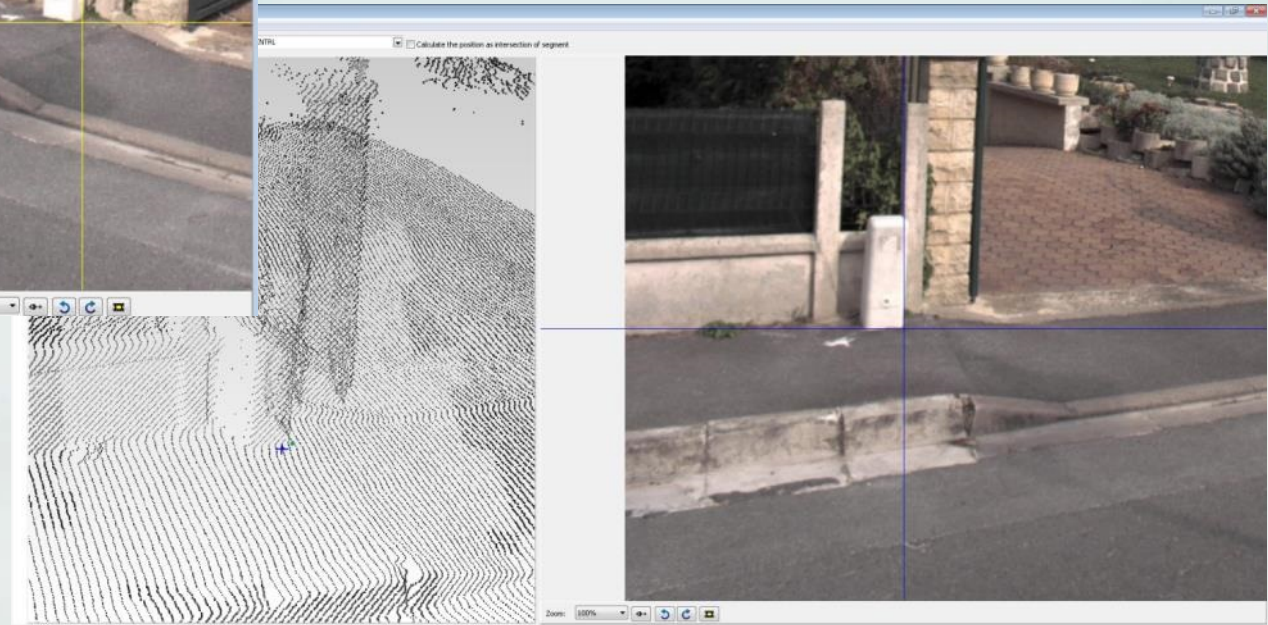
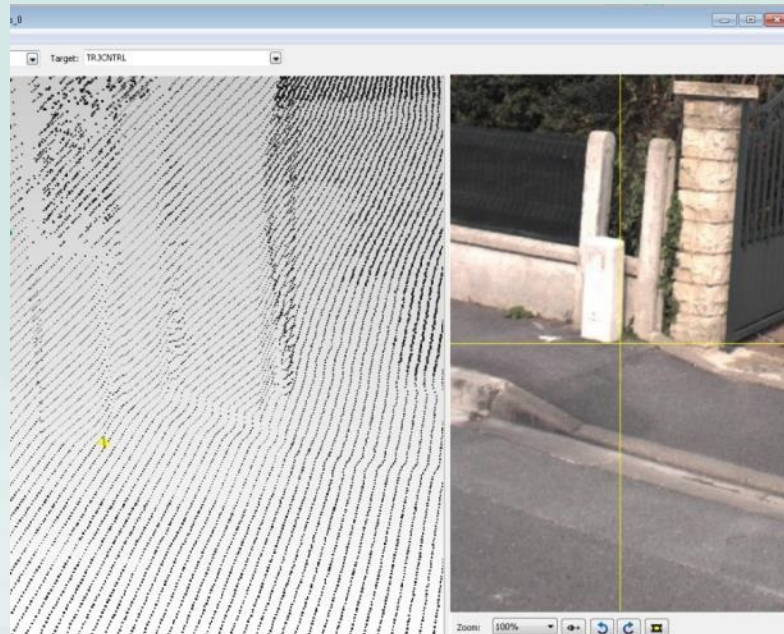




# Clouds and Control Alignment

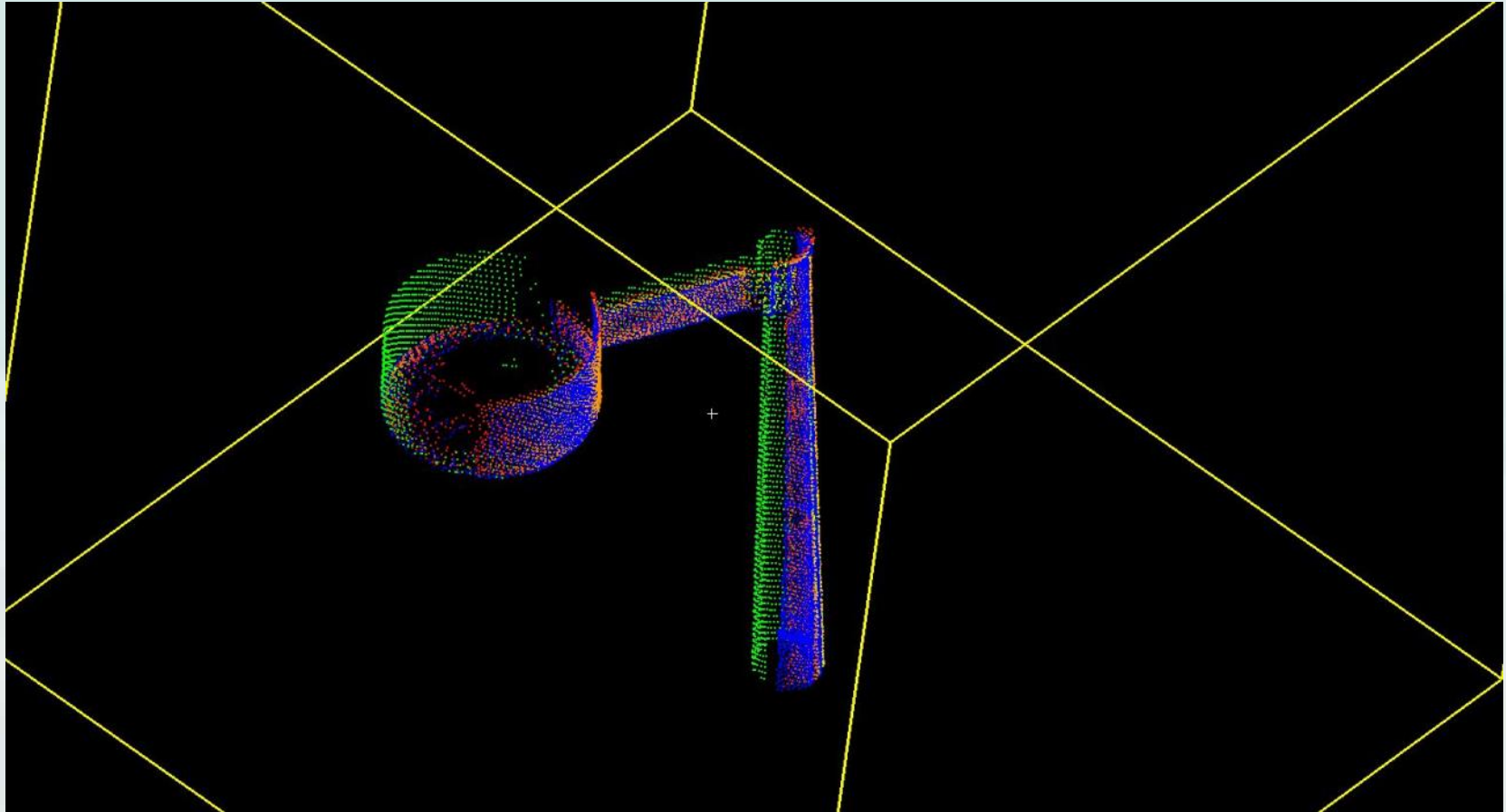


# LiDAR Point Cloud Alignment

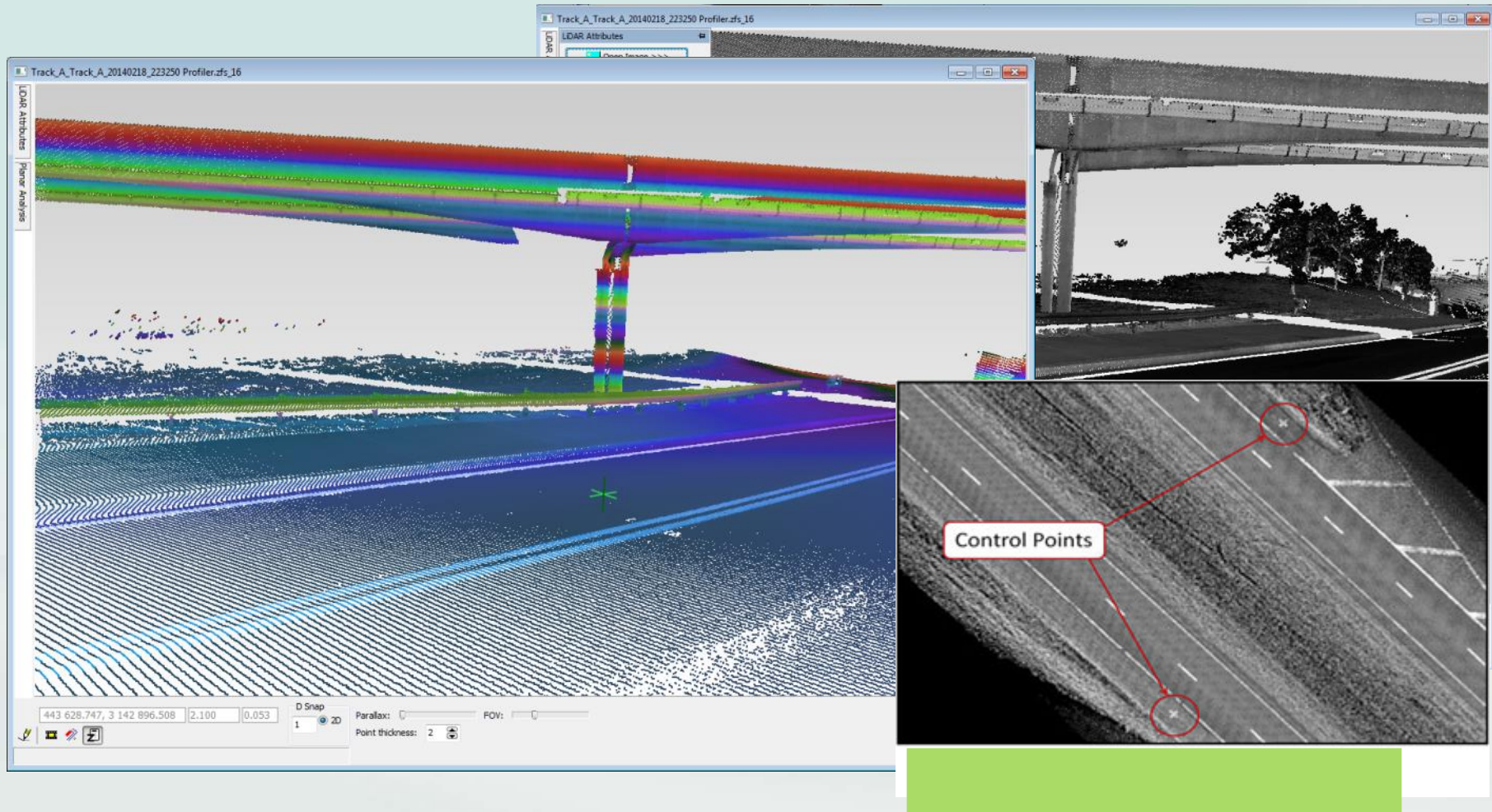




# 3D Alignment

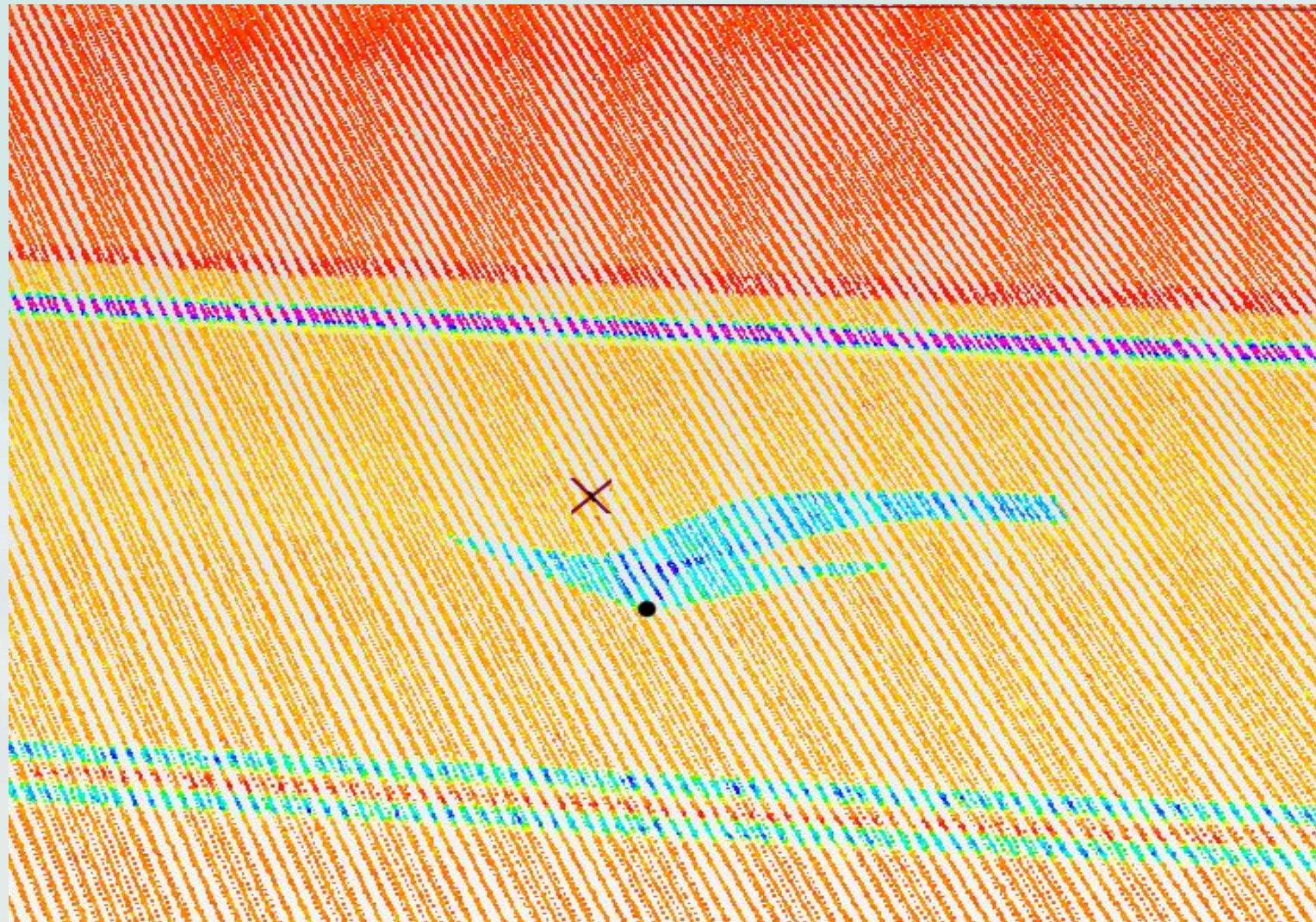


# Final Registration





# Registration Results





# Accuracy Results

**Track C Southbound Median Shoulder**

POINT ID	XGCP	YGCP	ZGCP	DX	DY	DZ
1051	13372033.091	112115.844	579.935	0.041	-0.027	0.035
1047	13371811.690	111725.857	579.823	0.025	0.001	0.000
1043	13371306.490	110842.915	579.844	0.008	-0.003	0.020
1039	13371039.180	110575.070	579.867	-0.003	-0.031	0.017
1035	13370658.360	109534.277	579.852	0.000	-0.025	0.033
1031	13370335.659	109145.008	579.935	0.000	-0.004	0.026
1131	13370054.931	106652.054	579.747	0.024	-0.021	0.009
1027	13369612.129	107877.567	580.361	-0.014	-0.008	0.033
1022	13369404.219	107514.404	580.898	-0.003	0.007	0.037
1017	13368887.231	106610.416	581.787	0.003	-0.016	0.016
1013	13368632.339	106160.718	582.167	-0.007	0.034	0.031
1009	13368135.499	105291.591	583.130	0.032	0.010	0.027
1005	13367882.651	104849.465	583.725	0.047	0.001	0.029
1001	13367392.900	103992.887	594.785	0.019	-0.012	0.001

**Track D Northbound Median Shoulder**

POINT ID	XGCP	YGCP	ZGCP	DX	DY	DZ
902	13363061.781	86129.772	581.710	-0.004	0.012	-0.002
906	13363159.281	86617.368	581.617	0.015	-0.021	-0.016
910	13363356.719	87591.010	581.892	0.000	0.044	-0.030
914	13363450.121	88072.128	581.669	0.018	0.004	0.022
918	13363642.110	89030.153	581.605	-0.005	0.009	0.002
921	13363739.449	89515.941	581.263	0.015	0.012	0.002
926	13363935.561	90494.116	580.308	-0.024	0.022	0.017
930	13364034.580	90989.682	579.765	0.016	0.004	0.032
934	13364272.290	92172.905	579.197	0.024	0.000	0.000
938	13364302.720	92327.113	579.173	-0.047	-0.017	-0.018
942	13364388.570	92751.619	579.753	-0.021	0.031	-0.030
946	13364587.861	93435.327	579.537	-0.021	0.004	-0.037
950	13364734.849	93827.932	579.286	-0.026	0.008	-0.030
1121	13364787.890	93969.513	579.147	-0.027	0.014	-0.032

**Track C**

**Validation Comparison Statistics**

	DX	DY	DZ
Variance	0.00032	0.00020	0.00034
Std Deviation	0.018	0.014	0.018
NSSD accuracy (dx, dy, dz)	0.044	0.035	0.036
Number of Samples	41	41	41
Confidence Level		95%	95%
Percent Control points with accuracy of +/- 0.06'	100%	0.018	100%
Avg/mean Control Error	0.008	-0.012	0.022
Positive Max Error	0.047	0.034	0.051
Negative Max Error	-0.036	-0.035	-0.028
RMSE for Sample (RMSE(dx, dy, dz))	0.018	0.014	0.018
FGDC/NSSDA: Accuracy	0.044	0.035	0.036

**Track D**

**Validation Comparison Statistics**

	DX	DY	DZ
Variance	0.00031	0.00035	0.00038
Std Deviation	0.018	0.019	0.019
NSSD accuracy (dx, dy, dz)	0.043	0.046	0.038
Number of Samples	41	41	41
Confidence Level		95%	95%
Percent Control points with accuracy of +/- 0.06'	100%	0.018	100%
Avg/mean Control Error	-0.004	0.007	-0.014
Positive Max Error	0.028	0.051	0.032
Negative Max Error	-0.047	-0.038	-0.051
RMSE for Sample (RMSE(dx, dy, dz))	0.018	0.019	0.019
FGDC/NSSDA: Accuracy	0.043	0.046	0.038



# Accuracy Results

Track C		
POINT ID	XGCP	YCP
1051	13372033.091	1121
1047	13371811.690	1117
1043	13371306.490	1108
1039	13371039.180	1103
1035	13370558.360	1095
1031	13370335.659	1091
1131	13370054.931	1086
1027	13369612.129	1078
1022	13369404.219	1075
1017	13368887.231	1066
1013	13368632.339	1061
1009	13368135.499	1052
1005	13367882.651	1048
1001	13367392.900	1039

## Track C Validation Comparison Statistics

Variance	
Std Deviation	
NSSD accuracy (dx, dy, dz)	
Number of Samples	
Confidence Level	
Percent Control points with accuracy of +/- 0.06'	
Avg/mean Control Error	
Positive Max Error	
Negative Max Error	

RMSE for Sample (RMSE(dx, dy, dz))  
FGDC/NSSDA Accuracy

DX	DY	DZ
0.00032	0.00020	0.00034
0.018	0.014	0.018
0.044	0.035	0.036
41	41	41
	95%	95%
100%	0.018	100%
0.008	-0.012	0.022
0.047	0.034	0.051
-0.036	-0.035	-0.028
0.018	0.014	0.018
0.044	0.035	0.036

DX	DY	DZ
0.00032	0.00020	0.00034
0.018	0.014	0.018
0.044	0.035	0.036
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	95%	95%
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-0.036	-0.035	-0.028
0.018	0.014	0.018
0.044	0.035	0.036

Track D		
POINT ID	XGCP	YCP
902	13363061.781	861
906	13363159.281	866
910	13363356.719	875
914	13363450.121	880
918	13363642.110	890
921	13363739.449	895
926	13363935.561	904
930	13364034.580	909
934	13364272.290	921
938	13364302.720	923
942	13364388.570	927
946	13364587.861	934
950	13364734.849	938
1121	13364787.890	939

## Track D Validation Comparison Statistics

Variance	
Std Deviation	
NSSD accuracy (dx, dy, dz)	
Number of Samples	
Confidence Level	
Percent Control points with accuracy of +/- 0.06'	
Avg/mean Control Error	
Positive Max Error	
Negative Max Error	

RMSE for Sample (RMSE(dx, dy, dz))  
FGDC/NSSDA Accuracy

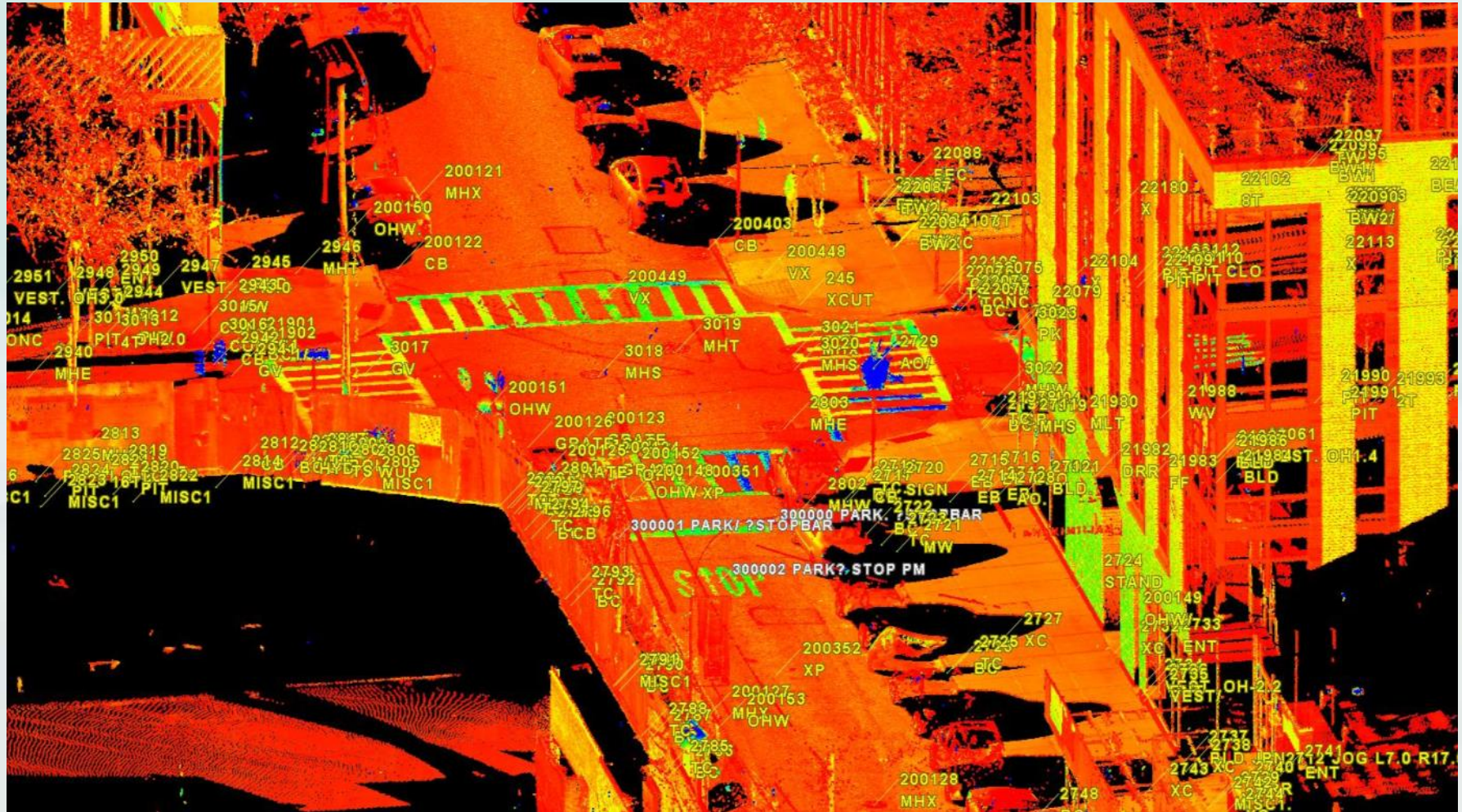
DX	DY	DZ
0.00031	0.00035	0.00038
0.018	0.019	0.019
0.043	0.046	0.038
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0.028	0.051	0.032
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0.018	0.019	0.019
0.043	0.046	0.038

DX	DY	DZ
0.00031	0.00035	0.00038
0.018	0.019	0.019
0.043	0.046	0.038
41	41	41
	95%	95%
100%	0.018	100%
-0.004	0.007	-0.014
0.028	0.051	0.032
-0.047	-0.038	-0.051
0.018	0.019	0.019
0.043	0.046	0.038

# CADD/GIS & Modeling

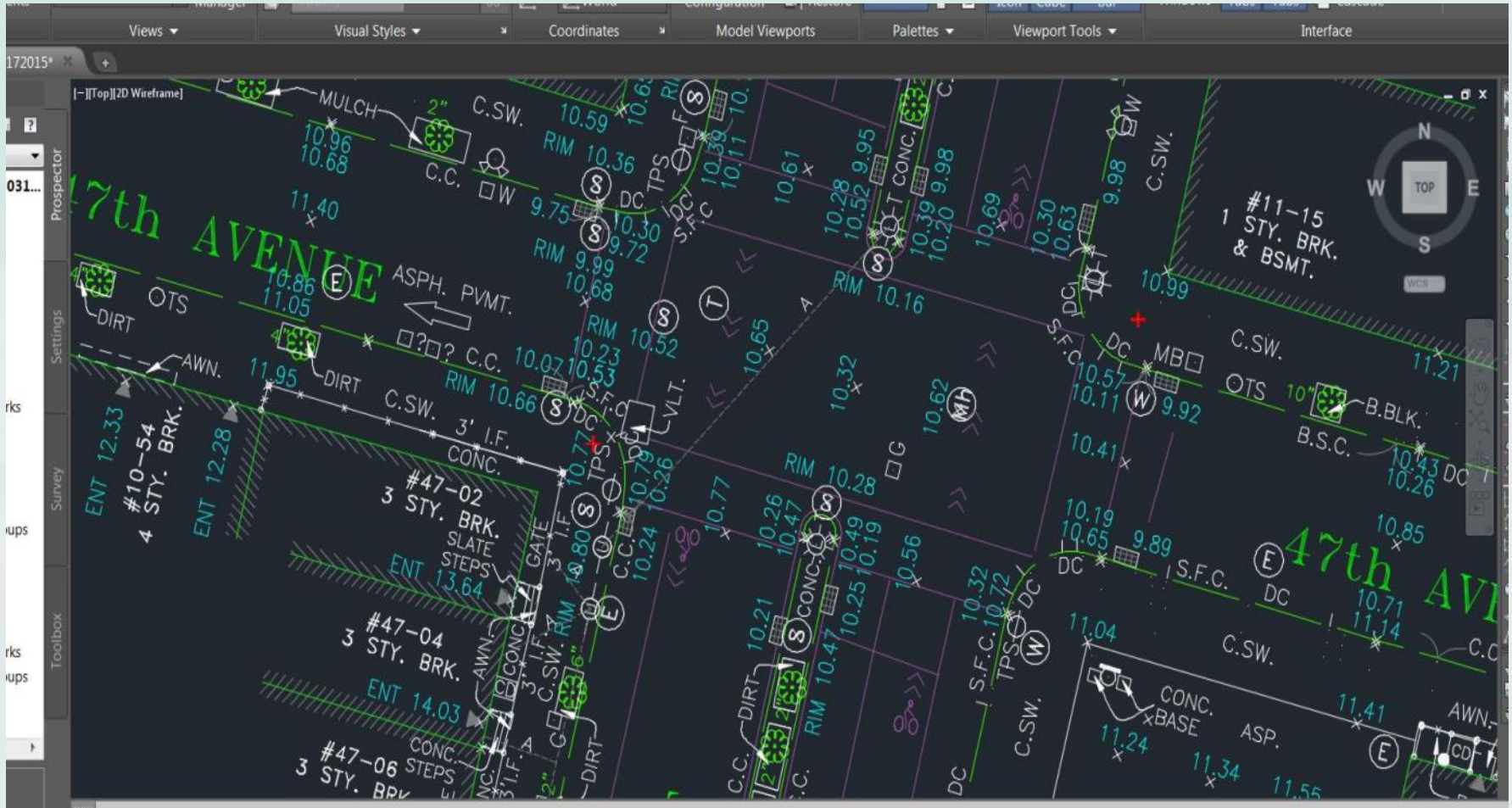


# Cyclone Virtual Surveyor



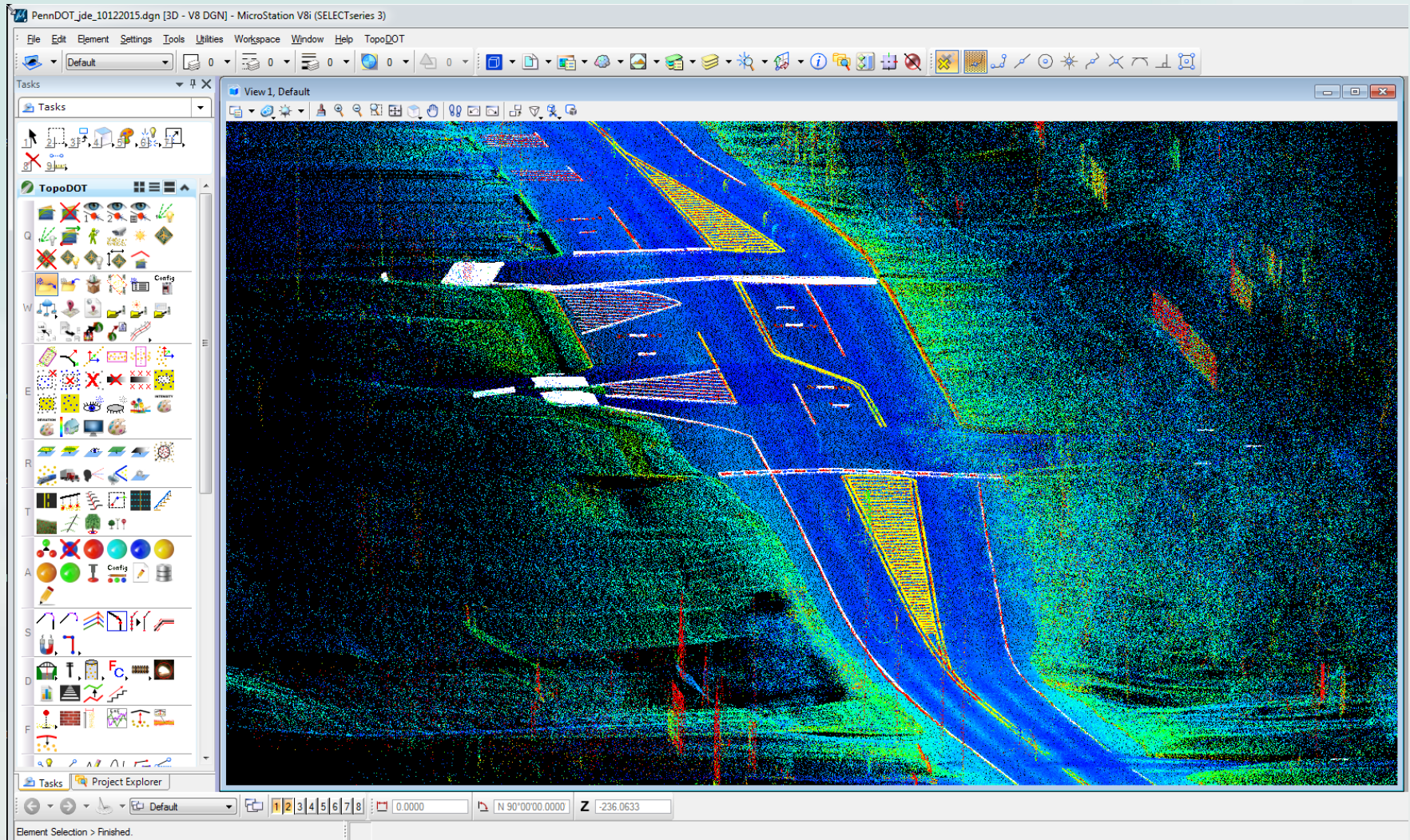


# AutoCAD 2D and 3D As-built Drawings (Cyclone Extraction to Carlson)

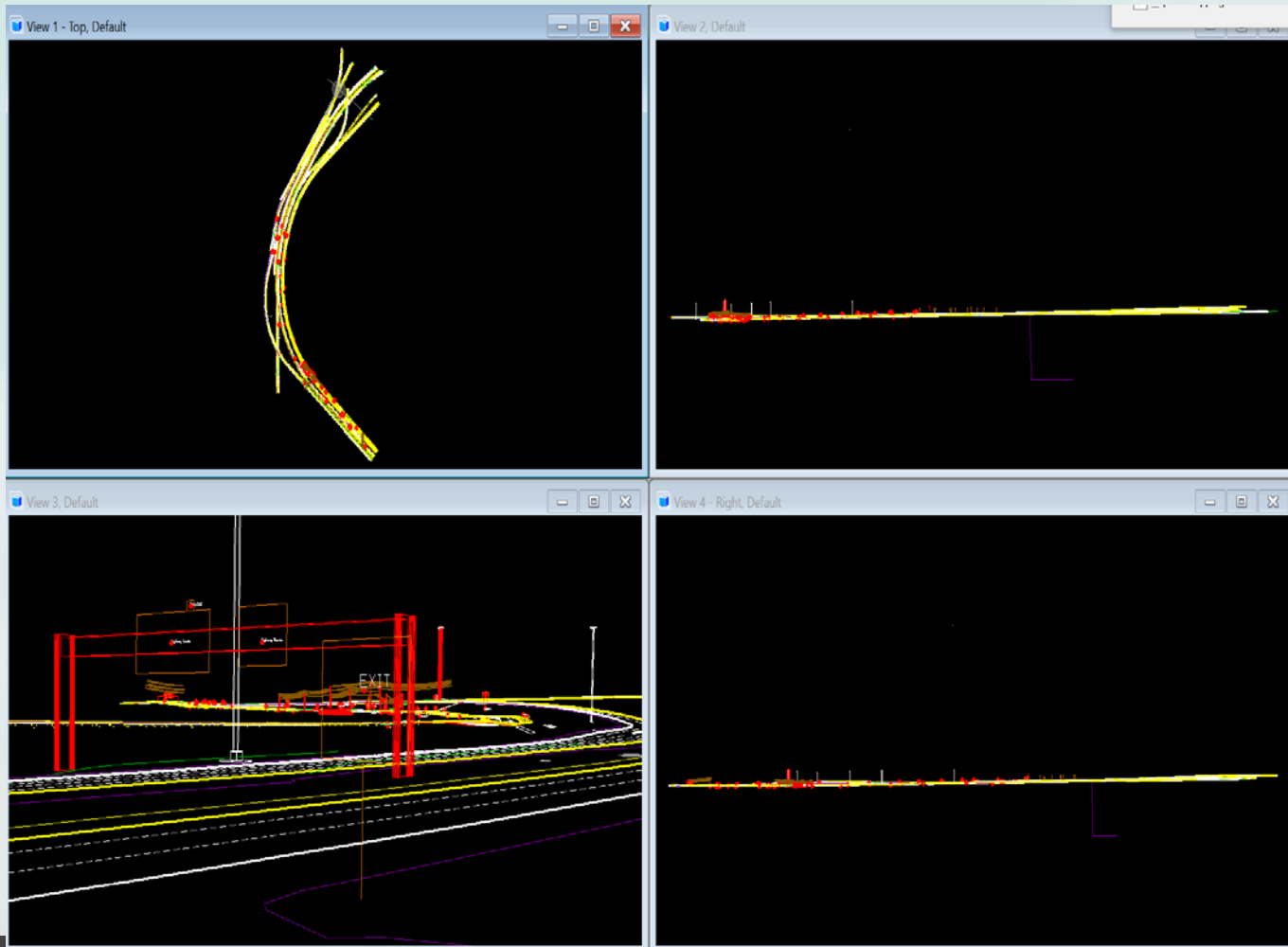




# Microstation



# Microstation Inroads 3D Modeling (TopoDOT Extraction)



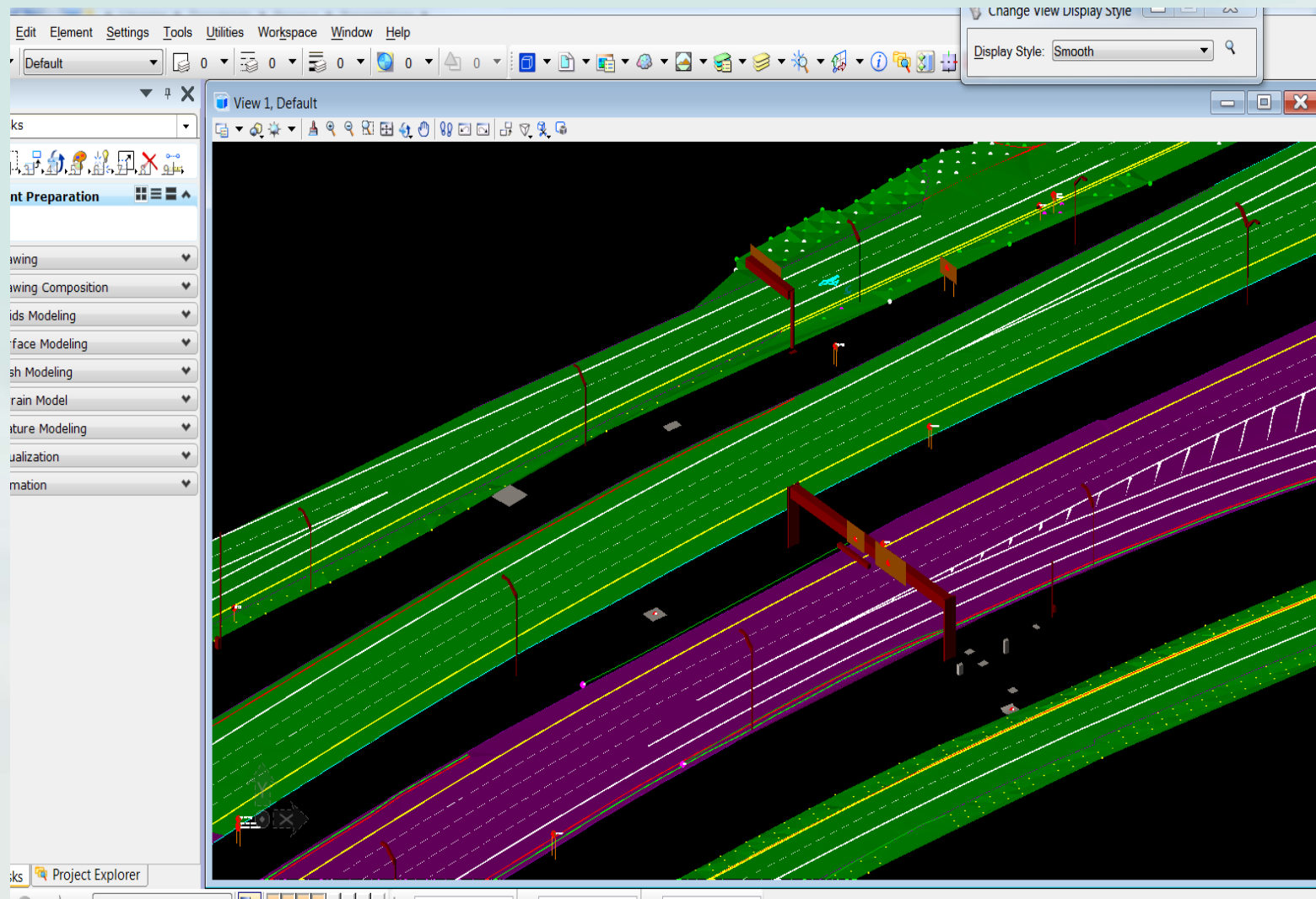
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# Surfaces



# ArcGIS Features

PennDOT\_Langan.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:400

Table Of Contents

- Layers
  - ADA\_Ramps
  - Flashing\_Beacons
  - Overpass\_Vertical
  - PennDOT\_GIS\_DBO\_PAVEMENTMARKING
  - PennDOT\_GIS\_DBO\_SIGNS\_3D
  - Signals
  - CL\_Rumble
  - EL\_Rumble
  - Guiderail
  - PAVEMENTMARKING\_LINE
  - PennDOT\_GIS\_DBO\_ROADWAYGEOMETR
  - World\_Imagery

Identify

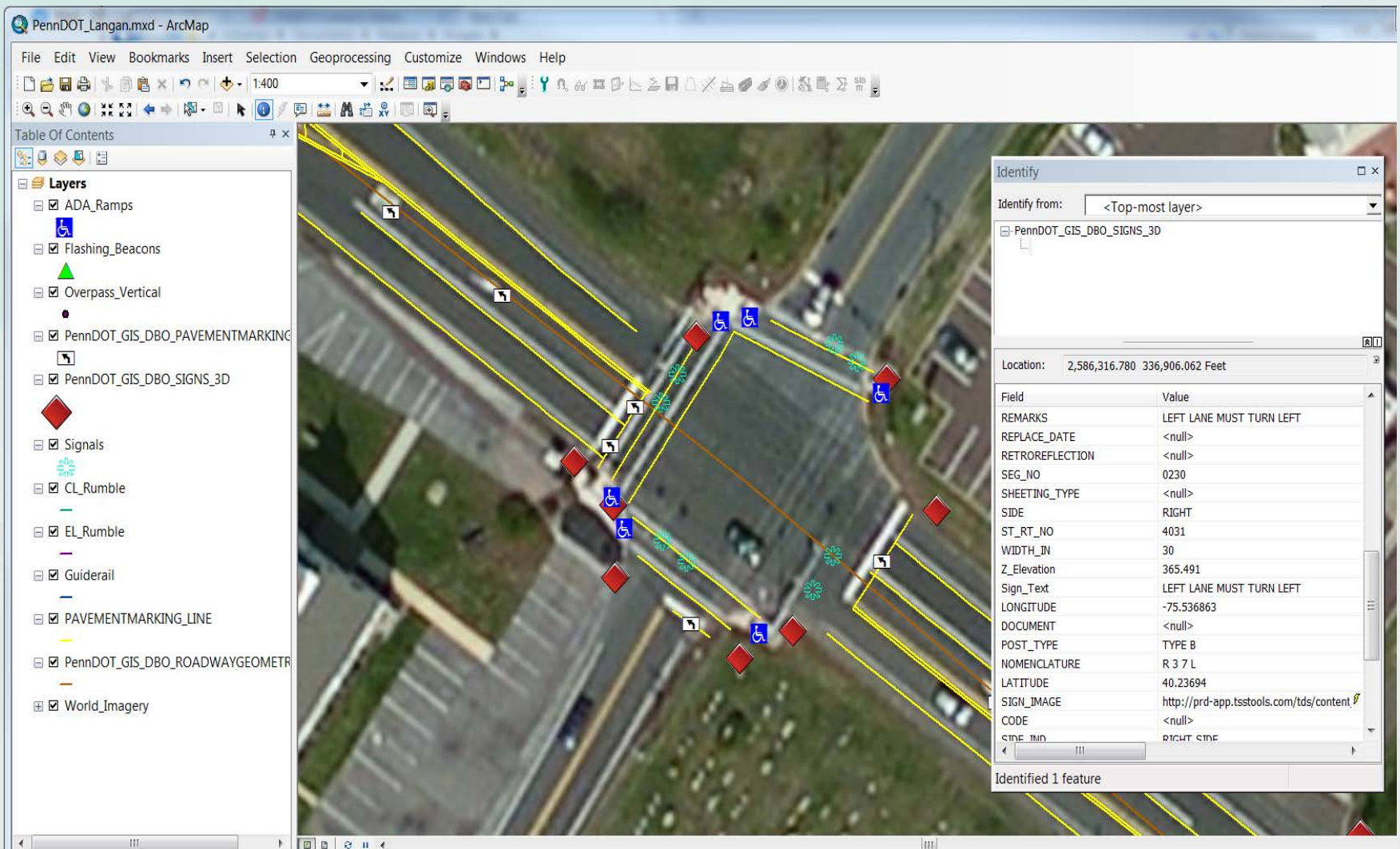
Identify from: <Top-most layer>

PennDOT\_GIS\_DBO\_SIGNS\_3D

Location: 2,586,316.780 336,906.062 Feet

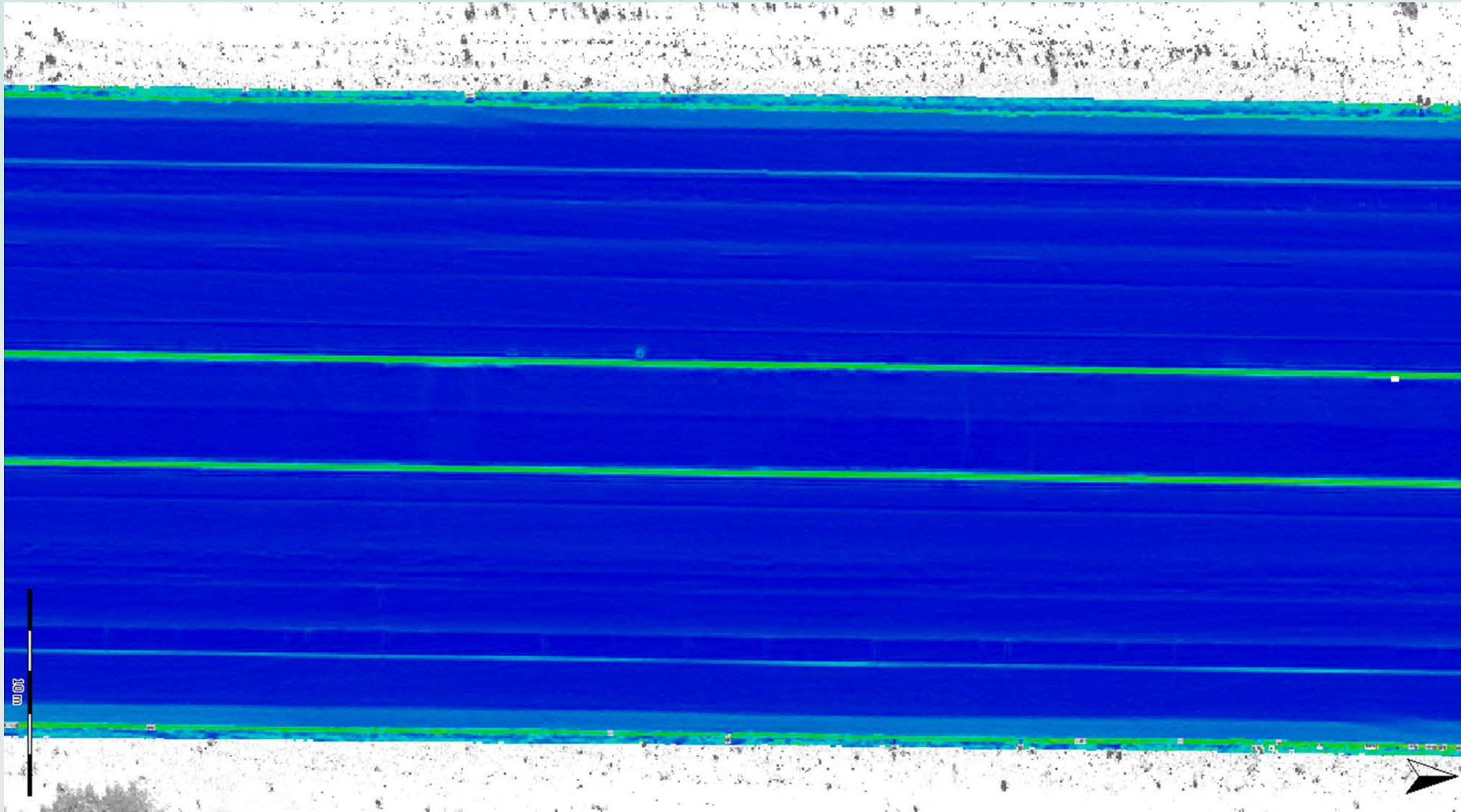
Field	Value
REMARKS	LEFT LANE MUST TURN LEFT
REPLACE_DATE	<null>
RETROREFLECTION	<null>
SEG_NO	0230
SHEETING_TYPE	<null>
SIDE	RIGHT
ST_RT_NO	4031
WIDTH_IN	30
Z_Elevation	365.491
Sign_Text	LEFT LANE MUST TURN LEFT
LONGITUDE	-75.536863
DOCUMENT	<null>
POST_TYPE	TYPE B
NOMENCLATURE	R 3 7 L
LATITUDE	40.23694
SIGN_IMAGE	<a href="http://prd-app.tsstools.com/tds/content/">http://prd-app.tsstools.com/tds/content/</a>
CODE	<null>
SIDE_IN	RIGHT SIDE

Identified 1 feature



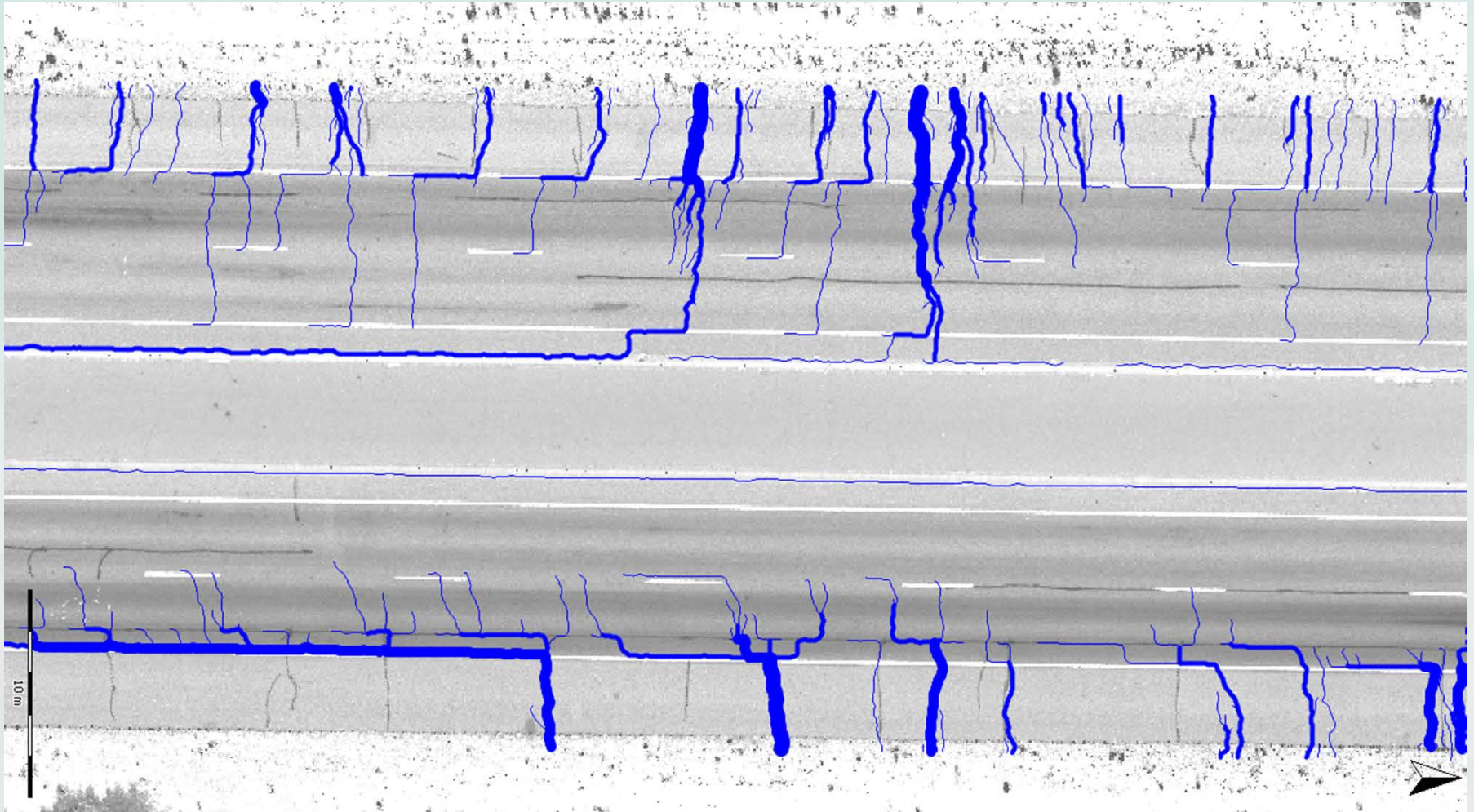


# Pavement Slope Analysis





# Flow Aspect Model





# Thank You

Steve Ellis

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Bradley Adams

[badams@tssgis.com](mailto:badams@tssgis.com)