Mobile Digital Imagery Mapping

2500kms Roadway Asset Inventory
Snohomish County, Washington, U.S.A.

F.I.G. CONGRESS 2014

KUALA LUMPUR, MALAYSIA

JON WARREN, P.L.S.

Puget Sound Region Survey Manager

David Evans and Associates

DAVID EVANS AND ASSOCIATES INC.

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OUTLINE

- INTRODUCTION
    - Personal and Firm
- MOBILE LIDAR - MOBILE DIGITAL IMAGERY
- COMPARISON with GOOGLE STREET VIEW
- SNOHOMISH COUNTY MAPPING PROJECT
- ADDITIONAL APPLICATIONS

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To improve the **quality** of life while demonstrating stewardship of the built and **natural** environments.

DAVID EVANS AND ASSOCIATES INC.

DEA is a multi-discipline engineering and surveying firm founded in 1976 employing over 600 professionals serving the Transportation, Energy, Land Development, Water Infrastructure, Surveying and Geomatics, and Marine Services markets.

Offices located in Oregon, Washington, Arizona, California, Colorado, Idaho, and New York.
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Mobile Laser Scanning
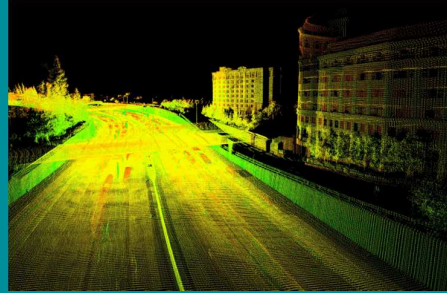
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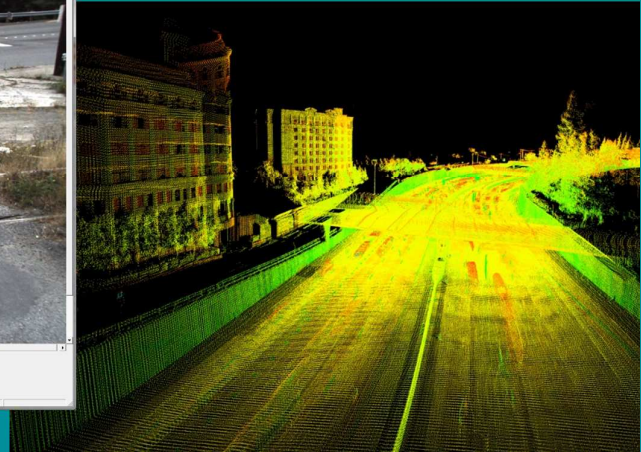# Mobile Laser Data – Raw Point Cloud
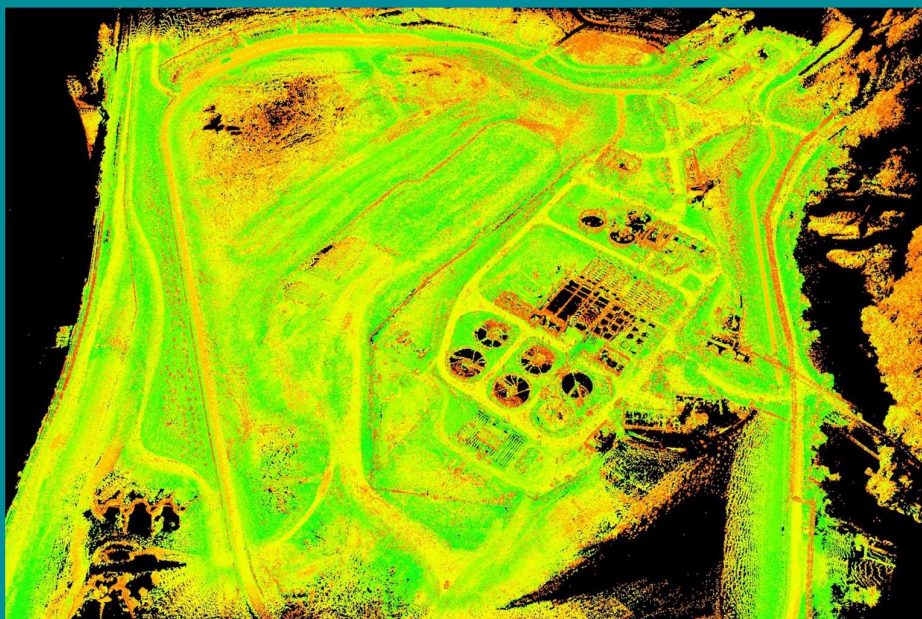
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Asset and Infrastructure Mobile Mapping

Imagery Based System
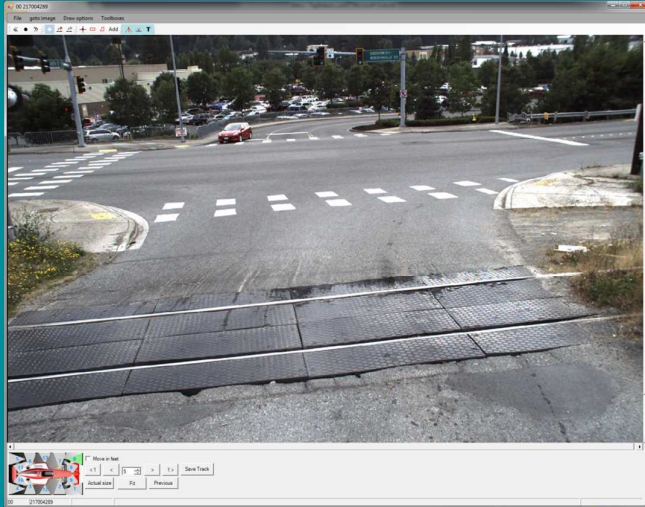
Point Cloud Based System

Asset and Infrastructure Mobile Mapping

- AIMM
- Photogrammetry based, terrestrial data collection system.
- Photogrammetry is a proven and reliable science
- Imagery is more intuitive than a point cloud
- The technology has been developed by our partner in Belgium-

GeoAutomation

Value

- AMMS- Asset Maintenance Management System
- AIMM will provide you with:
  - Data to populate the AMMS system
  - Accurate position
    - "resource" grade up to precise location at the 2-3cm level
  - Feature identification and attribution
  - Imagery record of the asset
  - Condition assessment from the imagery
  - Relative measurements between features in the imagery
  - Desktop reconnaissance of maintenance/emergency calls

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How It Works- Briefly

- Vehicle travels at typical traffic speed
  - 20-35 in developed areas
  - Higher rates of speed on highways
- 14 cameras – 360 field of view – 11 to 22 images per sec.
- On board dual frequency GPS
  - Supplemental ground control can be added for higher accuracy
- Stereo imagery develops a "3D" image environment
- Click on a feature in the image to send it into your basemap.
- Data is collected directly into AutoCAD, MicroStation, or Esri ArcGIS

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14 Cameras   22 Frames p/s   360° View
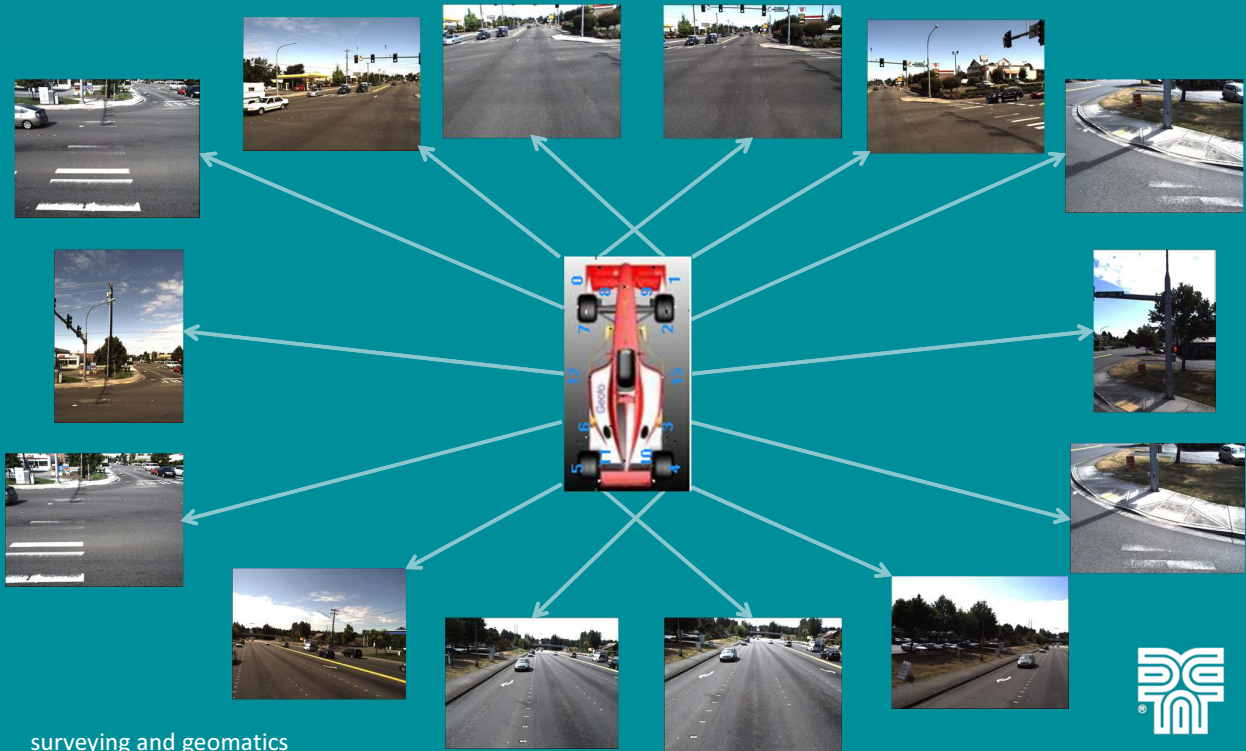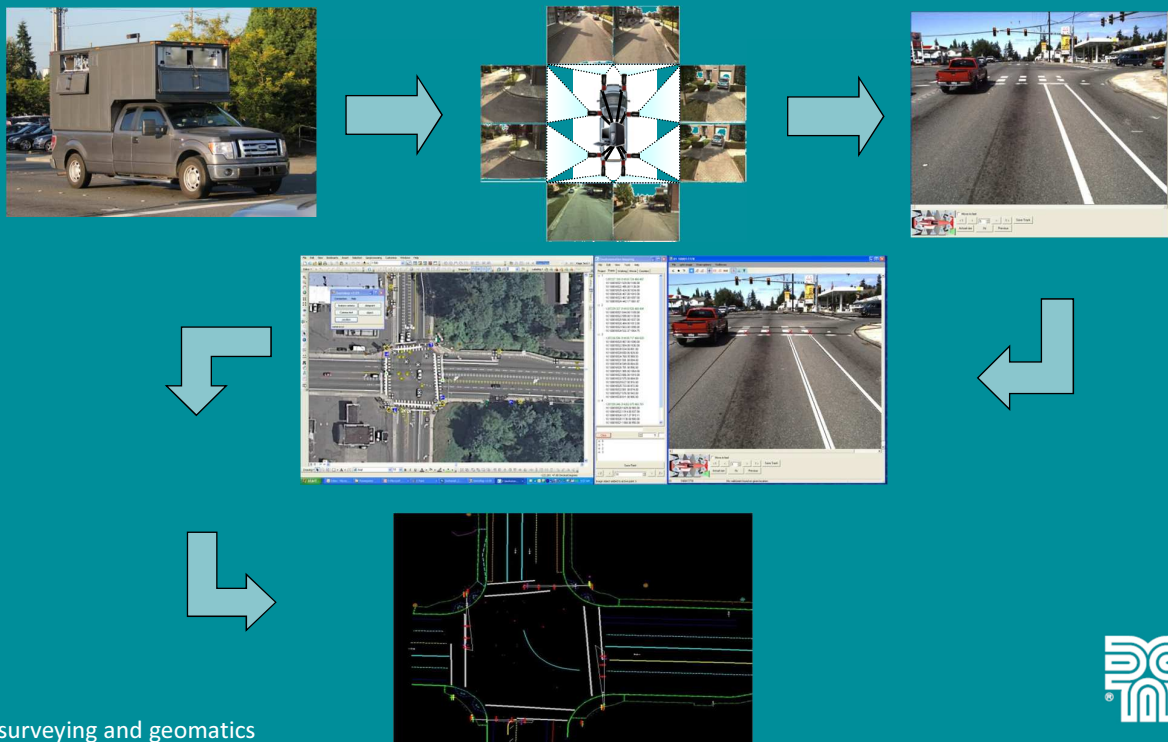
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Workflow

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Comparison to Google Street View

"We no longer go to maps, they come to us…" – The Guardian (2010)
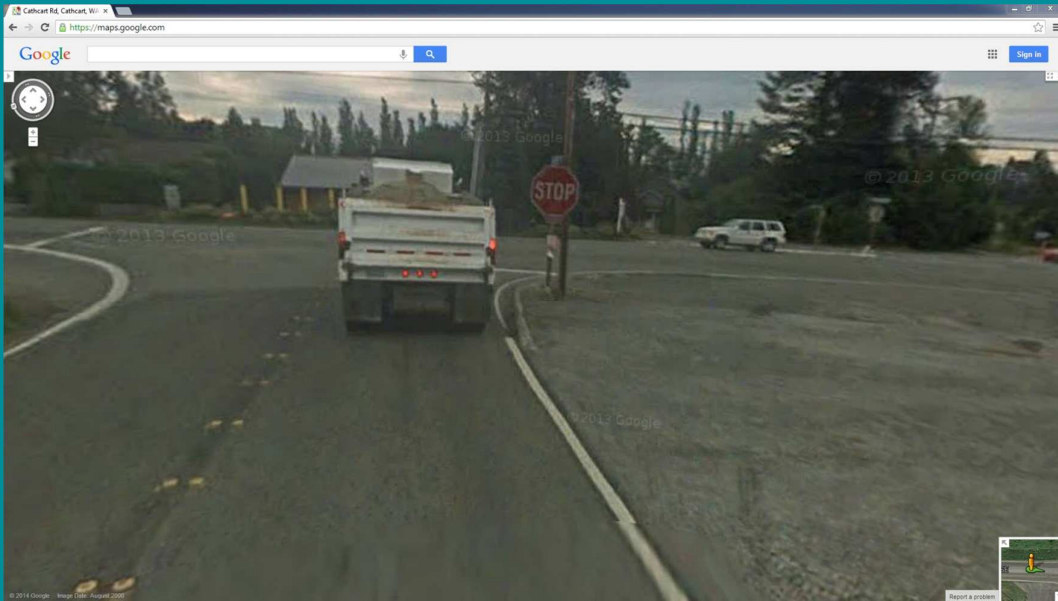
Average distance between images ~ 50 feet

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Comparison to Google Street View

"We no longer go to maps, they come to us…" – The Guardian (2010)
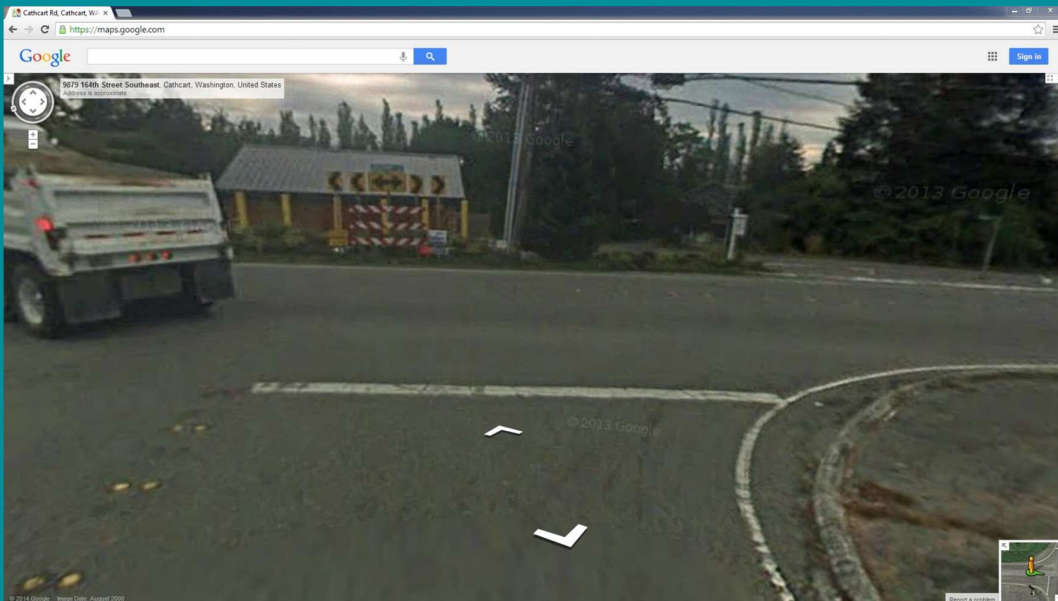
Average distance between images ~ 50 feet

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Comparison to Google Street View
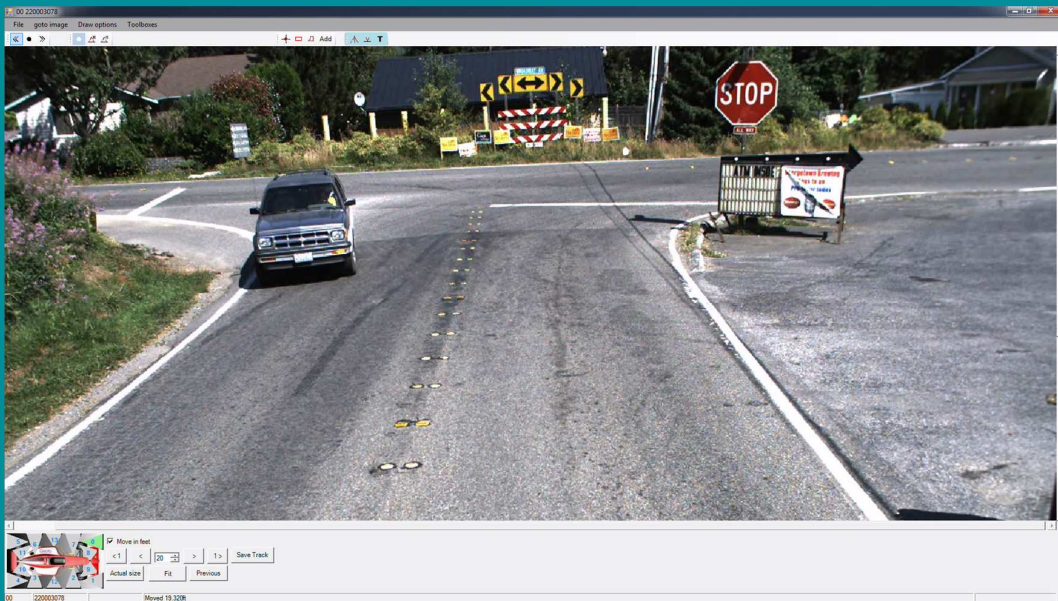
Distance between images as little as 1 foot

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Comparison to Google Street View

Integration With ArcMap
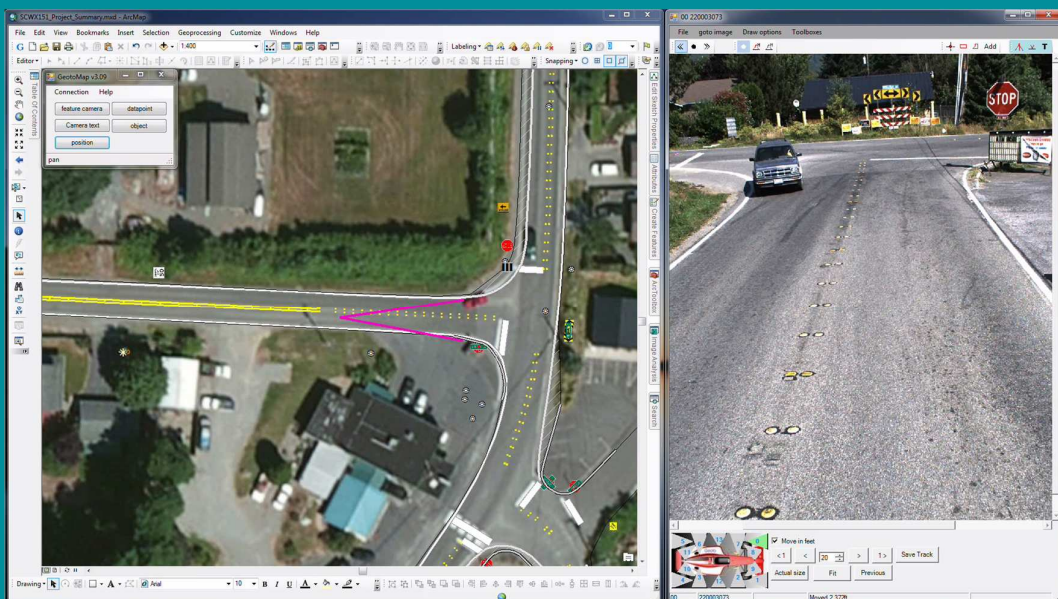
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Data Superimposition
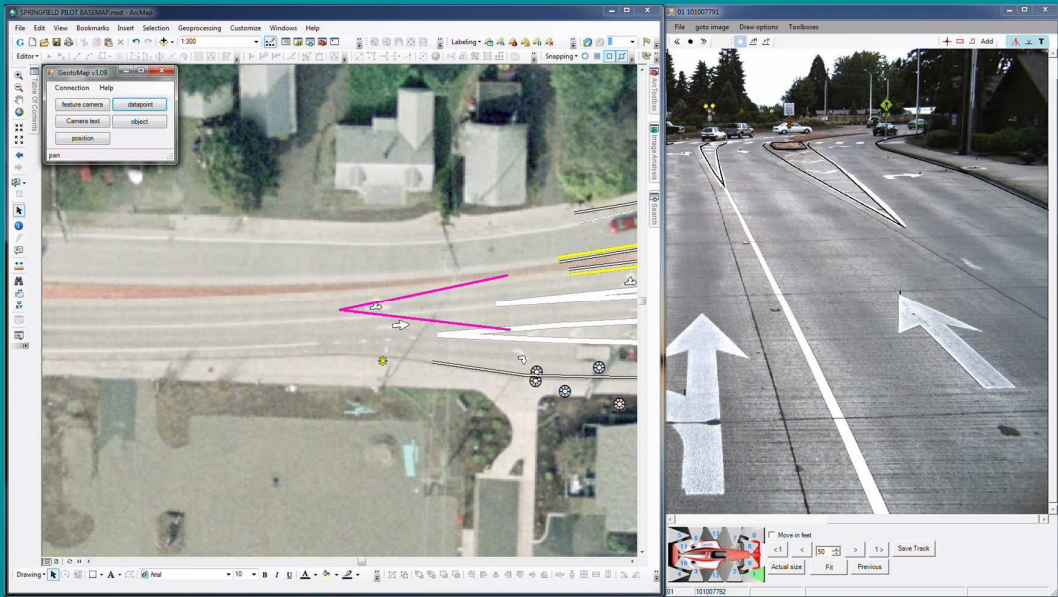
Extraction of Feature Thumbnails
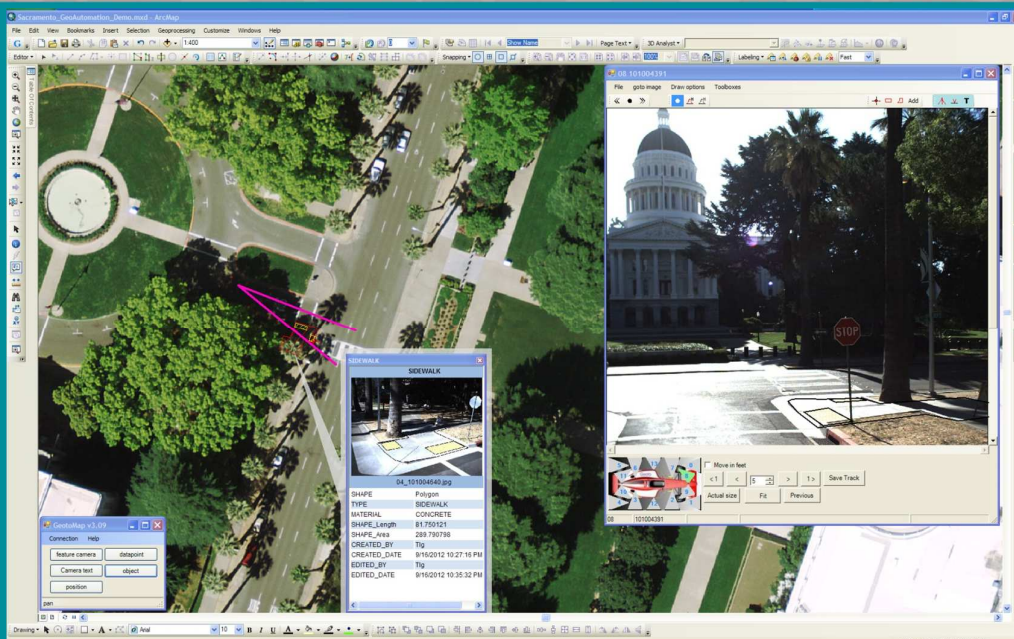
Snohomish County, WA
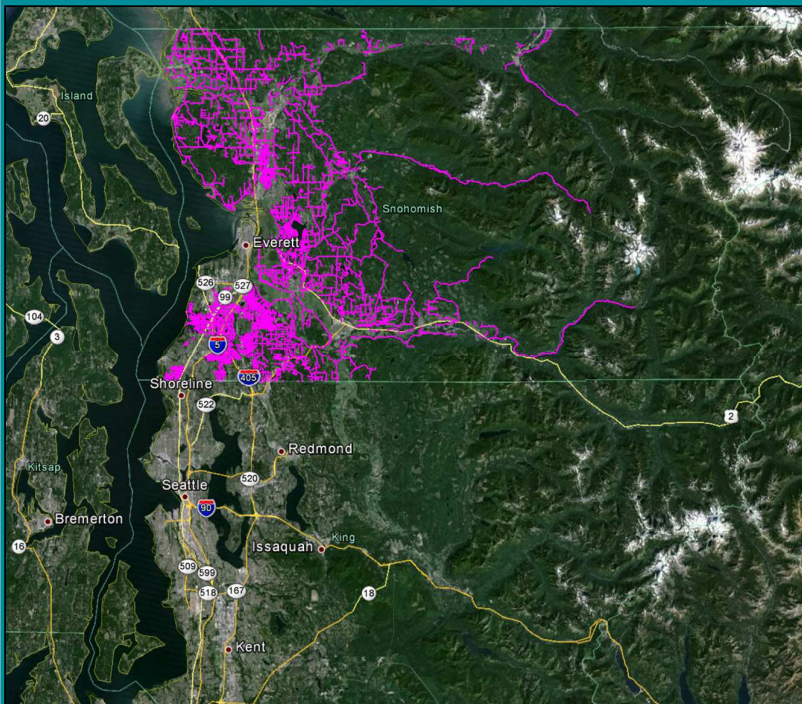
- Recording: Jul 12 – Aug 8, 2012
- Total Recording: 2580 miles
- Net Mapped: 1533 miles
- No. of images: 7,998,369 (X 14)
  - 111,977,166 Total
- Total Mapped Features: 317,952
- Final Delivery: Dec 2013

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	Feature	Number	Total Dimensions
Traffic_Management	CABINETS	246	
	CCTV	297	
	HEADS_PED_VEHICLE	1,940	
	LUMINAIRE	13,535	
	LUMINAIRE_POLE	13,234	
	PED_SIG_PUSH_BUTTON	700	
	SIGNAL_POLE	584	
Traffic_Pedestrian_Services	ADA_ACCOMMODATIONS	6,603	
	BARRIERS	301	10 Miles
	CURBING	14,436	688 Miles
	GUARD_RAILS	1,691	65 Miles
	NON_MOTORIZED_FACILITIES	7,700	1730 Miles
	PAVEMENT_MARKING_LNS	19,227	2126 Miles
	PAVEMENT_MARKING_PTS	2,439	
	PLANTER_AREAS	12,313	101 Acres
	SIGN_PLATES	26,053	
	SIGN_POSTS	24,226	
	SPOT_POST_PTS	1,460	
	SPOT_POSTS	60	
	STREET_NAME_SIGNS	13,239	
	TRAFFIC_CALMING	110	
Other Objects	CATCH_BASIN	29,504	
	EDGE_PAVEMENT	15,810	3061 Miles
	UTIL_COV	112,244	
	TOTAL NUMBER OF FEATURES	**317,952**	

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Snohomish County, WA
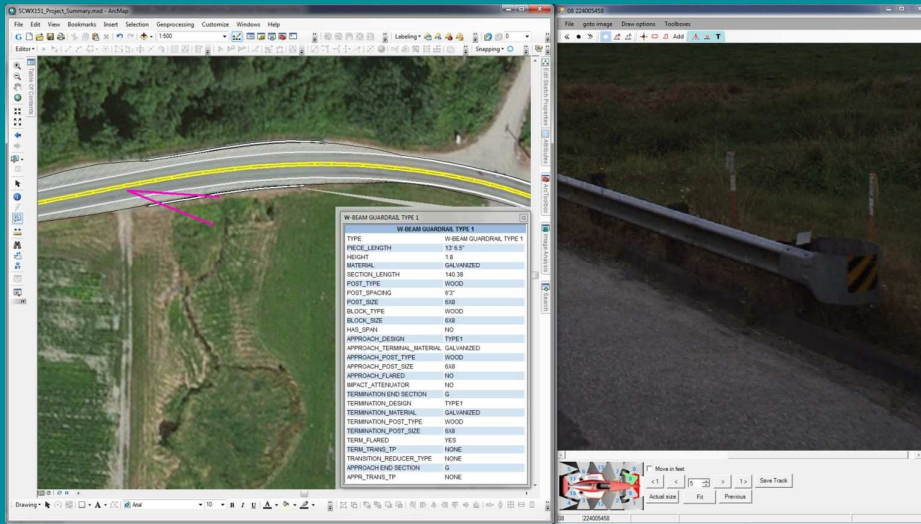
Guard Rails

- Attribution Based on WSDOT Standards
- Rail Types
- Segment Lengths
- Post Spacing
- Post Types
- Impact Attenuators
- Approaches & Terminations

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Snohomish County, WA

Summary of all guard rails within proposed construction project limits

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Snohomish County, WA

GIS data and attributes feed into external asset management program for work orders etc.
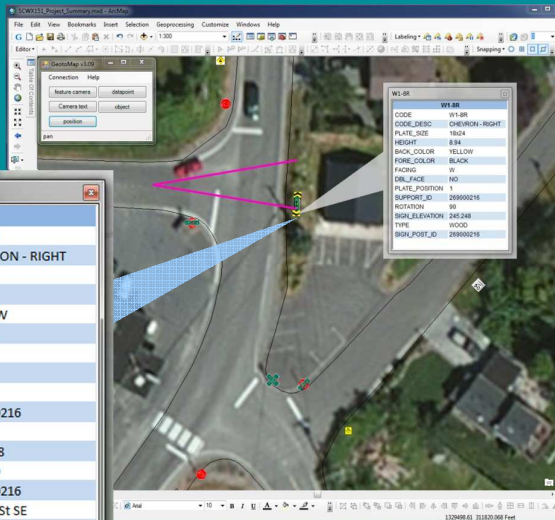
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Sign Plates
- MUTCD Codes
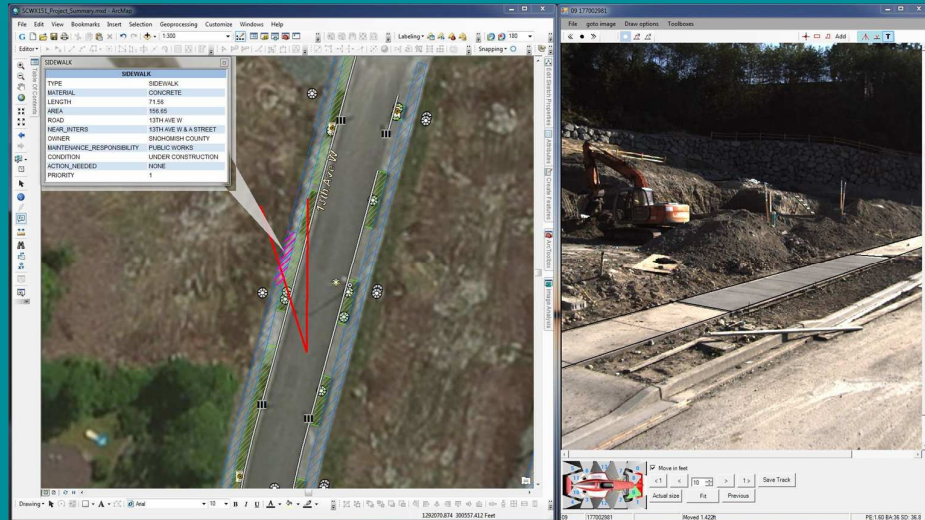- Dimensions
- Materials
- Maintenance Records

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Snohomish County, WA

Sidewalks

- Condition Assessments
- Materials
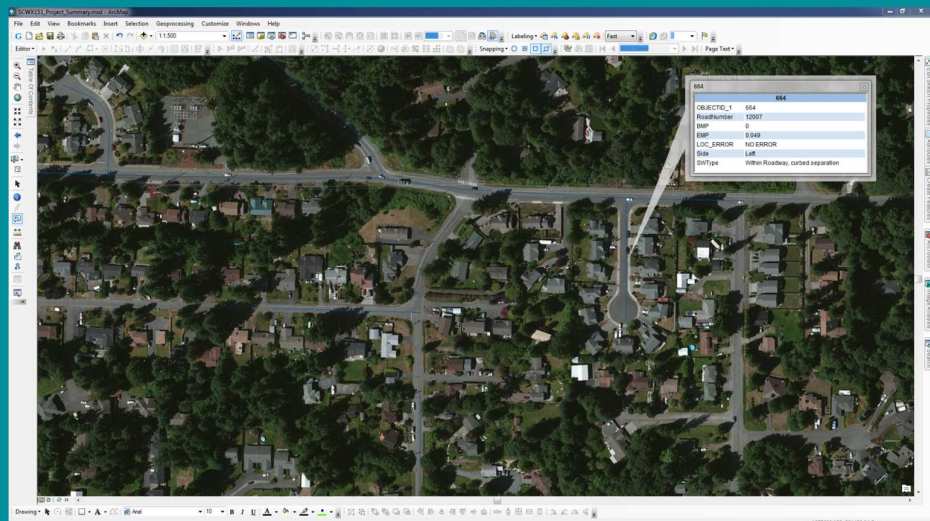- Impervious Surfaces
- ADA Requirements

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Snohomish County, WA
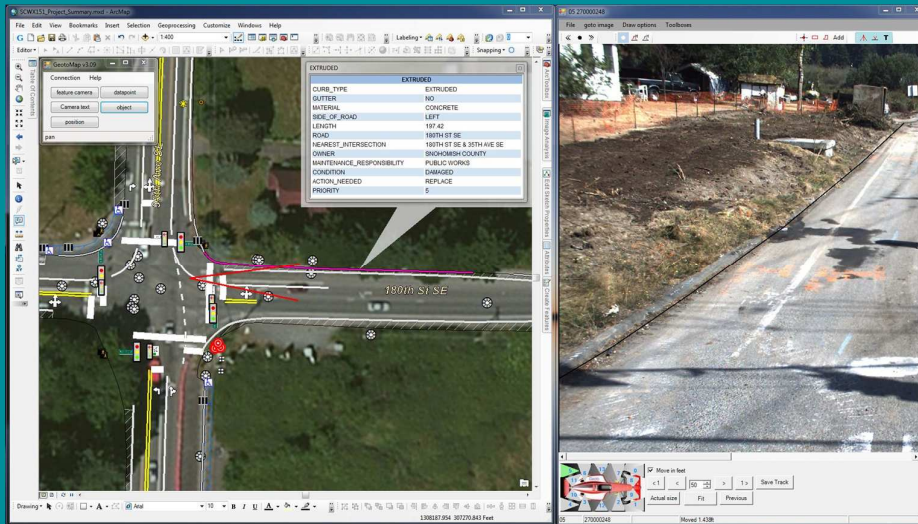
Previous S/W Inventory

- Road CL Based
- Road Number
- Begin/End Milepost
- Side of Road
- Sidewalk Type
- Difficult to Verify
- Limited Information

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Snohomish County, WA

Curbing

- **Curb Types**
    - Concrete Sidewalk
    - Curb and Gutter
    - Extruded
    - Pre-cast Concrete Dual Faced Mountable
    - Rolled Curb
    - Sloped Mountable
    - Thickened Edge
    - Vertical Curb
- **Materials**
    - Concrete
    - Asphalt
- **Side of Road**

Snohomish County, WA

Pavement Management

0.1 Mile Segments

Square Footage of Pavement Distress Types within Segment

Current Methodology

- Tabular Summaries
- Field Inspection of Pavement
- Division of Roads into 0.1 mile segments for analysis
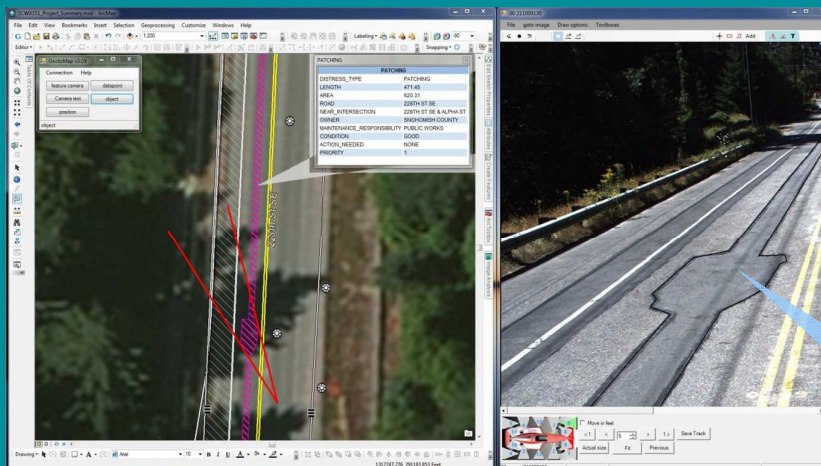- Adheres to ASTM D6433

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Pavement Management

- Locate Pavement Distress
- Prioritize Detailed Analysis
- Perform System-Wide Analysis

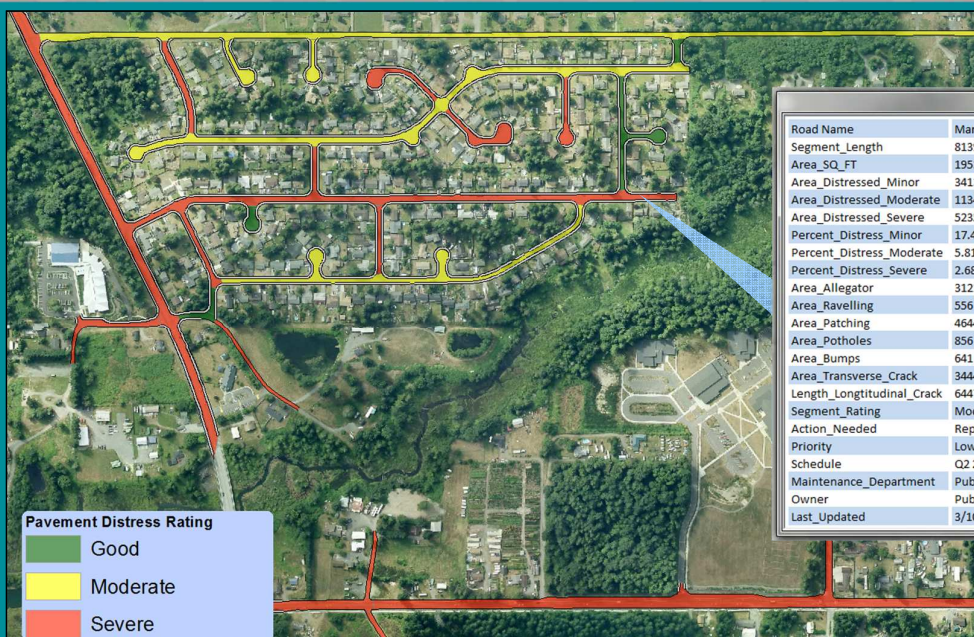| Road Name	Marine Dr NE
Segment_Length	8139.73
Area_SQ_FT	195353.57
Area_Distressed_Minor	34134.62
Area_Distressed_Moderate	11341.24
Area_Distressed_Severe	5235
Percent_Distress_Minor	17.47%
Percent_Distress_Moderate	5.81%
Percent_Distress_Severe	2.68%
Area_Allegator	3121
Area_Ravelling	556
Area_Patching	4644
Area_Potholes	856
Area_Bumps	641
Area_Transverse_Crack	3444
Length_Longtitudinal_Crack	6447
Segment_Rating	Moderate
Action_Needed	Repair
Priority	Low
Schedule	Q2 2015
Maintenance_Department	Public Works
Owner	Public Works
Last_Updated	3/10/2014 16:56

"Pavement Management is a program for improving the quality and performance of pavements and minimizing costs through good management practices"

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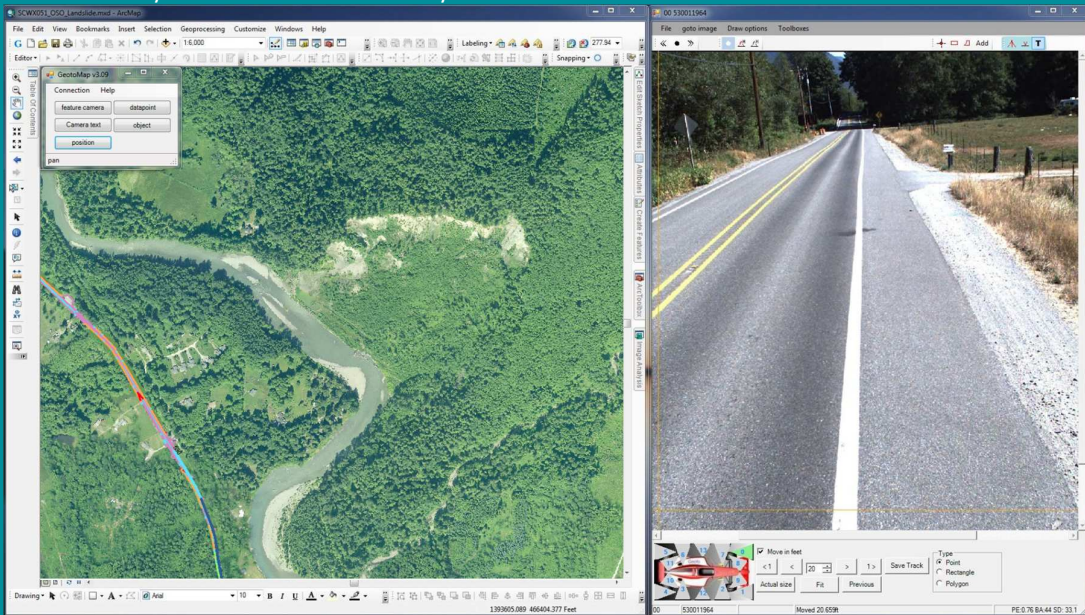

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Pavement Distress Rating
- Good
- Moderate
- Severe

Road Name	Marine Dr NE
Segment_Length	8139.73
Area_SQ_FT	195353.57
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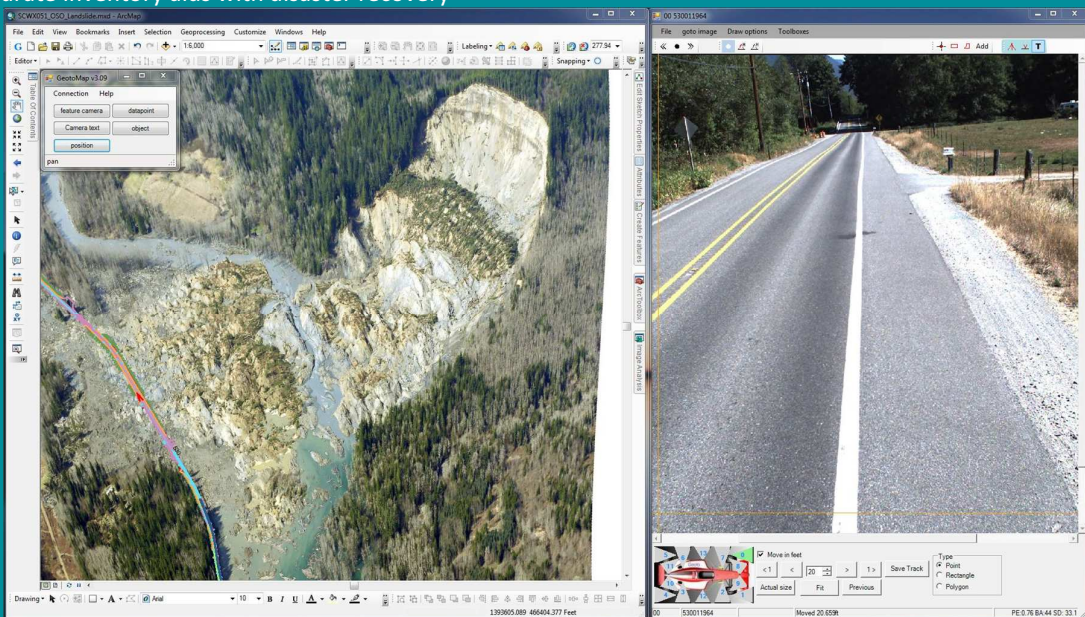# Snohomish County, WA

An accurate inventory aids with disaster recovery

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Snohomish County, WA

An accurate inventory aids with disaster recovery

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Getting Started

- ## Involve Stakeholders at Multiple Levels
  - ### Management
  - ### Power Users
  - ### Occasional Users
- ## Share expenses over multiple departments
  - ### Public Works, Assessors, Utilities, Police, Fire,
- ## Plan Plan Plan!
  - ### Pilot Projects Help

Decide What to Map

Define Features to Map
- Readily Visible Infrastructure
- Points, Lines, or Polygons
- Develop a data dictionary
- Keep the end user in mind

Define Mapping Procedures
- Where is it mapped
- Map it to enable to proper analyses

Define the Database
- How will the final AMMS consume the GIS

Define Attribution Procedures
- Attribute during mapping or later?

Mapping vs. Attribution

Build Templates to Automate Attribution
- Database Design
- Build Domains

Utilize Specialized Knowledge Base
- Some features can be attributed after mapping.
- Current workforce can be leveraged for attribution of complex features
  - Guard Rails
  - Power Infrastructure
  - Etc.

Document and Follow Consistent Workflow

Document and Follow Consistent Workflow

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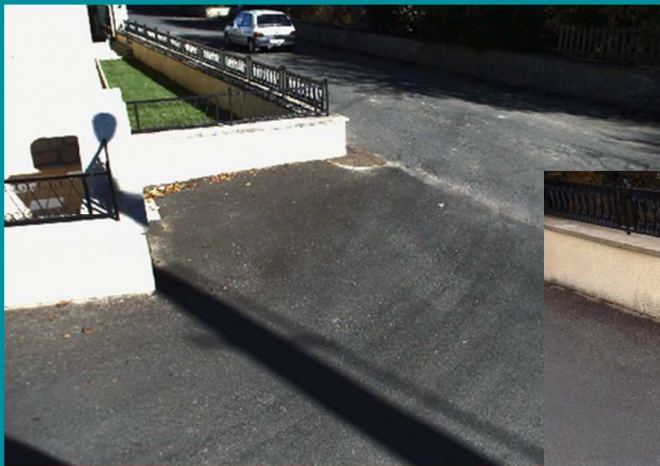

Plan for Implementation and Maintenance

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Plan for Implementation and Maintenance

Supplemental Imagery

Original Imagery

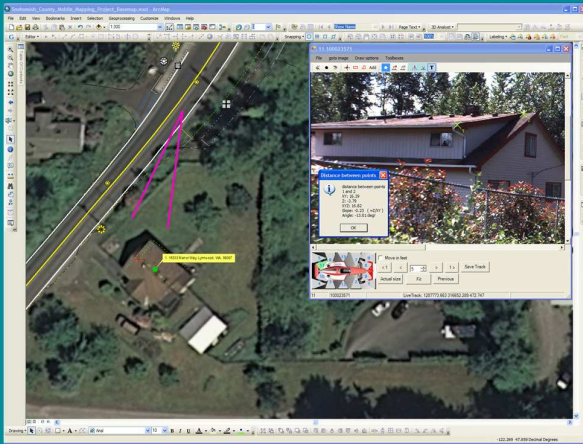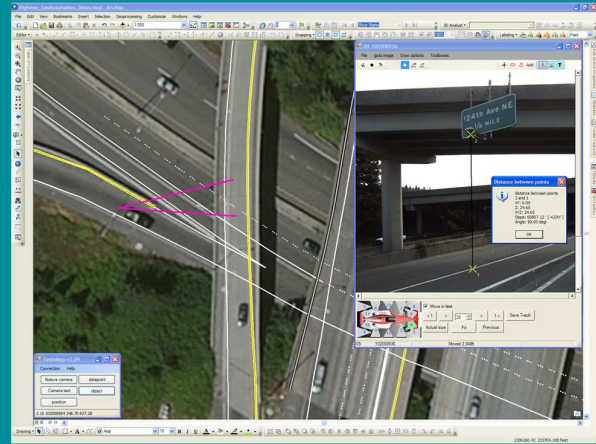surveying and geomatics

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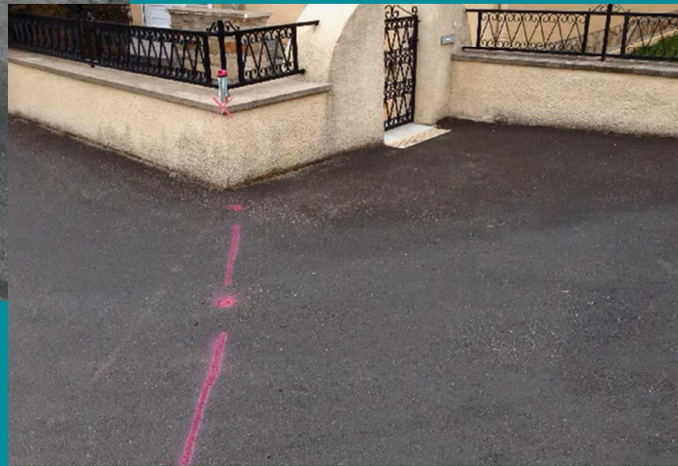
Other Applications

- ***Scratching the Surface-*** once imagery is acquired, users find reasons to use it:
  - Law enforcement
  - Emergency Response/ 911
  - Assessors Office
  - Legal (Photo record of conditions)
  - Pavement condition assessment (analysis takes some field work)

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Other Applications
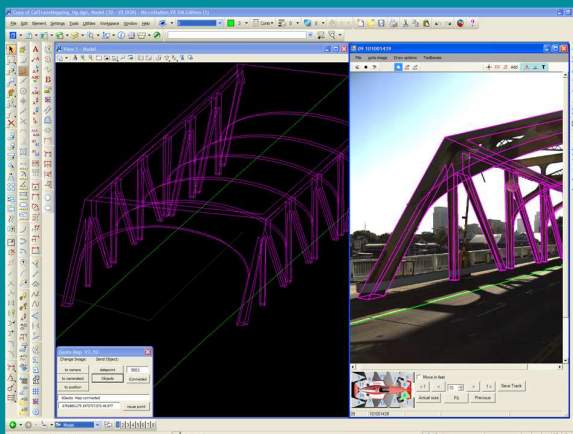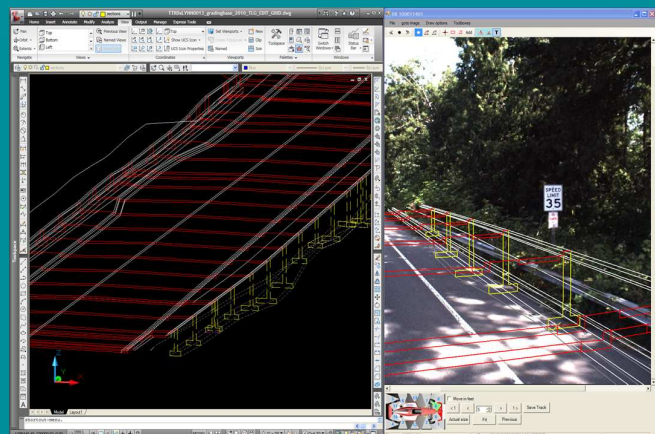

Assessor Review

Clearance Measurement

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Other Applications- 3D mapping - Design Review

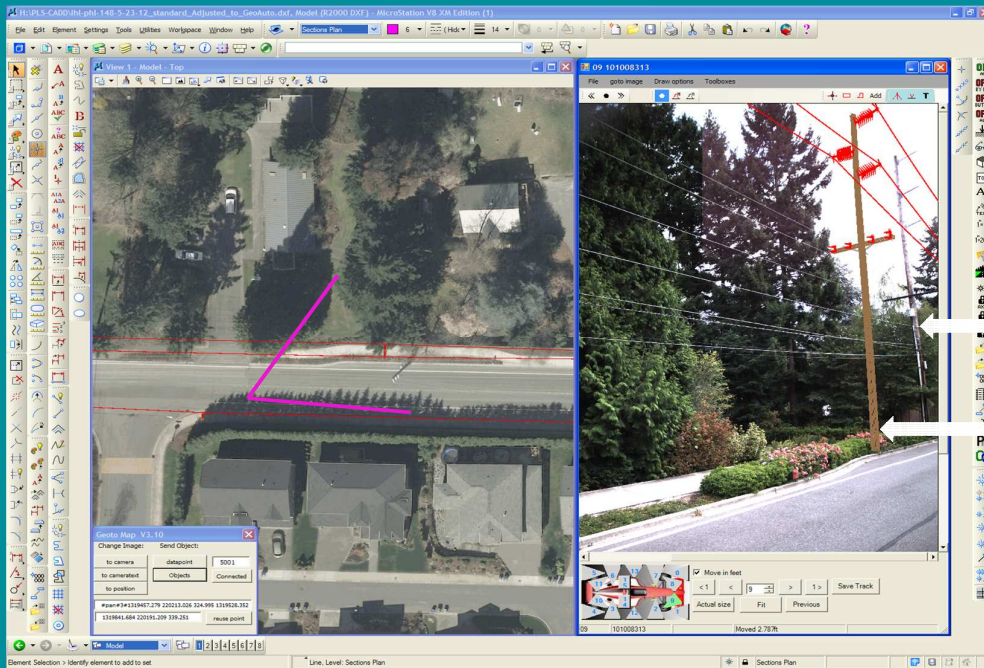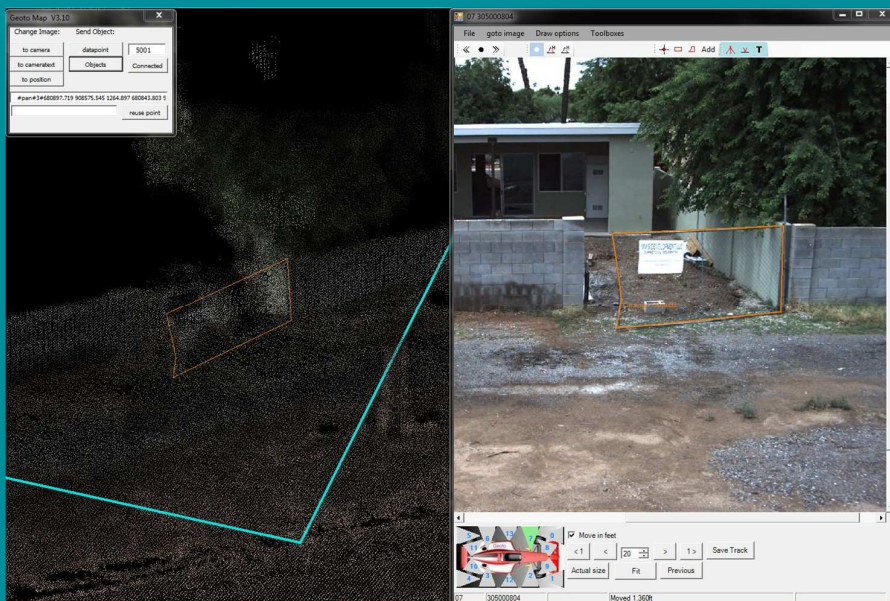Complex 3D Mapping

Design Review

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Other Applications – Design Visualization

Existing Pole Location

Proposed Pole Location From PLS-CADD

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Point Cloud Generation

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Questions?

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Thank You

JON P. WARREN, P.L.S.

Puget Sound Region Survey Manager

David Evans and Associates

415 118th Ave SE

Bellevue, WA. 98005

jpwa@deainc.com

President-Elect National Society of Professional Surveyors

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