



Mobile Digital Imagery Mapping

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

F.I.G. CONGRESS 2014

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surveying and geomatics

OUTLINE

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

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



DAVID EVANS
AND ASSOCIATES INC.

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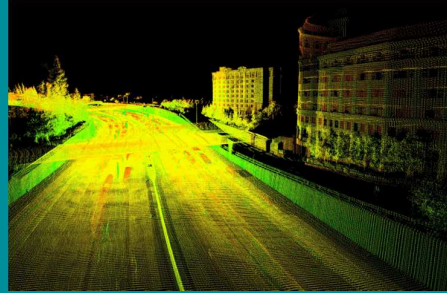
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To improve the **quality** of life
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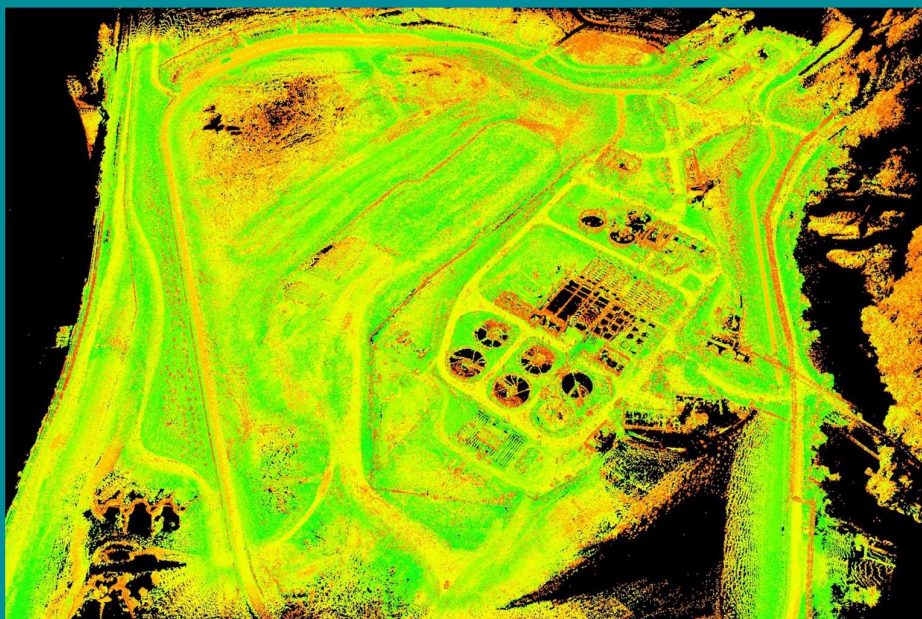
Mobile Laser Scanning



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Mobile Laser Data – Raw Point Cloud

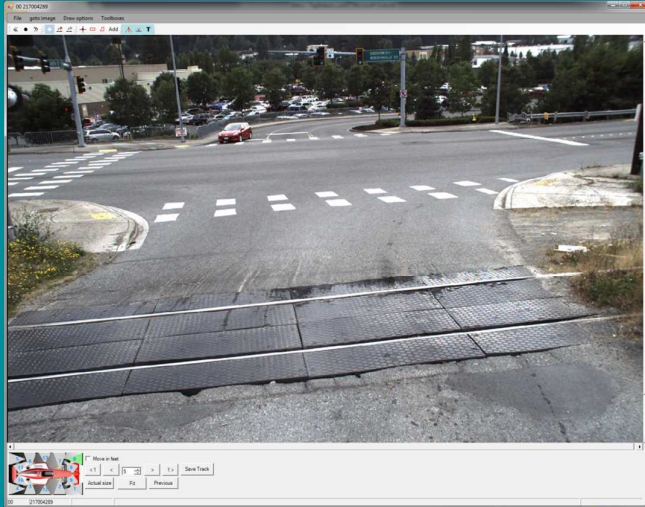


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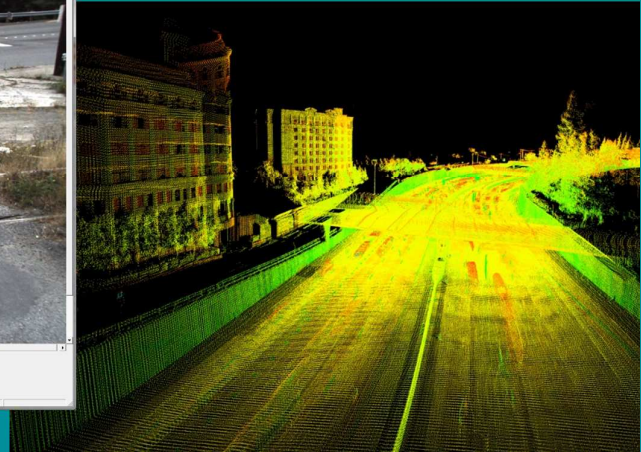


Asset and Infrastructure Mobile Mapping

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

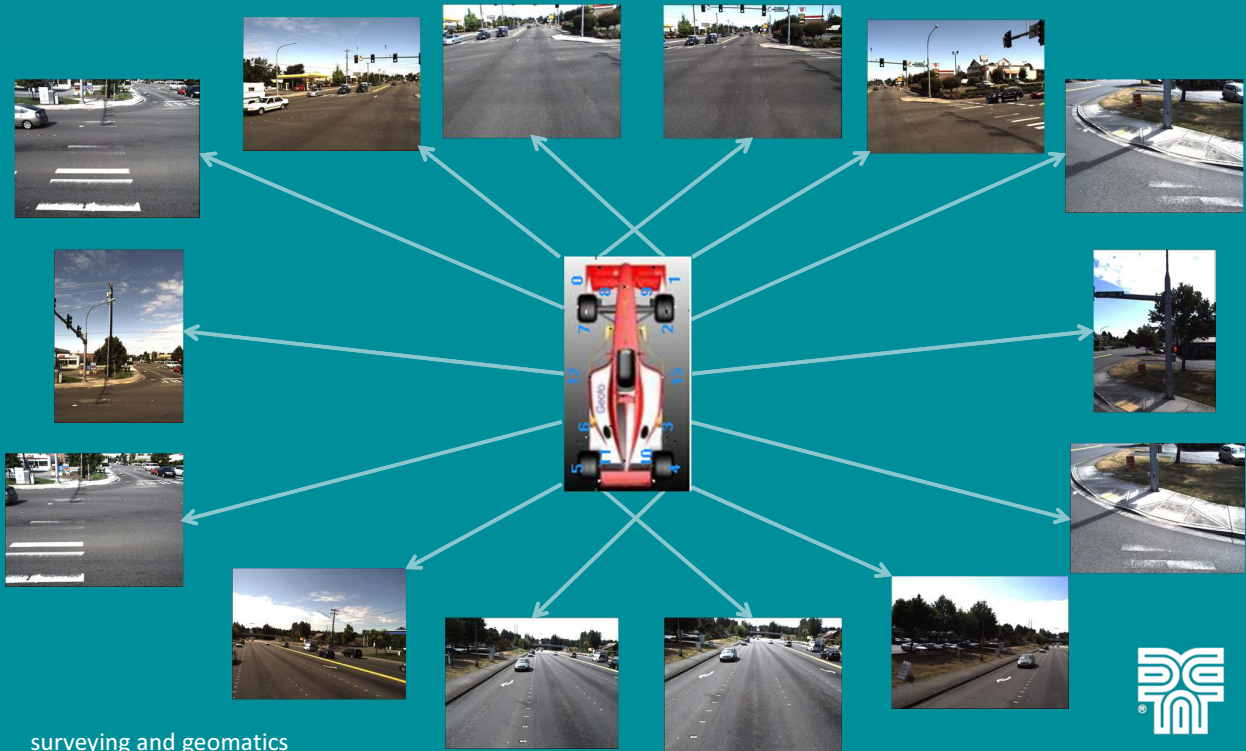
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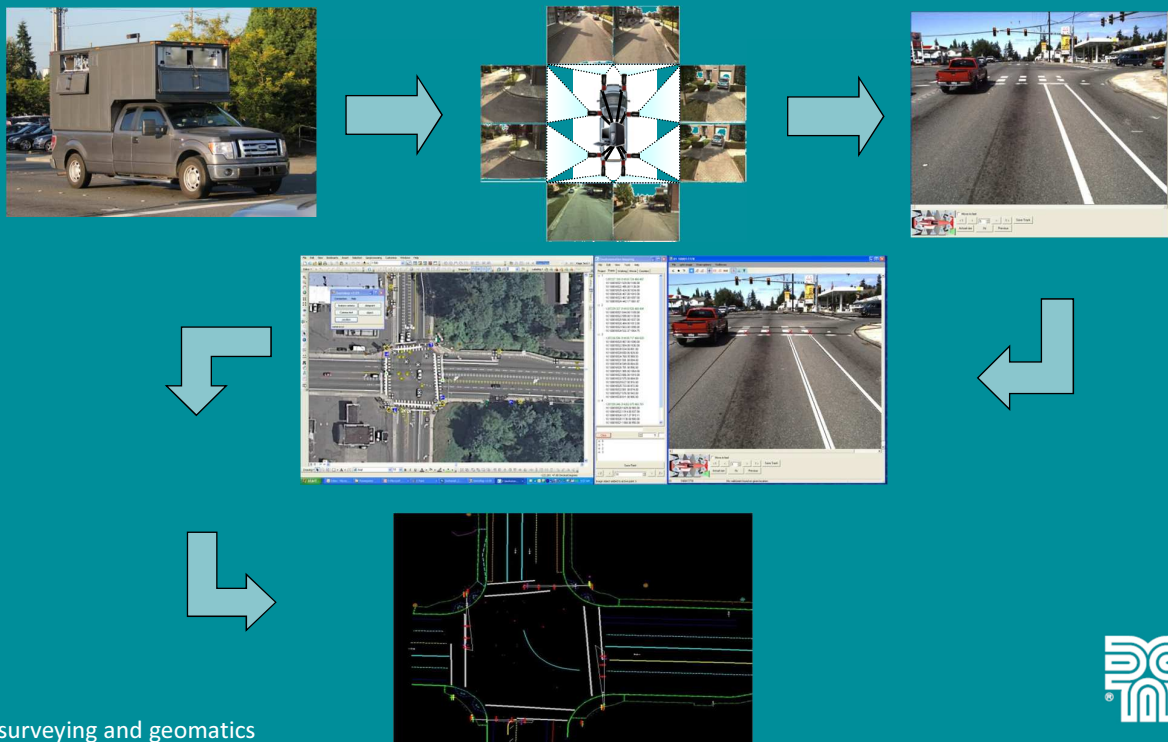
14 Cameras

22 Frames p/s

360° View

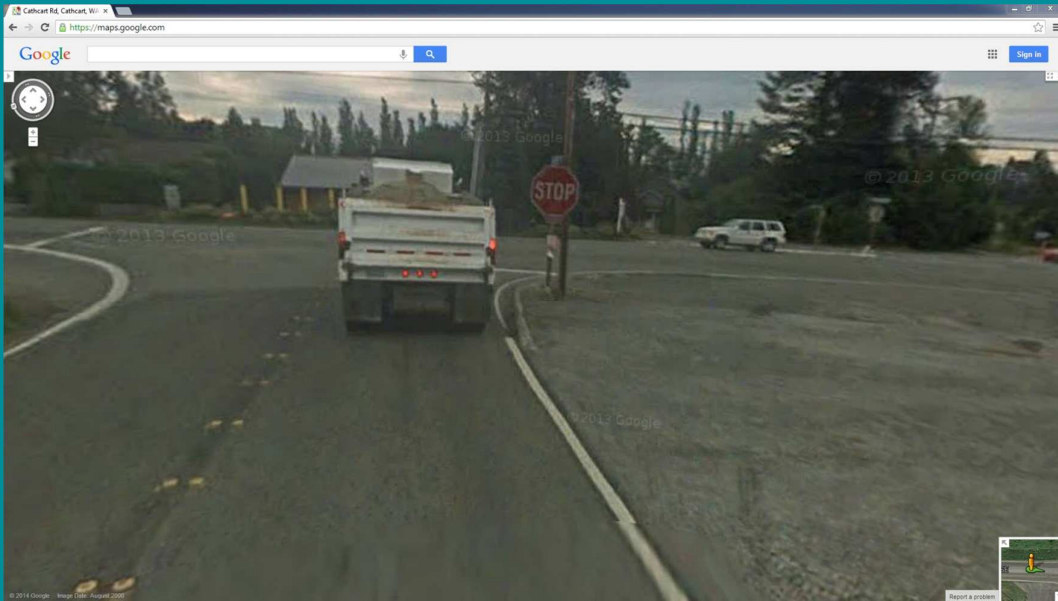


Workflow



Comparison to Google Street View

“We no longer go to maps, they come to us...” – The Guardian (2010)



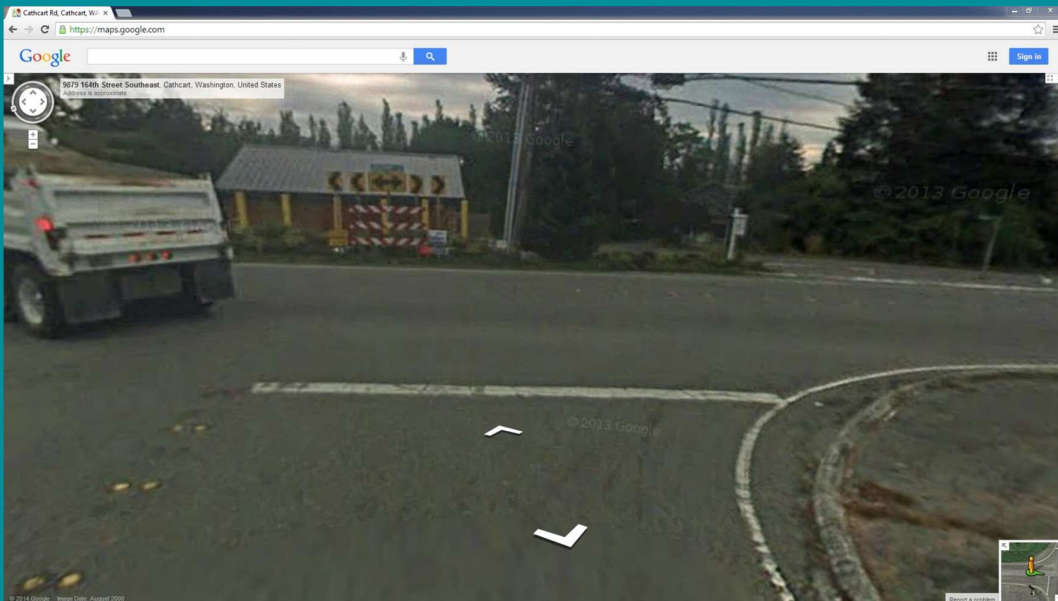
Average distance between images ~ 50 feet

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Comparison to Google Street View

“We no longer go to maps, they come to us...” – The Guardian (2010)

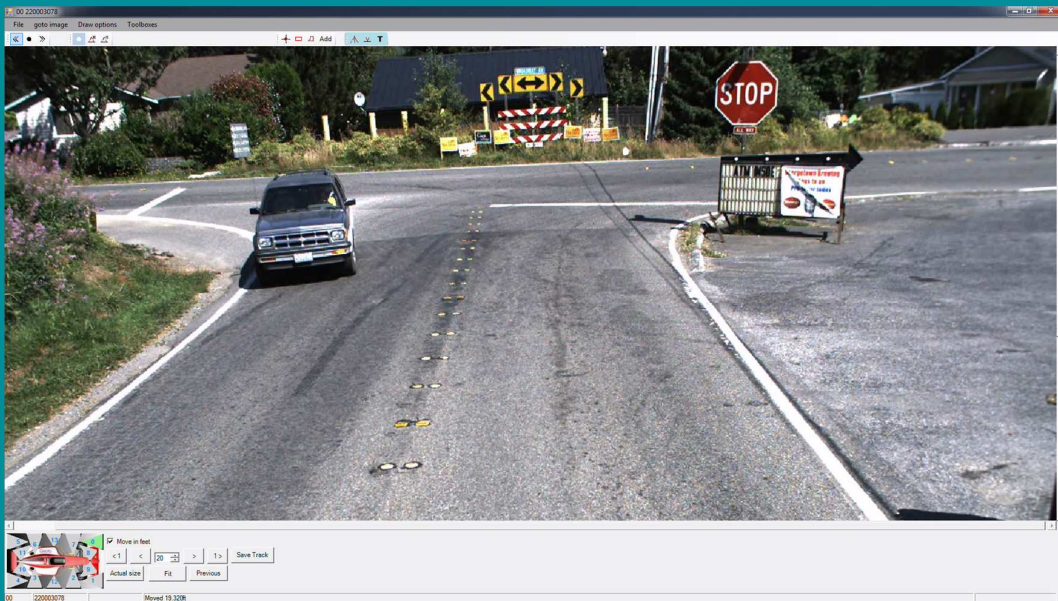


Average distance between images ~ 50 feet

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Comparison to Google Street View

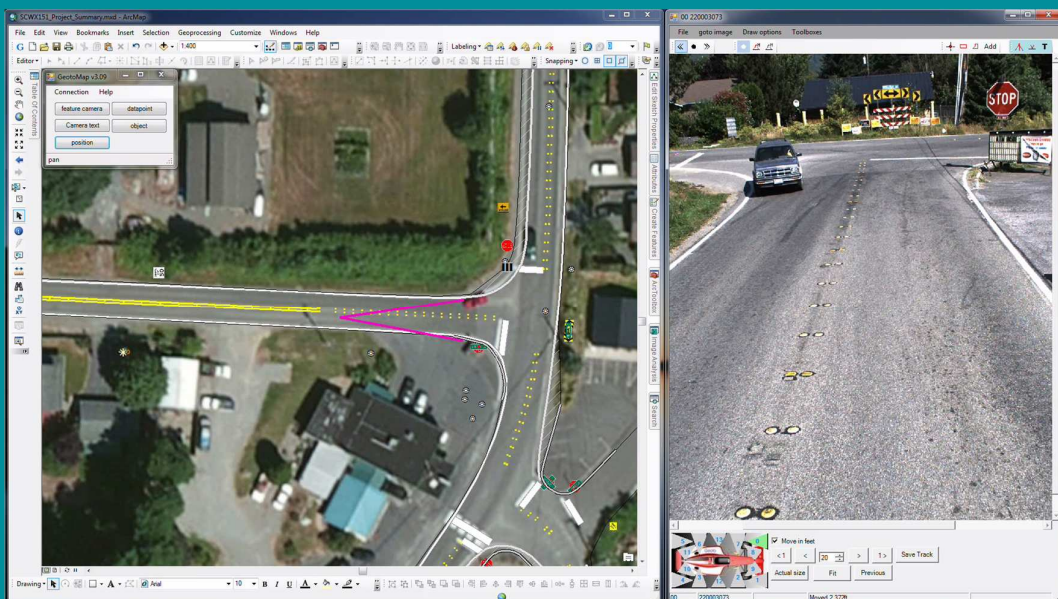


Distance between images as little as 1 foot
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Comparison to Google Street View

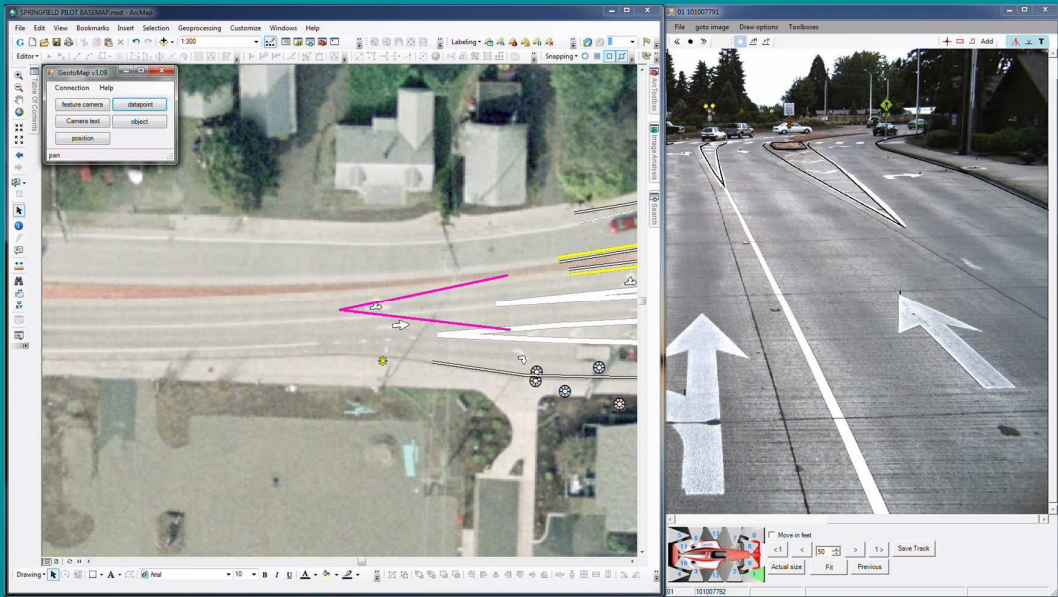
Integration With ArcMap



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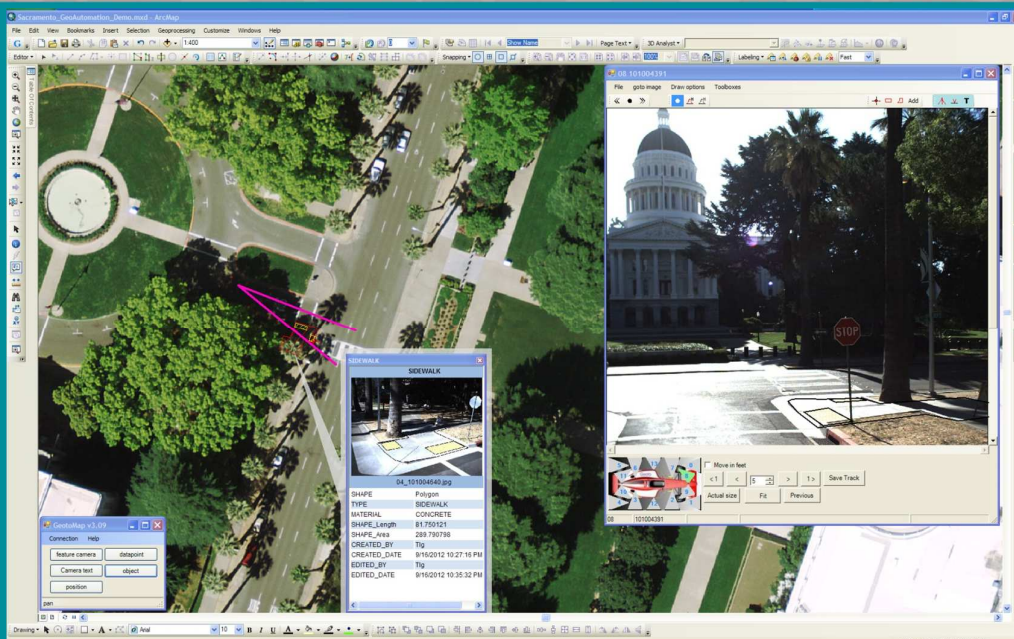
Data Superimposition



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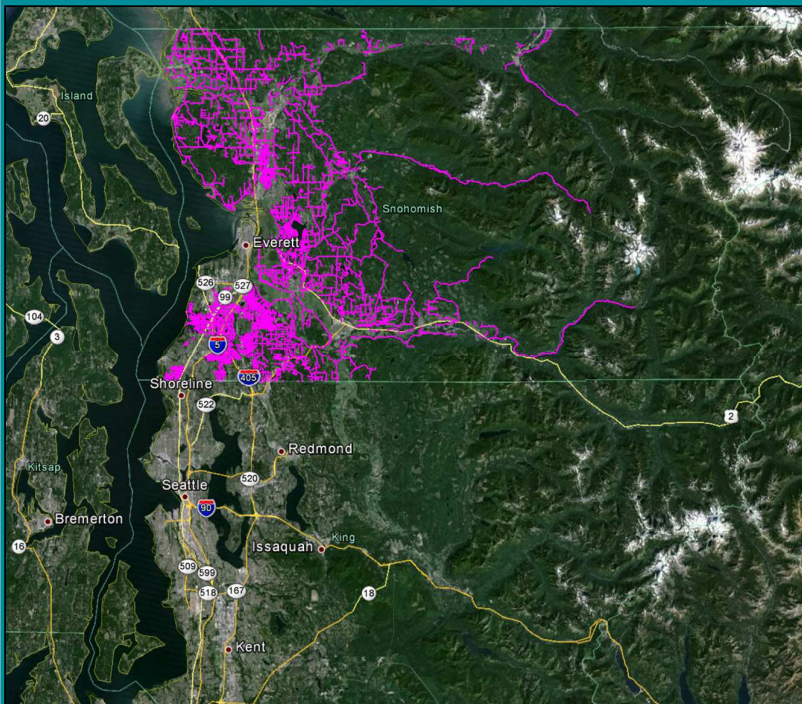
Extraction of Feature Thumbnails



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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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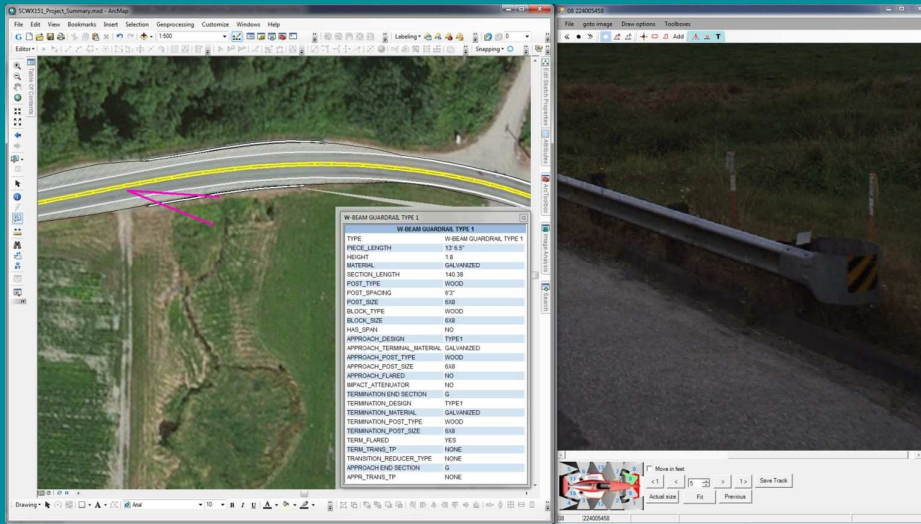
Snohomish County, WA

	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	
Other_Objects	TRAFFIC_CALMING	110	
	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

TYPE	PRECE_LENGTH	HEIGHT	MATERIAL	SECTION_LENGTH	POST	POST_SIZE	BLOCK	HAS_SPAN	APPROACH_DESIGN	APPROACH_TERMINAL_MATERIAL	APPROACH_POST_TYPE	APPROACH_POST_SIZE	APPROACH_FLARED	IMPACT_ATTENUATOR	TERMINATION_END_SECTION	TERMINATION_DESIGN	TERMINATION_MATERIAL	TERMINATION_POST_TYPE	TERMINATION_POST_SIZE	TERM_FLARED	TERM_TRANSL_IP	TRANSITIONAL_REDUCER_TYPE	APPROACH_END_SECTION	APPL_TRANSL_IP
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	145.38'	WOOD	6" x 8"	WOOD	NO	TYPE1	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	TYPE1	GALVANIZED	WOOD	6" x 8"	YES	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	157.84'	WOOD	6" x 8"	WOOD	NO	ET2000	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	TYPE1	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	43.87'	WOOD	6" x 7"	WOOD	NO	NO	GALVANIZED	WOOD	4x6	YES	NO	NO	TYPE1	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	157.67'	WOOD	6" x 8"	WOOD	NO	NO	NO	NO	NO	NO	NO	NO	C	TYPE1	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	456.2'	WOOD	6" x 8"	WOOD	NO	NO	NO	NO	NO	NO	NO	NO	C	TYPE1	GALVANIZED	WOOD	6" x 8"	YES	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	275.77'	WOOD	6" x 8"	WOOD	NO	ET2000	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	44.38'	WOOD	OTHER	6" x 8"	WOOD	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	196.1'	WOOD	6" x 8"	WOOD	NO	TYPE1	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	C	TYPE1	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	NO
W-BEAM GUARDRAIL	19.8'	1.8'	GALVANIZED	27.11'	METAL	4" x 7"	OTHER	WOOD	OTHER	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	189.12'	WOOD	6" x 8"	WOOD	NO	NO	NO	NO	NO	NO	NO	NO	C	TYPE1	GALVANIZED	WOOD	6" x 8"	YES	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	145.3'	WOOD	6" x 8"	WOOD	NO	ET2000	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	C	TYPE1	GALVANIZED	WOOD	6" x 8"	YES	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	212.44'	WOOD	6" x 8"	WOOD	NO	ET2000	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL	19.8'	1.8'	GALVANIZED	31.85'	METAL	4" x 7"	OTHER	WOOD	OTHER	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	39.81'	WOOD	6" x 7"	WOOD	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	193.88'	WOOD	6" x 8"	WOOD	NO	TYPE1	GALVANIZED	WOOD	6" x 8"	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
W-BEAM GUARDRAIL TYPE 1	19.8'	1.8'	GALVANIZED	189.12'	WOOD	6" x 8"	WOOD	NO	ET2000	GALVANIZED	WOOD	6" x 8"	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

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Snohomish County, WA

GIS data and attributes feed into external asset management program for work orders etc.

TYPE	PIECE_LEN	HEIGHT	MATERIAL	SECTION_LEN	POST_TP	POST_SP	POST_SZ	BLOCK_TP	BLOCK_SIZE	HAS_SPAN	APPR_DES	APPR_TERM	APPR_POST	APPR_POST2	APPR_FLARE	IMPACT_ATT	TERM_END_SE	TERM_DES
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.3	GALVANIZED	114.8	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.3	GALVANIZED	15.9	NONE	NONE	NONE	NONE	NONE	NO	TYPE1	GALVANIZED	CONCRETE	OTHER	NO	NO	F	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.8	GALVANIZED	114.9	WOOD	63"	6X8	WOOD	6X8	NO	SRT350	GALVANIZED					NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.9	GALVANIZED	389.6	WOOD	63"	6X8	WOOD	6X8	NO	ET2000 (I)	GALVANIZED	WOOD	6X8	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.2	GALVANIZED	59.2	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	OTHER	ET2000 (I)
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.4	GALVANIZED	46.6	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	OTHER	ET2000 (I)
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.9	GALVANIZED	38	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	G	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.9	GALVANIZED	357	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.1	GALVANIZED	284.9	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.9	GALVANIZED	96.5	WOOD	63"	6X8	WOOD	6X8	NO	ET2000 (I)	GALVANIZED	WOOD	6X8	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.4	GALVANIZED	15.8	NONE	NONE	NONE	NONE	NONE	NO	TYPE1	GALVANIZED	CONCRETE	OTHER	NO	NO	F	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.9	GALVANIZED	45.6	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.1	GALVANIZED	288	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	YES	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	184.1	WOOD	63"	6X8	WOOD	6X8	NO	ET2000 (I)	GALVANIZED	WOOD	6X8	NO	NONE	NONE	NONE
THREE-BEAM GUARDRAIL	13' 6.5"	2.1	GALVANIZED	262.4	CONCRETE	OTHER	OTHER	NONE	NONE	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
THREE-BEAM GUARDRAIL	13' 6.5"	1.9	GALVANIZED	260	CONCRETE	OTHER	OTHER	NONE	NONE	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.1	GALVANIZED	14.1	WOOD	3' 1"	10X10	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.1	GALVANIZED	109.9	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.9	GALVANIZED	162.3	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.4	GALVANIZED	29	WOOD	63"	6X8	NONE	NONE	NO	TYPE1	GALVANIZED	WOOD	6X8	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	192.2	WOOD	63"	6X8	WOOD	6X8	NO	ET2000 (I)	GALVANIZED	WOOD	6X8	NO	NO	C	TYPE1
THREE-BEAM GUARDRAIL	13' 6.5"	2.7	GALVANIZED	30.3	METAL	63"	OTHER	WOOD	OTHER	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	13.6	WOOD	3' 1"	10X10	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	G	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.4	GALVANIZED	27	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	YES	NO	NONE	NONE
THREE-BEAM GUARDRAIL	13' 6.5"	2.4	GALVANIZED	30.5	METAL	63"	OTHER	WOOD	OTHER	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.1	GALVANIZED	14.3	WOOD	3' 1"	10X10	WOOD	10X10	NO	NONE	NONE	NONE	NONE	NO	NO	G	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.3	GALVANIZED	13.4	WOOD	3' 1"	10X10	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	YES	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.3	GALVANIZED	408.7	WOOD	63"	6X8	WOOD	6X8	NO	ET2000 (I)	GALVANIZED	WOOD	6X8	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	314.5	WOOD	63"	6X8	WOOD	6X8	NO	ET2000 (I)	GALVANIZED	WOOD	6X8	NO	NO	G	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.6	GALVANIZED	214.8	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	283.5	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	YES	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	252.3	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.3	GALVANIZED	802.3	WOOD	63"	6X8	WOOD	6X8	NO	ET2000 (I)	GALVANIZED	WOOD	6X8	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.3	GALVANIZED	988.7	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	YES	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	634.6	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.6	GALVANIZED	40.2	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	YES	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.1	GALVANIZED	162.7	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED			YES	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	832.7	WOOD	63"	6X8	WOOD	6X8	NO	ET2000 (I)	GALVANIZED	WOOD	6X8	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.8	GALVANIZED	569.8	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.1	GALVANIZED	103.7	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	312.8	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2	GALVANIZED	327.4	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	NO	NO	NONE	NONE
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	1.8	GALVANIZED	327.2	WOOD	63"	6X8	WOOD	6X8	NO	NONE	NONE	NONE	NONE	NO	NO	C	TYPE1
W-BEAM GUARDRAIL TYPE 1	13' 6.5"	2.6	GALVANIZED	101	WOOD	63"	6X8	WOOD	6X8	NO	TYPE1	GALVANIZED	WOOD	6X8	NO	NO	C	TYPE1



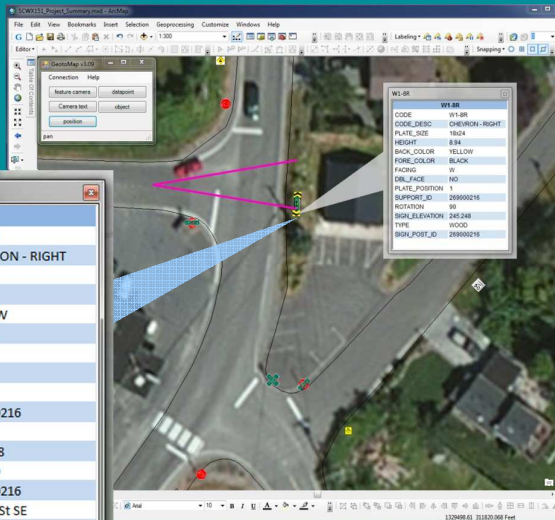
surveying and geomatics

Snohomish County, WA

Sign Plates

- MUTCD Codes
- Dimensions
- Materials
- Maintenance Records

W1-8R	
CODE	W1-8R
CODE_DESC	CHEVRON - RIGHT
PLATE_SIZE	18x24
HEIGHT	8.94
BACK_COLOR	YELLOW
FORE_COLOR	BLACK
FACING	W
DBL_FACE	NO
PLATE_POSITION	1
SUPPORT_ID	269000216
ROTATION	90
SIGN_ELEVATION	245.248
TYPE	WOOD
SIGN_POST_ID	269000216
ROAD_NAME	132nd St SE
ROAD_NUMBER	52860
MP	0.992868
CL_OFFSET	16.610732
SIDE	LEFT
OWNERSHIP	PW COUNTY ROAD FUND
MAINT_RESP	ROAD MAINTENANCE
FINANCE_RESP	PW COUNTY ROAD FUND

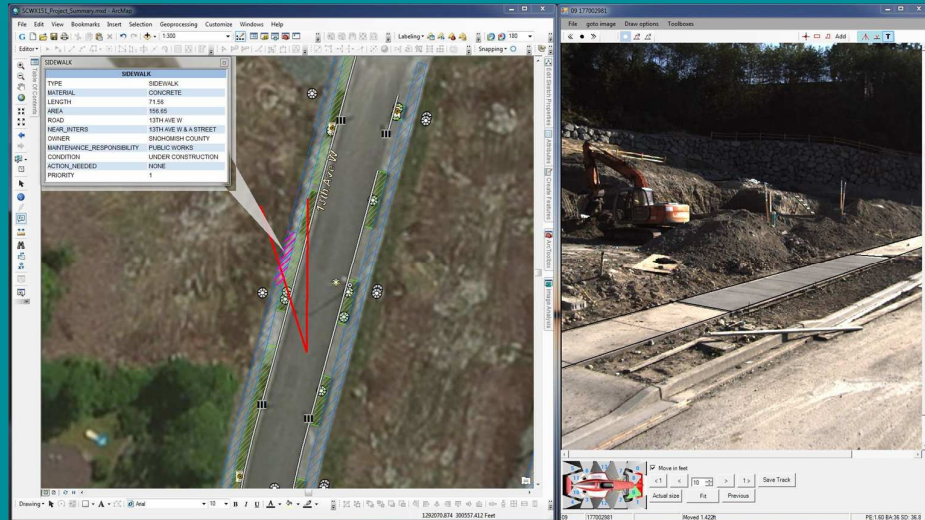


surveying and geomatics

Snohomish County, WA

Sidewalks

- Condition Assessments
- Materials
- Impervious Surfaces
- ADA Requirements



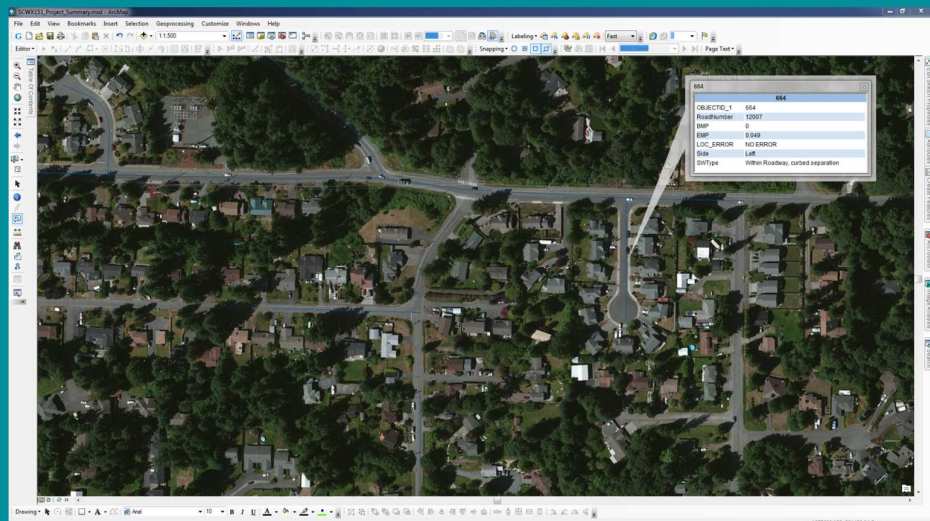
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Snohomish County, WA

Previous S/W Inventory

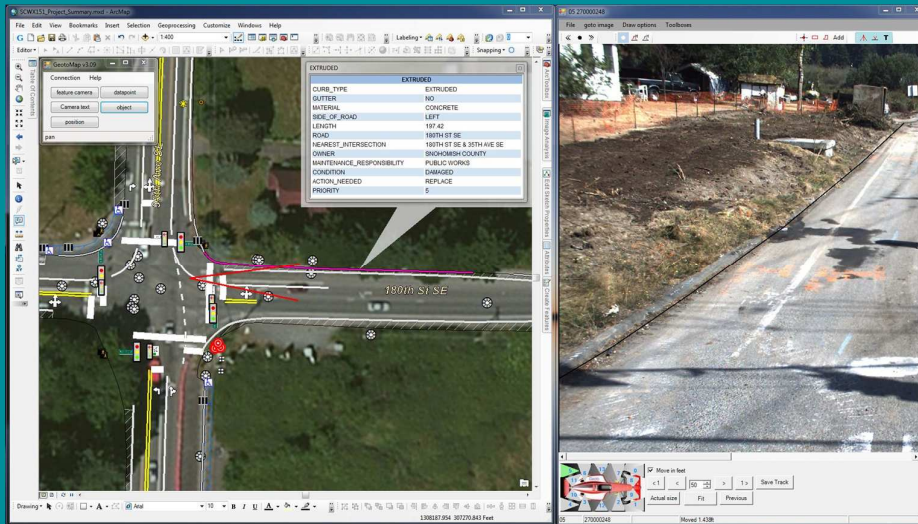
- Road CL Based
- Road Number
- Begin/End Milepost
- Side of Road
- Sidewalk Type
- Difficult to Verify
- Limited Information



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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

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Pavement Management

Road Name	Mile	...
180TH ST SE	1.0	...
180TH ST SE	1.1	...
180TH ST SE	1.2	...
180TH ST SE	1.3	...
180TH ST SE	1.4	...
180TH ST SE	1.5	...
180TH ST SE	1.6	...
180TH ST SE	1.7	...
180TH ST SE	1.8	...
180TH ST SE	1.9	...
180TH ST SE	2.0	...
180TH ST SE	2.1	...
180TH ST SE	2.2	...
180TH ST SE	2.3	...
180TH ST SE	2.4	...
180TH ST SE	2.5	...
180TH ST SE	2.6	...
180TH ST SE	2.7	...
180TH ST SE	2.8	...
180TH ST SE	2.9	...
180TH ST SE	3.0	...
180TH ST SE	3.1	...
180TH ST SE	3.2	...
180TH ST SE	3.3	...
180TH ST SE	3.4	...
180TH ST SE	3.5	...
180TH ST SE	3.6	...
180TH ST SE	3.7	...
180TH ST SE	3.8	...
180TH ST SE	3.9	...
180TH ST SE	4.0	...
180TH ST SE	4.1	...
180TH ST SE	4.2	...
180TH ST SE	4.3	...
180TH ST SE	4.4	...
180TH ST SE	4.5	...
180TH ST SE	4.6	...
180TH ST SE	4.7	...
180TH ST SE	4.8	...
180TH ST SE	4.9	...
180TH ST SE	5.0	...

Current Methodology

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

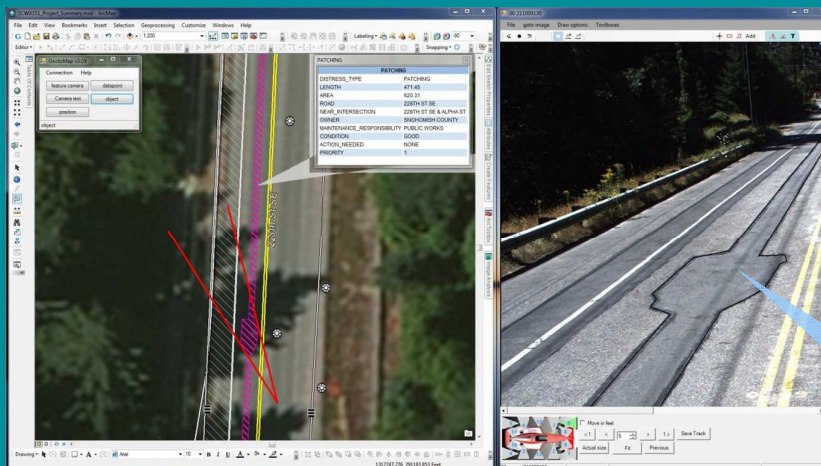
0.1 Mile Segments

Square Footage of Pavement Distress Types within Segment

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Snohomish County, WA



Pavement Management

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

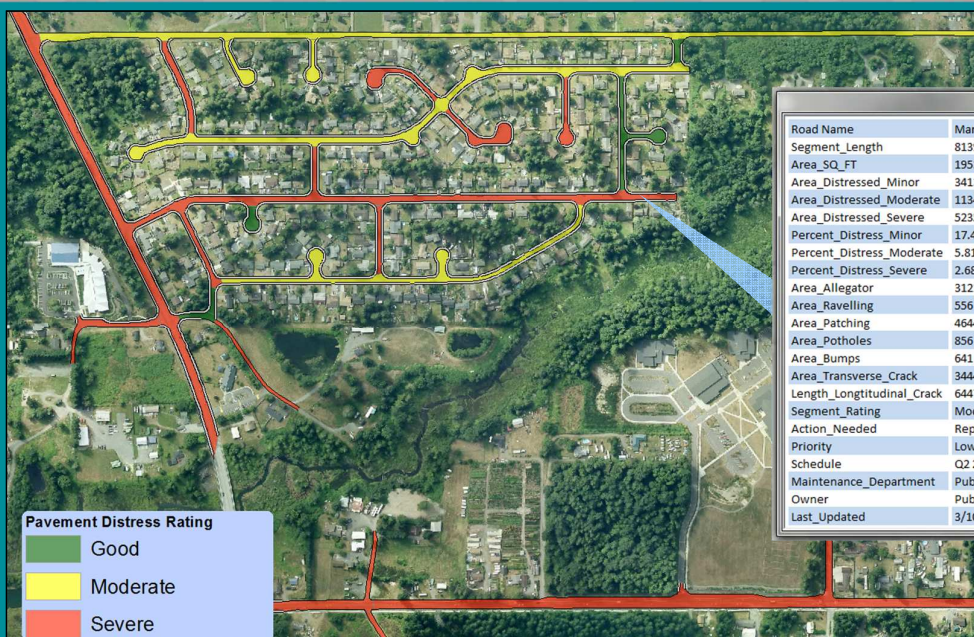
Road Name	Marine Dr NE
Segment_Length	8139.73
Area_SQ_FT	195353.57
Area_Distressed_Minor	34134.62
Area_Distressed_Moderate	11341.24
Area_Distressed_Severe	5235
Percent_Distress_Minor	17.47%
Percent_Distress_Moderate	5.81%
Percent_Distress_Severe	2.68%
Area_Allegator	3121
Area_Ravelling	556
Area_Patching	4644
Area_Potholes	856
Area_Bumps	641
Area_Transverse_Crack	3444
Length_Longitudinal_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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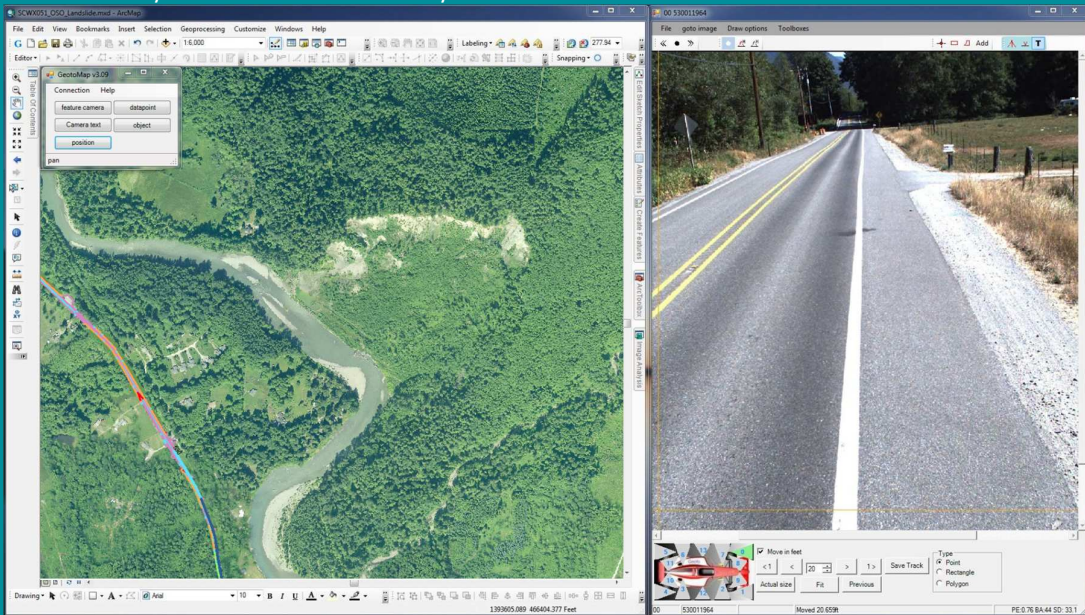
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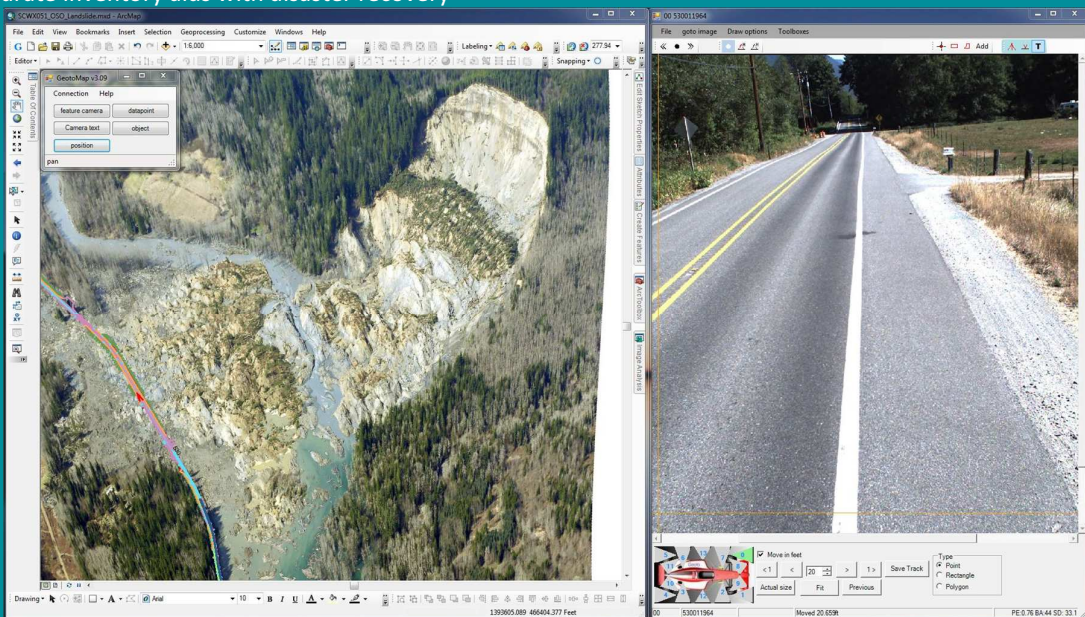
An accurate inventory aids with disaster recovery



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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



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Decide What to Map

The screenshot shows a database structure on the left and a 'Feature Class Properties' dialog box on the right. The database structure is organized into folders: 'Other_Items', 'Traffic_Management', and 'Traffic_Pedestrian_Services'. The 'Traffic_Management' folder contains items like CABINETS, CCTV, HEADS_PED_VEHICLE, LUMINAIRE, LUMINAIRE_POLE, PED_SIG_PUSH_BUTTON, SERVICE_CAB, and SIGNAL_POLE. The 'Traffic_Pedestrian_Services' folder contains items like ADA_ACCOMMODATIONS, BARRIERS, CURBING, GUARD_RAILS, NON_MOTORIZED_FACILITIES, PAVEMENT_MARKING_LNS, PAVEMENT_MARKING_PTS, PLANTER_AREAS, SIGN_PLATES, SIGN_POSTS, SPOT_POST_PTS, SPOT_POSTS, STREET_NAME_SIGNS, and TRAFFIC_CALMING. The 'Feature Class Properties' dialog box is open to the 'Fields' tab, showing a table of fields with their names and data types. The 'OBJECTID' field is highlighted, and its properties are shown in the 'Field Properties' section below the table.

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
TYPE	Text
PIECE_LN	Text
HEIGHT	Double
MATERIAL	Text
SECTION_LN	Double
POST_TP	Text
POST_LN	Double
POST_SP	Text
POST_SZ	Text
BLOCK_TP	Text
BLOCK_SIZE	Text

Field Properties

Alias	OBJECTID
-------	----------

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?

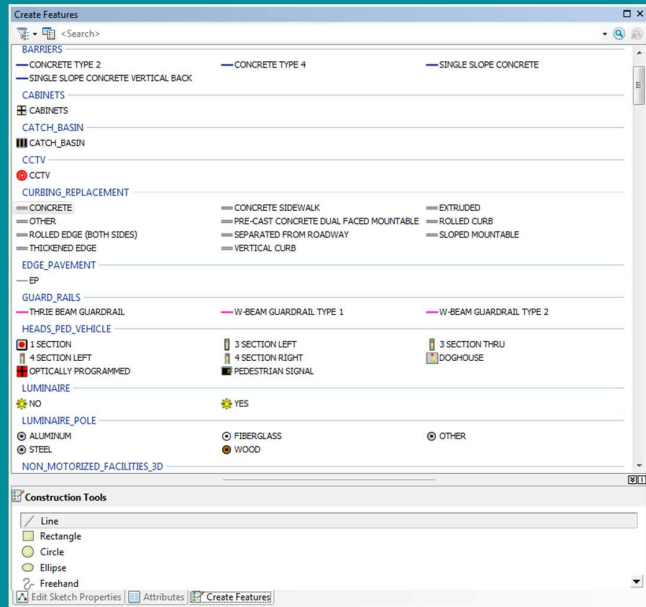


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Mapping vs. Attribution

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.



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Document and Follow Consistent Workflow

GUARDRAILS
Last change: 2012 12 19

Description
Guard rails are metal line objects to guide traffic as protective measure.

Object type
The guard rail is a line object, but we add point objects as extent for the beginning and the end of the rail to add extra information.

IMPORTANT: this document only describes the rail line object. Additional guardrail attributes are explained in a second document (Guardrail attributes). The reason for this is that the rail line (if this document) can be measured by the road edge operator. A specialized guardrail operator can add the extra attributes afterwards.

Attributes
The guard rail has several attributes. Only a few of them are collected using the level of the guard rail polyline. More attributes are added using the elements mapped to the polyline.

Usage: Guardrail type
Explanation:
This attribute indicates what kind of guard rail is.

Usage: Guardrail type	Explanation:
W-beam type 1	This is the default value. The cross section of the guardrail has the shape of a W turned 90 degrees.
W-beam type 2	This is the same as type 1, but there is an additional rectangular tube placed beneath the w-beam.
Thin beam	This type has the shape of a V turned 90 degrees.
Other	If the rail is not one of the previous types. Can happen on small bridges.

Usage: Guardrail material
Explanation:
This attribute indicates what material the guardrail is made of. Normally galvanized, except when the entire rail appears completely rusted, in that case it is core10.

Usage:

Usage:	Explanation:
Galvanized	This is the default value.
Core10	When the rail is rusted.

Measurement and attribute collection
Guard rails are measured on the top of the rail. Due to overmeasure, it is often difficult to measure points exactly on the higher point of the guard rail. The guard rail has a W shape (turned 90 degrees). At regular distances, at a guard rail point you can see the rails used to connect the different guard rail segments. These rails are often visible even if the guard rail is overtopped. Measure the top level of the guard rail through these rails. This is approximately in the middle of the upper rail surface.
In the image, measure the rail on the red line. The blue circles are the connection rails.

The size attribute is collected using the Microstation level:

Attribute type	Attribute (rail material)	Microstation level
w-beam type 1	galvanized	guardrail_wb_galv
w-beam type 2	galvanized	guardrail_wb_galv
thin beam	galvanized	guardrail_thin_galv
other	galvanized	guardrail_other_galv
w-beam type 1	core10	guardrail_wb_core10
w-beam type 2	core10	guardrail_wb_core10
thin beam	core10	guardrail_thin_core10
other	core10	guardrail_other_core10

Special remarks
Be aware of the difference between the measurement location for guardrails and barriers: guardrails are measured on top, barriers are measured at the ground.
A guardrail has extra attributes for the beginning (approach) and end (termination), and also for the change between different types (transition). Because of that it is very important that each rail is 1 object as long as the type does not change. If there is a transition between different types, the transition is part of the rail the traffic is approaching. See the examples.

Examples

Guardrail_wb_galv measure the guardrail on the top

Real life W-beam type 2 guardrail example will be added when available. Core10 material guardrail will be added when available. The next to images illustrate the difference between W-beam type 1 and type 2


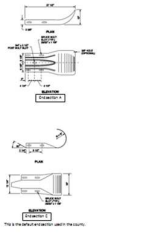
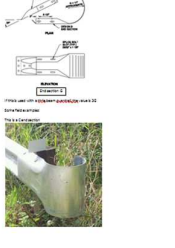




w-beam type 1

W-beam type 2: same beam as type 1, but there is an extra rectangular tube beneath the w-beam.



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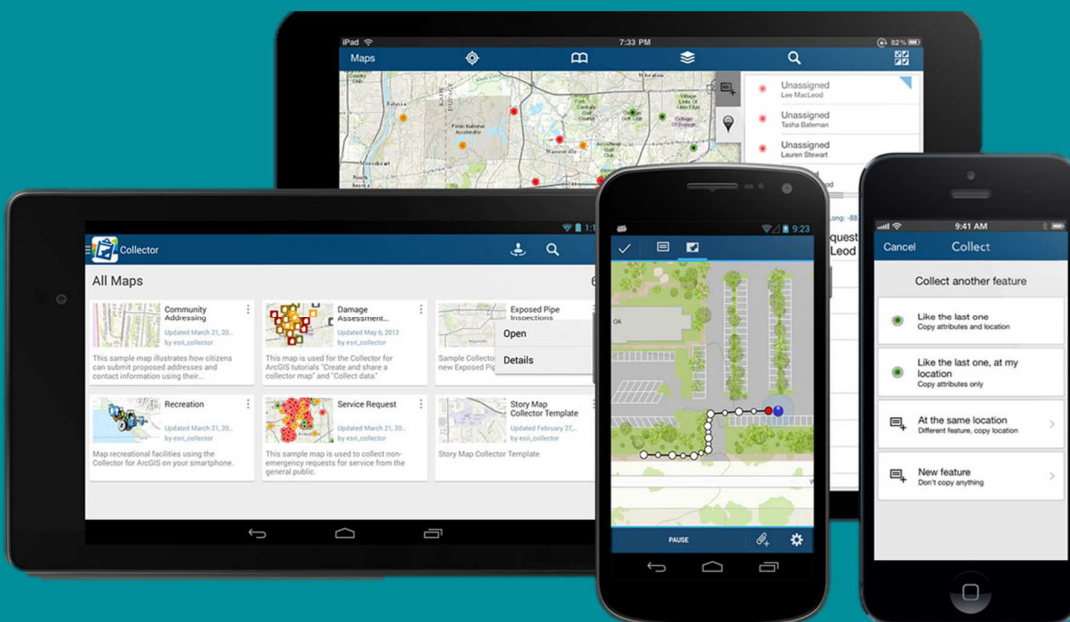
Document and Follow Consistent Workflow

<p>CHARACTERISTICS</p> <p>Category: 002-210</p> <p>Use this template to document the characteristics of a feature. The template is used to document the characteristics of a feature. The template is used to document the characteristics of a feature. The template is used to document the characteristics of a feature.</p> <p>Attributes</p> <p>Category: 002-210</p> <p>Use this template to document the characteristics of a feature. The template is used to document the characteristics of a feature. The template is used to document the characteristics of a feature.</p>	<p>Attributes</p> <p>Category: 002-210</p> <p>Use this template to document the characteristics of a feature. The template is used to document the characteristics of a feature. The template is used to document the characteristics of a feature.</p>	<p>Attributes</p> <p>Category: 002-210</p> <p>Use this template to document the characteristics of a feature. The template is used to document the characteristics of a feature. The template is used to document the characteristics of a feature.</p>	<p>Examples</p> 	
				

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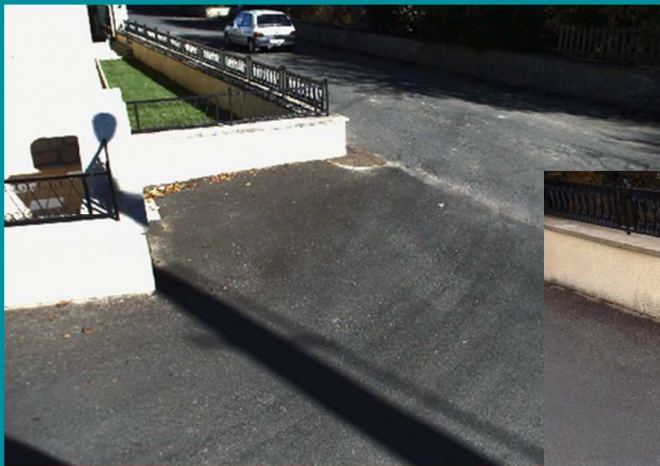
Plan for Implementation and Maintenance



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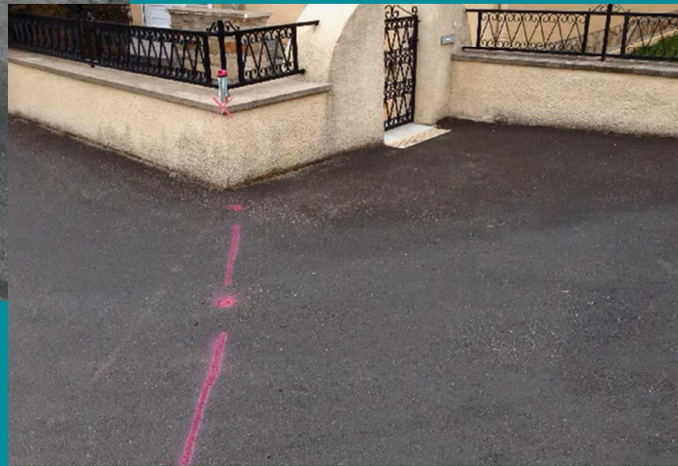


Plan for Implementation and Maintenance



Original Imagery

Supplemental Imagery

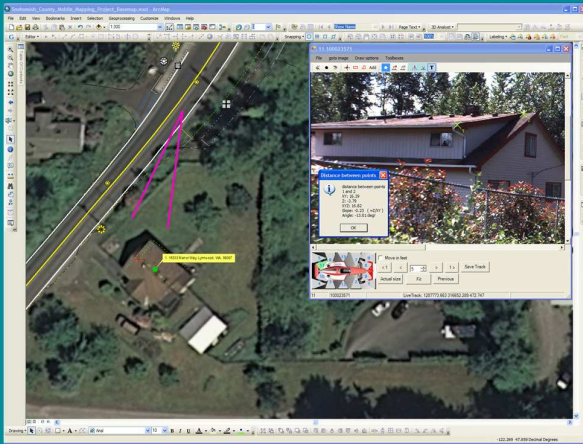


Other Applications

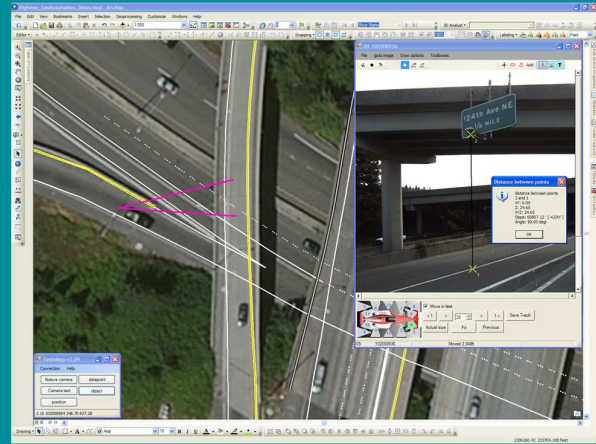
- ***Scratching the Surface***- once imagery is acquired, users find reasons to use it:
 - Law enforcement
 - Emergency Response/ 911
 - Assessors Office
 - Legal (Photo record of conditions)
 - Pavement condition assessment (analysis takes some field work)



Other Applications



Assessor Review

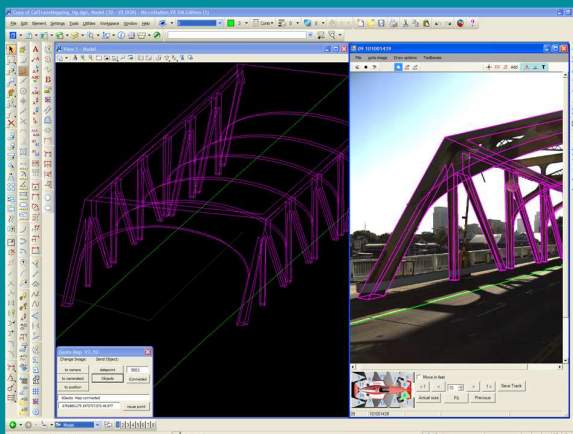


Clearance Measurement

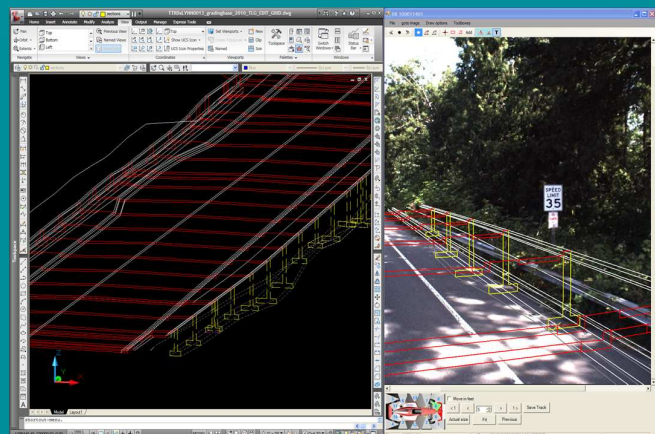
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Other Applications- 3D mapping - Design Review



Complex 3D Mapping

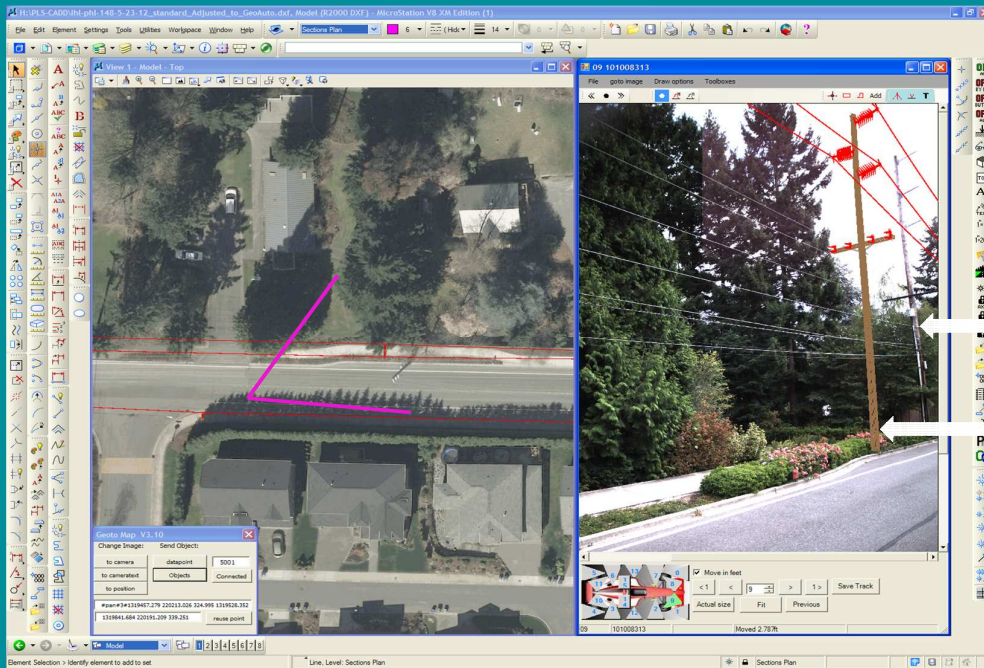


Design Review

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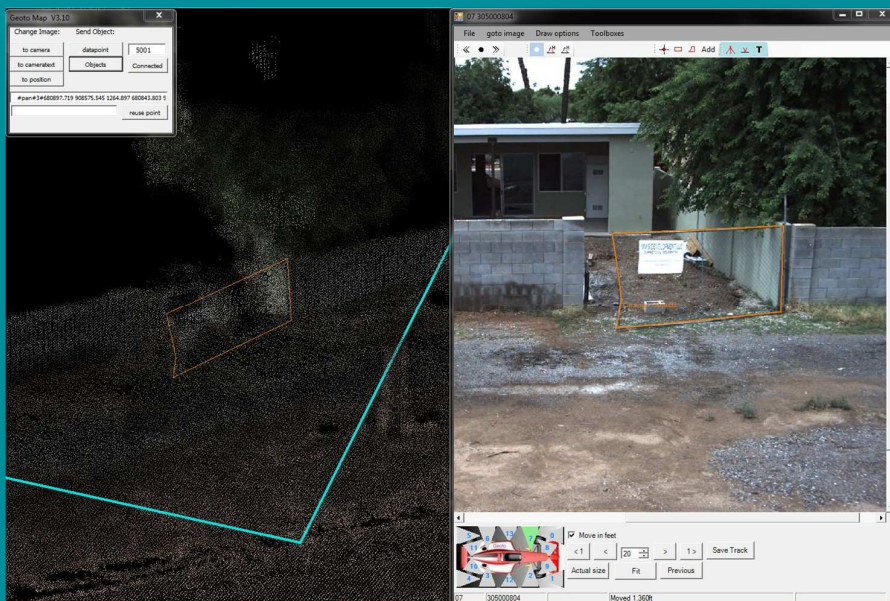
Other Applications – Design Visualization



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Point Cloud Generation



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Questions?

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Thank You

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