

Measuring, Mapping & Modeling in Motion: Toolset Innovation to Productivity



2018 SYMPOSIUM

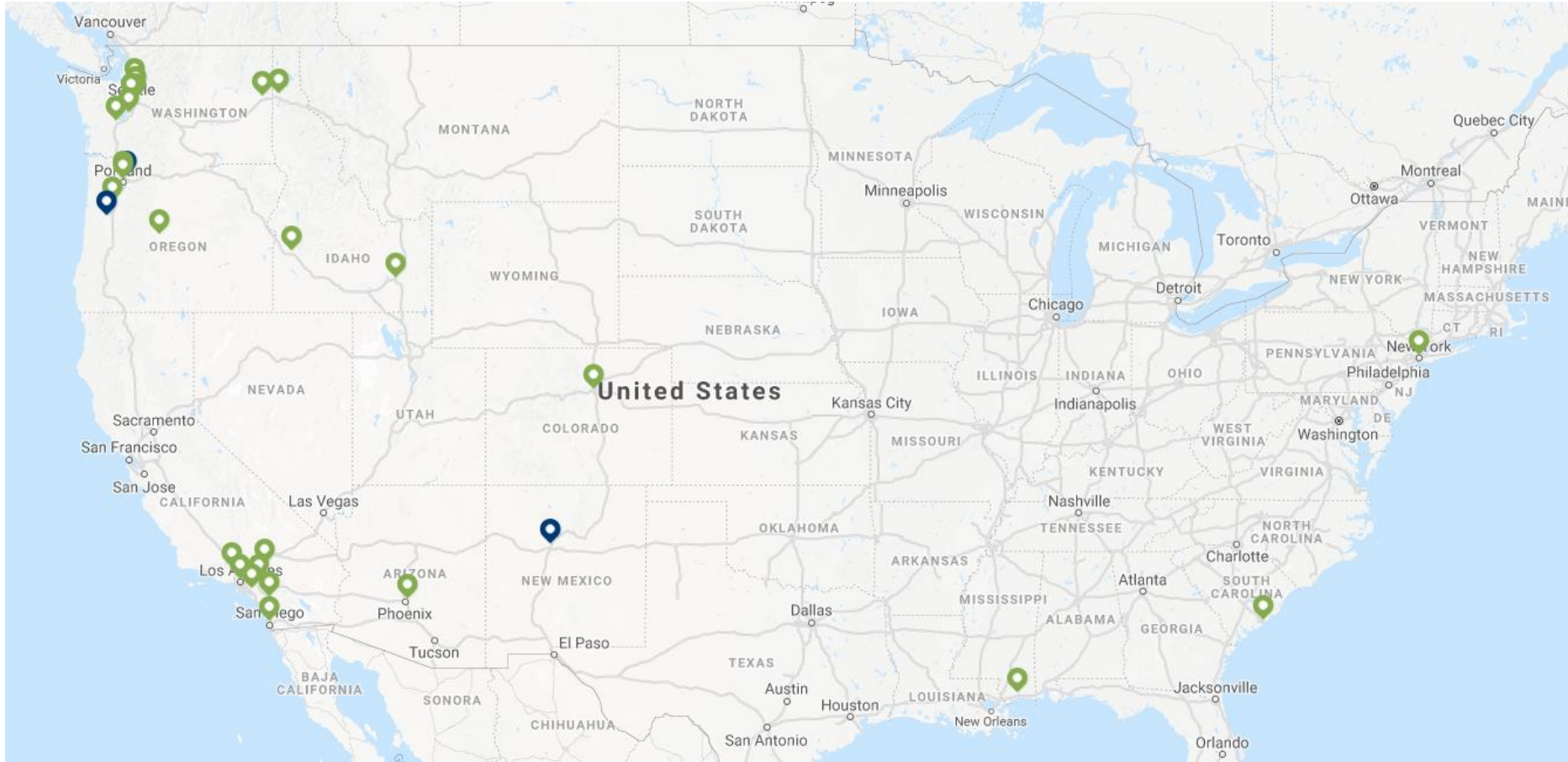
Technology Innovation **Change** Compel Challenge
Transcend Reshape Build **Examine** Motivate

1. Understand How to Leverage **LiDAR, Imagery, Modeling & Mapping**
2. Obtain **Added Value** from Your Projects/Programs
3. Make Better Decisions on Appropriate **Technology Pairing**

OBJECTIVE

Evolution **Vision** **Perspective** Analytics Judgement **Clarity**
Modeling Algorithms Access **Insight** Efficiency Future

DEA was founded in 1976 in Portland, Oregon and employs more than 800 professionals in offices located in 9 states.



ABOUT DEA

Accountability Over 40 Years **Solutions** **Stories** **Teamwork**
Clarity **Initiative** **Creativity** **Networking** **Awareness**



ENERGY



LAND DEVELOPMENT



TRANSPORTATION



WATER AND ENVIRONMENT



SURVEYING AND GEOMATICS



MARINE SERVICES

PLANNING

TRANSPORTATION

RAIL

ENERGY

GEOSPATIAL

SURVEYING

LAND DEVELOPMENT

INSPECTION

ASSET MANAGEMENT



LinkedIn

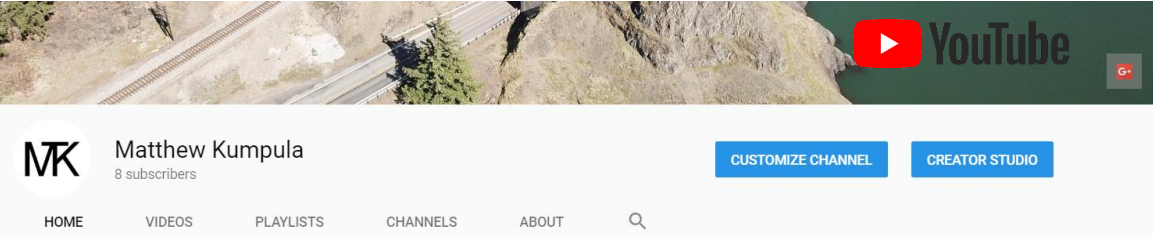


Matthew Kumpula
Head of sUAS Flight Operations at David Evans and Associates, Inc.
Greater Seattle Area

-  David Evans and Associates, Inc.
-  St Cloud Technical and Community College
-  See contact info
-  See connections (500+)

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Matthew Kumpula
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250 posts 81 followers 50 following
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kumpula.co



Matthew Kumpula
@KumpulaMatthew

Head of sUAS Flight Operations at David Evans and Associates, Inc.
Washington, USA

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194	258	72	20	0	0

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Matthew Kumpula @KumpulaMatthew · Apr 10

Just #FOCUS. If you can't, you won't see or capture what you intend. #DJI has tools for... [instagram.com/p/BhamwWkIiDI/](https://www.instagram.com/p/BhamwWkIiDI/)

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WHO AM I

Accountability Communication Solutions **Stories** Teamwork
Clarity Initiative **Creativity** Networking **Awareness**



WEATHER

INCLEMENT
foggy, windy, cloudy, high chance of precipitation, etc.

MODERATE
minimal wind, partly cloudy, minimal chance of precipitation, etc.

CLEAR

DATA COLLECTION MAGNITUDE

LARGE
city: > 10 linear miles

MEDIUM
neighborhood: 1–10 linear miles

SMALL
local site: < 1 linear mile

VERTICAL ACCURACY REQUIRED

LOOSE
> 0.50 feet/0.150 m

MODERATE
0.05–0.50 feet

TIGHT
< 0.05 feet/0.015 m

PROJECT COMPLEXITY

HIGH
> 40 constraint/design features

MEDIUM
10–40 constraint/design features

LOW
< 10 constraint/design features

ACQUISITION RISK

HIGH
obstructed, slow acquisition, significant interference potential to public

MEDIUM
partial impediments, moderate acquisition time, minimal interference potential to public

LOW
unimpeded, rapid acquisition, no interference to public

OPERATOR SAFETY RISK

HIGH
physical presence on site

MEDIUM
physical presence near site

LOW
protected

SPEED OF DELIVERY

FAST
< 2 days

MODERATE
2–30 days

SLOW
> 30 days

LEVEL OF DETAIL

LEVEL 1
spatial extents

LEVEL 2
detail on large objects

LEVEL 3
coarse detail on small objects

LEVEL 4
fine detail of small objects

TOOLBOX

-  Total Station/Digital Level
-  RTK-GNSS
-  MTLS (survey)
-  MTLS (asset)
-  STLS
-  ALS (manned)
-  ALS (sUAS)
-  Aerial Imagery (manned)
-  Aerial Imagery (sUAS)



RECENT FOCUS

FHWA Study Program Integration **USIC** Legislation Diversity
 AUVSI **Organic** Client Driven Regulation **Testing** Benefit-Cost



1. **Data collection magnitude**
How large is the area of interest?
2. **Project complexity**
How many critical features need to be mapped/measured/captured?
3. **Accuracy**
How accurate does the data need to be horizontally and vertically?
Relative versus absolute.
4. **Resolution/Level of Development (LOD)**
How in depth does the resultant deliverable need to be?
5. **Speed of delivery**
How soon is the data needed?
6. **Operator safety risk**
What level of safety risk is allowable for those conducting the field work?
7. **Environment requirements**
Are there any weather, interference or environmental challenges?
What combination of technologies and professionals do we require?

CONSIDERATIONS

Safety **Funding Availability**
Specialized Professionals

Schedule
Industry Testing

Experience **Phasing**
Pilot Project

Asset Management > *Supporting the*

INFRASTRUCTURE LIFE CYCLE



DAVID EVANS
AND ASSOCIATES INC.

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LOCATIONS

- Arizona
- California
- Colorado
- Idaho
- Mississippi
- New York
- Oregon
- Texas
- Washington

SERVICES

- Geographic Information Systems
- Asset & Infrastructure
- Mobile Mapping
- Surveying & Geomatics
- Land Surveying
- Hydrographic Surveying
- Laser Scanning & Mapping
- Water Resources

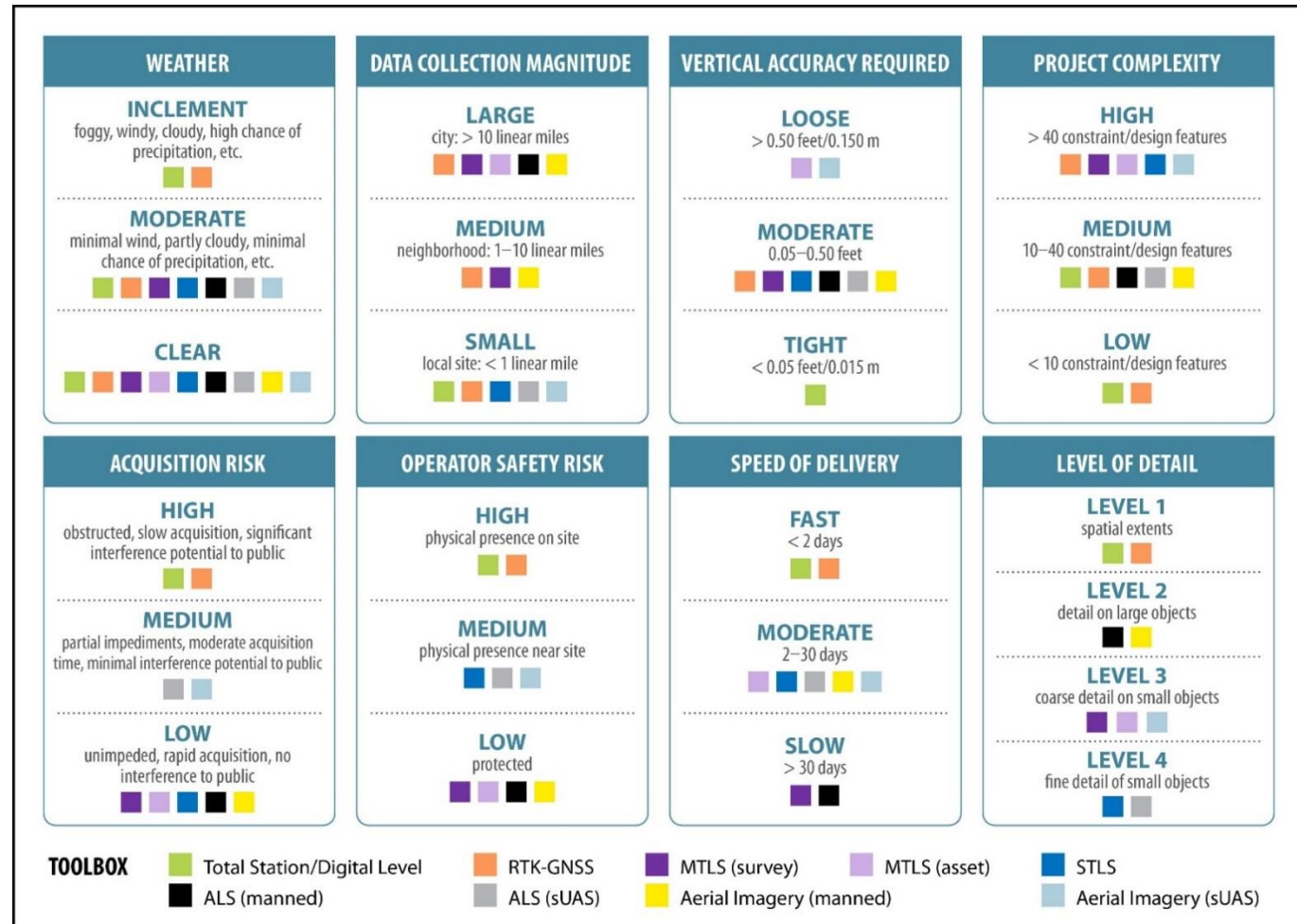


ASSET MANAGEMENT

Visualization Condition O&M Compliance
Asset Features MAP 21 Access GIS LOS

MAPPING

ANALYSIS



REQUIREMENTS

Mandated
Sustainable
e

Program Integration
Regulation
Testing

Support
Benefit-Cost

Scalable

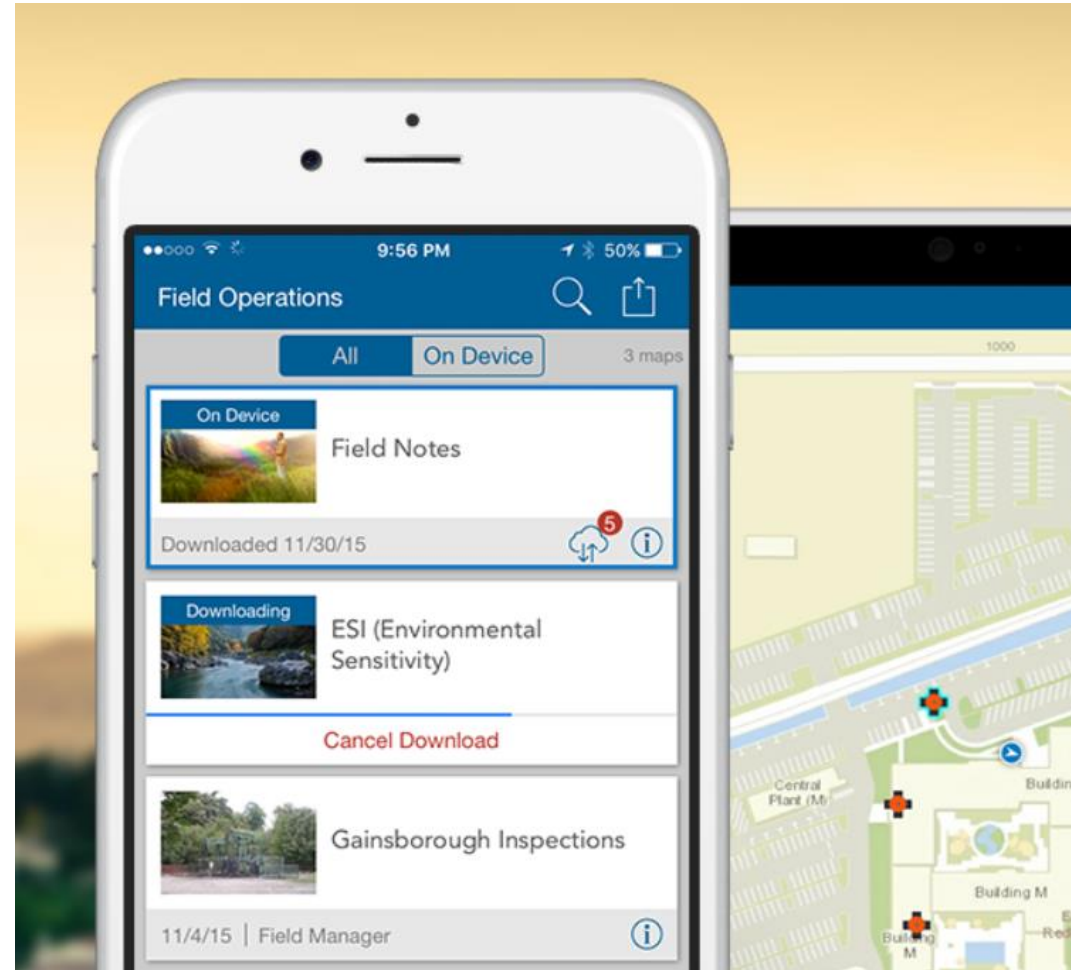
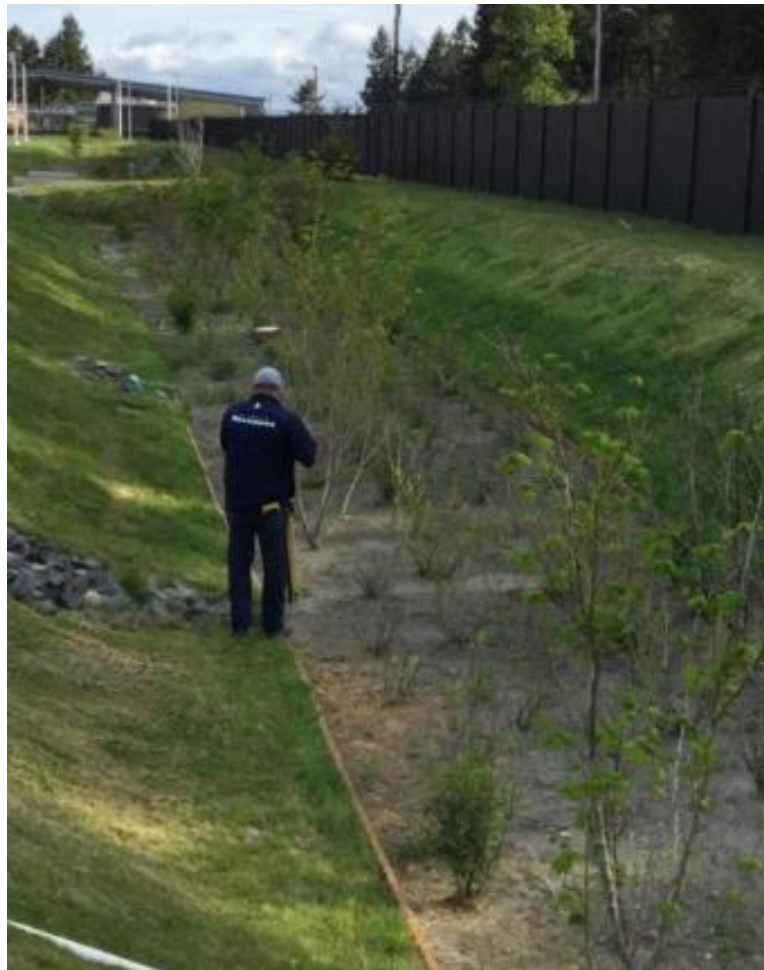
Longevity
Pilot
Experience

The Data Challenge



PLANNING

Geospatial Background **Detail Oriented** **Ability to Self Learn**
Understanding of Design **Multiple Software** **Modeling Techniques**

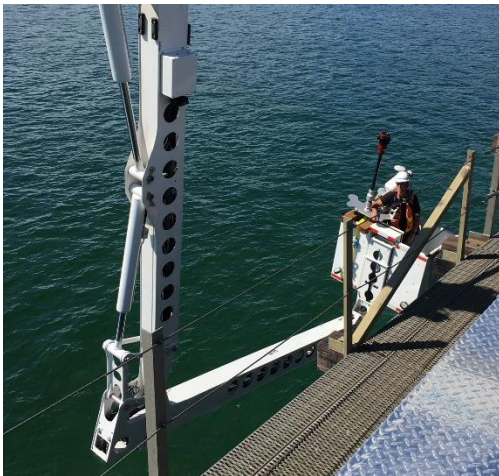


COLLECTOR

Scalable GPS/GNSS
Enterprise Controls Reliant

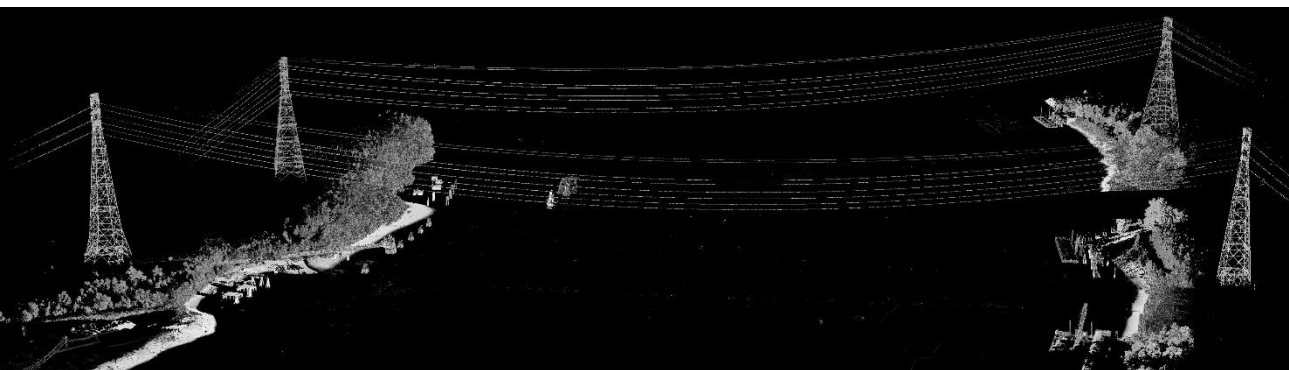
Intuitive Interface Well Supported

Flexible Adopted by Numerous Industries
Secure



MMS SYSTEMS

Last 16 Years **LiDAR** **Imagery** Thousands of Miles **Roadways**
By Land & By Sea **All Over the Western US** **High Accuracy** **Niche**



MAPPING

Last 16 Years **LiDAR** **Imagery** Tens of Thousands of Miles
By Land & By Sea Currently 300 Meter Range High Accuracy **Shoreline**



ONLINE POINT CLOUD VIEWER

Accessibility
y
Interactive

Imagery **3D**
Database Driven

Responsiveness
All Mode Platform



Sky View



Sea View



Site View



Sky Log



Street View



Street Log



IMAGERY

Coordination
Documentation

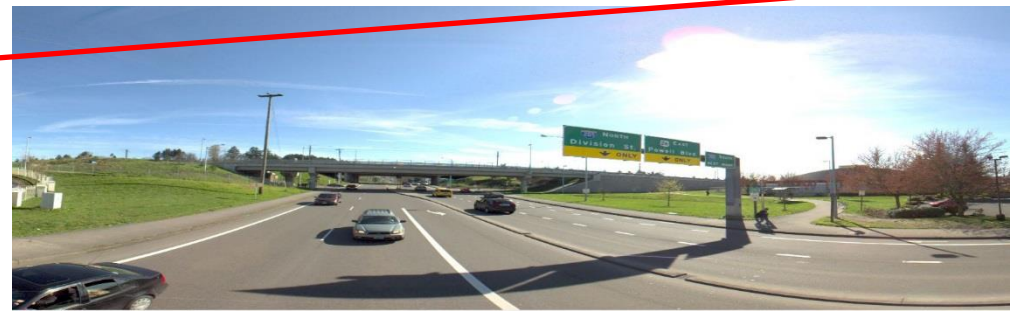
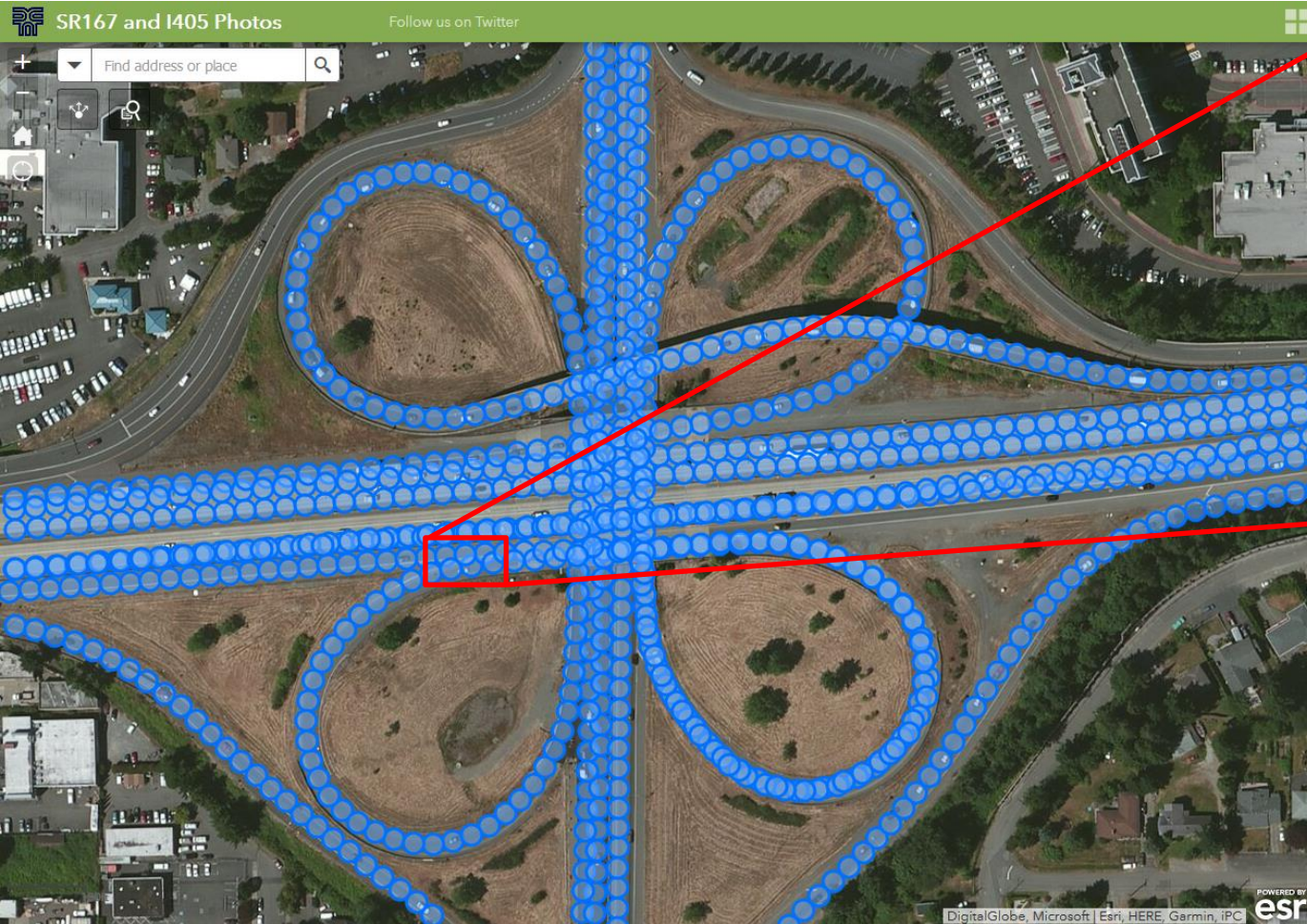
36
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Accessibility
Interactive

Imagery
Database Driven

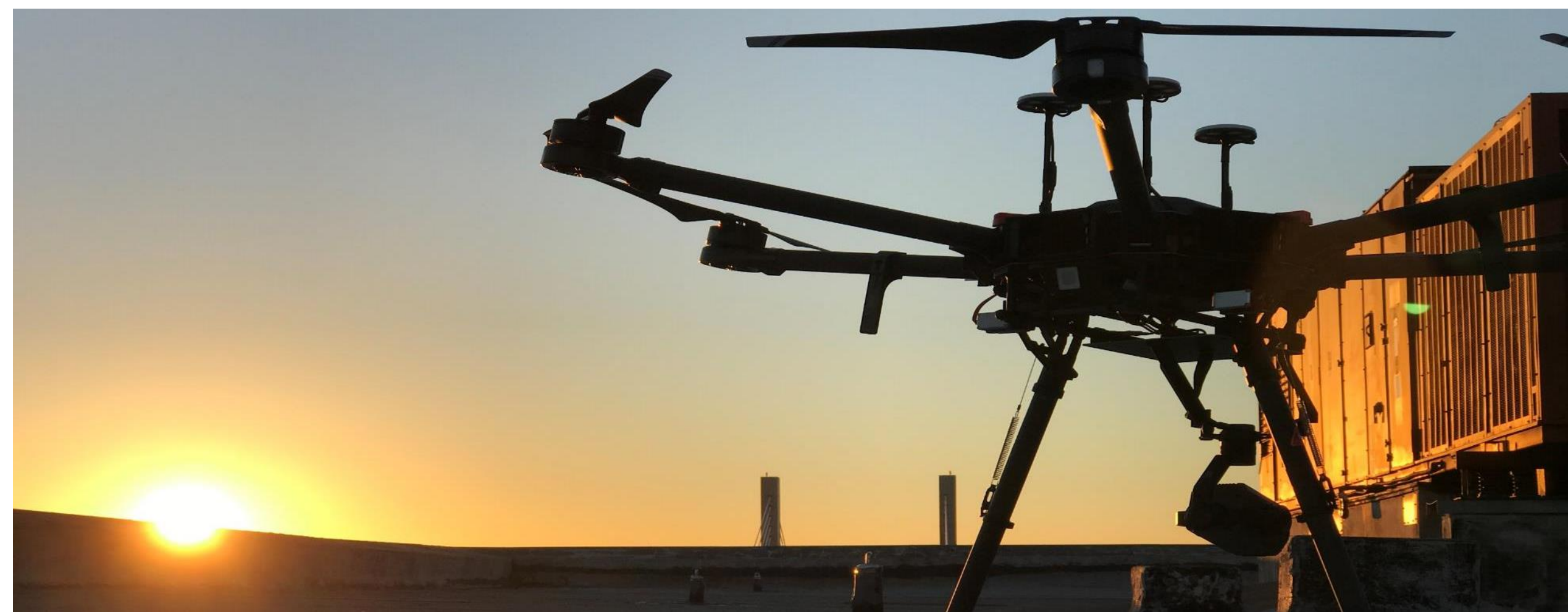
3
D

Secure
Online
All Mode Platform



IMAGERY MAP

Coordination
Documentation
36
0
Accessibility
Interactive
Imagery
Database Driven
Location Aware
All Mode Platform



s U A S P R O G R A M

160 Project Locations
Over 1,100 Flights

1ST Droneport of the Northwest
Organic-Integration

Operating Since 2016
Western US



FLEET

12 Aircraft **114 Support Equipment** **Different Payloads** **FAA Registered**
130+ Managed Batteries **Over 1,000 Flights** **Biggest Sensor on Smallest UA**



SENSORS

Metric Cameras **150** Support Equipment **Different Payloads** FAA Registered
136+ Managed Batteries **Over 1,100** Flights **All Different Tools**

Unmanned Platform Manufacturer

Agriculture

Delivery Systems

Safety & Security

VTOL Fixed-Wing

Services

Maintenance

Market Research

System Integration, Engineering, Advisory

Education, Simulation, Training

Drone Show Provider

Logistics

Business Accelerators

Supplier, Retailer

PIX4D
 MEASURE FROM IMAGES

amazon web services™

orbit
 GEOSPATIAL TECHNOLOGIES

PHASE ONE

FLIR®

esri

LIDAR USA
 Fagerman Technologies Inc.

Flight Planning

Computer Vision & Navigation

Software

Data Processing, Workflow & Analytics

Components & Systems

Launch & Recovery

Propulsion & Power

Cameras & Vision Systems

Navigation & Guidance Systems

Cases

Counter Drone

Media, News, Blogs & Magazines

Insurance

Test Sites

Marketplace

User Groups, Networks

Coalitions, Organizations & Initiatives

Shows, Conferences, Events

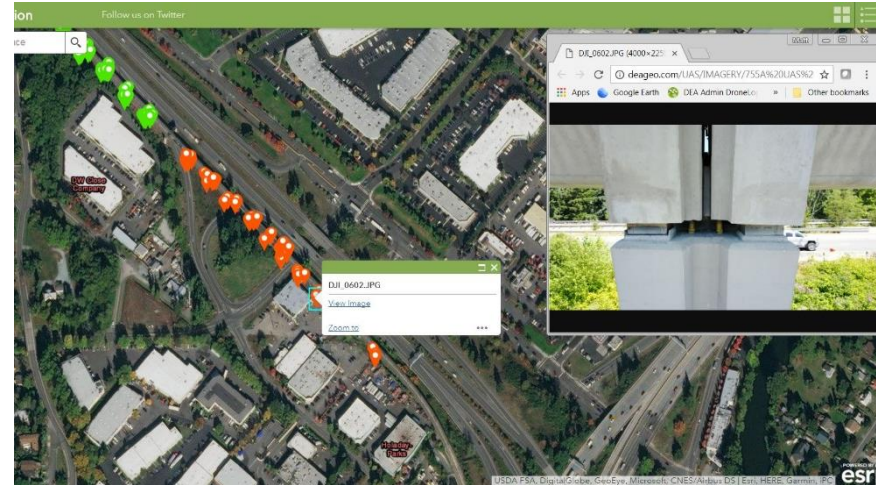
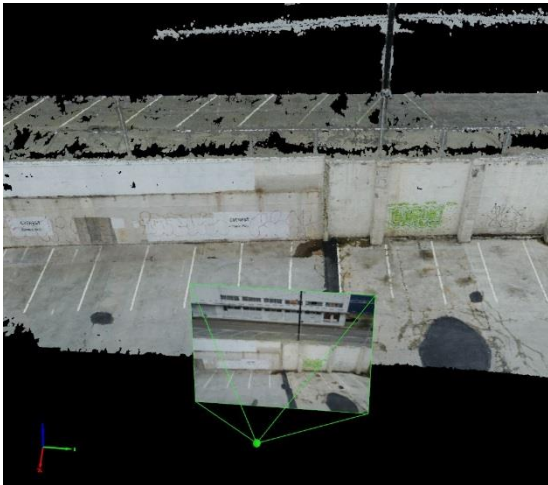
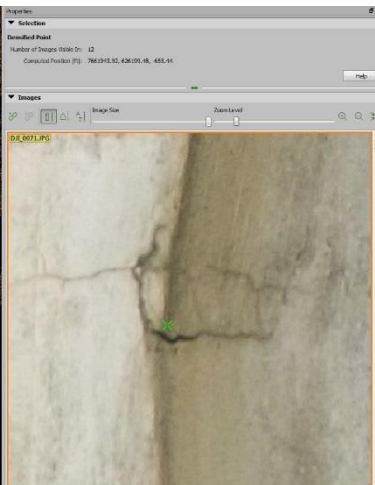
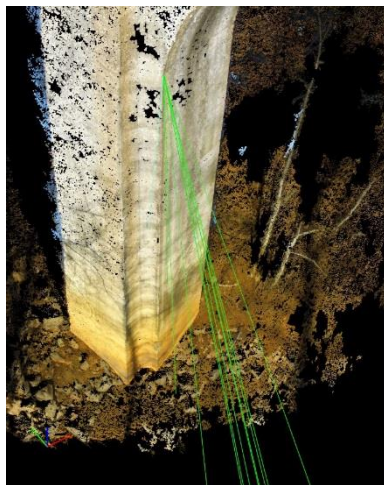
THE JUNGLE

Manufacturer's **Sensor** **User Groups** **Media** **Marketplace**
Software **Insurance** **Services** **Anti-Drone** **Conferences**



STORYTELLING

Depict Project **Change** Compel Challenge **Whiteboard**
Transcend Reshape Build **Examine** Motivate Involve

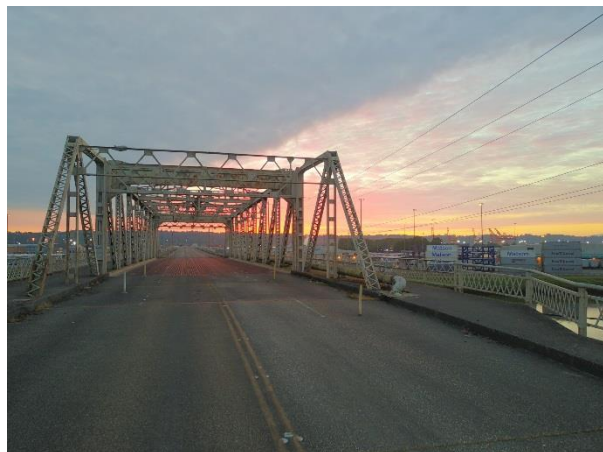
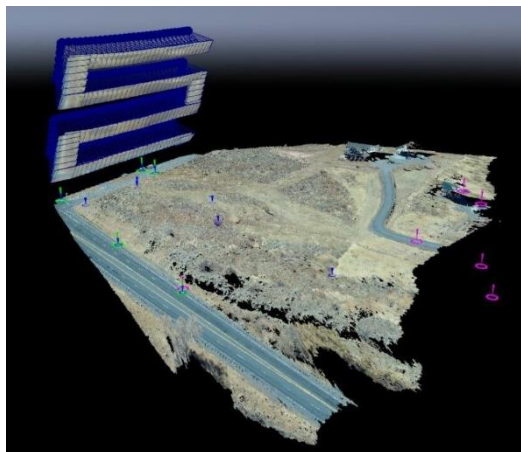
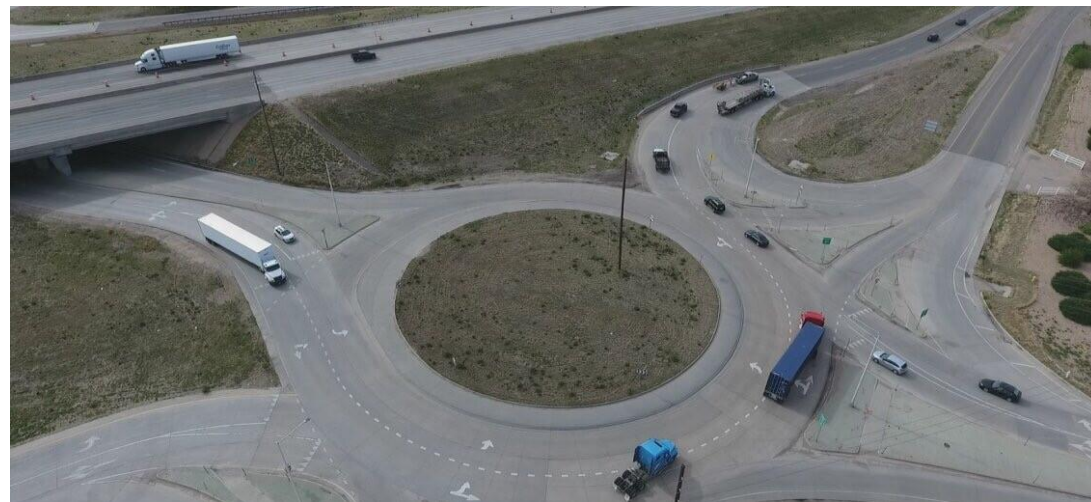


INSPECTION

Condition Analysis Defects Reduce Safety
Productivity Stat e O&M Document Investigate

ASSETS

REPORTING

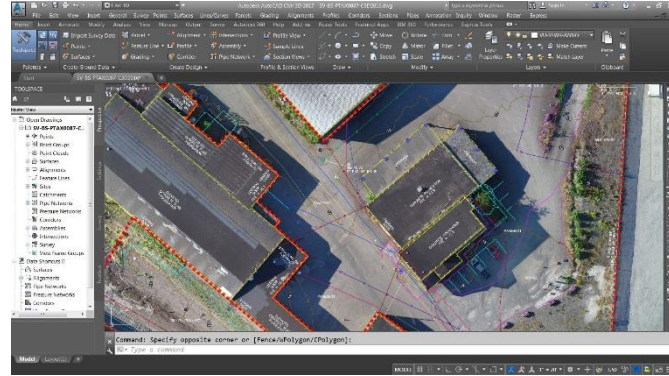
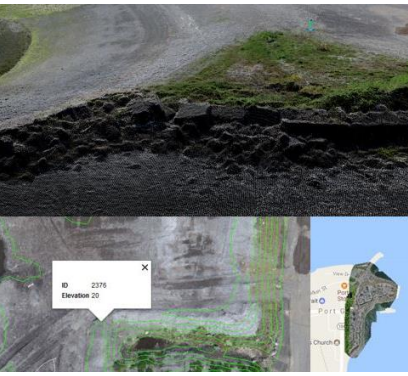
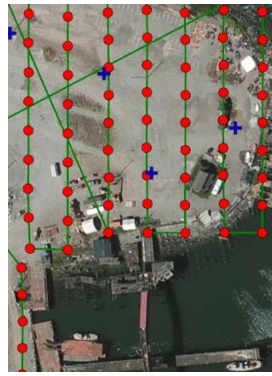
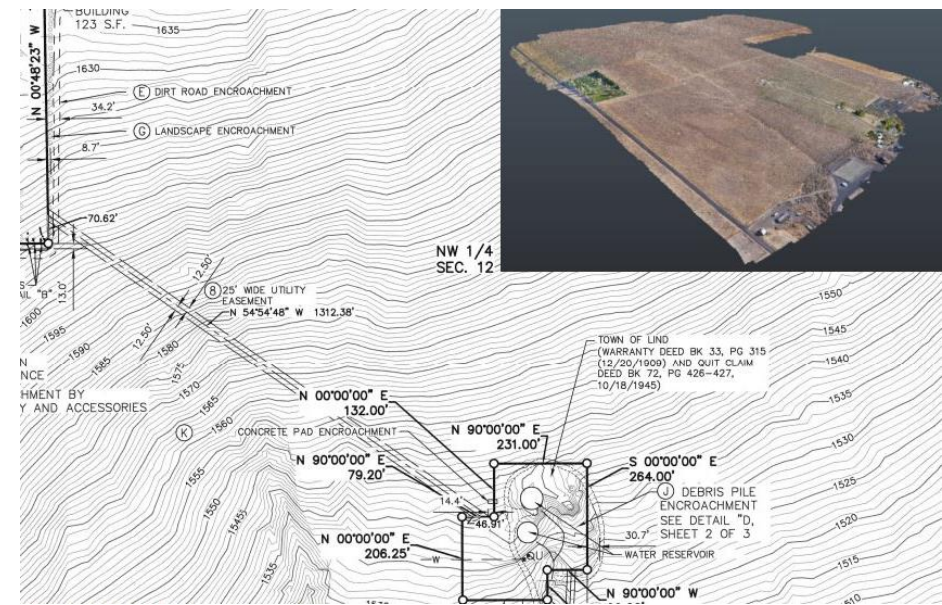


TRANSPORTATION

Analysis Traffic **Access** Visualization **CIM**
Utilities Grading **Preliminary** **LEAN** Change

PLANNING

MODELING



LAND DEVELOPMENT

Responsive Scalable Comprehensive
Utilities Grading Preliminary

VOLUMETRICS
MAPPING



RAIL

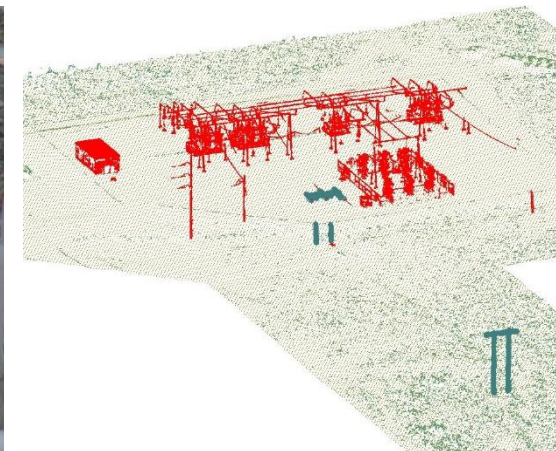
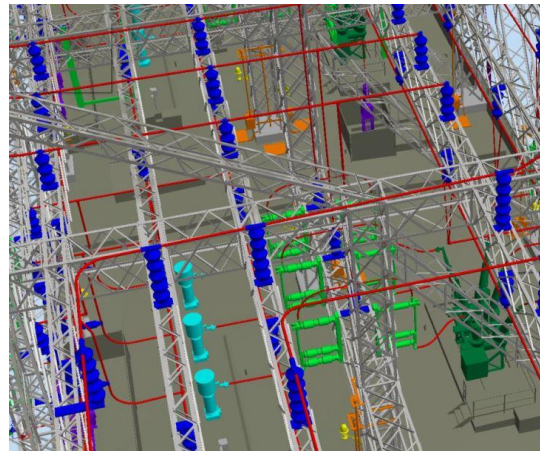
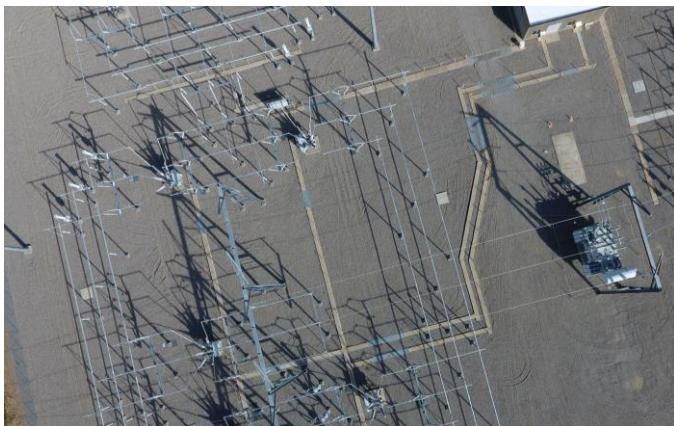
Condition Analysis Details **Access** Safety Utilities **Logistic**
Contours **Alignment** O&M Compliance **Preservation** **LEAN**

DETAILS

MAPPING



Feat. Code	Feature Description
17	114 Water
18	116 Manmade Object Unclassif
19	118 Miscellaneous : building
20	120 Vegetation Unclassified
21	122 Small Vegetation < 7.5ft
22	124 Medium Vegetation 7.6ft
23	126 Medium Large Vegetation
24	128 Large Vegetation > 25ft
25	130 Miscellaneous : bridges
26	200 Overhead Wire Unclassifi

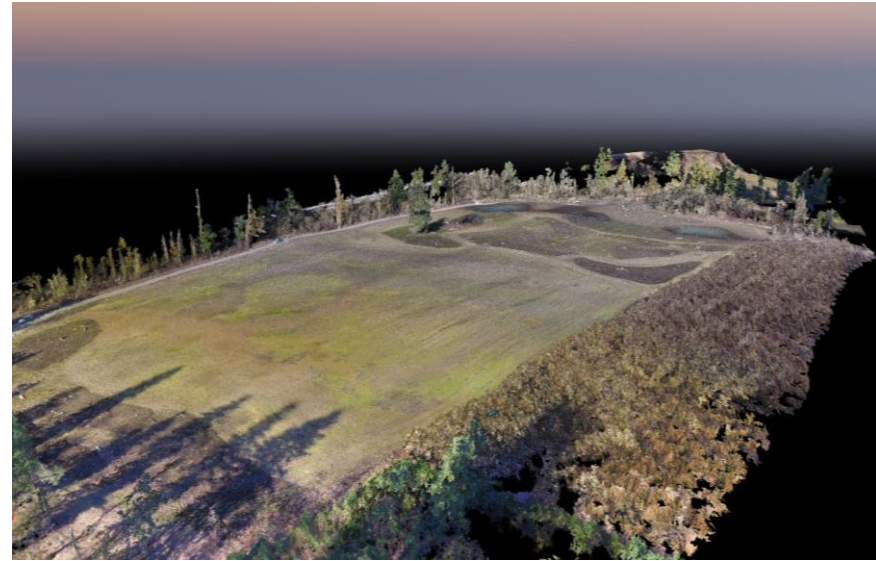


ENERGY

Qualitative Triage Scaling Safety Parametric Compliance Classified Comprehensive

INSPECTION

CONDITION

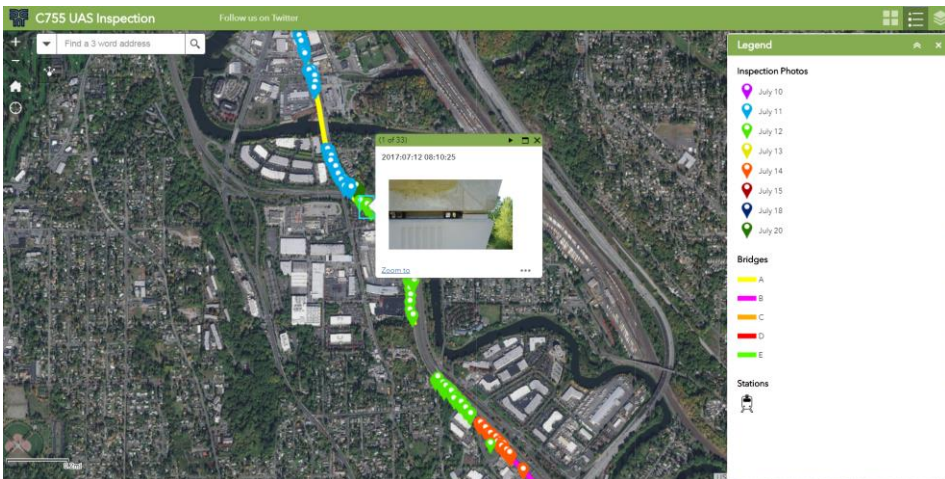
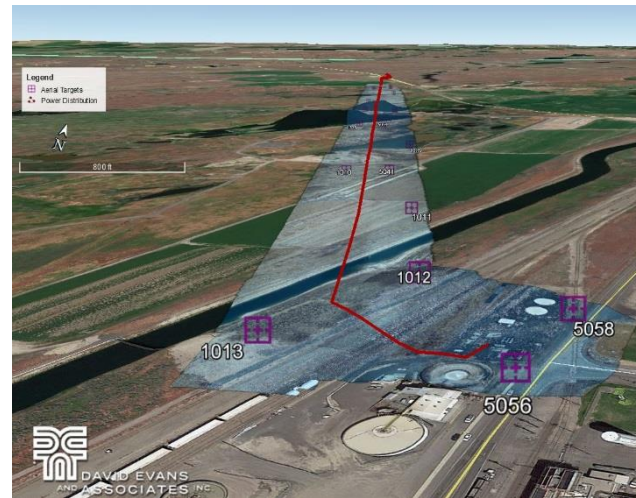


ENVIRONMENTAL

Resource Condition GI Health Compliance
s Perspective Quantitative Spectra Access

MAPPING

ANALYSIS

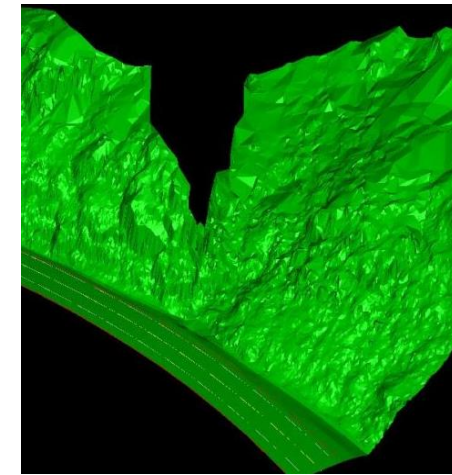
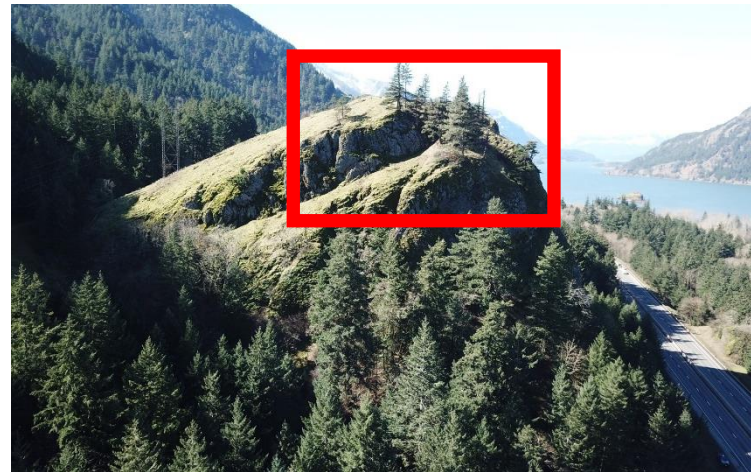
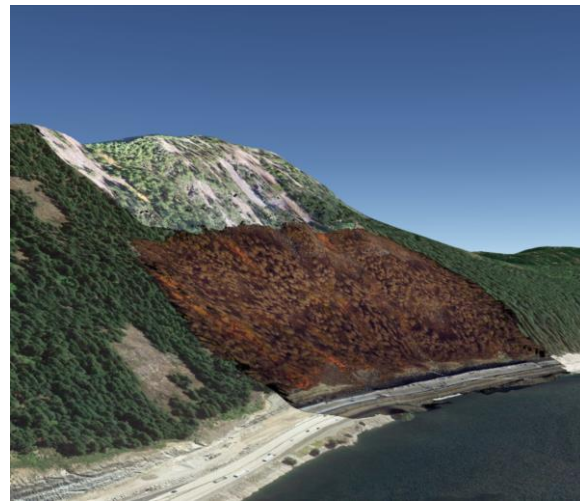


ASSET MANAGEMENT

Visualization Condition O&M Compliance
Asset Features MAP 21 Access GIS FTA

MAPPING

ANALYSIS



GEOTECHNICAL

Qualitative Slope Character Risk
Safe Perspective Condition Change

INVESTIGATION

ANALYSIS

Stream from MissionCaster Box - 4230



01:25 94%

H: 0.0ft D: N/A Az: N/A HS: 0.0mph VS: 0.0mph

04:46 36:11



EMERGENCY RESPONSE

Responsive
Willingness

Scalabl
e Training

Acces
s

Experienc
e

Liability

Resources
Dedication

TRIAGE

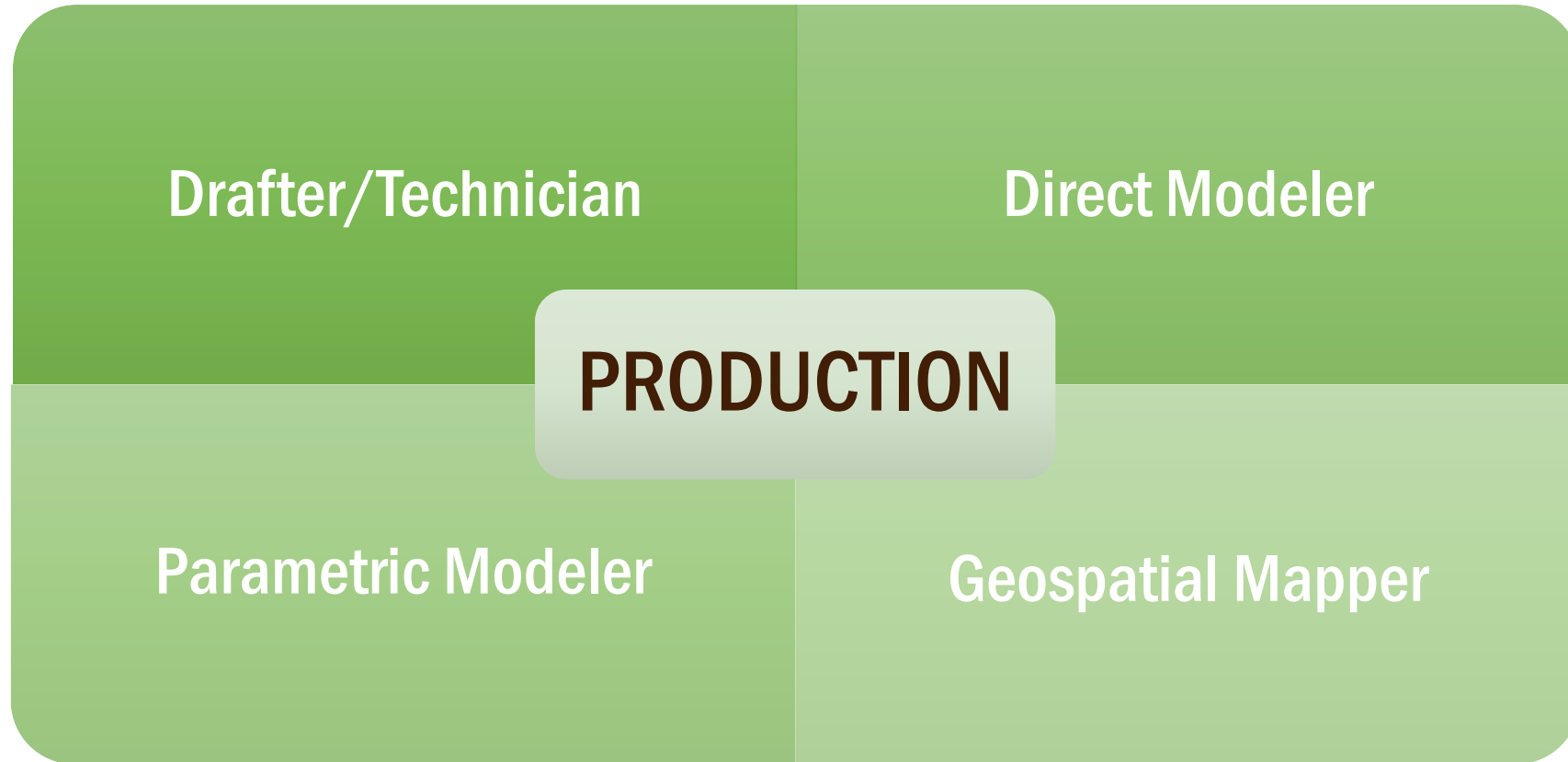
SAFETY

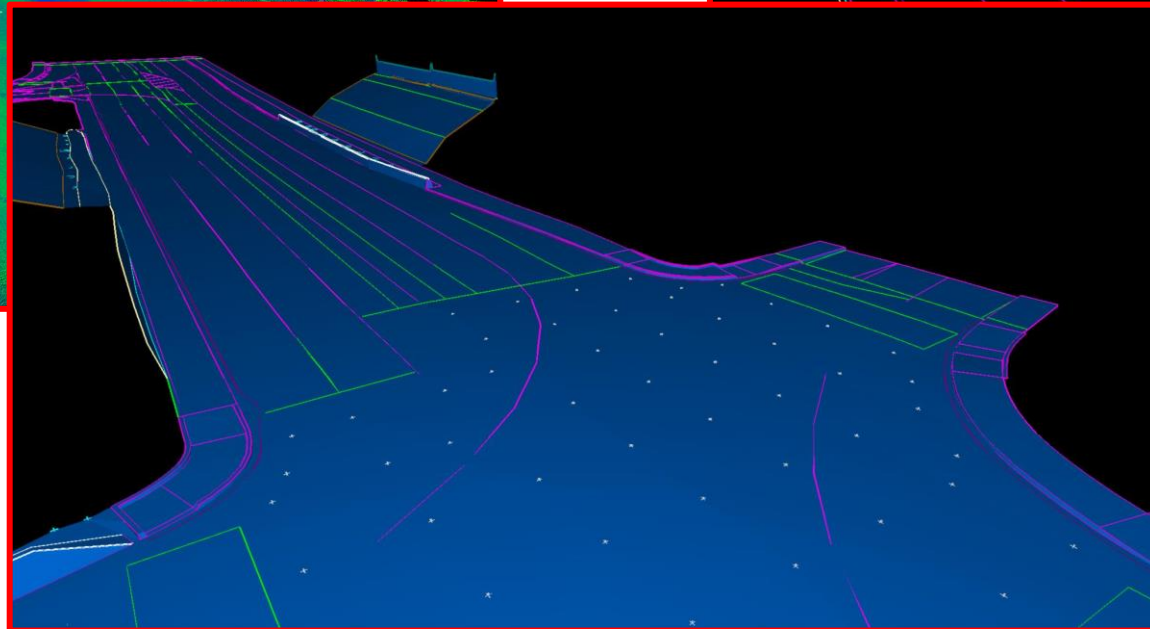
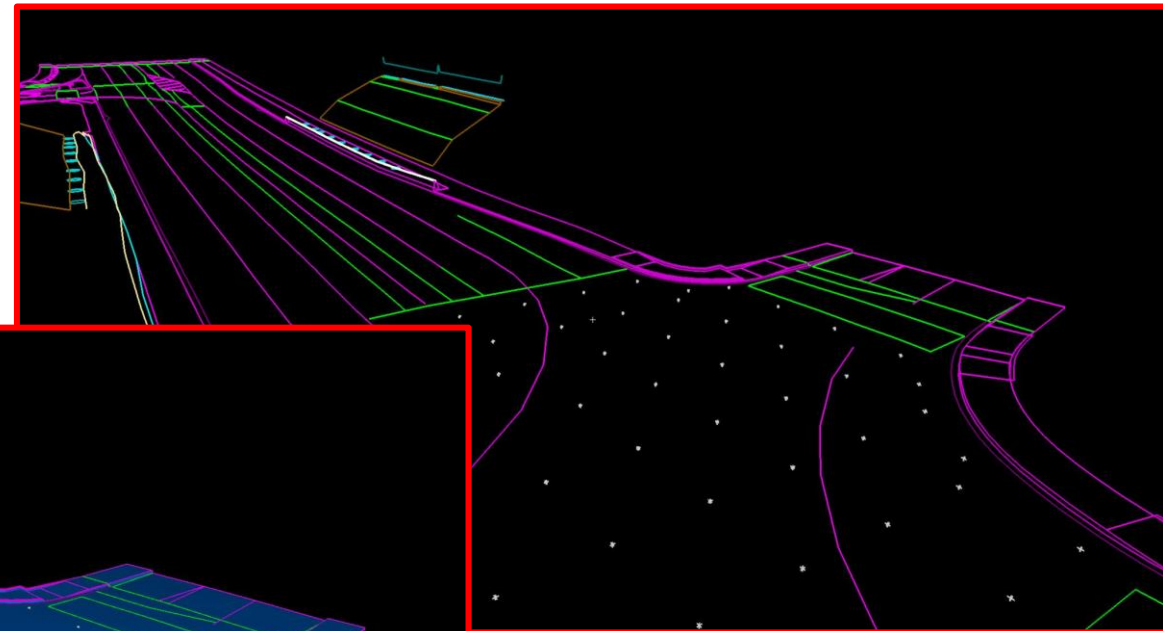
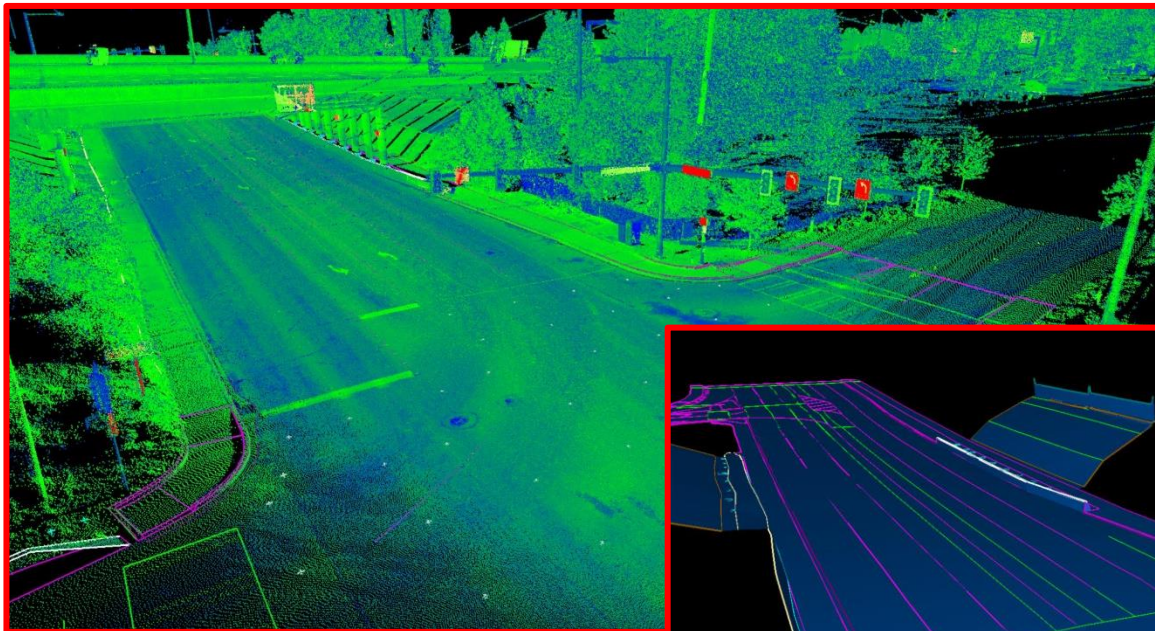
The Geospatial Professional

“We can no longer think of Surveying, GIS, Photogrammetry, LiDAR, Cartography, etc. as separate entities. It has all come together into a single discipline... (Call it Geomatics, Geospatial,... whatever) ...and it will(already does) touch every aspect of our lives.”

PROFESSIONAL

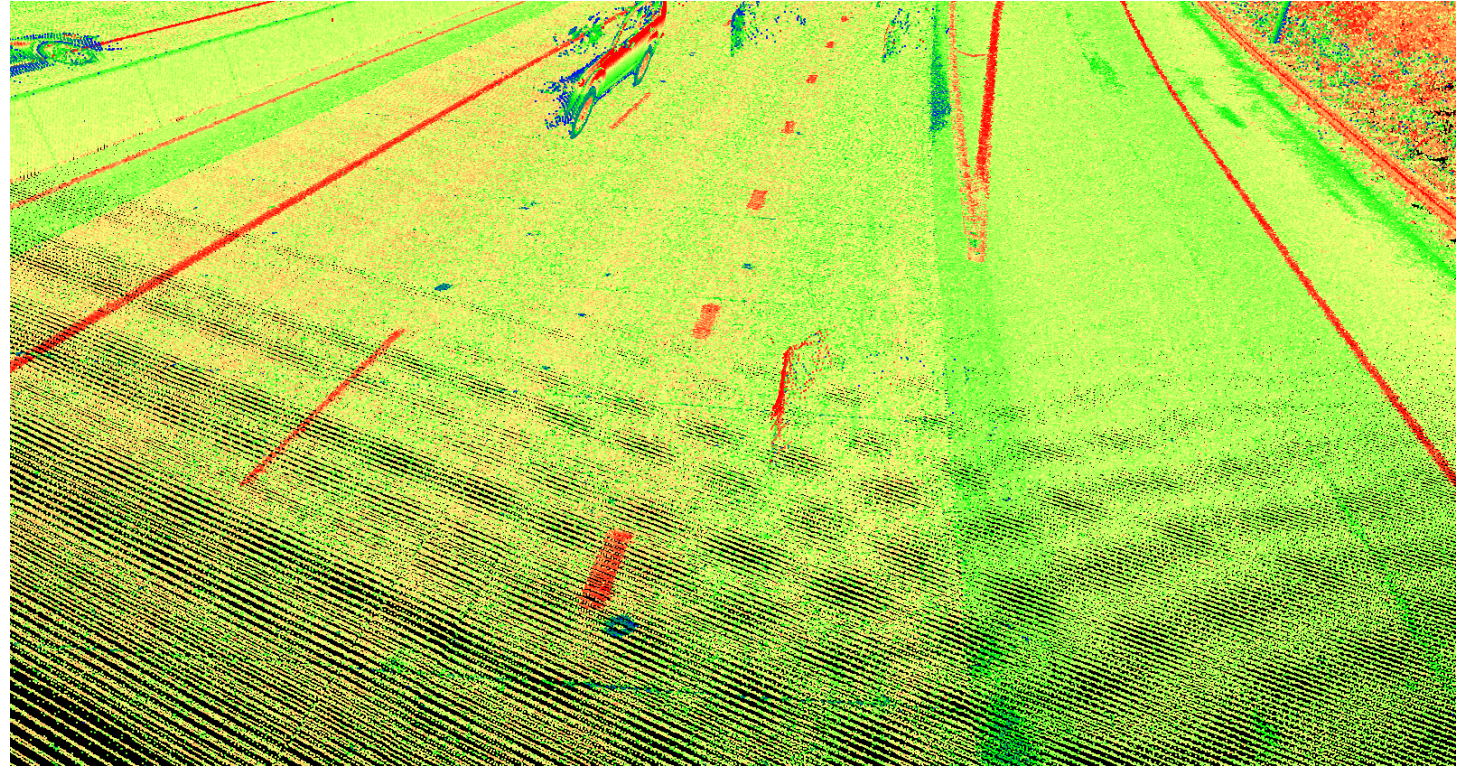
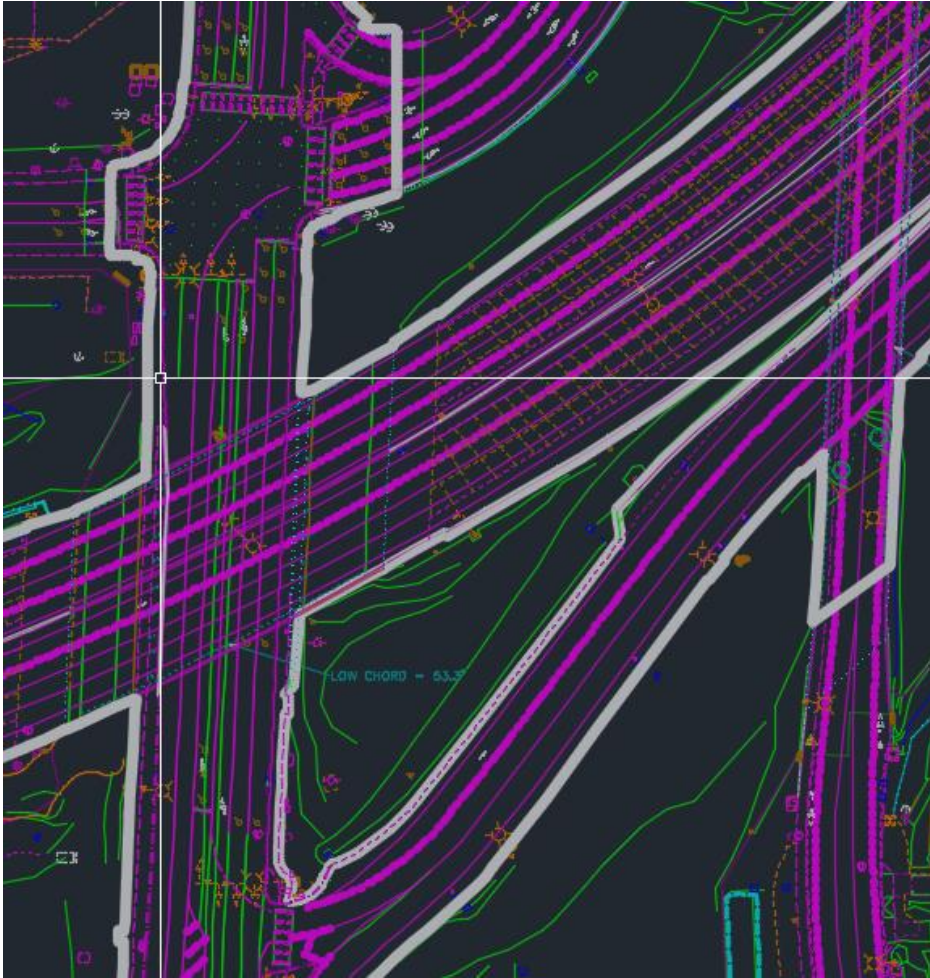
Accountability Communication **Solutions** **Stories** Teamwork
Clarity Initiative **Creativity** Networking Awareness





DIRECT

Last 16 Years **LiDAR Intersections** Thousands of Projects Roadways
Details Matter **Model to Map** High Detail **DTM** CAD Base Maps



MAPPING

Detailed Mapping

LiDAR Imagery

Supplemental Mapping

Roadways

Discernment

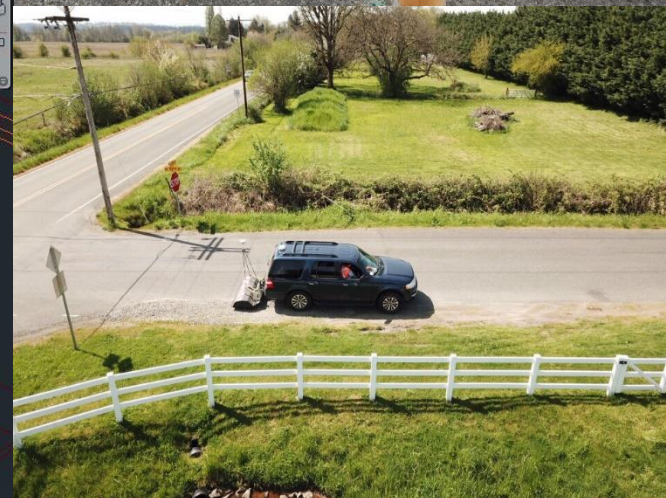
Concrete Joints

Surface Deviations

DTM

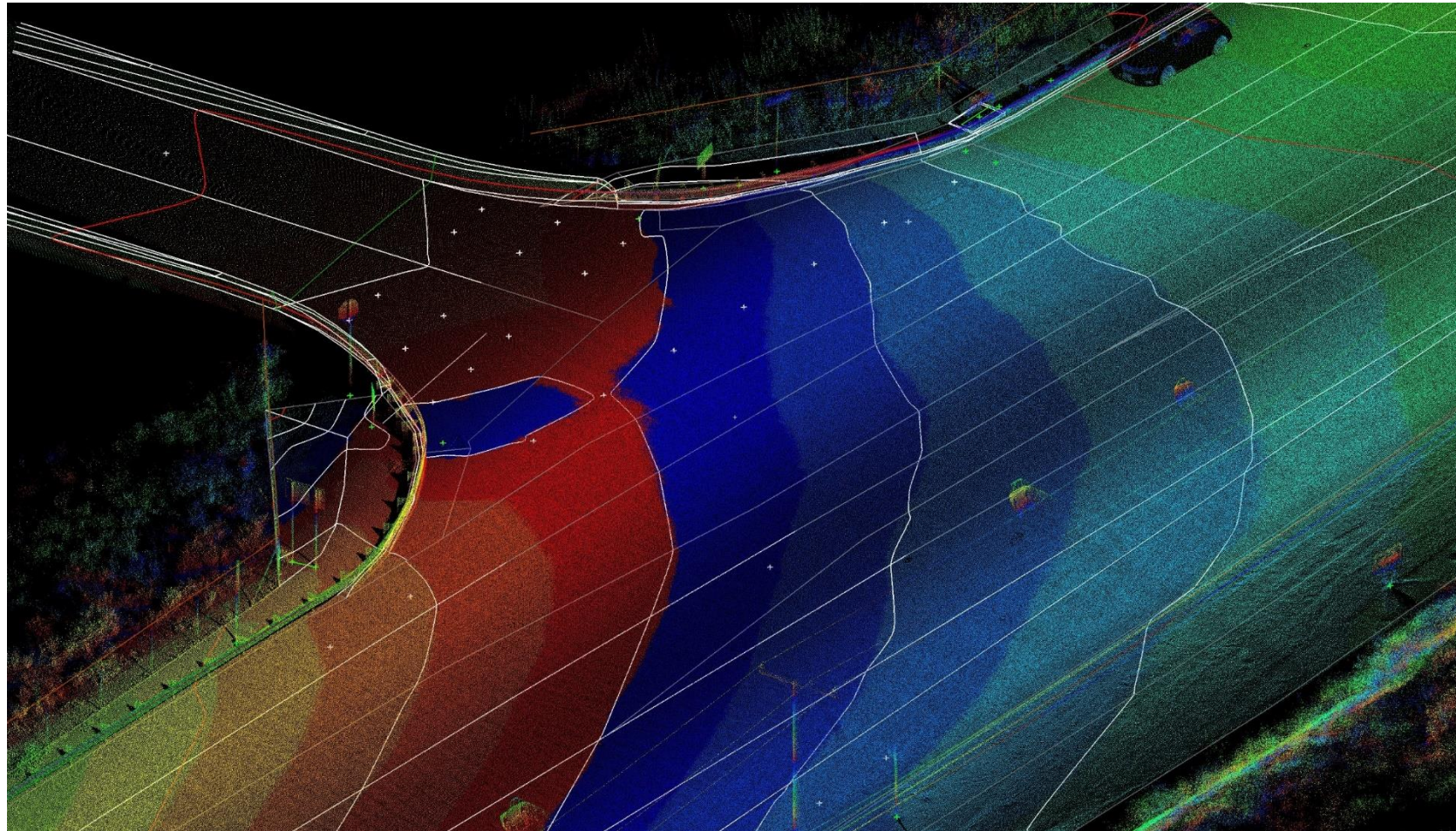
Clearance

[--][Custom View][Realistic]



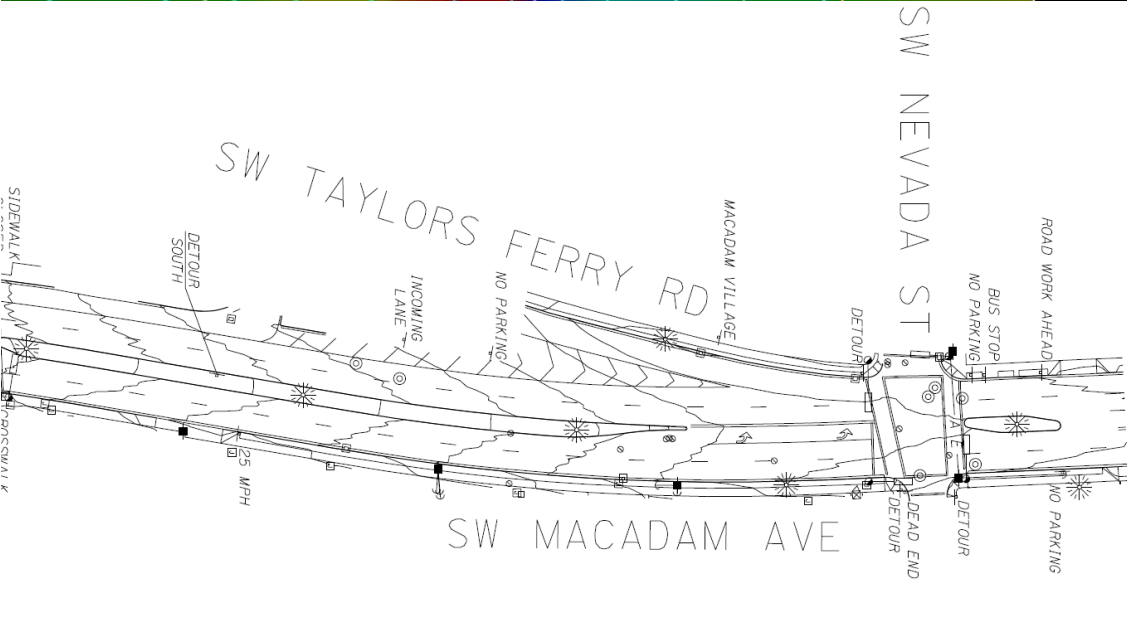
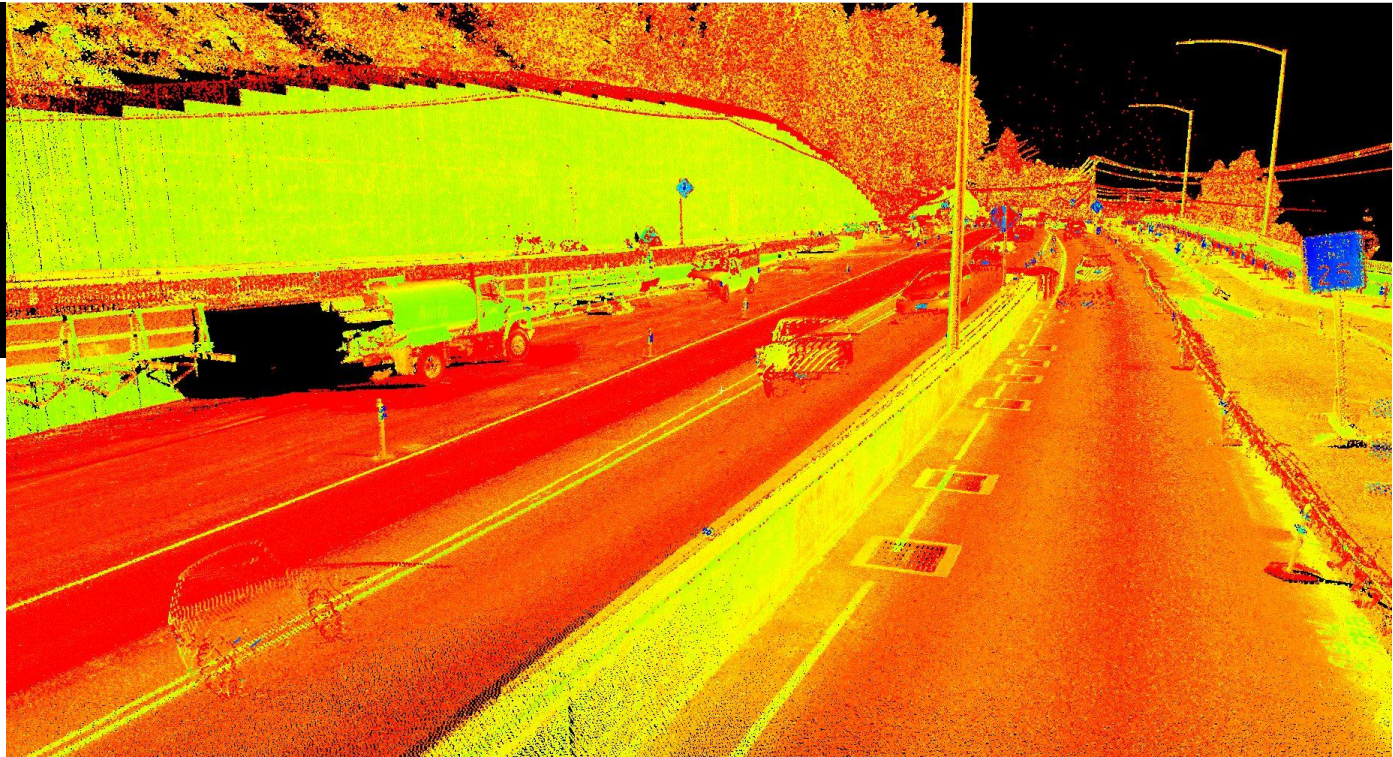
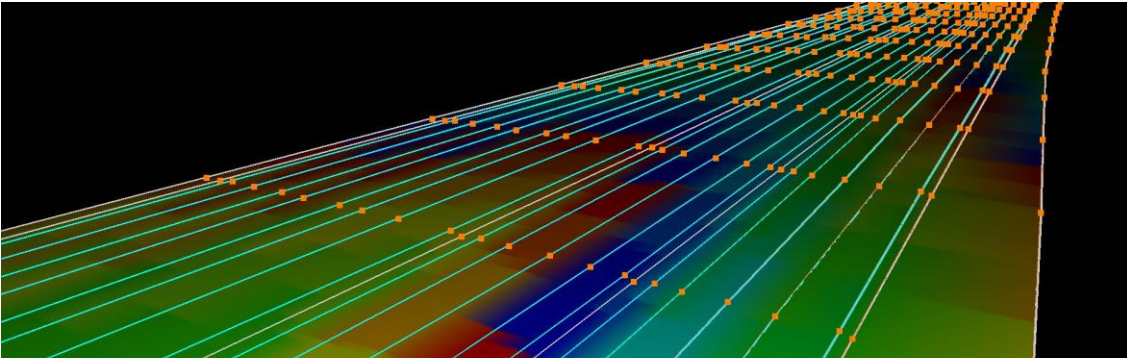
SUBSURFACE

GPR LiDAR Measurement Materials Connectivity Records
Geophysical Verification Condition Quality Levels 3D Clash Detection



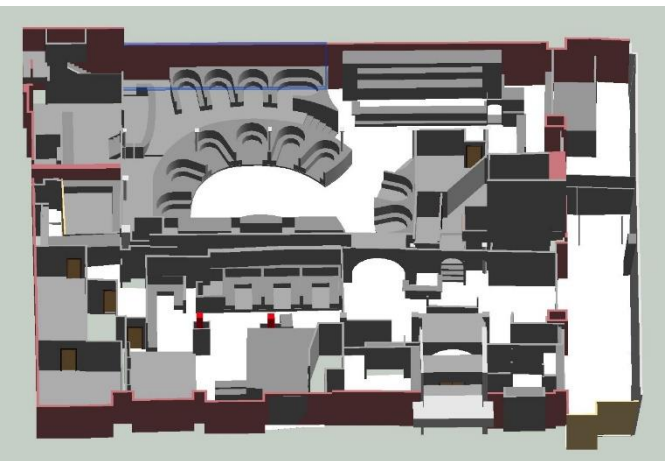
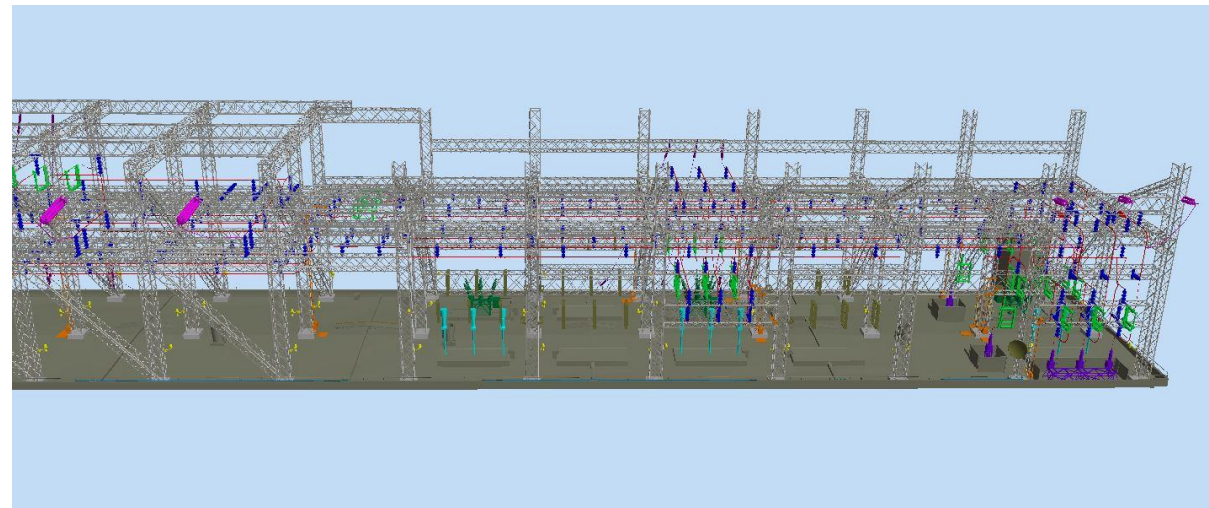
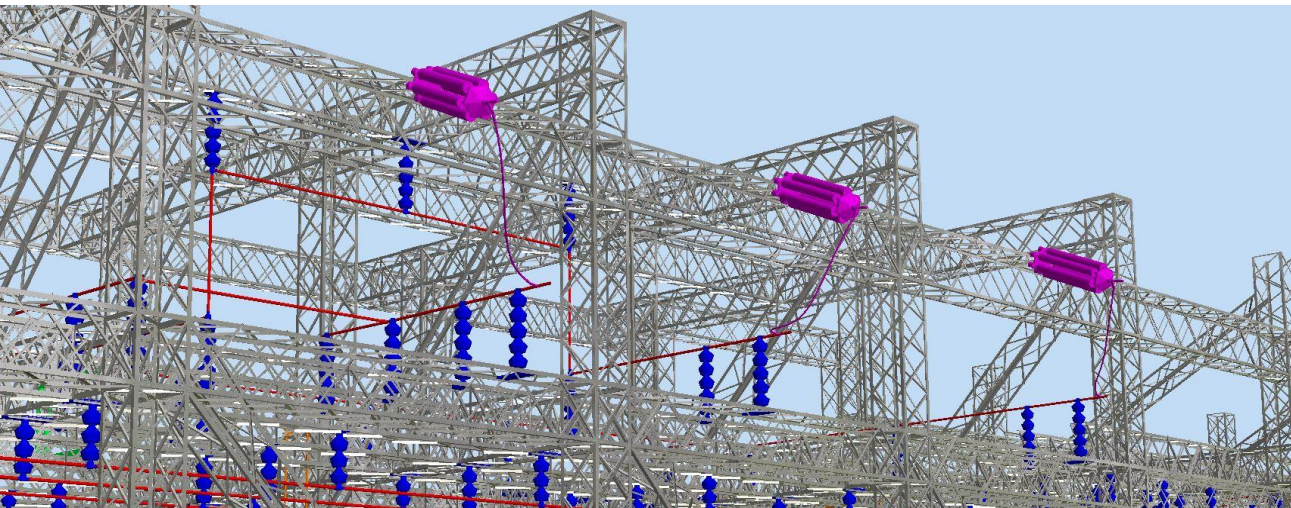
MODELING

Detailed Mapping **LiDAR** Imagery Quality Control Roadway Modeling
Discernment **Vegetation** Contour Lines **DTM** Clearance Terrain



MODELING

Detailed Mapping LiDAR Record Surface Model of Rutting As-Built
Resolution Features Contour Lines DTM Clearance Slope



PARAMETRIC

Design Understanding Limited Toolsets for Existing Conditions **LOD**
Dynamic Relationships BIM Revit **Inventor** Infracore CIM **Coordination**

Legend

Stormwater Structures

- DEA
- Other Source

Drain Points

- ◆ DEA Culverts
- ▲ DEA Ditch Shots
- ◆ Other Culverts
- ▲ Other Ditch Shots

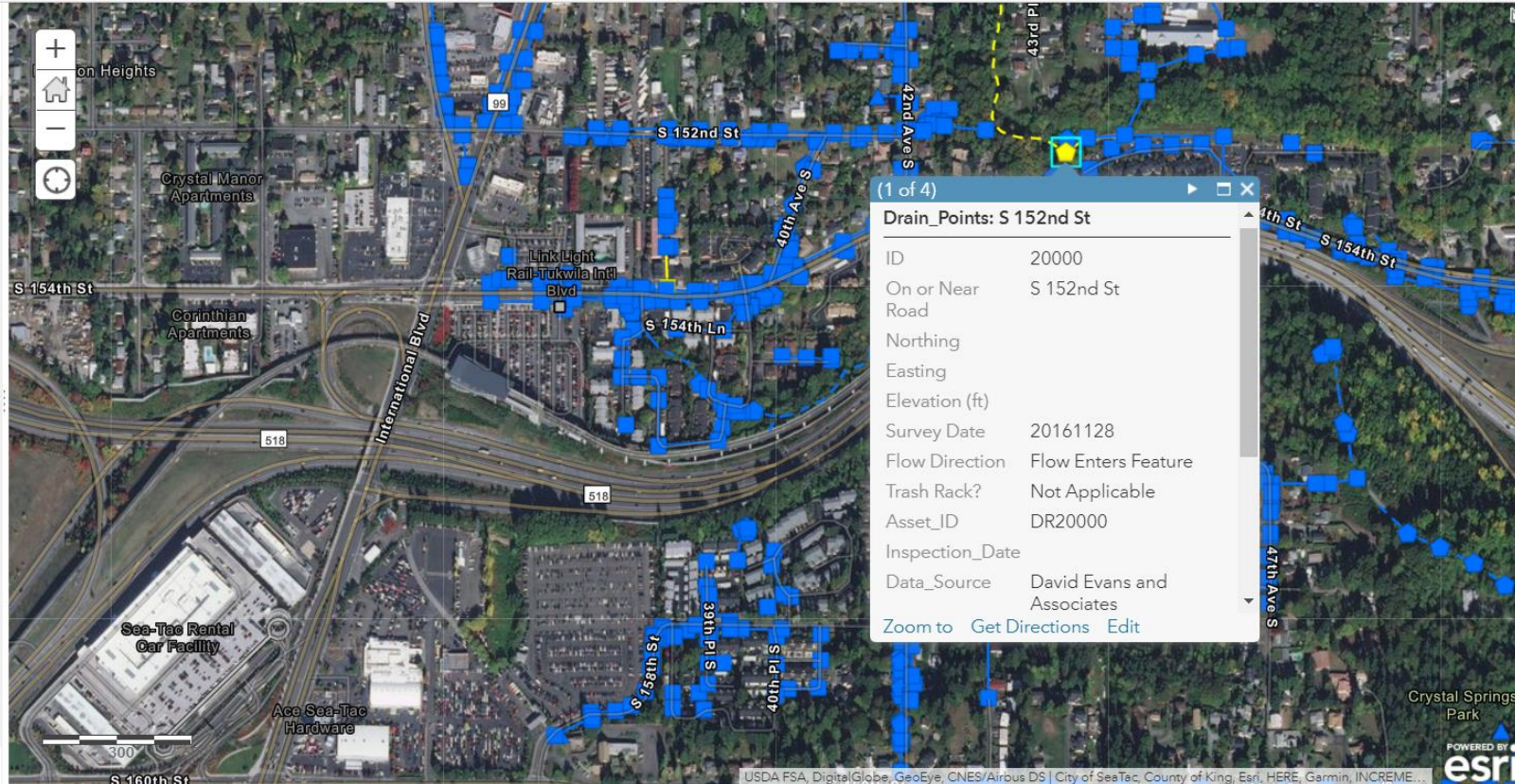
Storm Clean Out

-

Pipes and Ditches

- DEA Ditch
- DEA Pipes
- Other Ditch
- Other Pipes

Stormwater Detention Ponds



GEOSPATIAL

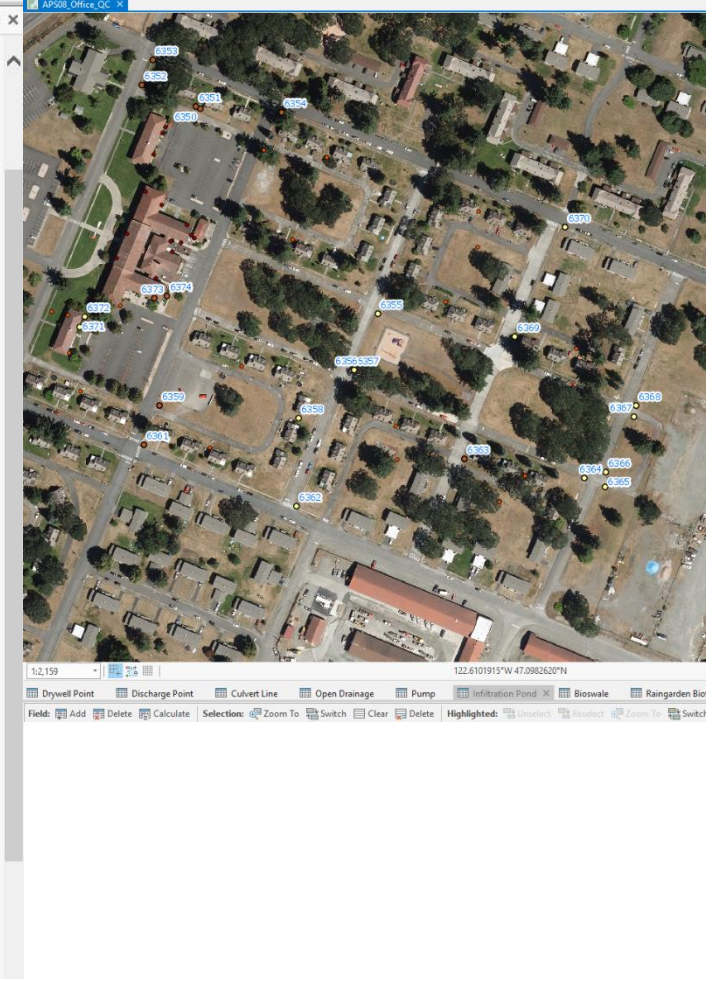
Condition Attribution Programmatic
Real-time Accuracy Connectivity

ASSET INVENTORY UPDATE
COLLECTOR FOR ARCGIS




Infiltration Pond - Infiltration Pond

COORD_X	500211072002
COORD_Y	5216742.094697
COORD_Z	236.88
DATE_ACQRD	0
DATE_CONST	0
DEPTH_AVG	0
DIM_U_D	
DISPOSTN_D	
ELV_U_D	
FACIL_ID	TBD
FLCTDEV_ID	
INSTLN_ID	53465
INV_ELV_AV	0
MEDIA_ID	
NAME_D	
NARRATIVE	Outfall #3; large bioretention pond; second of 2 ponds in series and connected by concrete spillway; 1 outlet on NW side to OWS; rockery wall on SW side; Z value taken from LiDAR
OBJECTID_1	17
OUT_CNTR	
OWNER_ID	JBLM
PERIM	1256.798406
PERIM_U_D	FT
SBN_ID	
SBN_LEN	0
SBN_WIDTH	0
STODCRG_ID	
TYPE_D	
USER_FLAG	Detention
X_DIKES_D	
Side Slope Horiz/Vert	3
LM_Outlet	Grate
LM_Outlet_Other	<Null>
LM_Outlet_Invert	236.7
LM_Outlet_Invert_UOM	A conventional unit of measurement of area whose dimensions are one foot on each side, being 0.09290304 square



Drywell Point - Drywell Point

OBJECTID	676
MIAT_D	Concrete
MIH_DIA	24
MIH_LEN	<Null>
MIH_WIDTH	<Null>
NARRATIVE	UIC Survey Project Done on 2007; 24" drywell lid and concrete vault; no pipes; receives surface drainage; 6.80' to bottom
NO_PIPES	0
LM Condition Status	Good condition but requires cleaning
LM Edit Status	Multiple Changes (Describe in LM Edit Status Comment Field)
LM Edit Status Comment	Geometry and attribution edits
BASIN_ID	<Null>
BUILDING_ID	<Null>
COORD_X	529758.309
COORD_Y	521585.728
COORD_Z	298.009
DIM_U_D	<Null>
DISPOSTN_D	<Null>
DRAIN_TY_D	<Null>
ELV_U_D	<Null>
FACIL_D	TBD
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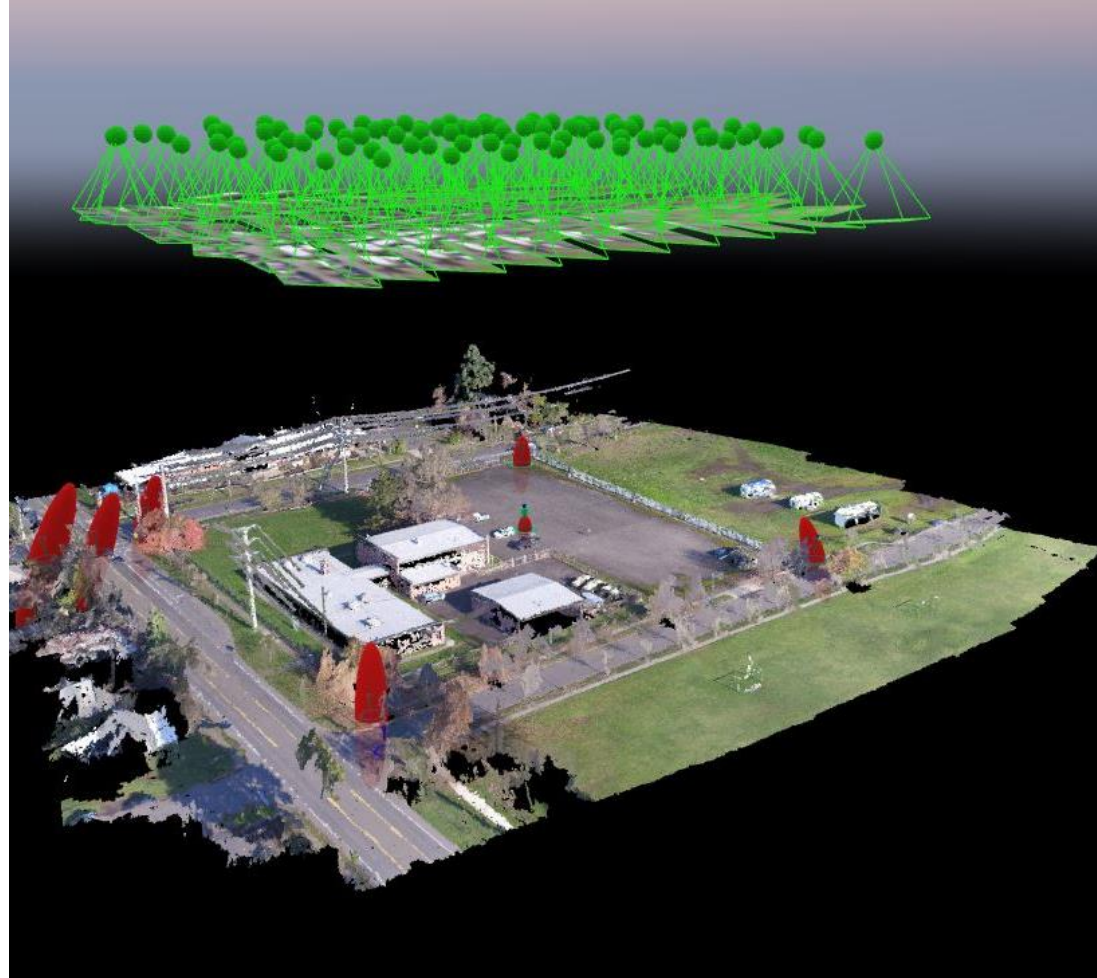
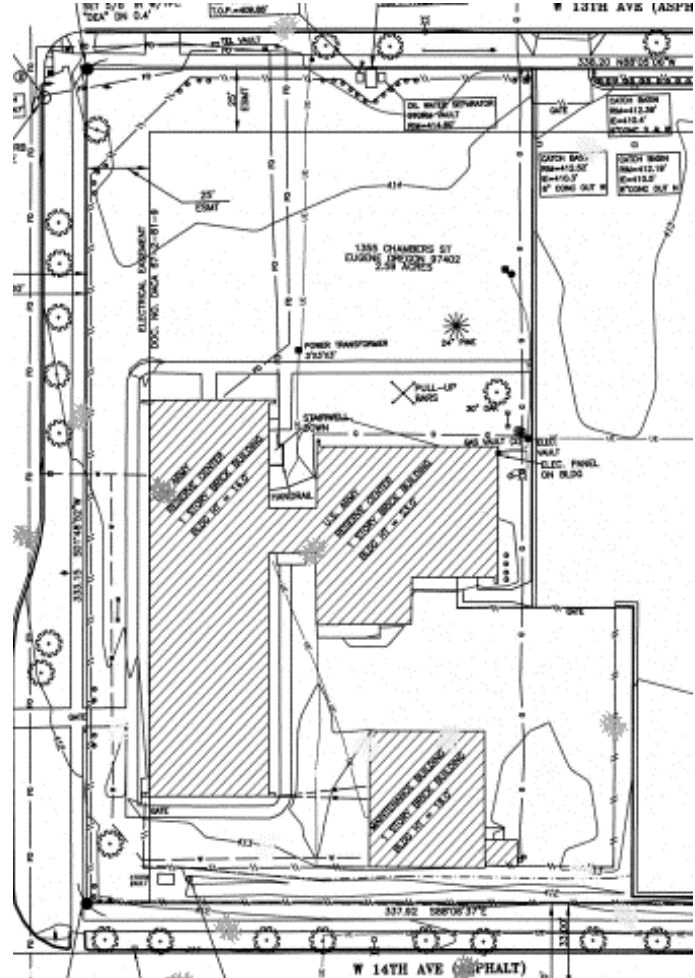


GEOSPATIAL

12 Feature Classes
10-20 Attributes

Improve Accuracy
Points & Polygons

ASSET CONDITION REPORT
COLLECTOR FOR ARCGIS



**35 Feature
Classes**

ALTA/ACSM Survey

GIS Database Update

Multiple Technologies

**Lifecycl
e**

Programmatic Microstation

**ESR
|
sUAS**

EXAMPLE



- ❖ **Data Privacy**
(Cambridge Analytica, GDPR)
- ❖ **Source Feed Integrity**
(Trust)
- ❖ **Broader Social Reckoning in Apps**
(Can we Trust Ourselves in the Oasis)
- ❖ **Crowd Sourced Data**
(Automated Vehicles)

NEW DATA RESPONSIBILITY

Responsive
Willingness

Scalabl
e
Training

Acces
s
Experie
e

Liability
Resources
Dedication

LEGAL
OWNER

LEGAL

OWNER

Measuring, Mapping & Modeling ...in Motion

**It is not one of us,
but the sum of us.**

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THANK YOU, TIME FOR QUESTIONS

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