Improved Project Delivery Using GIS and Advanced Survey Techniques Webinar

Zoom Meeting Platform User Information

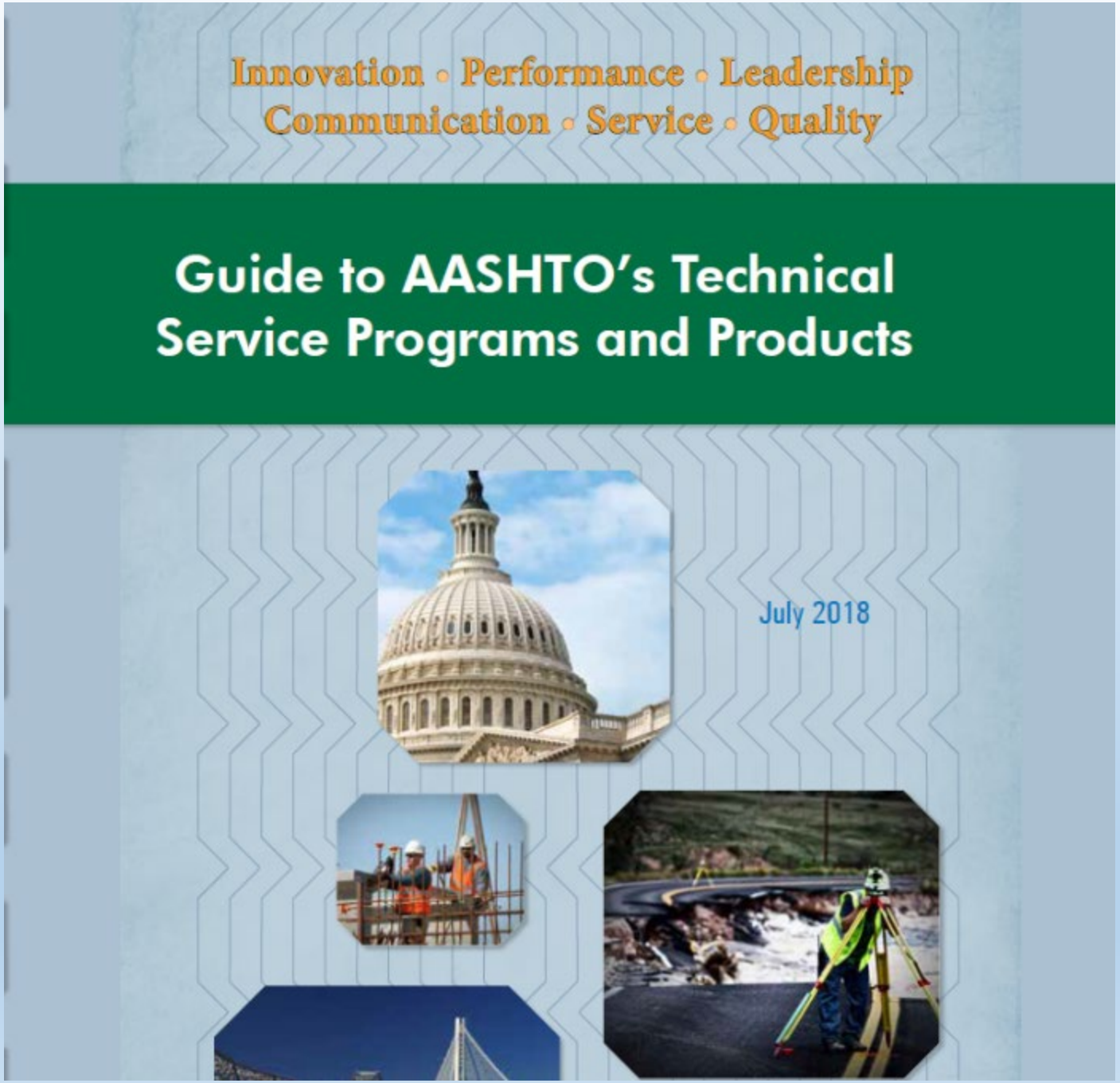
- Participants are currently muted.
- A Question and Answer Session will follow presentations.
- Use Zoom Q & A button to ask questions at any time during the presentations.
- The meeting is being recorded and will be shared on the AII website at aii.transportation.org.

AASHTO
Innovation Initiative

Agenda

1. Overview of AII Program
2. Introduction and Overview of Improved Project Delivery Using GIS and Advanced Survey
3. Speaker Introductions
4. Caltrans Perspective
5. Colorado Department of Transportation Perspective
6. Michigan Department of Transportation Perspective
7. Key Takeaways and National Survey Results
8. Question and Answer Session with Panel

AASHTO Technical Service Programs



AASHTO Innovation Initiative (A.I.I.)

AASHTO Re:source

AASHTOWare

National Transportation Product Evaluation Program (NTPEP)

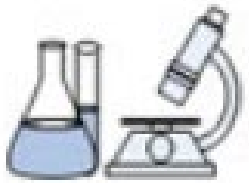
Development AASHTO Materials Specifications (DAMS)

All about All – *The AASHTO Innovation Initiative*

- Established in 1999 & Operating since 2000
- Previously called the *Technology Implementation Group (TIG)*
- Facilitate the implementation of **high-payoff**, **ready-to-use**, **innovative technologies**
  - Focus Technologies
  - Additionally Selected Technologies

Support the implementation of 100+ technologies since 2001

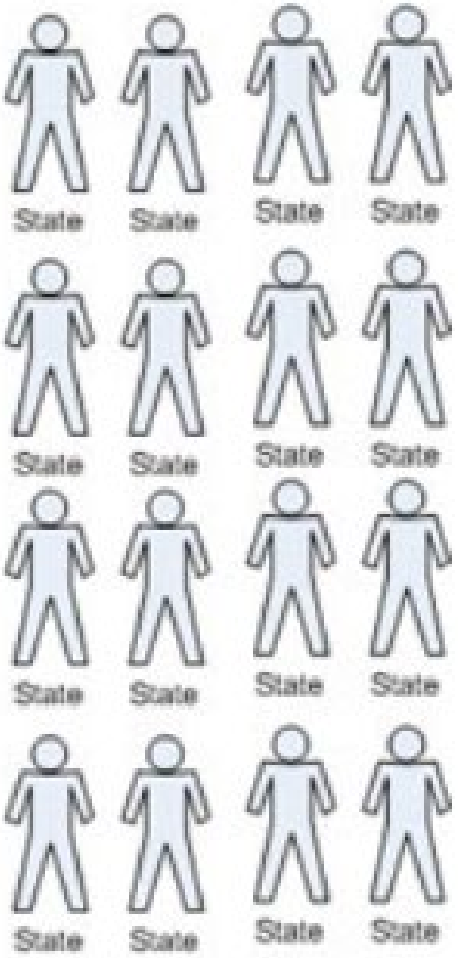
AII's Role in the Technology Lifecycle



Research

Lead States Pursue Practical Applications

AII



Industry Practice

Current Active Focus Technologies

- Saw Cut Vertical Curb
- Freight Operations eXchange
- Hydrogen Fuel Cell Technology
- Electrically Conductive Concrete Heated Pavement System
- Steel Press Brake Formed Tub Girder
- Improved Project Delivery Using GIS
- Wrong Way Driving Systemic Approach
- Laser Ablation Coating Remove
- Beam End Repair with Ultra High Performance Concrete

AASHTO Innovation Initiative (AII)

What is AII?

Formerly the AASHTO Technology Implementation Group, AII advances innovation from the grassroots up: by agencies, for agencies, peer-to-peer.
More >>

Active Focus Technologies | **Previous Focus Technologies** | **Additional Technologies**

Nominate a Technology | **Contact Us**

Submit Your Nomination Today!

Active Lead States Teams Focus T

- Saw Cut Vertical Curb
- Steel Press-Brake-Formed Tub Girder
- Beam End Repair Using Ultra-High Performance Conc
- Improved Project Delivery with GIS & Surveying
- Laser Ablation Coating Removal
- Systemic Approach to Wrong Way Driver Safety
- Electrically Conductive Concrete (ECON) Heated

Resources

- Caltrans Process Improvement Project Report (pdf)
- Caltrans Process Improvement Project Presentation (pdf)
- Caltrans Improved Project Delivery Memo (pdf)
- Base Mapping and Preliminary Design Process Flow Chart (pdf)
- Activities in Environmental Document Phase (pdf)
- Caltrans District 3 Development Policy Document (pdf)
- Caltrans 3D Utility Database Memo (pdf)
- CDOT Mapping the Underground Presentation (pdf)

Contacts

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Expert Panel

Lance Parve, WSP
Improved Project Delivery Webinar Facilitator

Caltrans

MDOT
Michigan Department of Transportation

CDOT
COLORADO
Department of Transportation

Anand Maganti

Aaron Ott

Rob Martindale

Andrew Block

Participant Poll #1

General Overview of Project Delivery Using GIS and Advanced Survey Techniques

Lance Parve, WSP

Transportation Facilities Lifecycle Digital Delivery

Planning & Programming

- Program/Projects Prioritization/Scoping/Costs
- Program Annual Construction Plans
- Transportation Asset Management Plan
- Transportation Improvement Plan-Long-term
- Assets Data Requirements/Analysis

Planning GIS/Survey

Surveying, Utilities & Environmental

- Project Development & Detailed Scoping
- Project Data Requirements/Data Collection
- 2D/3D Existing Conditions Survey/Reality Capture/DTM
- Utilities Surface/Subsurface/Geotech Borings Subsurface
- Environmental NEPA/Permits/Local Preferred Alternative

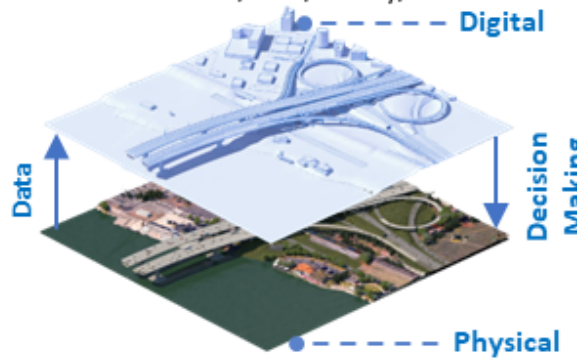
Prelim Design/Env Survey/CAD/GIS

Facilities GIS Asset Mgmt Systems-AMS

Facilities & Asset Management

- Asset Inventories/Lifecycle Analysis
- Assets Monitoring/Inspection
- System Performance Monitoring
- Real-time Sensors/IoT/AI/ML Monitoring
- Emergency Response/Analysis
- Renewal/Rehabilitation/Reconstruction
- Commissioning/Decommissioning

Tools: GIS/AMS/Survey/CAD



Tools: GIS/AMS

Tools: CAD/BIM/Survey

Transportation Assets

(Roads, Structures, Drainage, Utilities, Geotech, RR, ITS, Traffic Signals, Signs, Lighting, ROW, Buildings)

Design & PS&Es/Models

- Conceptual, Preliminary, Detailed & Final Design
- Environmental/LPA/Stakeholder-Public Outreach
- 3D Multi-disciplinary Design/PS&Es/Models/BEP
- 4D Schedule & 5D Cost Estimates
- Simulation & Visualization/AR-VR-MR
- Constructability & Coordination/Clash Detection
- Risk Identification/Mitigation & Value Engineering

Design CAD/BIM PS&Es/Models

Maintenance GIS Asset Mgmt Systems-AMS

Operations & Maintenance

- Roads/Structures/Ancillary Assets Inspection
- Maintenance & Scheduling
- Traffic/Safety Operations
- Traffic/Safety Assets Inspection/Maintenance
- Emergency Response Maintenance
- Maintenance Management/Operations Systems
- Assets Post-construction Survey Data Collection
- Lifecycle As-Built Model Updates

Tools: Survey/Mobile Apps

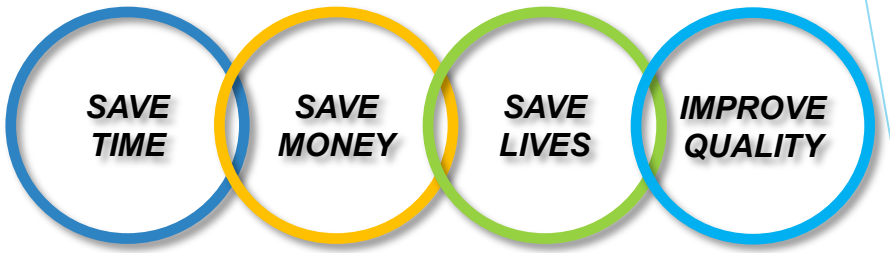
Construction Survey As-Builts

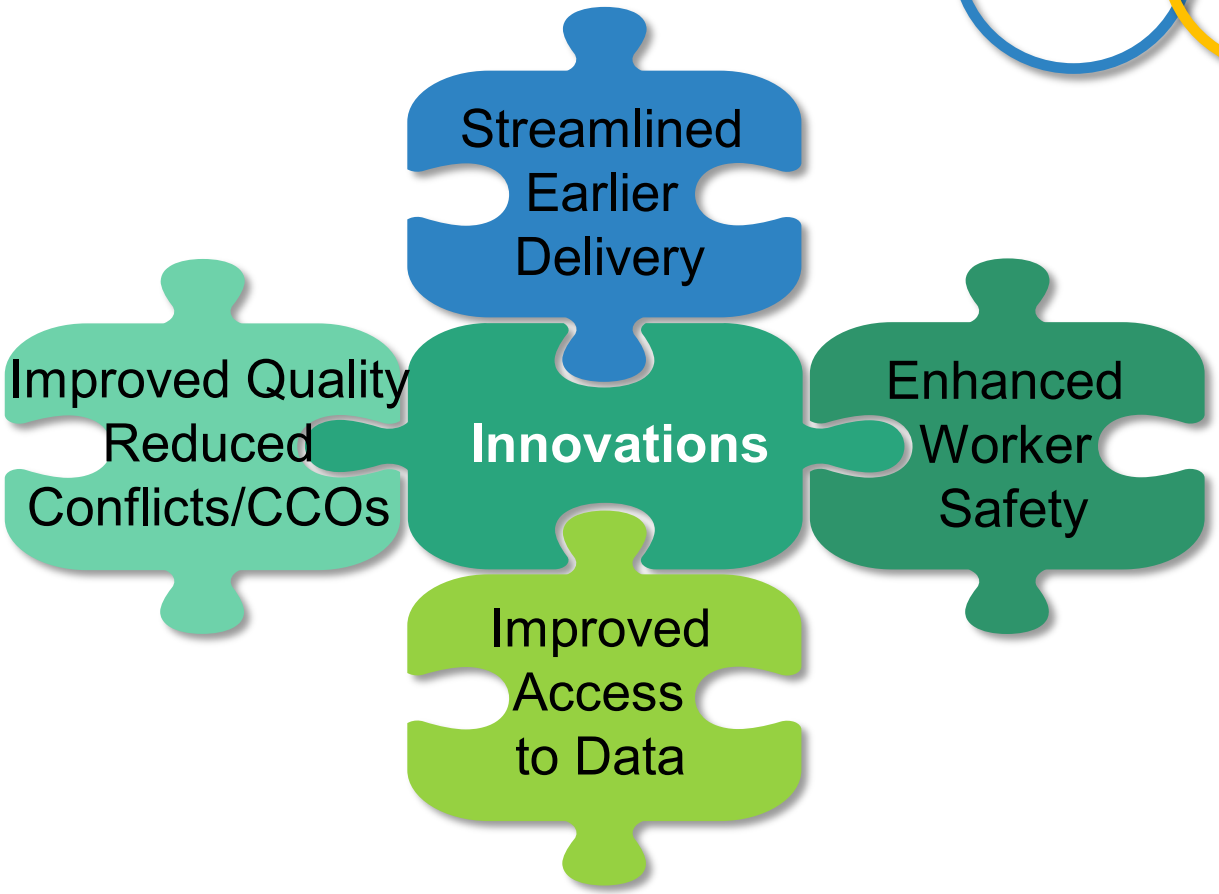
Bidding & Construction

- Bids & Estimates from Contractors
- Procurement & Fabrication
- Scheduling, Phasing & Staging
- Construction Layout & Safety
- RFIs & Contract Change Orders/Modifications
- Work Inspection & Field Survey Verification
- Materials, Pay Quantities & Acceptance
- As-Built Markup Plans/Record Models

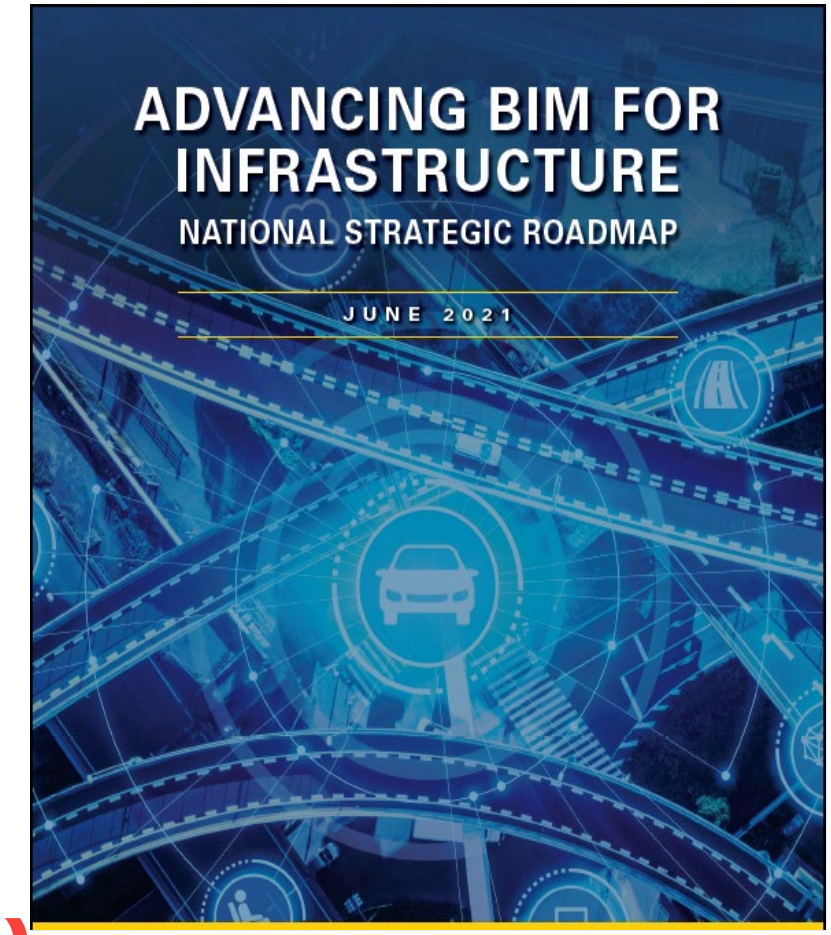
Source: Parve, WSP USA, 2023.

Benefits


SAVE TIME
SAVE MONEY
SAVE LIVES
IMPROVE QUALITY


Streamlined Earlier Delivery
Improved Quality Reduced Conflicts/CCOs
Innovations
Enhanced Worker Safety
Improved Access to Data

BIM4I National Strategic Roadmap and Key Components



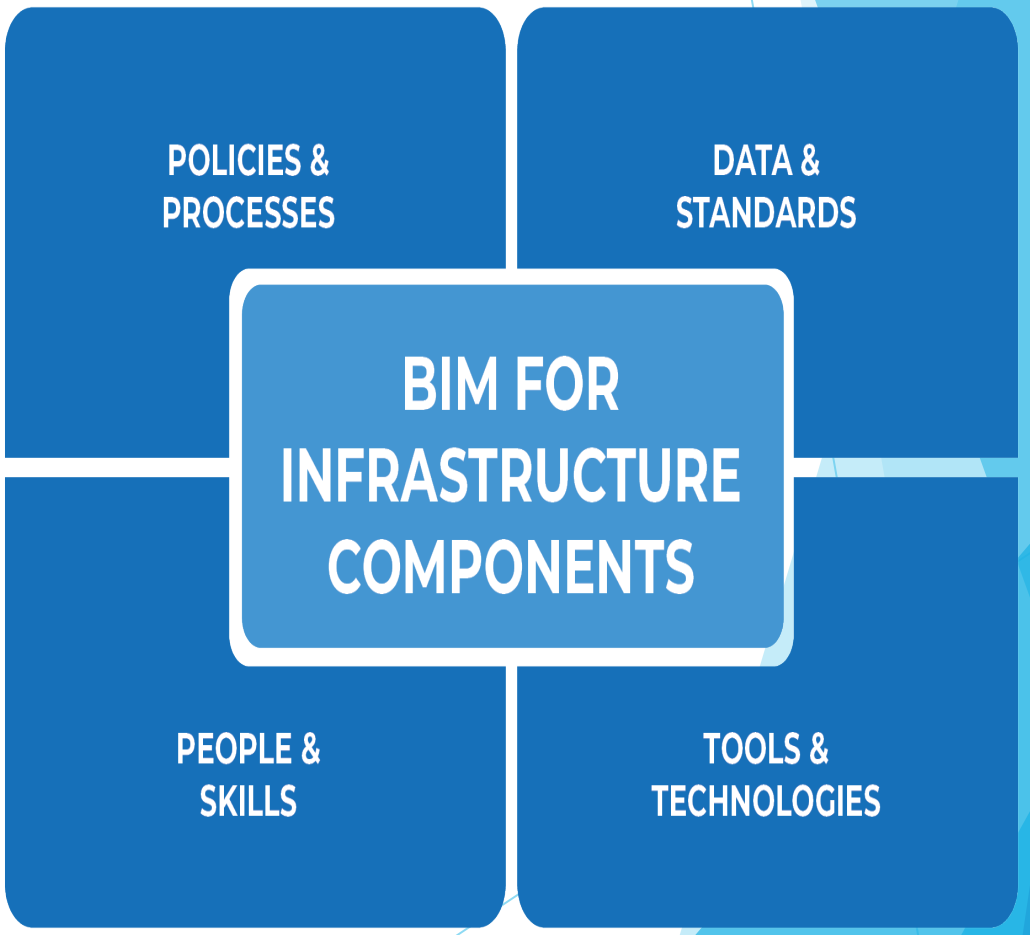
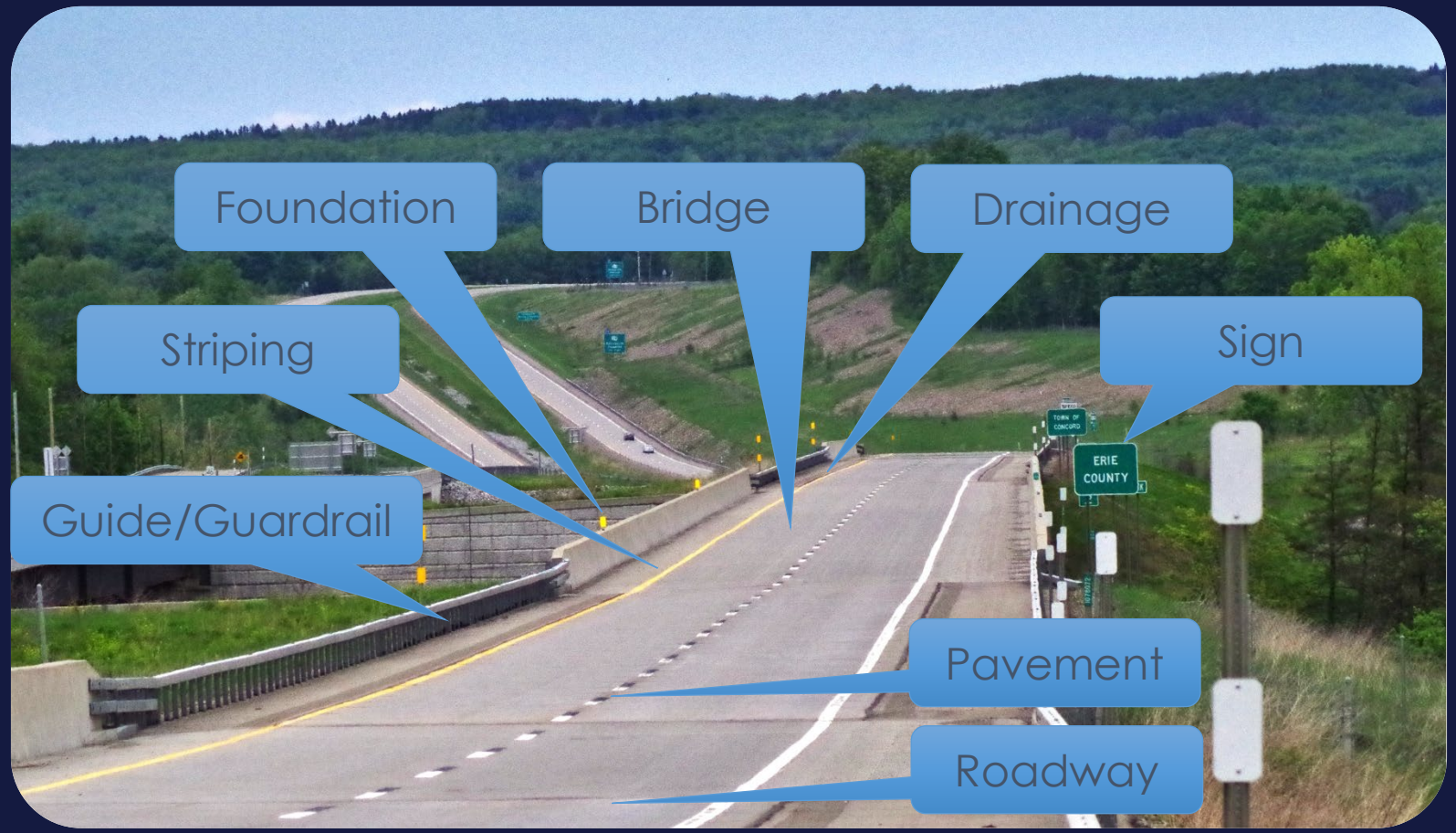


Image Credit: FHWA-HRT-21-064 Advancing BIM for Infrastructure: National Strategic Roadmap

DABs: DOT Priority Assets



Images Courtesy of and Adapted from: Utah DOT

Utilities/GIS/Survey Use Cases

Primary Use Cases

- Geospatially locate utility/ROW/assets earlier for improved project delivery
- Use Advanced Survey & Model/Cloud-based Tools for Improved Accuracies
- Use 2D/3D visual models & AR/VR/MR in field to streamline e-construction
- Record Data to Systems of Record & Common Data Environment Repositories
- Extract model-based asset data for lifecycle uses to GIS, CAD & AMS

Key Barriers & Overcoming Strategies

- Higher cost for mobile LiDAR scanners/UAS to RTS/GNSS Rovers - Resourcing
- Shortage of technical & experienced staff – Training, Knowledge Transfer & Retention
- Lack of best practices guidance - Workflow, Specification & Policy Review/Changes
- Silos in agency organization business areas - Internal & External Collaboration
- Lack of available agency resources & funding - Resourcing & Grants

CALTRANS PERSPECTIVE

1) Advancement in Surveys

2) GIS Repository

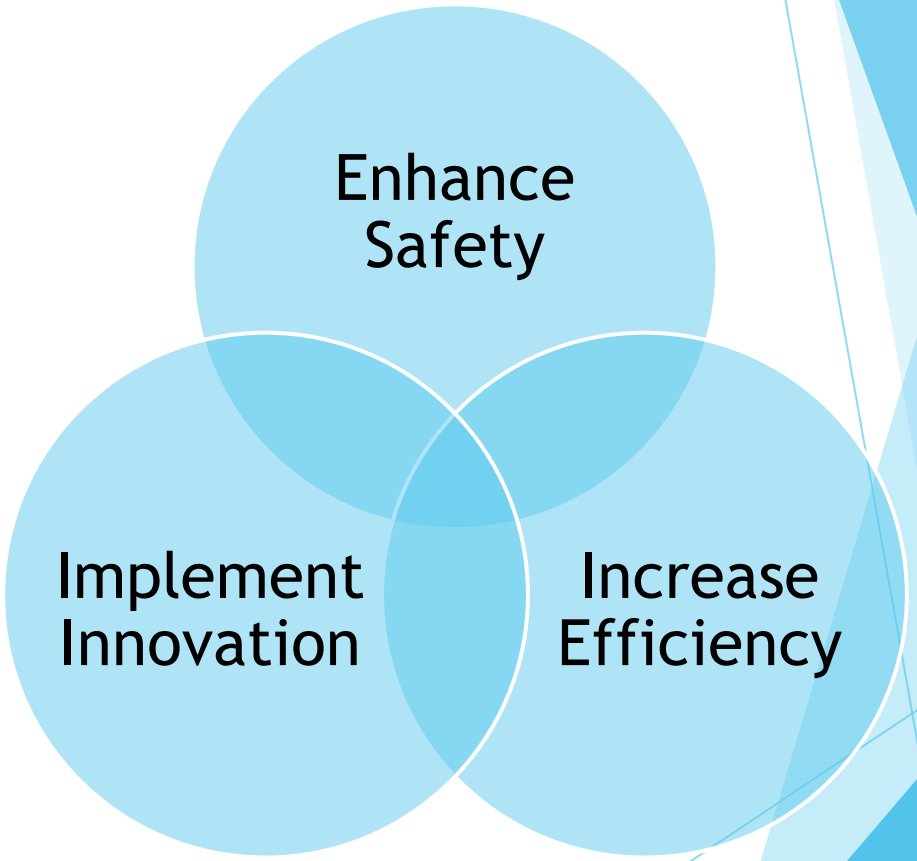
3) Process Improvements

4) Vision


Advancements in
Surveys

Why UAS?

- Cross Functional Application
- Accelerated Project Delivery
- New Technology



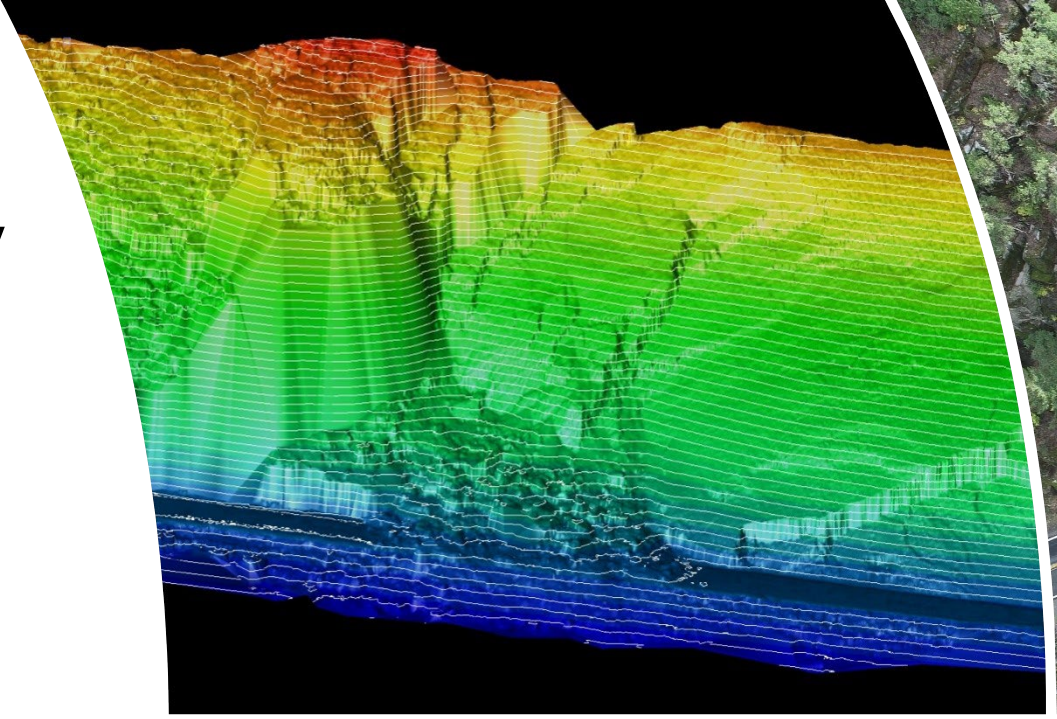
UAS Accomplishments

- Unmanned Aerial Systems (UAS)
  - $498,218 savings FY 20/21 for D3
  - $438,708 savings FY 21/22 for D3
  - $321,332 savings FY 22/23 for D3
  - Increased Efficiencies
  - Improved Safety
  - Rapid Response to Emergency Work

Pre & Complete Earthwork

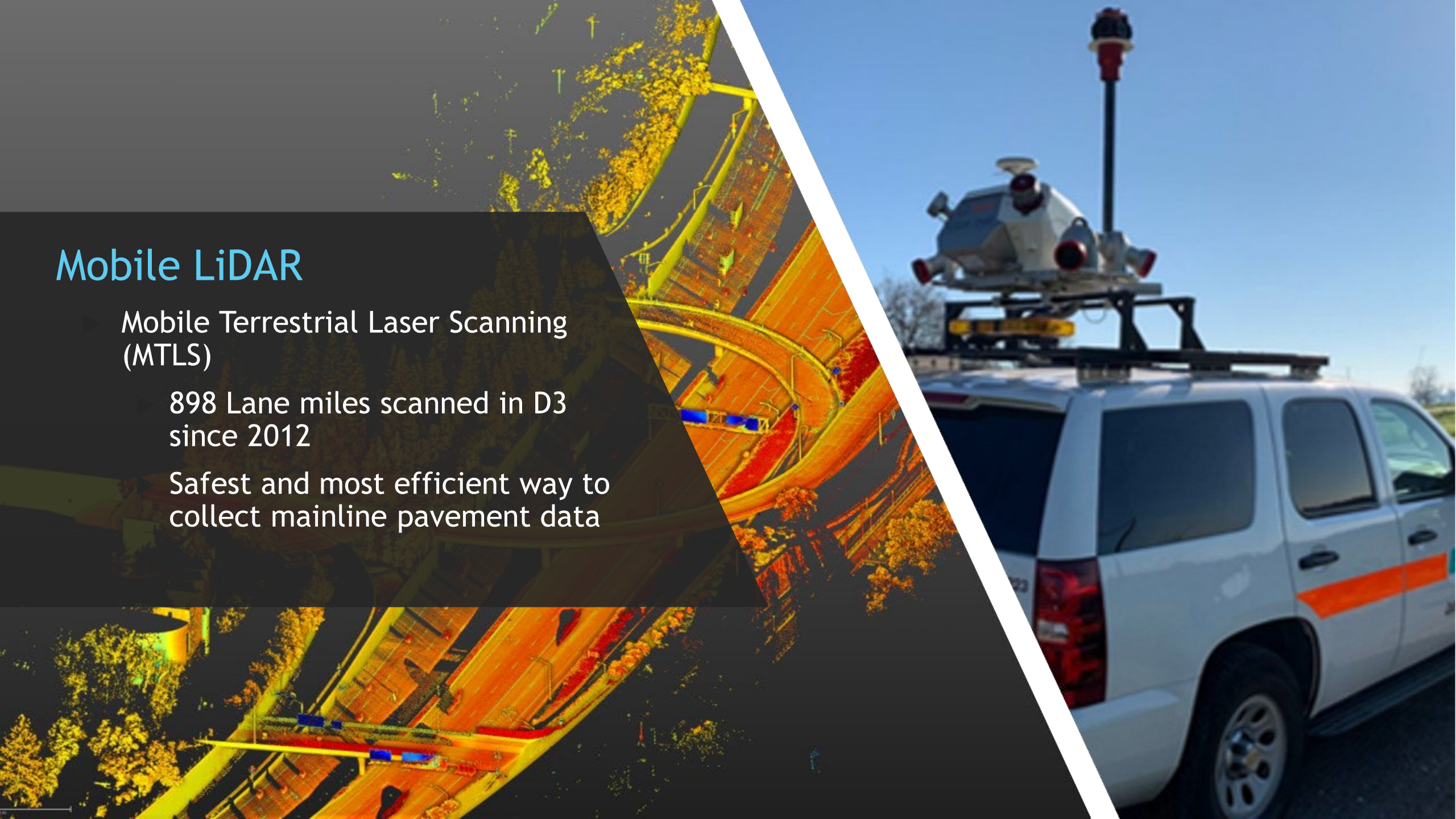
UAS Technology at Work

- **10/24/2021** Slide Event Highway 70 in Plumas County
- Initial request to Point Cloud Contour Surface Took 2 Days
- Earthwork Volume Report **10/27/2021**



Mobile LiDAR

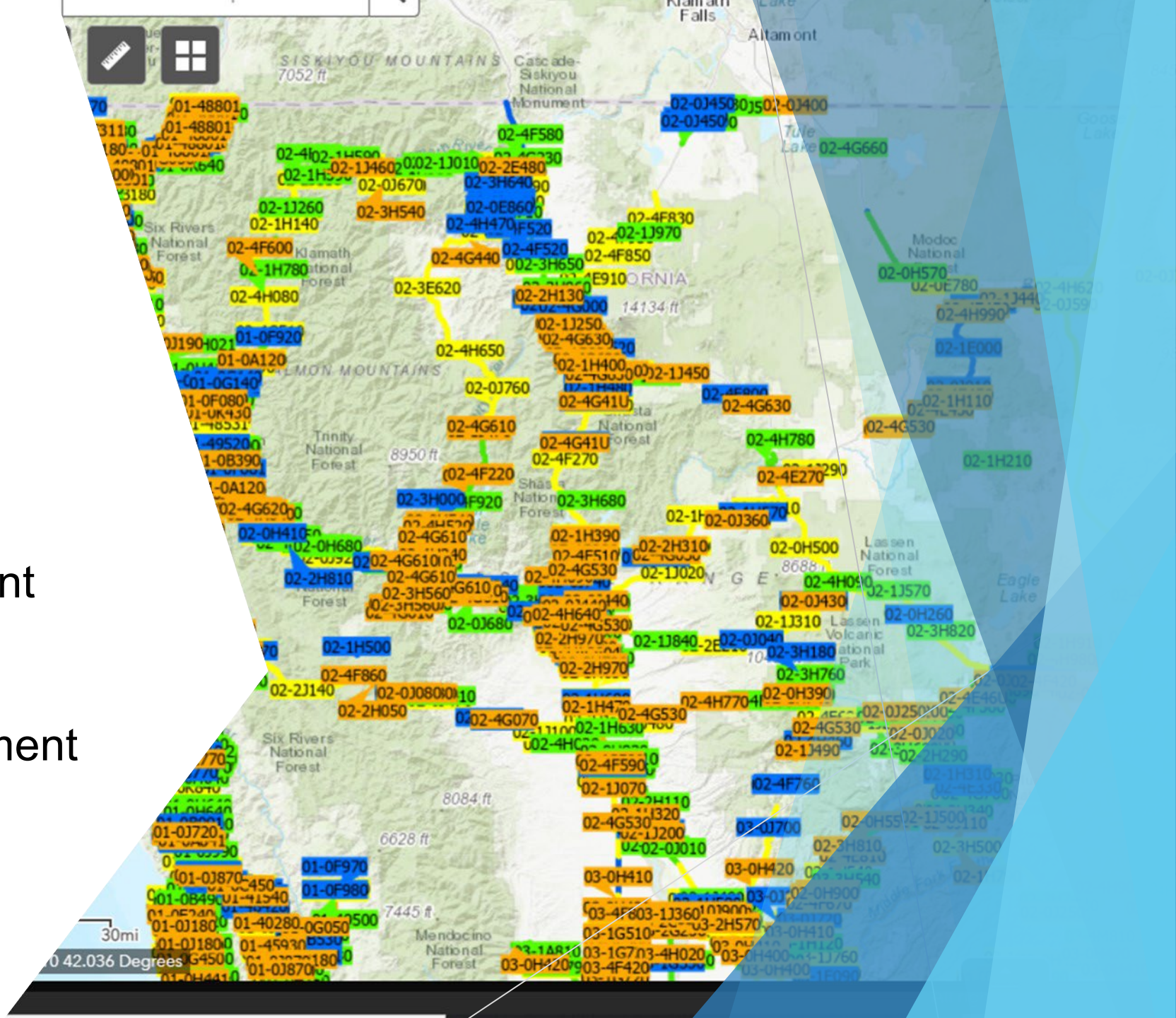
- Mobile Terrestrial Laser Scanning (MTLS)
  - 898 Lane miles scanned in D3 since 2012
  - Safest and most efficient way to collect mainline pavement data



GIS Repository

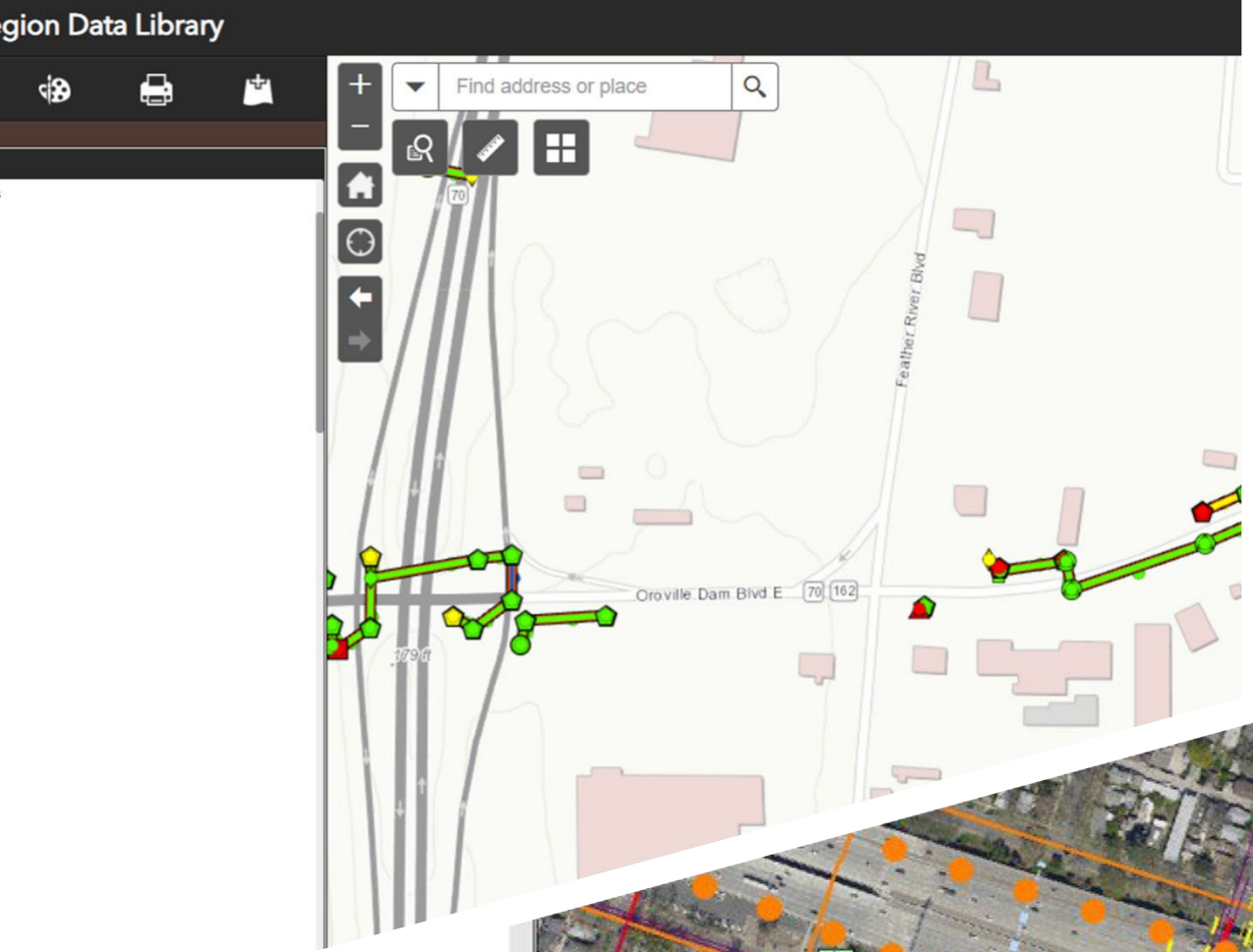
Ongoing GIS Efforts

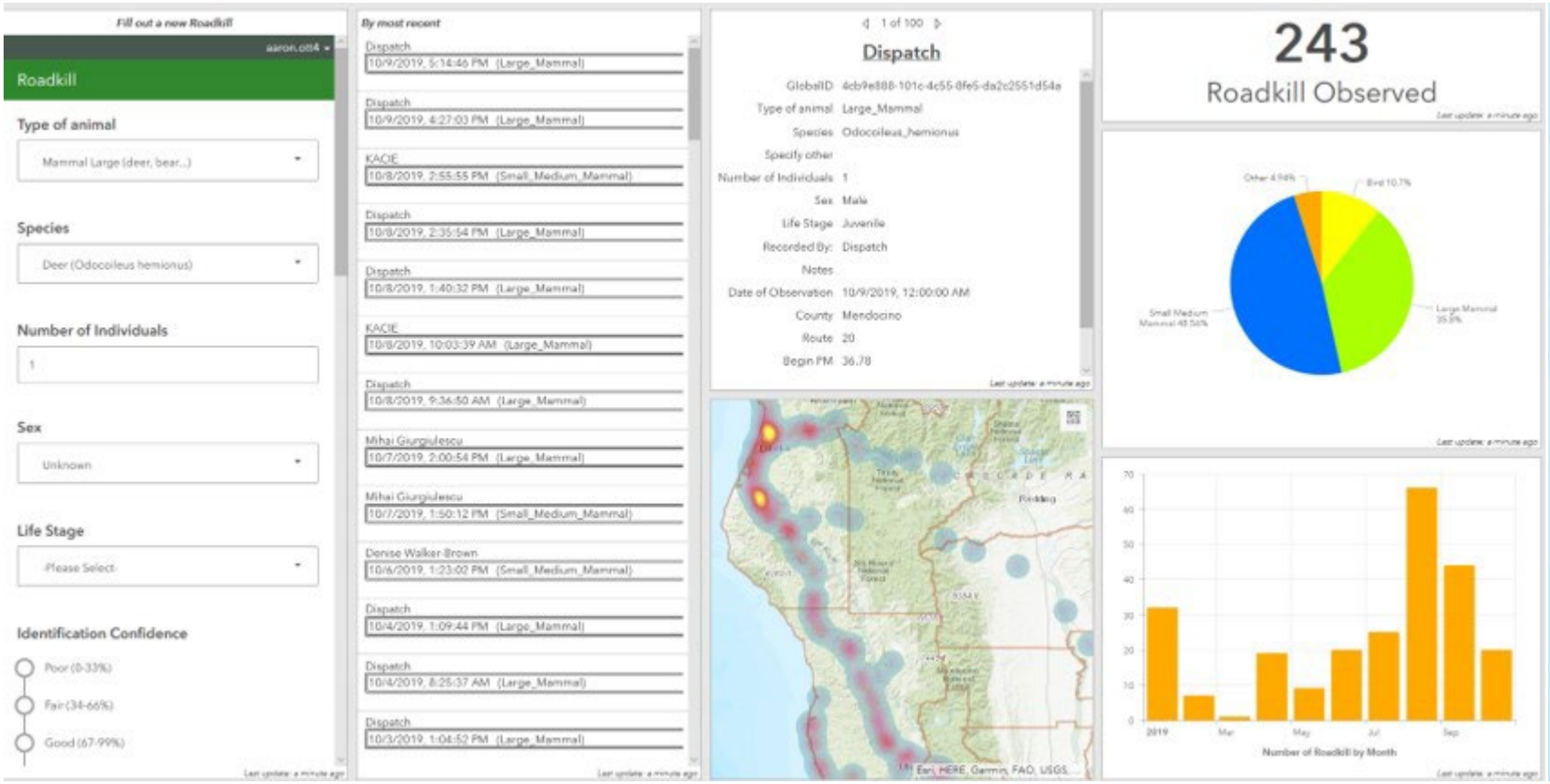
- Project As-builts
- Right of Way lines
- Record Maps
- Topographic Footprint
- Utilities
- Culverts
- Pavement Management
- ADA ramps
- Guardrail
- ITS elements



GIS REPOSITORY

GIS REPOSITORY





Dashboard Gives an Overall View

Hotspot Map Highlights Areas of Concern

Roadkill

- Roadkill Application and Dashboard
- Data can be entered in the Field through Application
- Dispatch can enter data when reported on radio
- No more paper forms or record on chalkboard
- Updated as incidents are encountered

Benefits of a Robust GIS Repository

- Start with existing data – ***No more groundhog day***
- 3D Archival of project As-builts including utilities
- One Stop Shop for All Data Needs
- Time savings
- Risk reduction
- Preservation of Information for Future Projects

Process Improvements

Programming Document-Planning Document: 30/60/90% Project Initiation Report (PIR)

@30% PIR

- Purpose & Need
- Scope
- Alternatives
- Assets to be delivered.

@60% PIR

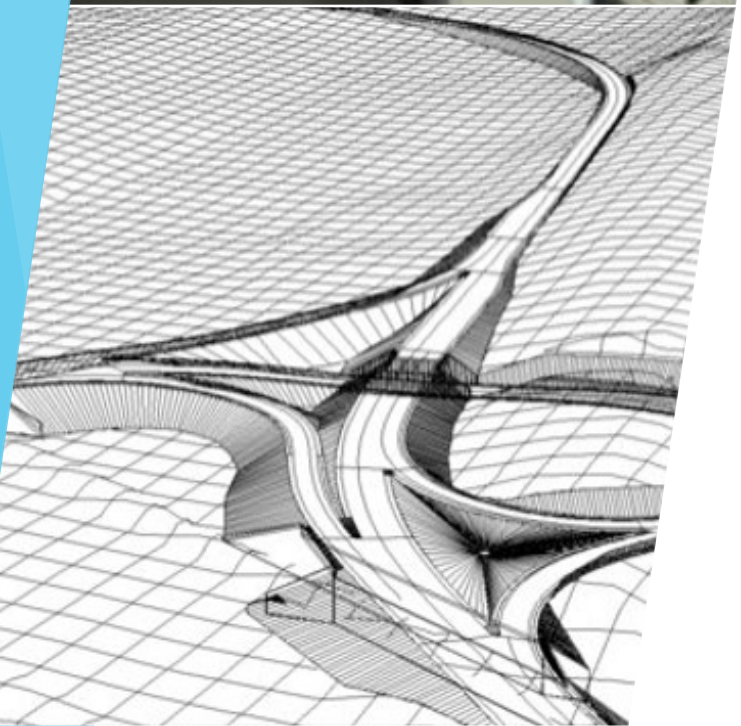
- Workplan is confirmed.
- Resources and schedule are loaded for review by all.
- PDT reviews and comments

@90% PIR

- PDT final review and comments on the 90% PIR.
- The Risk Management Plan is reviewed and certified by executive staff.

Need for Data Collection

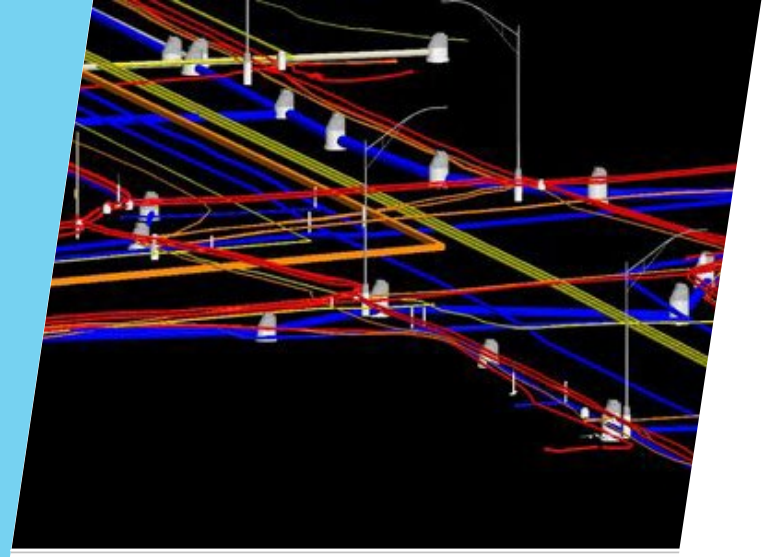
Having stored reusable data ready to go will help future projects to define better scope, be delivered more efficiently and on schedule while having a better understanding of the risks.

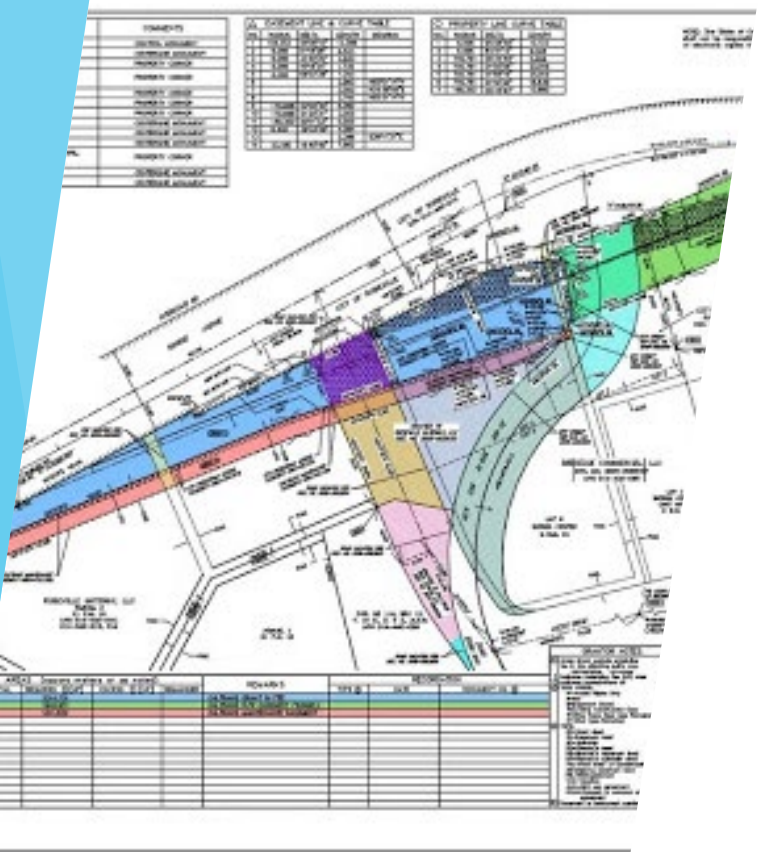


Improved Project Delivery Process

Environmental Phase

- Early Surveys
- Early Design Work
- Stake Holder Engagement
- Well Developed Design 3D Model



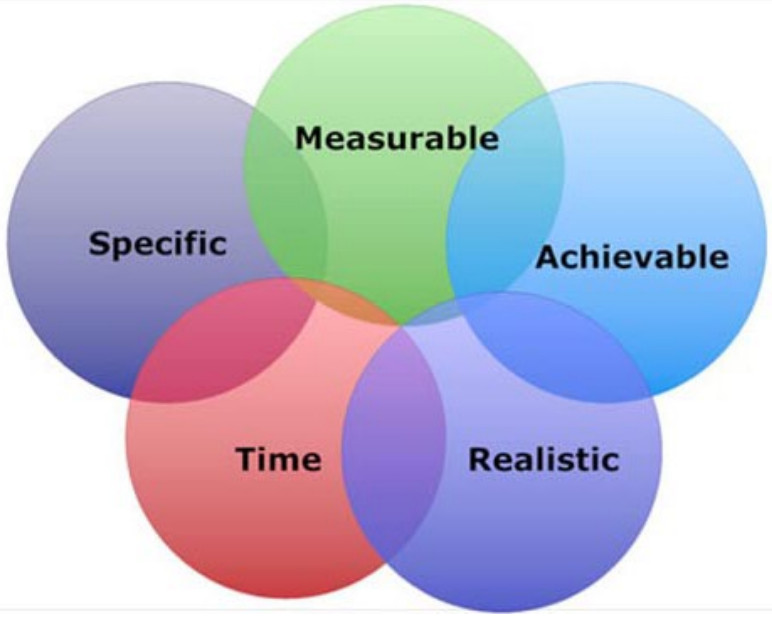


Improved Project Delivery Process

Environmental Phase

- Identify Utility Conflicts
- Develop Utility Relocation plans and utility easements
- Identify RW needs

Achievable Targets with the Improved Project Delivery Process:



Minimizes or eliminates changes to project scope, cost and schedule.

Identification of all Right of Way (R/W) requirements during Environmental Phase

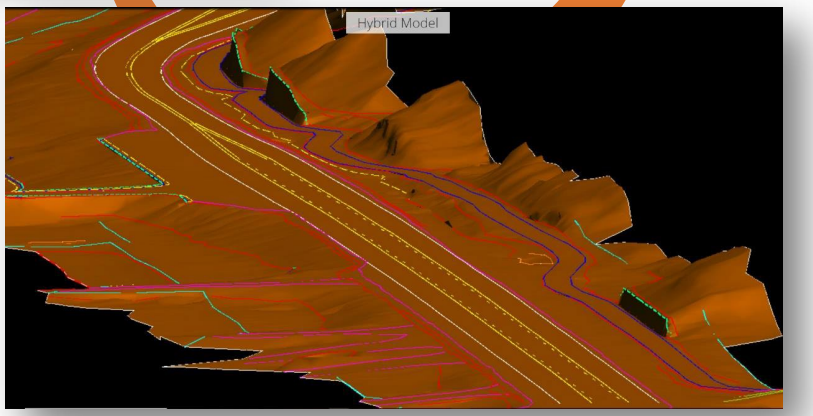
Utility relocation plans and easements during environmental phase.

Better assessment of environmental impacts with early designs.

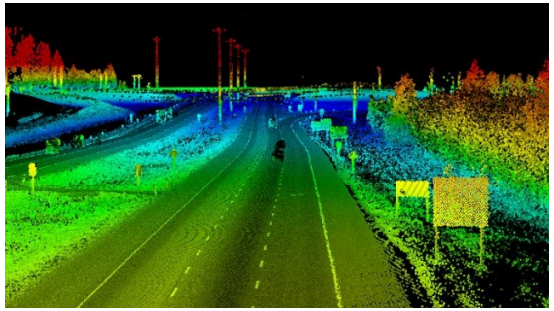
Complete relocation of utilities that are in conflict prior to construction.

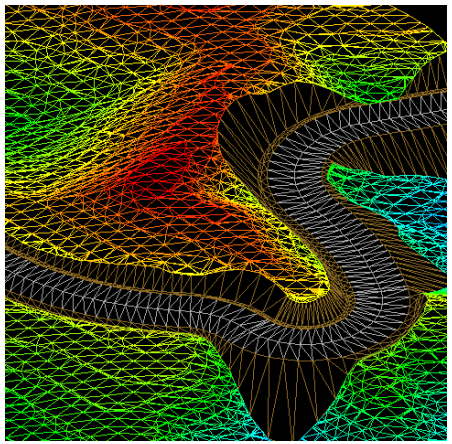

VISION

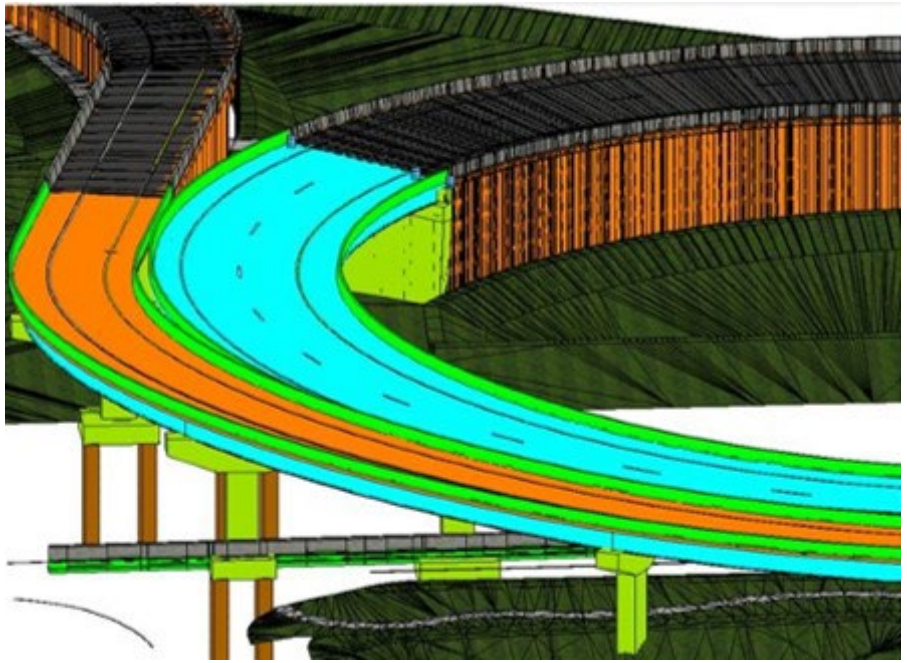
Building Information Modeling for Infrastructure (BIM4I)



CALTRANS Project Information Modelling





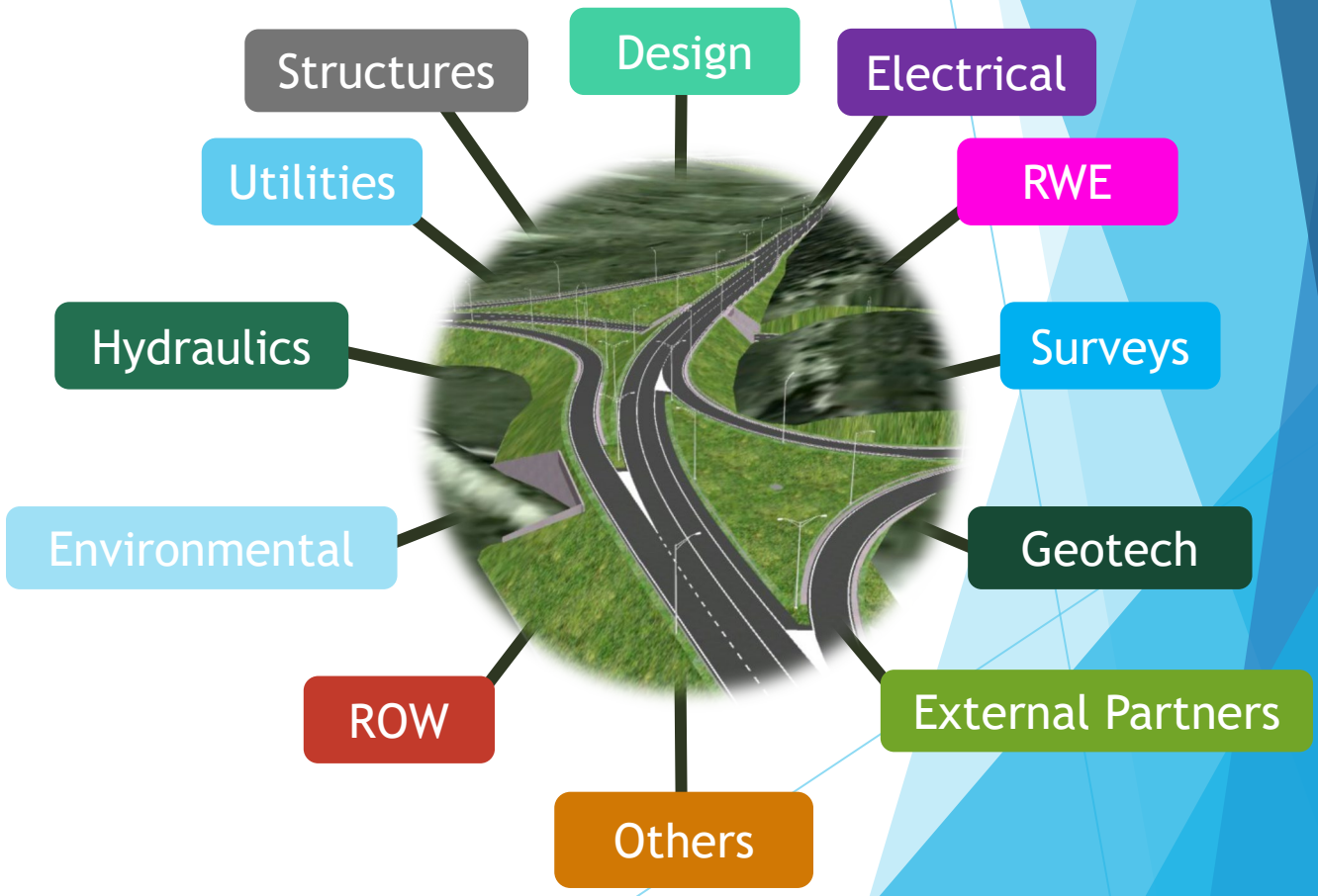


Early Surveys

- Innovation
- Reduce Risk
- “Living“ Asset Information Model (AIM).

DATA IS AN ASSET

- System Source of Record for All Project Data
- Enterprise Data Available for Everyone Through Web Applications



Improved Project Delivery Using GIS and Advanced Survey Techniques Webinar

COLORADO
Department of Transportation

Presented by
Rob Martindale, PLS

AASHTO
Innovation Initiative

What *is* Utilities Management & Asset GIS data?

Asset Type

Ownership

Maintenance

Dates

Notes

But GIS data doesn't come *pre-packaged*

GIS data is *designed*

Timeline

Utilities Management & Asset Mapping GIS

Before 2017

Background
The need to improve utility delays

2019

Evaluating and Designing software

2021

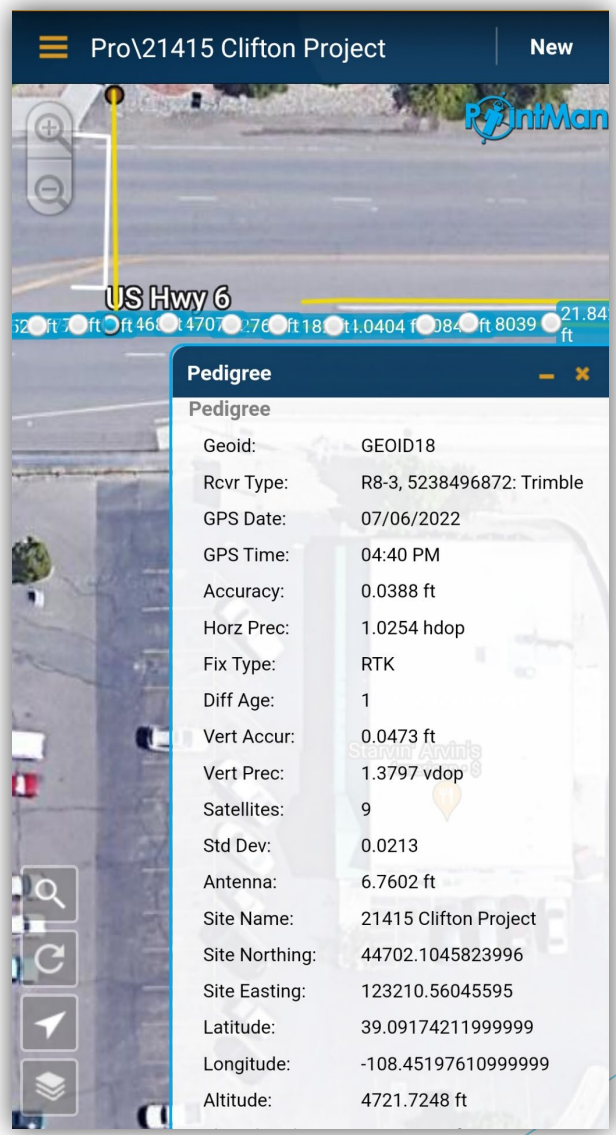
New Standards And Data Capture Requirements

After 2023

Future Aspirations

Program Goals

- *Having attribute data about each utility enables more efficient and productive coordination with utility owners.*
- *Knowing the location and depth of utilities enables designers to change designs to avoid costly utility relocation and delays in project delivery.*
- *During construction, contractors can pull up mapping systems that accurately display the location and depth of the utilities, so the utilities can be avoided and delays prevented.*
- *The ability to store data in a single platform can minimize the cost of data collection on future projects as well.*



- *Example of PointMan Data from R3 Project, SA 21415*

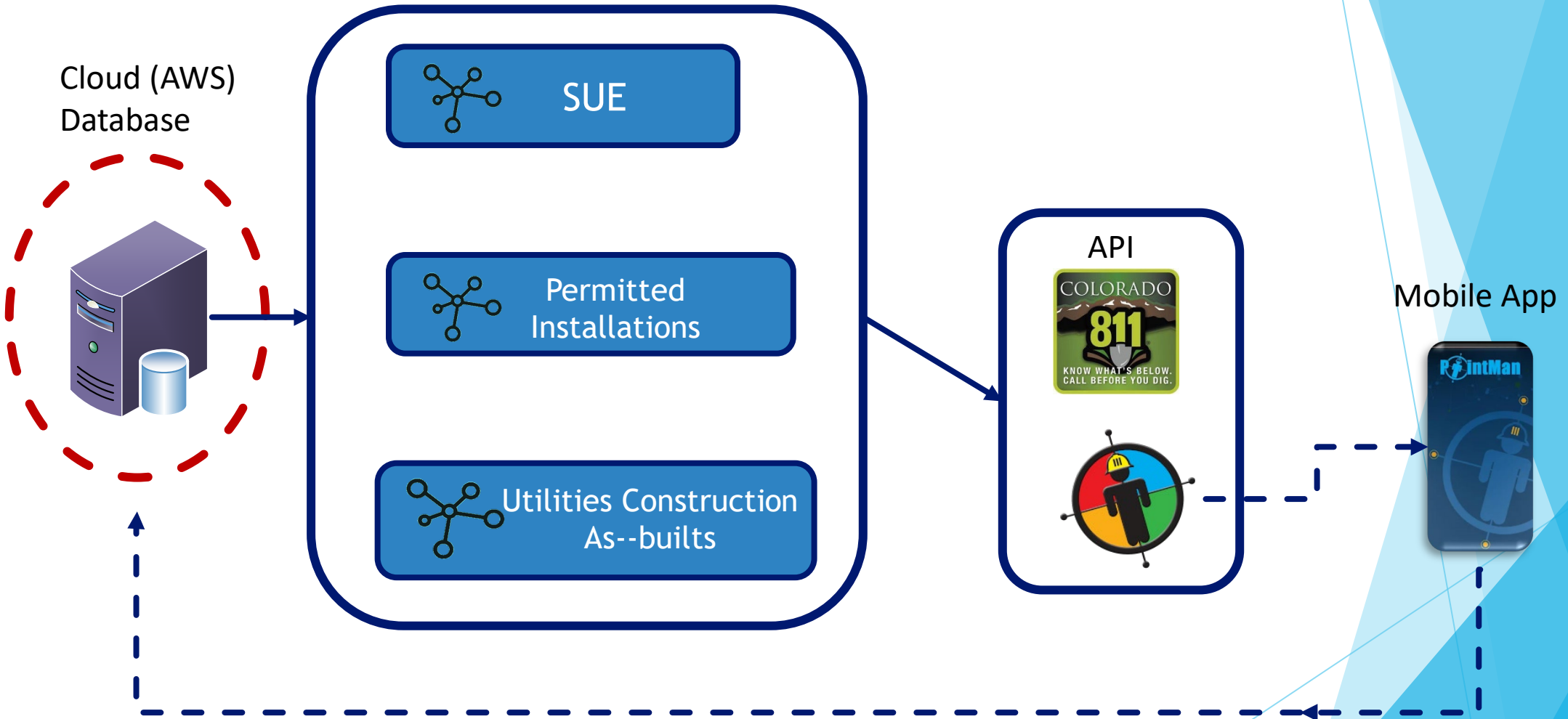
Subsurface Utility Engineering (SUE) – ASCE 38

Permitted Utility Installations

Construction Management ASCE 75

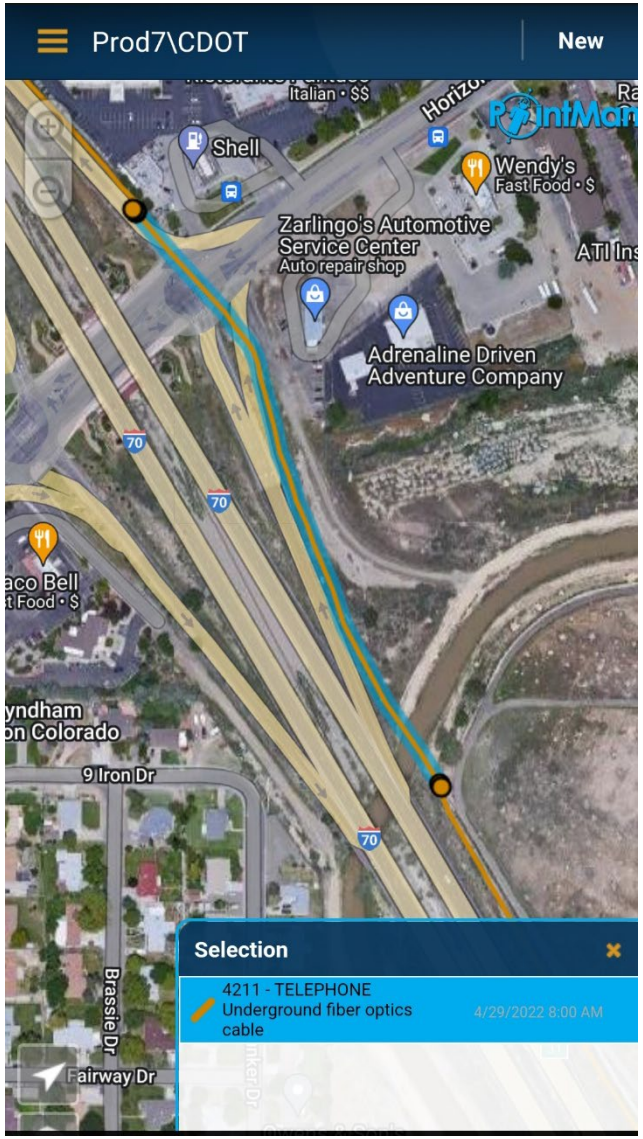
Technology and Data Collection

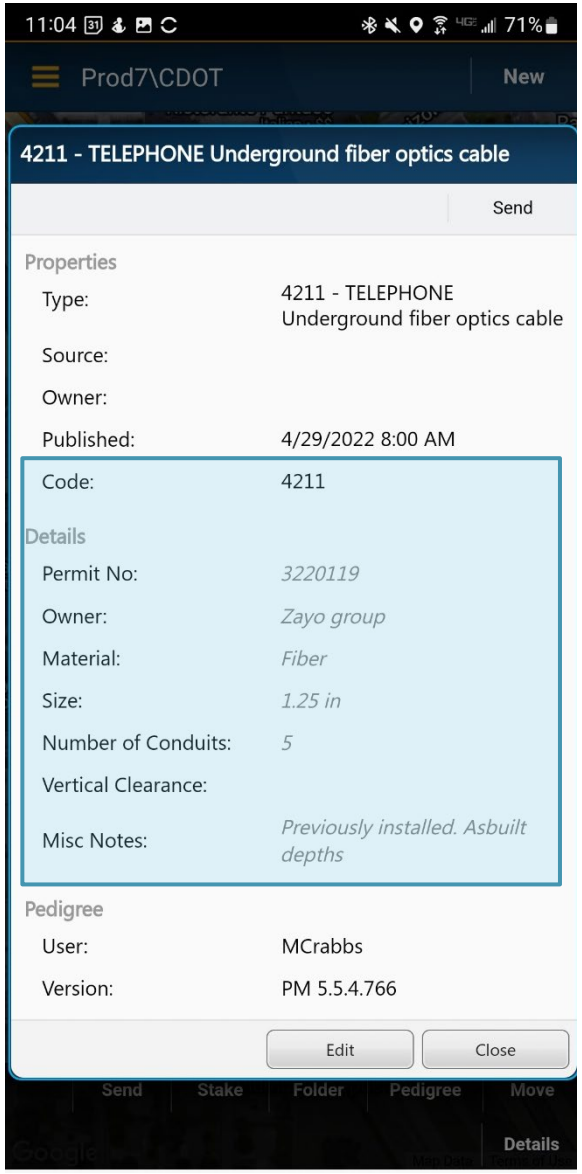
Technology and Data Collection

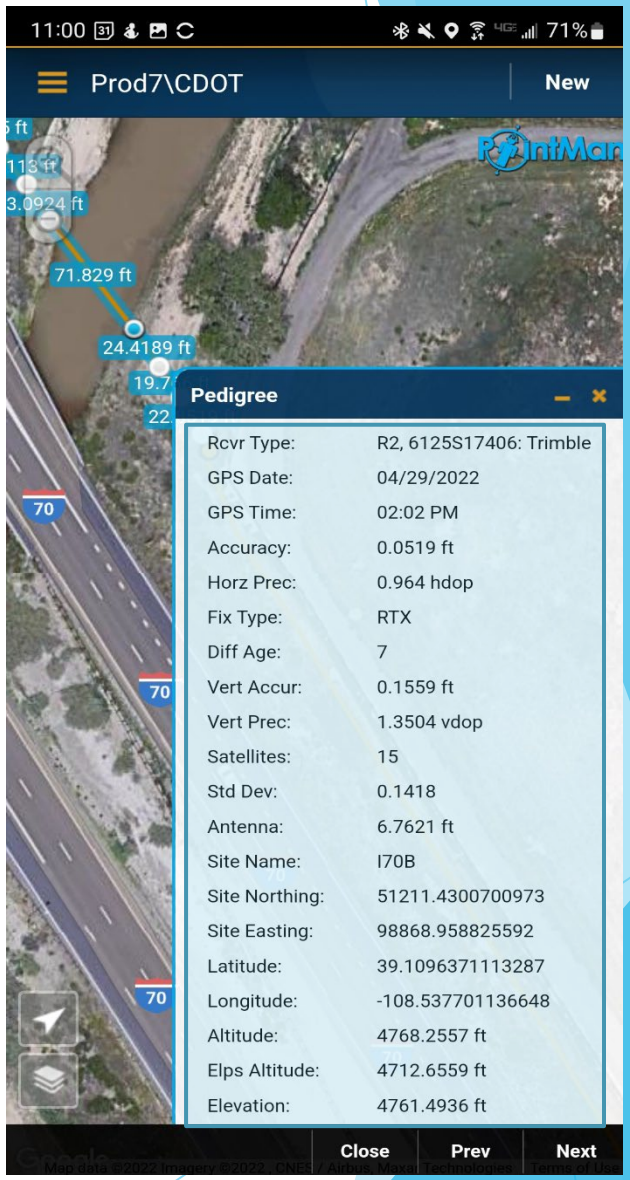


Subsurface Utility Engineering (SUE)

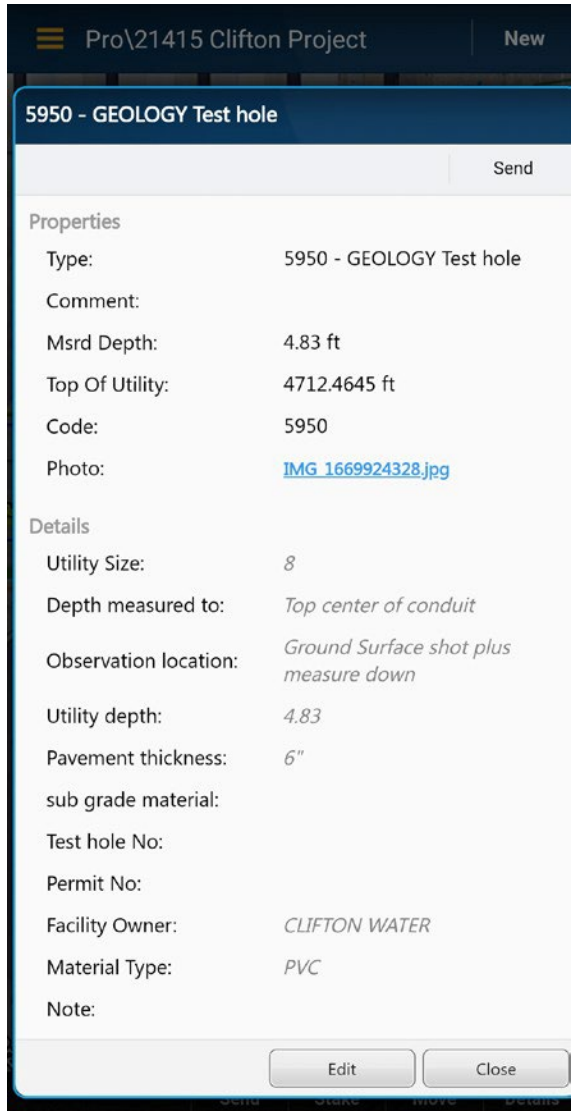
SUE Deliverables

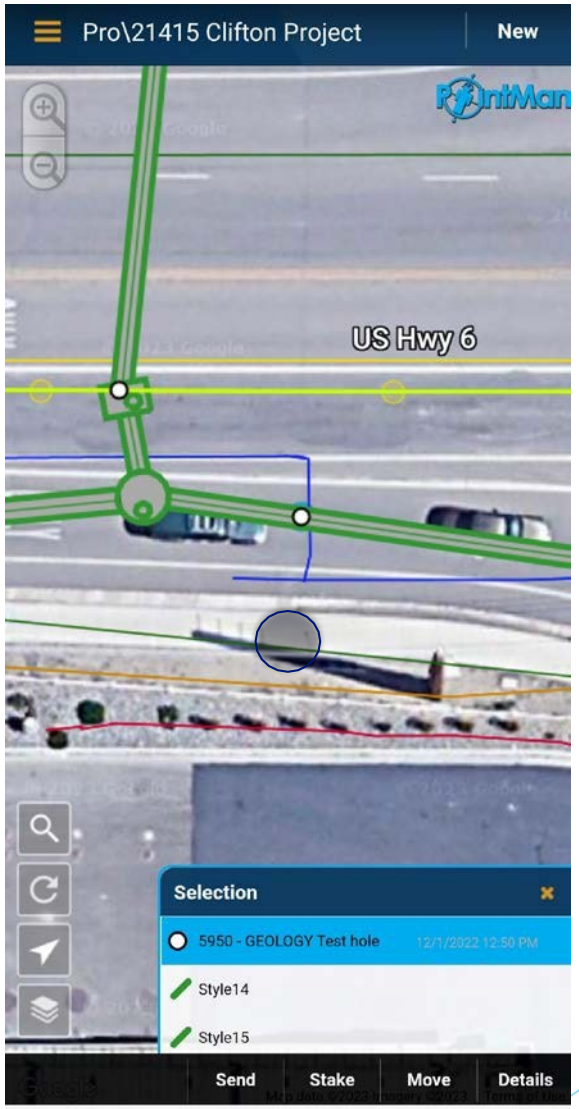


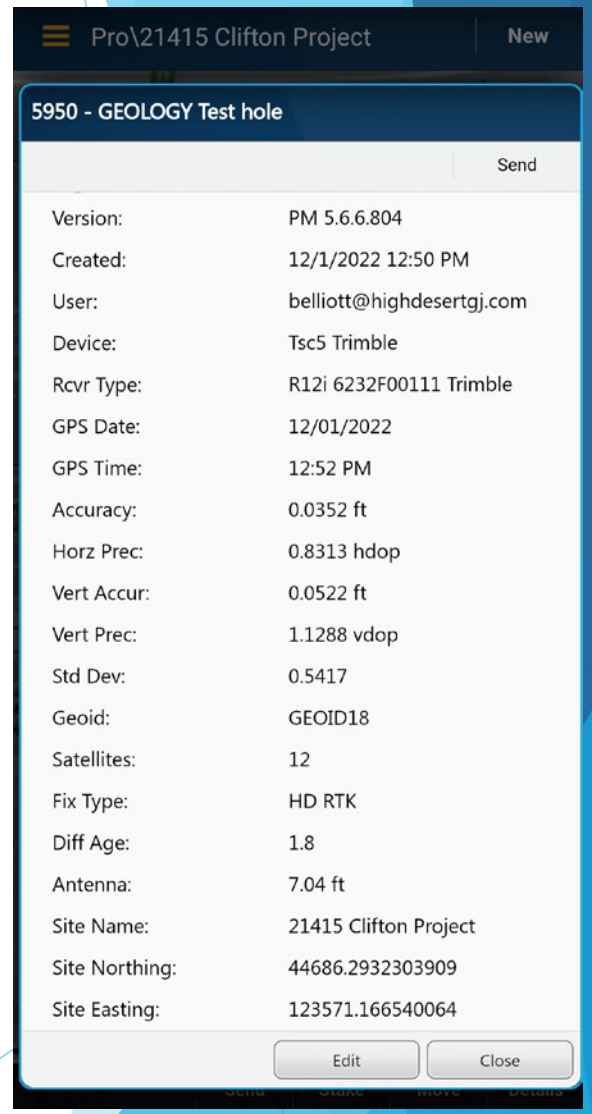




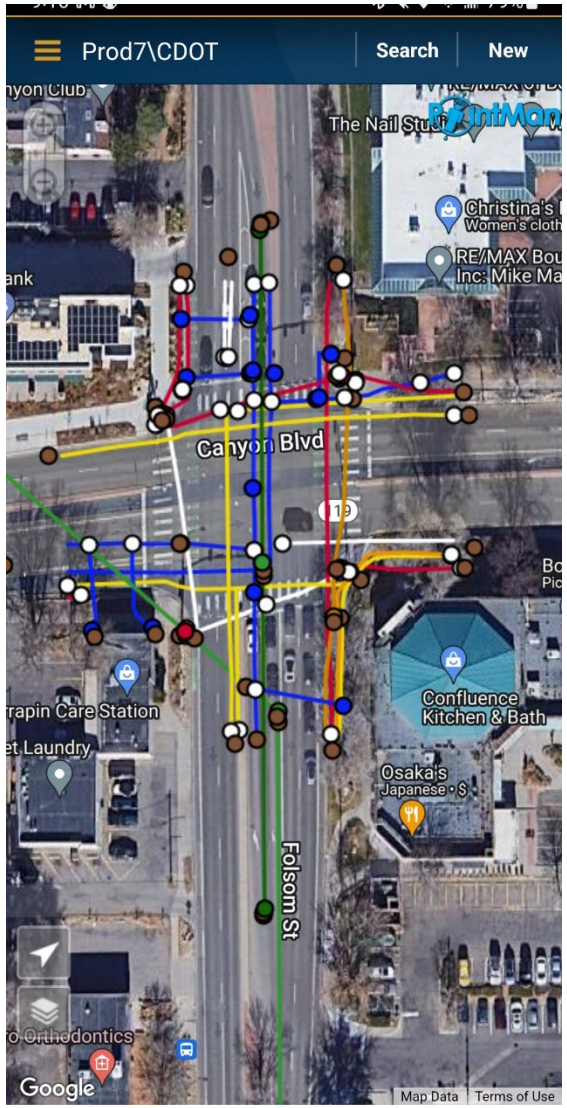
SUE QL-A per ASCE 38 Standards

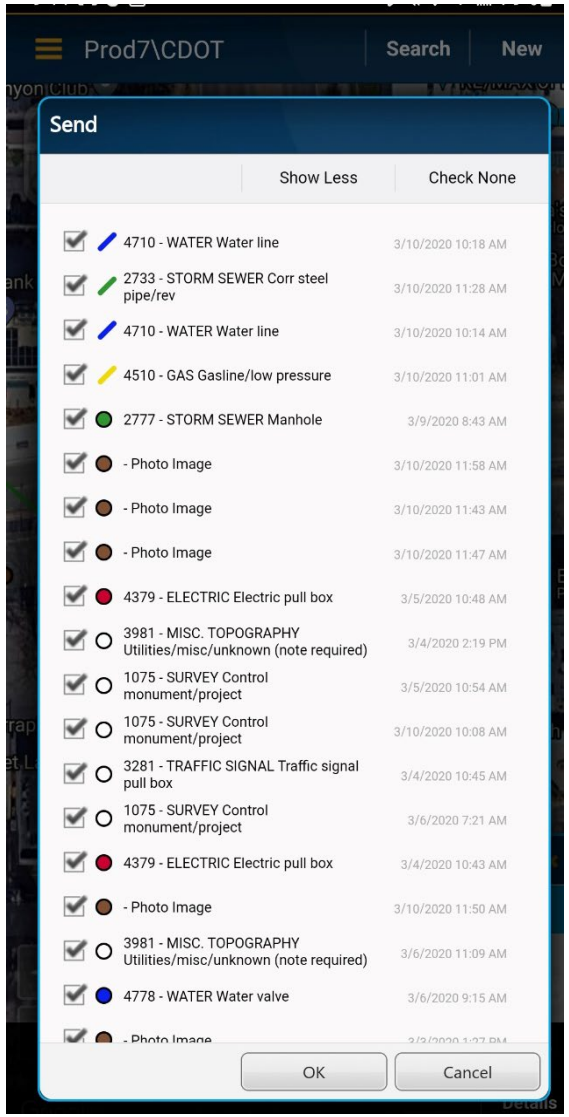


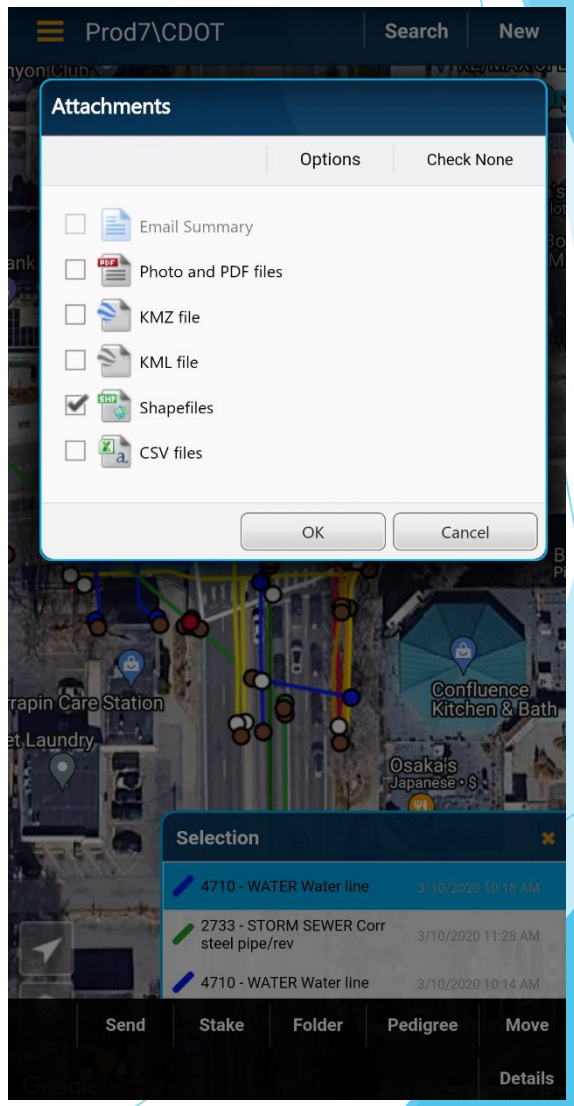




GIS export to CADD

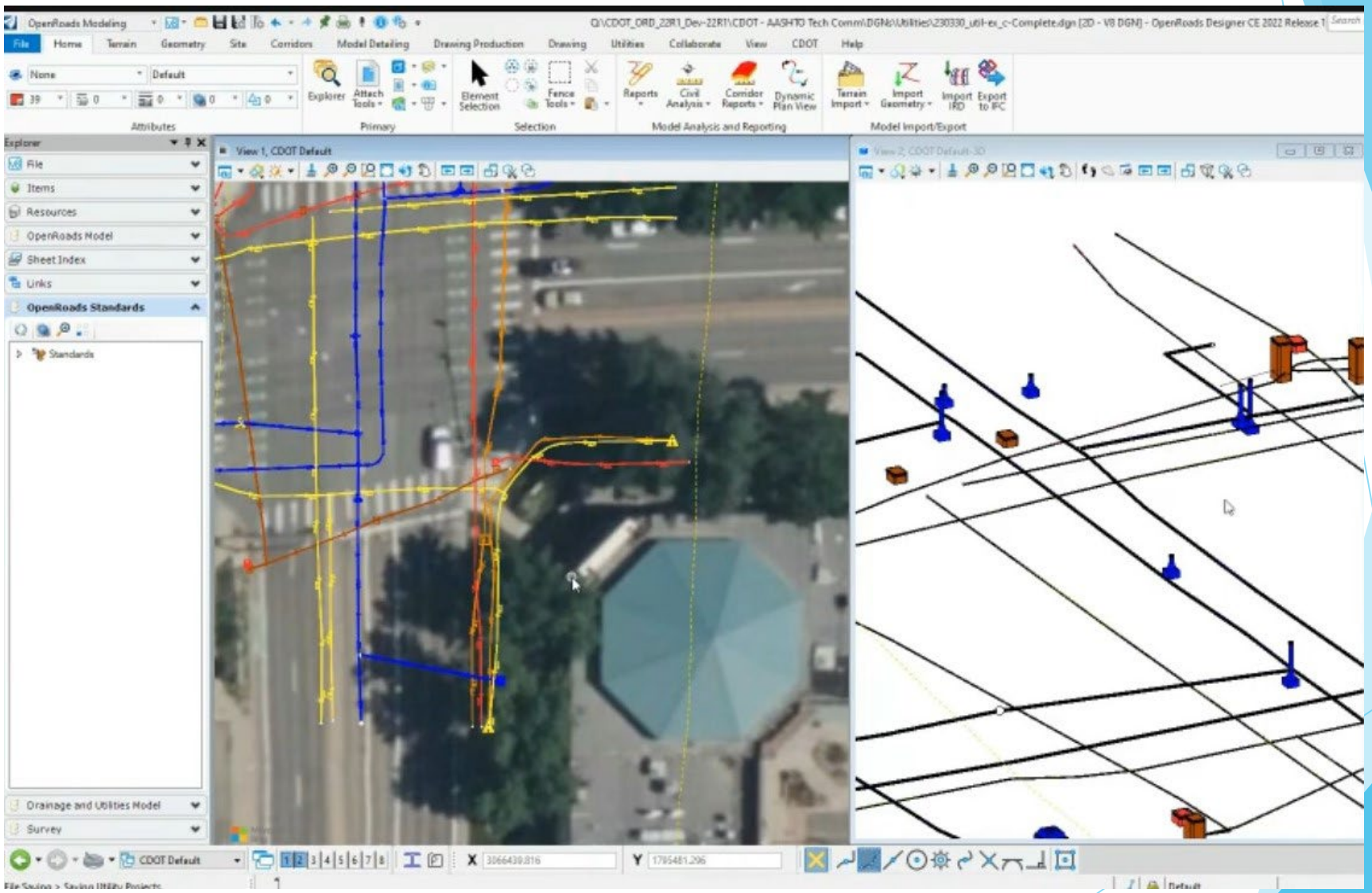






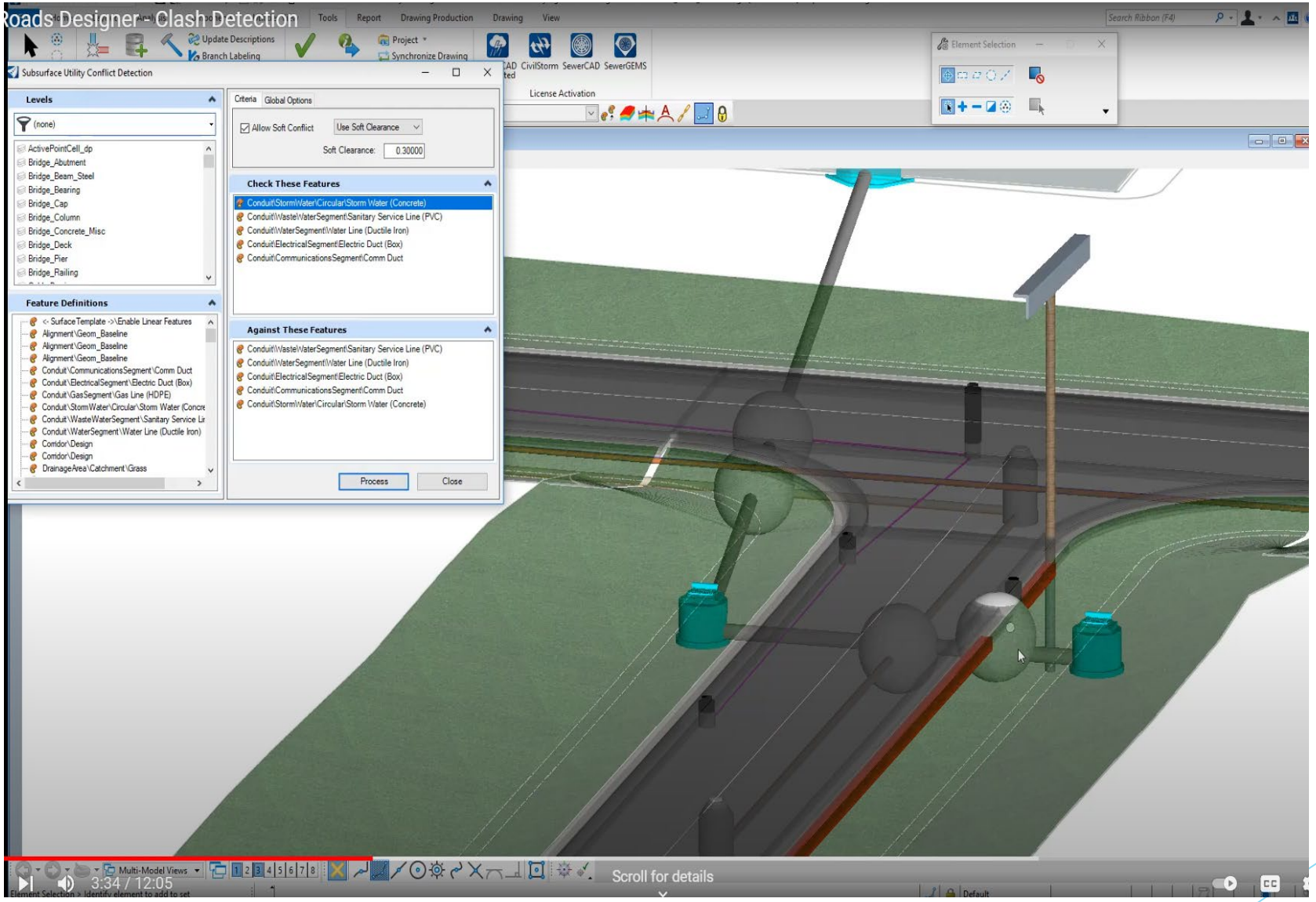
Data for Pre-construction Design

Plan View



3-D Modeling

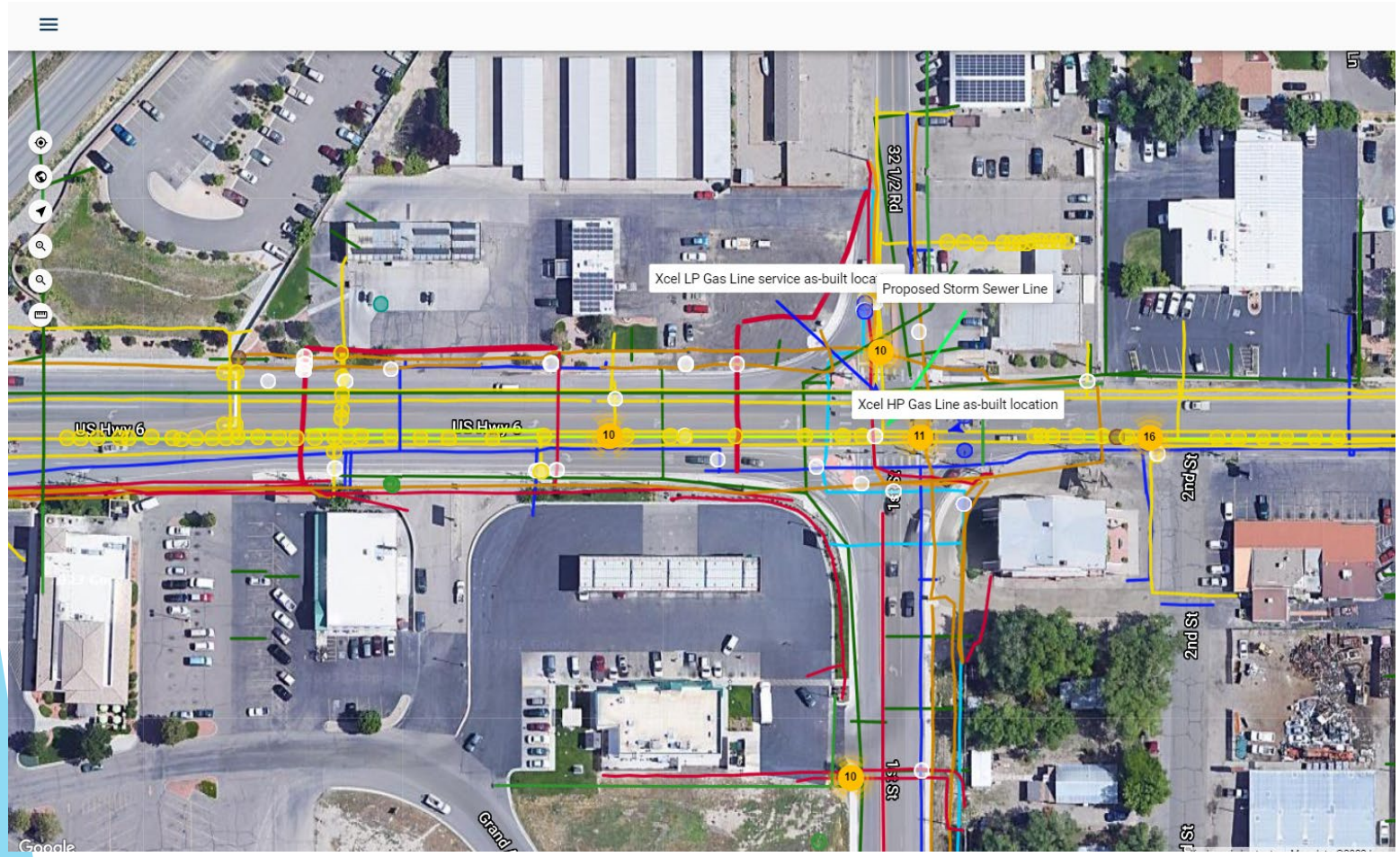
Data for Pre-construction Design



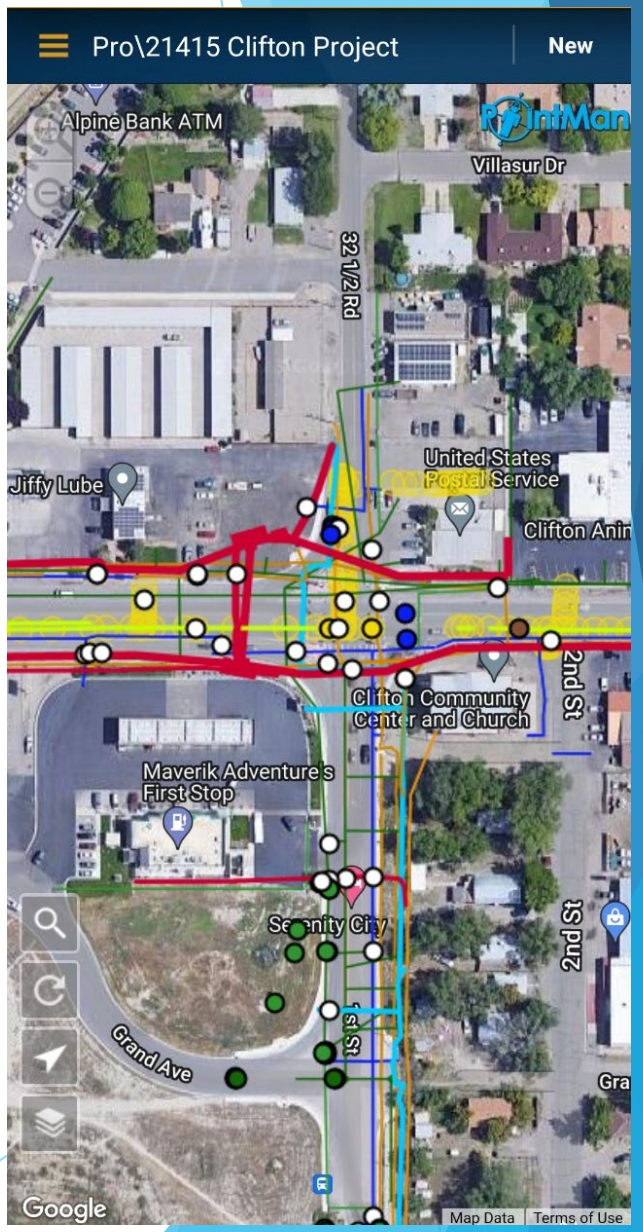
Construction

SUE CAD Data Available for Construction

GIS Database



Mobile Application



Construction Observation Reporting

Highway Construction Observation Report Form

COLORADO
Department of Transportation
eFORM

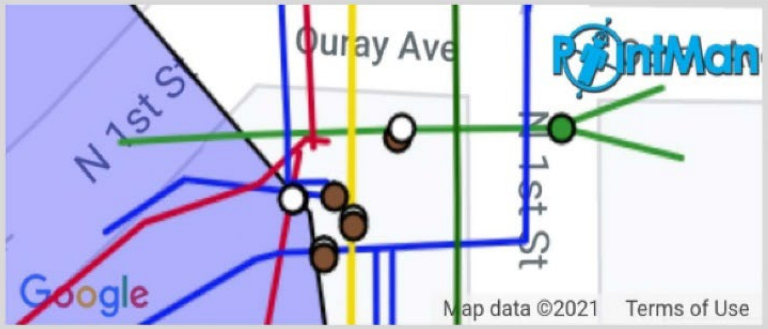
Highway Information

Permit Number:		Highway Milepost:	
Highway:	I-70B and 1 Street		
Permit Manager:	Joe Carter		
Utility Inspector:	Rob Martindale		

Location

Lat:	39.0713391666667	Long:	-108.570930833333
City:	Grand Junction	State:	CO

Map



Project Description

Xcel gas line relocation

Highway Construction Observation Report Form

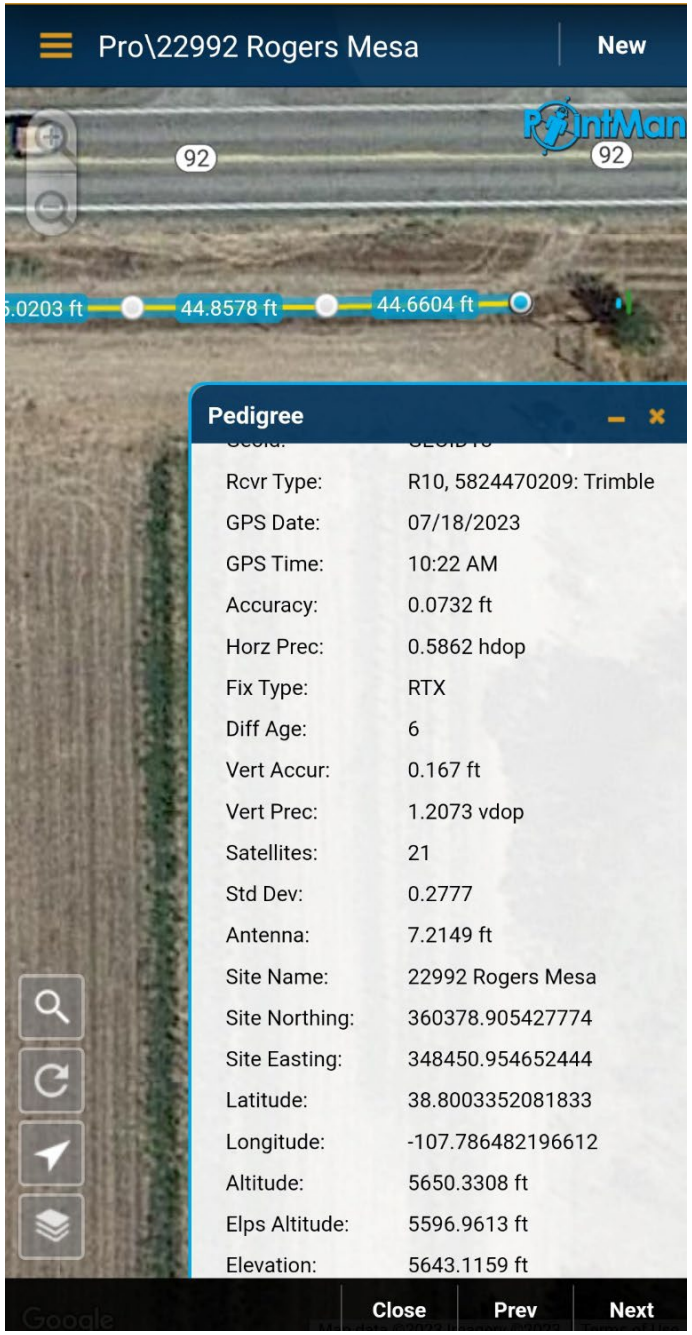
Photo 3

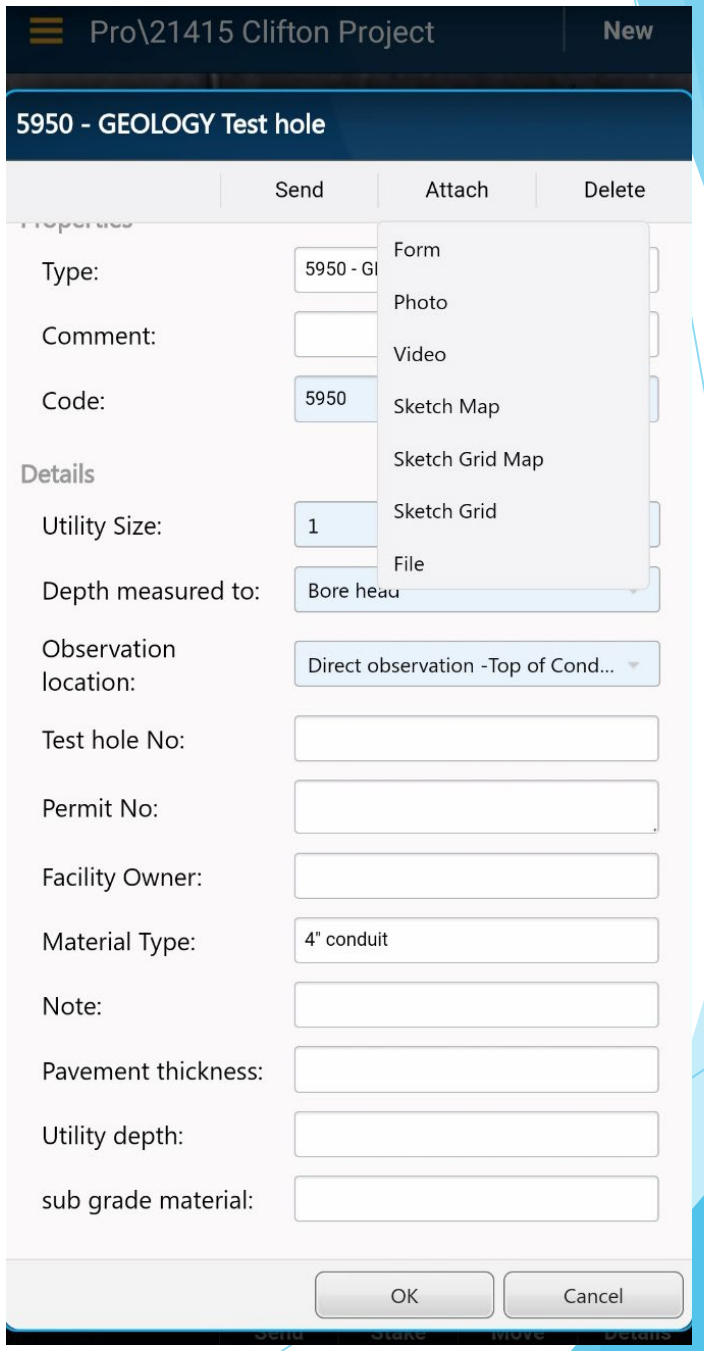
Notes

Photo 4

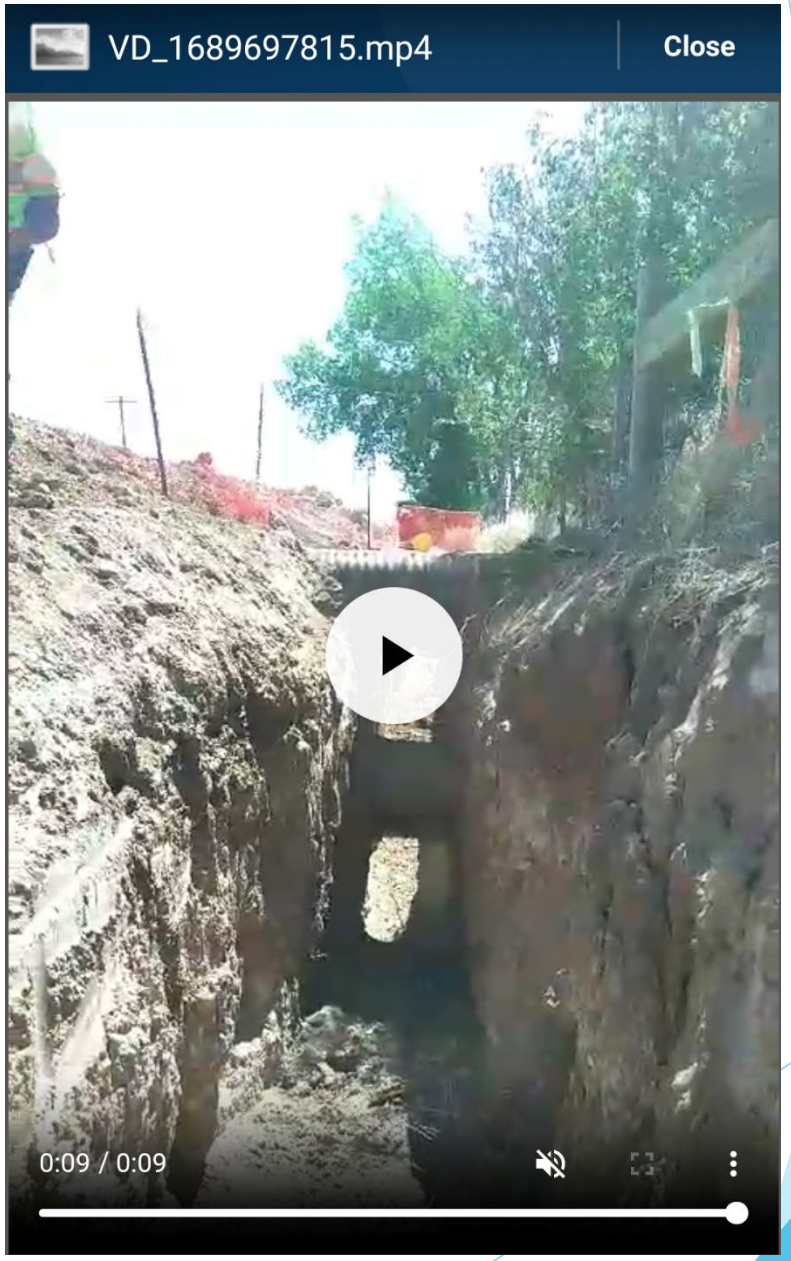
Notes

New line 90 degree bends will go under old gas line in black

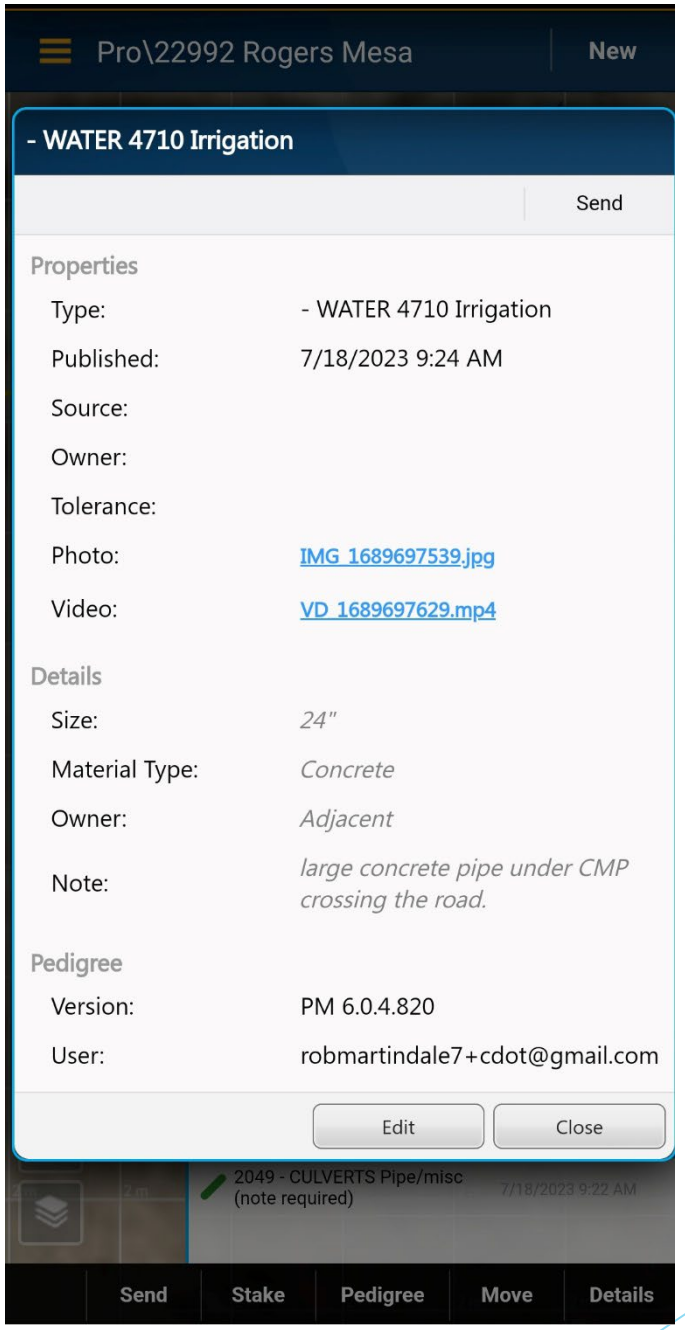

Pro\22992 Rogers Mesa
New
92
92
44.8578 ft
44.6604 ft
Pedigree
Rcvr Type: R10, 5824470209: Trimble
GPS Date: 07/18/2023
GPS Time: 10:22 AM
Accuracy: 0.0732 ft
Horz Prec: 0.5862 hdop
Fix Type: RTX
Diff Age: 6
Vert Accur: 0.167 ft
Vert Prec: 1.2073 vdop
Satellites: 21
Std Dev: 0.2777
Antenna: 7.2149 ft
Site Name: 22992 Rogers Mesa
Site Northing: 360378.905427774
Site Easting: 348450.954652444
Latitude: 38.8003352081833
Longitude: -107.786482196612
Altitude: 5650.3308 ft
Elps Altitude: 5596.9613 ft
Elevation: 5643.1159 ft
Close
Prev
Next

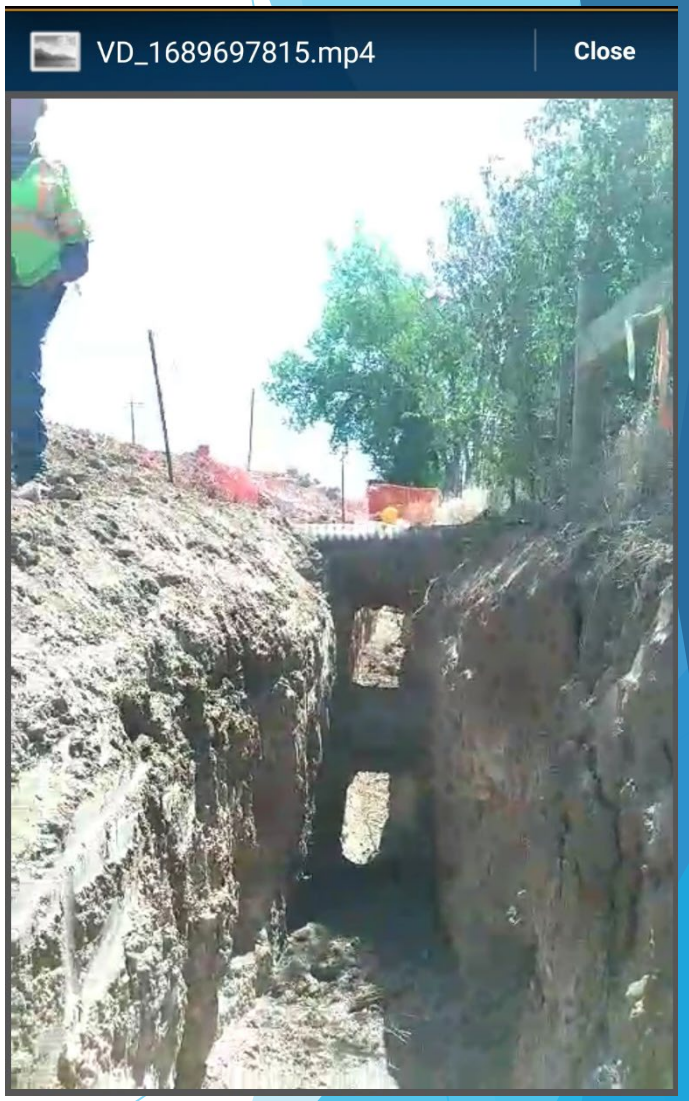

Pro\21415 Clifton Project
New
5950 - GEOLOGY Test hole
Send
Attach
Delete
Form
Photo
Video
Sketch Map
Sketch Grid Map
Sketch Grid
File
Type:
Comment:
Code:
5950
Details
Utility Size:
1
Depth measured to:
Observation location:
Direct observation -Top of Cond...
Test hole No:
Permit No:
Facility Owner:
Material Type:
4" conduit
Note:
Pavement thickness:
Utility depth:
sub grade material:
OK
Cancel


IMG_1689697744.jpg
Tools
Close
NW
N
NE


VD_1689697815.mp4
Close
0:09 / 0:09


Pro\22992 Rogers Mesa
New
Selection
- WATER 4710 Irrigation
7/18/2023 9:24 AM
2049 - CULVERTS Pipe/misc
(note required)
7/18/2023 9:22 AM
Send
Stake
Pedigree
Move
Details


Pro\22992 Rogers Mesa
New
- WATER 4710 Irrigation
Send
Properties
Type: - WATER 4710 Irrigation
Published: 7/18/2023 9:24 AM
Source:
Owner:
Tolerance:
Photo: IMG_1689697539.jpg
Video: VD_1689697629.mp4
Details
Size: 24"
Material Type: Concrete
Owner: Adjacent
Note: large concrete pipe under CMP crossing the road.
Pedigree
Version: PM 6.0.4.820
User: robmartindale7+cdot@gmail.com
Edit
Close
2049 - CULVERTS Pipe/misc
(note required)
7/18/2023 9:22 AM
Send
Stake
Pedigree
Move
Details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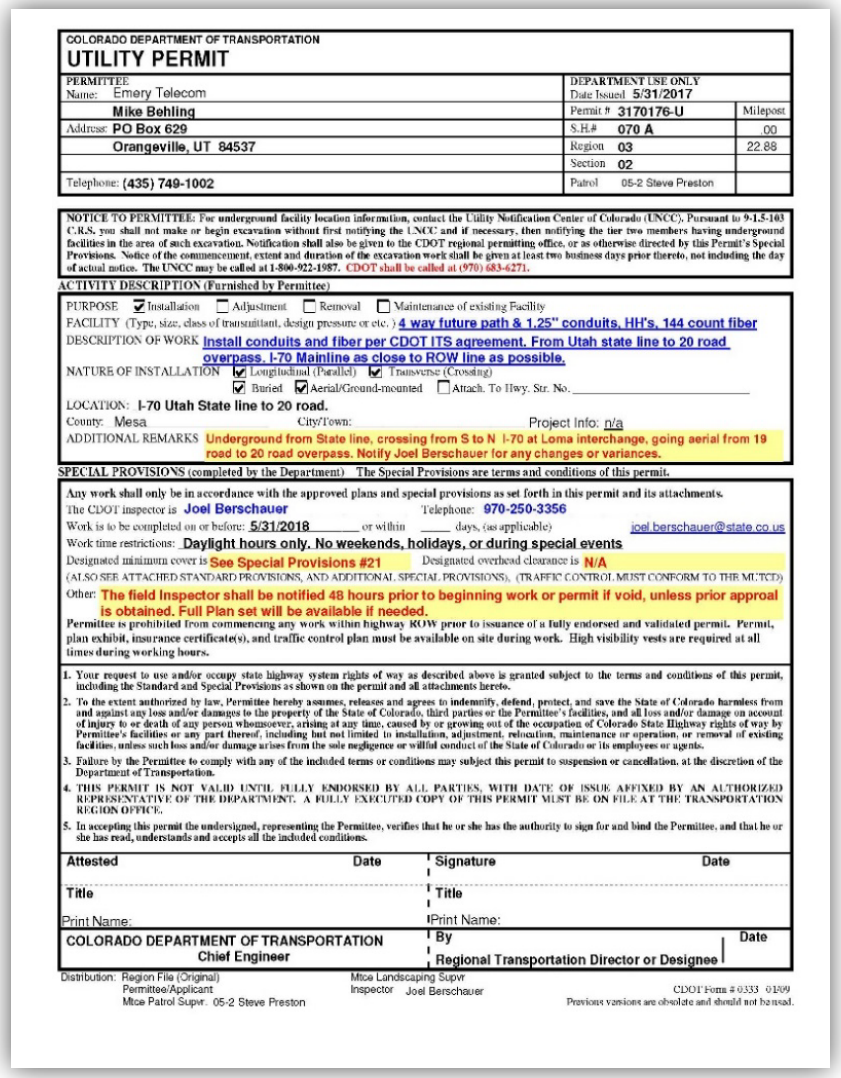
Close

Permitting

Digital As-builts Requirements



COLORADO DEPARTMENT OF TRANSPORTATION

UTILITY PERMIT

PERMITTEE	DEPARTMENT USE ONLY	
Name: Emery Telecom	Date Issued 5/31/2017	
Mike Behling	Permit # 3170176-U	Milepost
Address: PO Box 629	S.H.# 070 A	.00
Orangeville, UT 84537	Region 03	22.88
	Section 02	
Telephone: (435) 749-1002	Patrol 05-2 Steve Preston	

NOTICE TO PERMITTEE: For underground facility location information, contact the Utility Notification Center of Colorado (UNCC). Pursuant to 9-1.5-103 C.R.S. you shall not make or begin excavation without first notifying the UNCC and if necessary, then notifying the tier two members having underground facilities in the area of such excavation. Notification shall also be given to the CDOT regional permitting office, or as otherwise directed by this Permit's Special Provisions. Notice of the commencement, extent and duration of the excavation work shall be given at least two business days prior thereto, not including the day of actual notice. The UNCC may be called at 1-800-922-1987. CDOT shall be called at (970) 683-6271.

ACTIVITY DESCRIPTION (Furnished by Permittee)

PURPOSE ☑ Installation ☐ Adjustment ☐ Removal ☐ Maintenance of existing Facility

FACILITY (Type, size, class of transmittant, design pressure or etc.) 4 way future path & 1.25" conduits, HH's, 144 count fiber

DESCRIPTION OF WORK Install conduits and fiber per CDOT ITS agreement. From Utah state line to 20 road overpass. I-70 Mainline as close to ROW line as possible.

NATURE OF INSTALLATION ☑ Longitudinal (Parallel) ☑ Transverse (Crossing) ☑ Buried ☑ Aerial/Ground-mounted ☐ Attach. To Hwy. Str. No. _____

LOCATION: I-70 Utah State line to 20 road.

County: Mesa City/Town: _____ Project Info: n/a

ADDITIONAL REMARKS Underground from State line, crossing from S to N I-70 at Loma interchange, going aerial from 19 road to 20 road overpass. Notify Joel Berschauer for any changes or variances.

SPECIAL PROVISIONS (completed by the Department) The Special Provisions are terms and conditions of this permit.

Any work shall only be in accordance with the approved plans and special provisions as set forth in this permit and its attachments.

The CDOT inspector is Joel Berschauer Telephone: 970-250-3356

Work is to be completed on or before: 5/31/2018 or within ____ days, (as applicable) joel.berschauer@state.co.us

Work time restrictions: Daylight hours only. No weekends, holidays, or during special events

Designated minimum cover is See Special Provisions #21 Designated overhead clearance is N/A

(ALSO SEE ATTACHED STANDARD PROVISIONS, AND ADDITIONAL SPECIAL PROVISIONS), (TRAFFIC CONTROL MUST CONFORM TO THE MUTCD)

Other: The field Inspector shall be notified 48 hours prior to beginning work or permit if void, unless prior approal is obtained. Full Plan set will be available if needed.

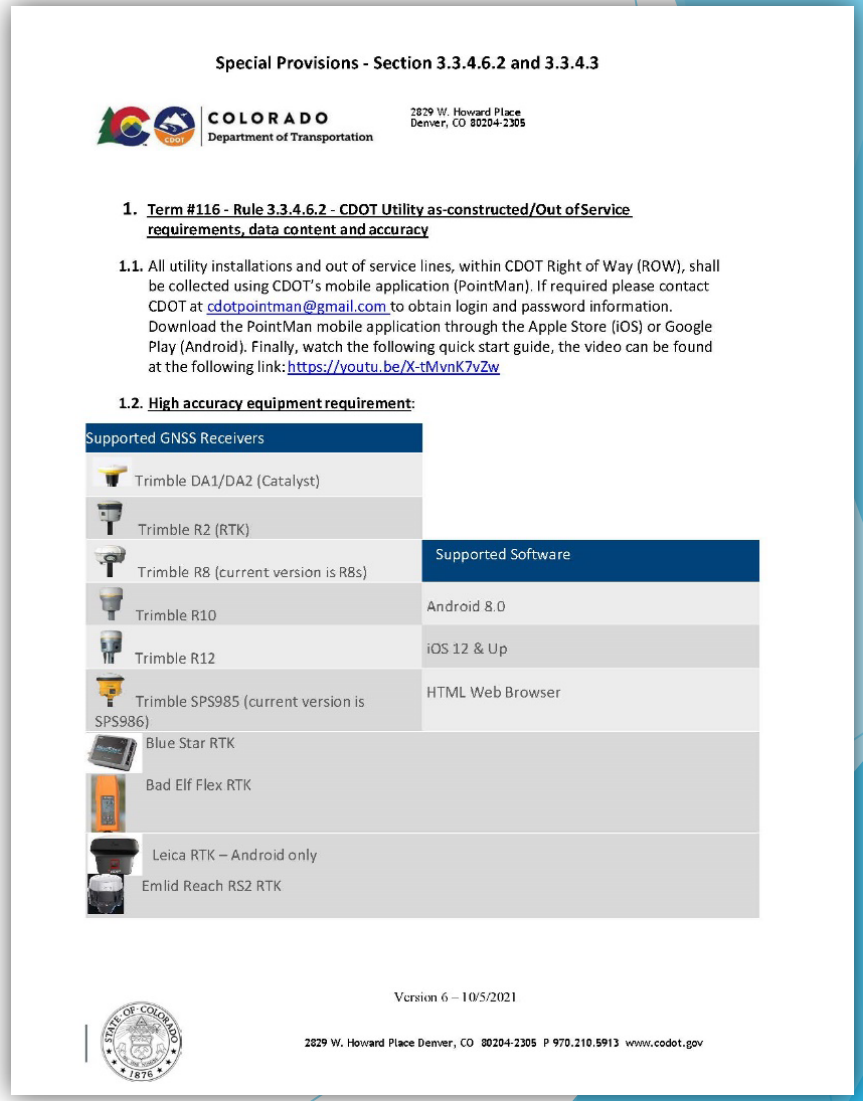
Permittee is prohibited from commencing any work within highway ROW prior to issuance of a fully endorsed and validated permit. Permit, plan exhibit, insurance certificate(s), and traffic control plan must be available on site during work. High visibility vests are required at all times during working hours.

1. Your request to use and/or occupy state highway system rights of way as described above is granted subject to the terms and conditions of this permit, including the Standard and Special Provisions as shown on the permit and all attachments hereto.
2. To the extent authorized by law, Permittee hereby assumes, releases and agrees to indemnify, defend, protect, and save the State of Colorado harmless from and against any loss and/or damages to the property of the State of Colorado, third parties or the Permittee's facilities, and all loss and/or damage on account of injury to or death of any person whomsoever, arising at any time, caused by or growing out of the occupation of Colorado State Highway rights of way by Permittee's facilities or any part thereof, including but not limited to installation, adjustment, relocation, maintenance or operation, or removal of existing facilities, unless such loss and/or damage arises from the sole negligence or willful conduct of the State of Colorado or its employees or agents.
3. Failure by the Permittee to comply with any of the included terms or conditions may subject this permit to suspension or cancellation, at the discretion of the Department of Transportation.
4. THIS PERMIT IS NOT VALID UNTIL FULLY ENDORSED BY ALL PARTIES, WITH DATE OF ISSUE AFFIXED BY AN AUTHORIZED REPRESENTATIVE OF THE DEPARTMENT. A FULLY EXECUTED COPY OF THIS PERMIT MUST BE ON FILE AT THE TRANSPORTATION REGION OFFICE.
5. In accepting this permit the undersigned, representing the Permittee, verifies that he or she has the authority to sign for and bind the Permittee, and that he or she has read, understands and accepts all the included conditions.

Attested	Date	Signature	Date
Title		Title	
Print Name:		Print Name:	
COLORADO DEPARTMENT OF TRANSPORTATION Chief Engineer		By Regional Transportation Director or Designee	Date

Distribution: Region File (Original) Permittee/Applicant Mtce Patrol Supvr: 05-2 Steve Preston Mtce Landscaping Supvr Inspector Joel Berschauer

CDOT Form # 0333 01/09 Previous versions are obsolete and should not be used.



Special Provisions - Section 3.3.4.6.2 and 3.3.4.3

COLORADO Department of Transportation

2829 W. Howard Place Denver, CO 80204-2305

1. **Term #116 - Rule 3.3.4.6.2 - CDOT Utility as-constructed/Out of Service requirements, data content and accuracy**

1.1. All utility installations and out of service lines, within CDOT Right of Way (ROW), shall be collected using CDOT's mobile application (PointMan). If required please contact CDOT at cdotpointman@gmail.com to obtain login and password information. Download the PointMan mobile application through the Apple Store (iOS) or Google Play (Android). Finally, watch the following quick start guide, the video can be found at the following link: https://youtu.be/X-tMvnK7vZw

1.2. **High accuracy equipment requirement**:

Supported GNSS Receivers
Trimble DA1/DA2 (Catalyst)
Trimble R2 (RTK)
Trimble R8 (current version is R8s)
Trimble R10
Trimble R12
Trimble SPS985 (current version is SPS986)
Blue Star RTK
Bad Elf Flex RTK
Leica RTK – Android only
Emlid Reach RS2 RTK

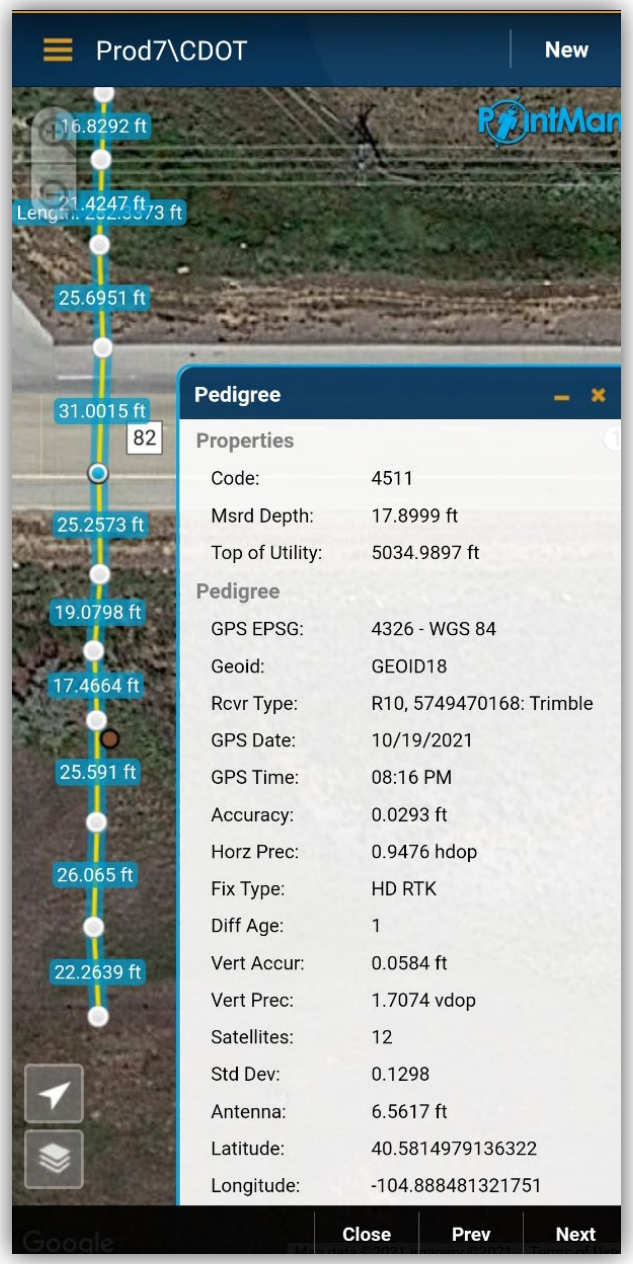
Supported Software
Android 8.0
iOS 12 & Up
HTML Web Browser

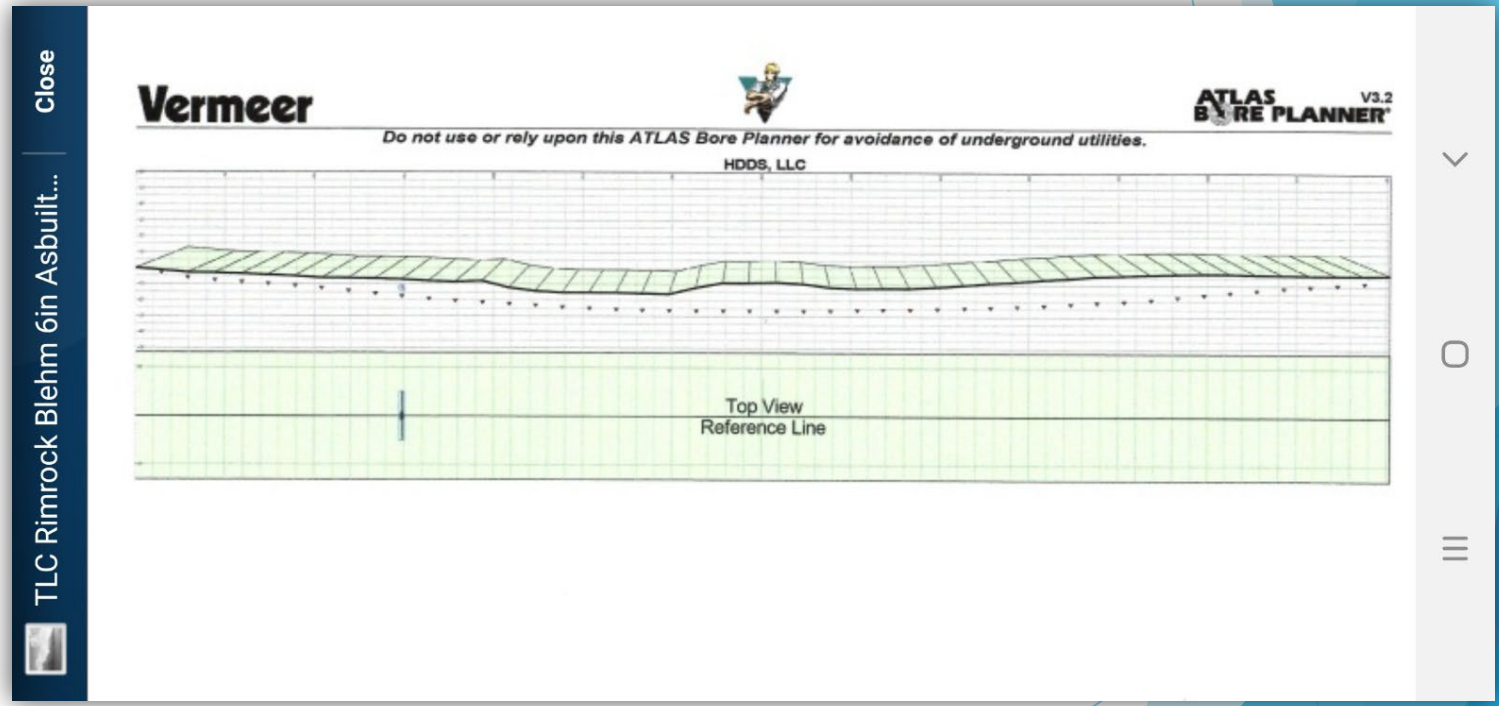
Version 6 – 10/5/2021

2829 W. Howard Place Denver, CO 80204-2305 P 970.210.5913 www.codot.gov

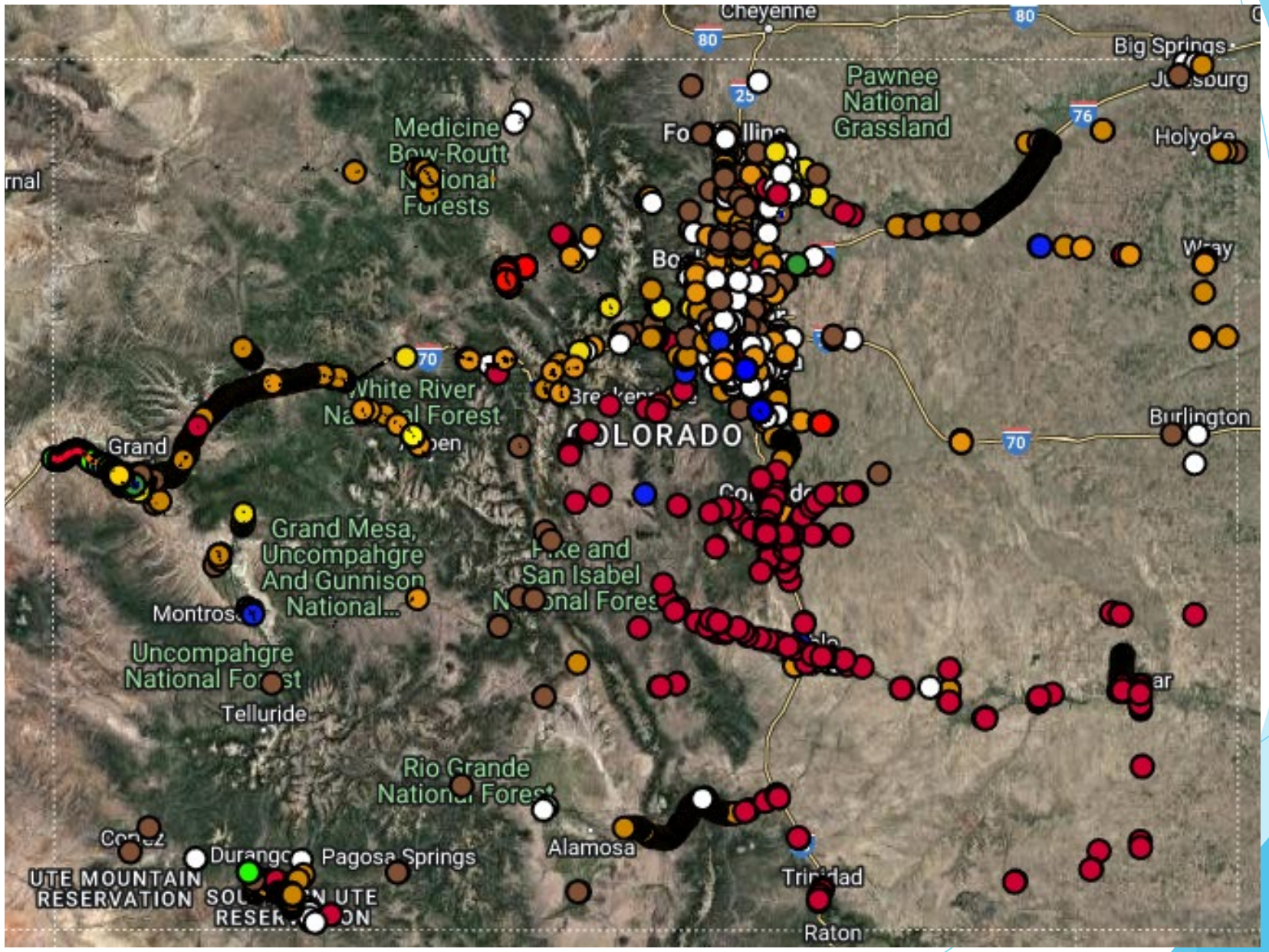
Example of Horizontal Directional Drilled (HDD or Bored) installation

Geospatial data





Statewide Database



MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT) DIGITAL VISION

ANDREW BLOCK – MDOT DESIGN SERVICES

Disruptive Change is NOT around the corner - it's here already

- Statewide Document Management System – 2003
- eProposal – 2005
- ArcGIS Enterprise geospatial database – 2008
- eConstruction – 2014
- Required 3D Design Models – 2015
- Automated Machine Guidance – 2016
- Digital Delivery Pilots – 2017
- Ancillary Asset Management System - 2020

ANCILLARY ASSET MANAGEMENT SYSTEM

Program Goals

- ☑ To minimize public safety risks due to deterioration of asset conditions
- ☑ To develop an asset management program for ancillary structures
- ☑ To develop and maintain an Ancillary Structures database framework
- ☑ To develop and maintain an ancillary structures program which results in consistency in managing the various ancillary structure types deployed by MDOT

ANCILLARY ASSET MANAGEMENT SYSTEM

Data Dictionary

- Living Document
- Data quality and understanding
- Continuous improvement as Inspectors and Program Staff identify areas

FieldName	Description/Definition	AliasName	DomainName	How to populate
GlobalID	Unique Global Asset ID (auto generated)	GlobalID		Auto
strc_num	Number uniquely identifies the structure and is a fixed ID within the AS program	Structure Number		Auto
strc_num_seq	Structure number sequence is the numeric component of strc_num. It will be calculated in a background, scripted process and concatenated with the prefix of the Ancillary Structure to create the strc_num field	Structure Number Sequence		Auto
serv_stat_cd	Service status of the asset. Options consist of Abandoned, Active, Proposed, Removed	Service Status	serv_stat_cdtb	Pre-populate, Inspector Verify
next_insp_freq	Inspection frequency in months	Next Inspection Frequency		Auto-populated from Inspection
insp_grp_cd	Inspection group assigned to inspect the structure. Coded-value where first four characters indicates the Inspection Company, and the second four characters indicates the group.	Inspection Group		Pre-populate, Inspector Verify
next_insp_date	Calculated field indicating the date of the next anticipated inspection based on date of previous inspection and the next_insp_freq value. (antcp_insp_date = last_insp_date + next_insp_freq)	Anticipated Inspection Date		Auto
crewhrs	Number of crew hours required for a regular inspection for the structure. This field is intended for staff and budget planning purposes. This value will initially be left blank and populated after a sufficient number of representative inspections have been completed.	Crew Hours		Office-populated

ANCILLARY ASSET MANAGEMENT SYSTEM

Michigan Ancillary Structure Inspection Manual

Programs › Bridges & Structures › Structure Preservation & Management › Ancillary Structures

MDOT's Ancillary Structures Unit implements the department's asset management program for ancillary structures per the Michigan Ancillary Structures Manual (MiASM). They perform comprehensive asset management of ancillary structures, serve as MDOT's ancillary structures expert, and provide data to region staff regarding ancillary structure inventory, inspection, and maintenance issues. They also perform structural design technical reviews of detailed shop drawings and field construction related documents required to be submitted for review and approval.

Ancillary Structures

- Sign Cantilever
- Communication Tower
- Dynamic Message Sign (DMS) Support Structure
- Environmental Sensor Station (ESS) Lattice Tower
- Lighting Tower
- Noise Barrier Wall
- Retaining Wall

Resources

Michigan Ancillary Structure Inspection Manual (MiASIM)

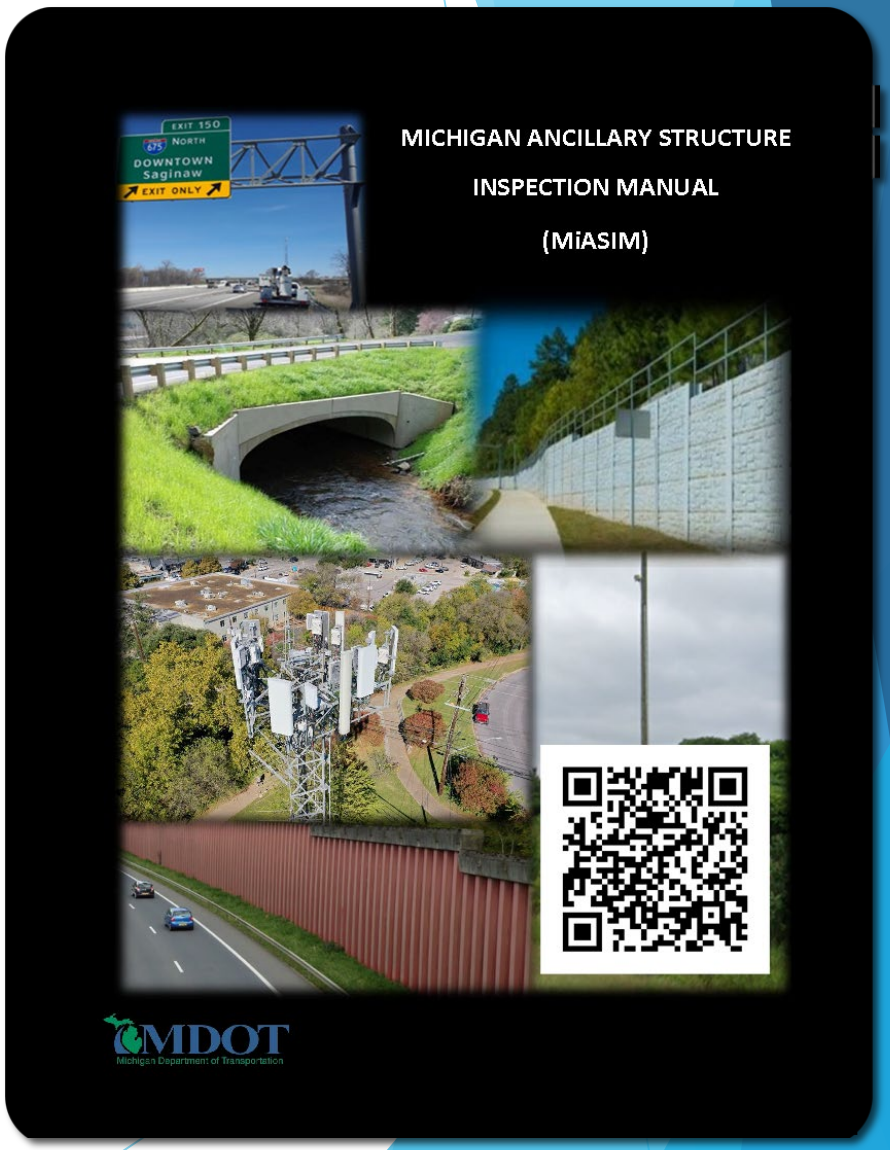
MiASIM Appendix A

MiASIM Appendix B

Cantilever, Type E Installation Inspection Procedure

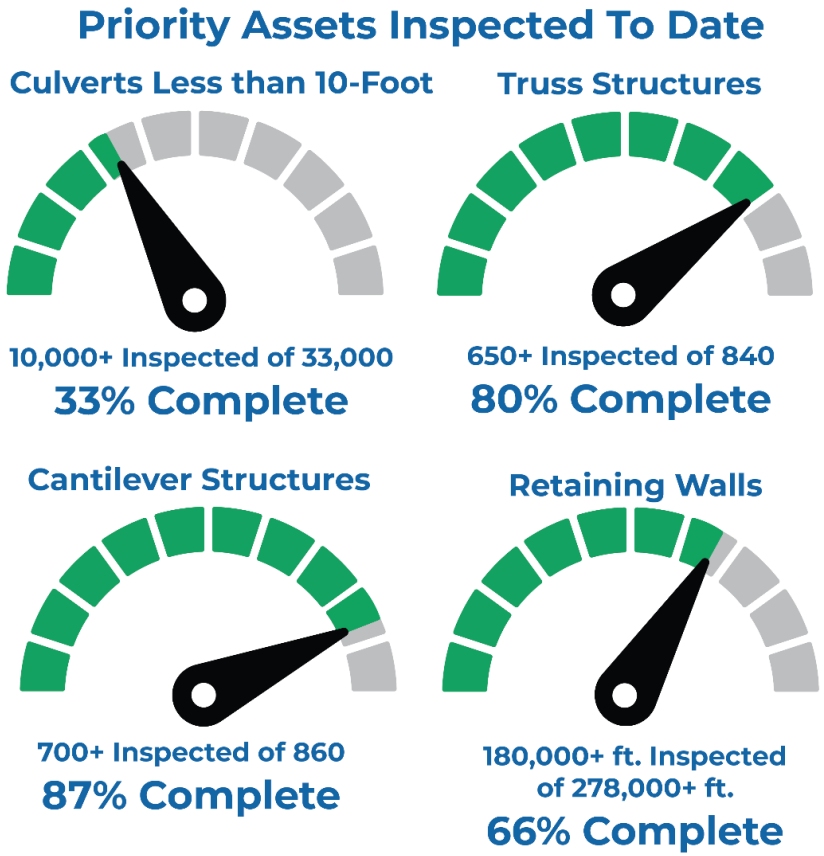
Cantilever, Type J Installation Inspection Procedure

Frangible Light Standard Installation Inspection Procedure



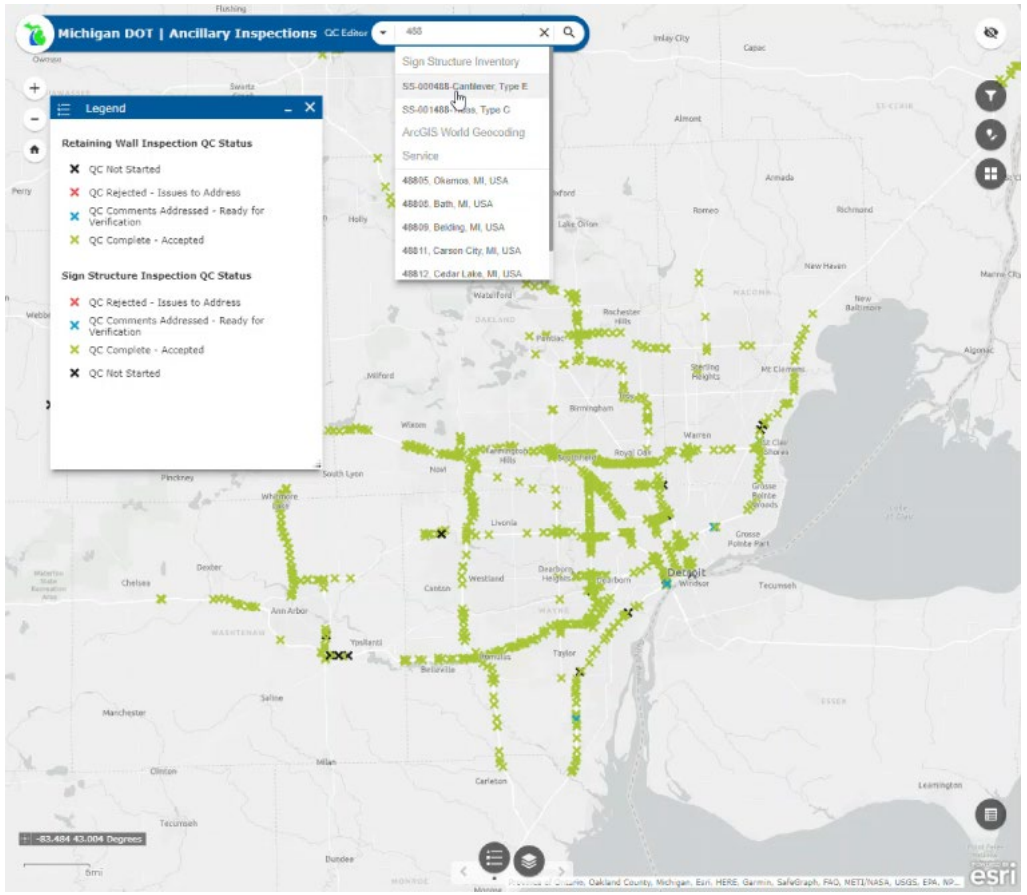
ANCILLARY ASSET MANAGEMENT SYSTEM

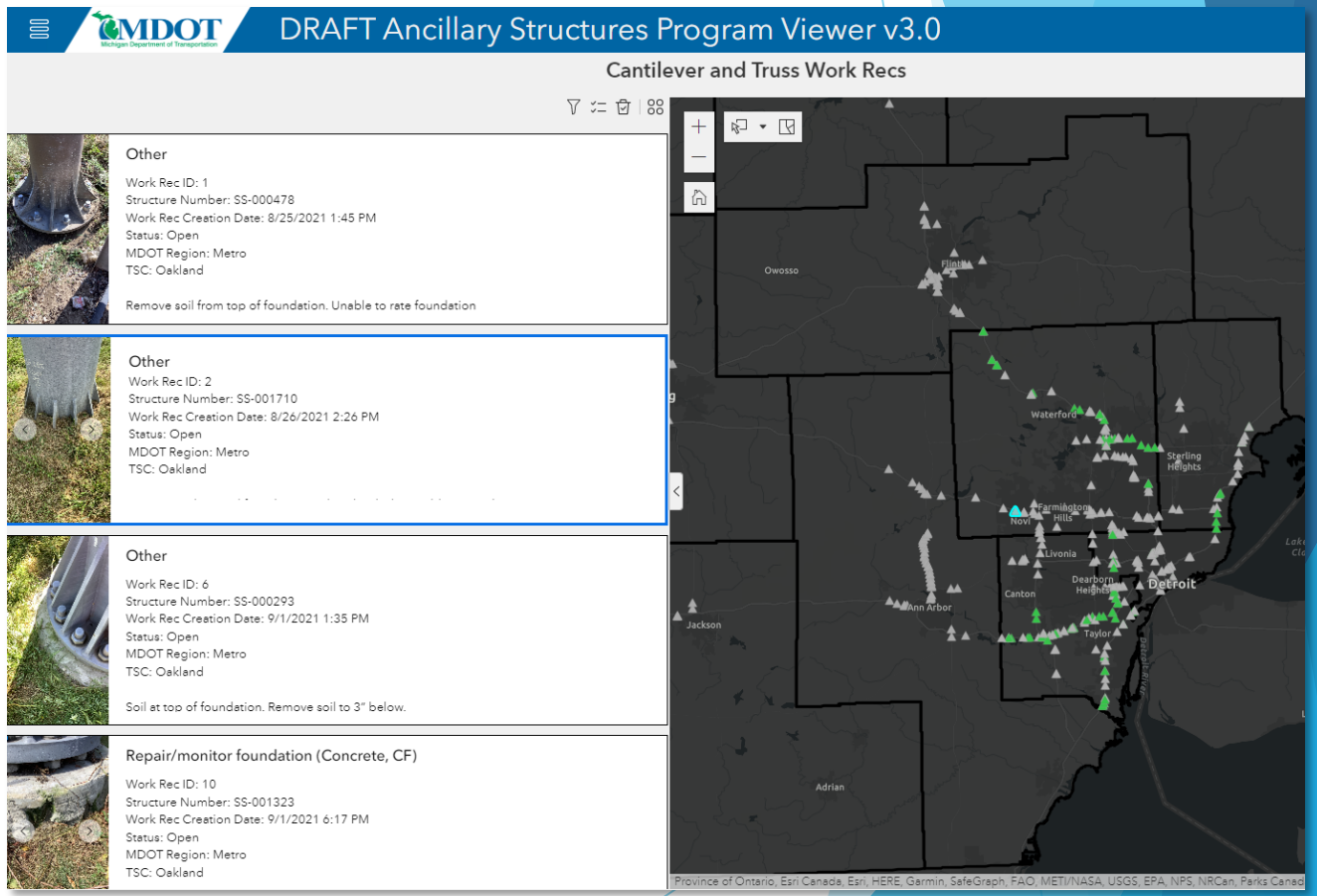
Priority Assets Inspected



ANCILLARY ASSET MANAGEMENT SYSTEM

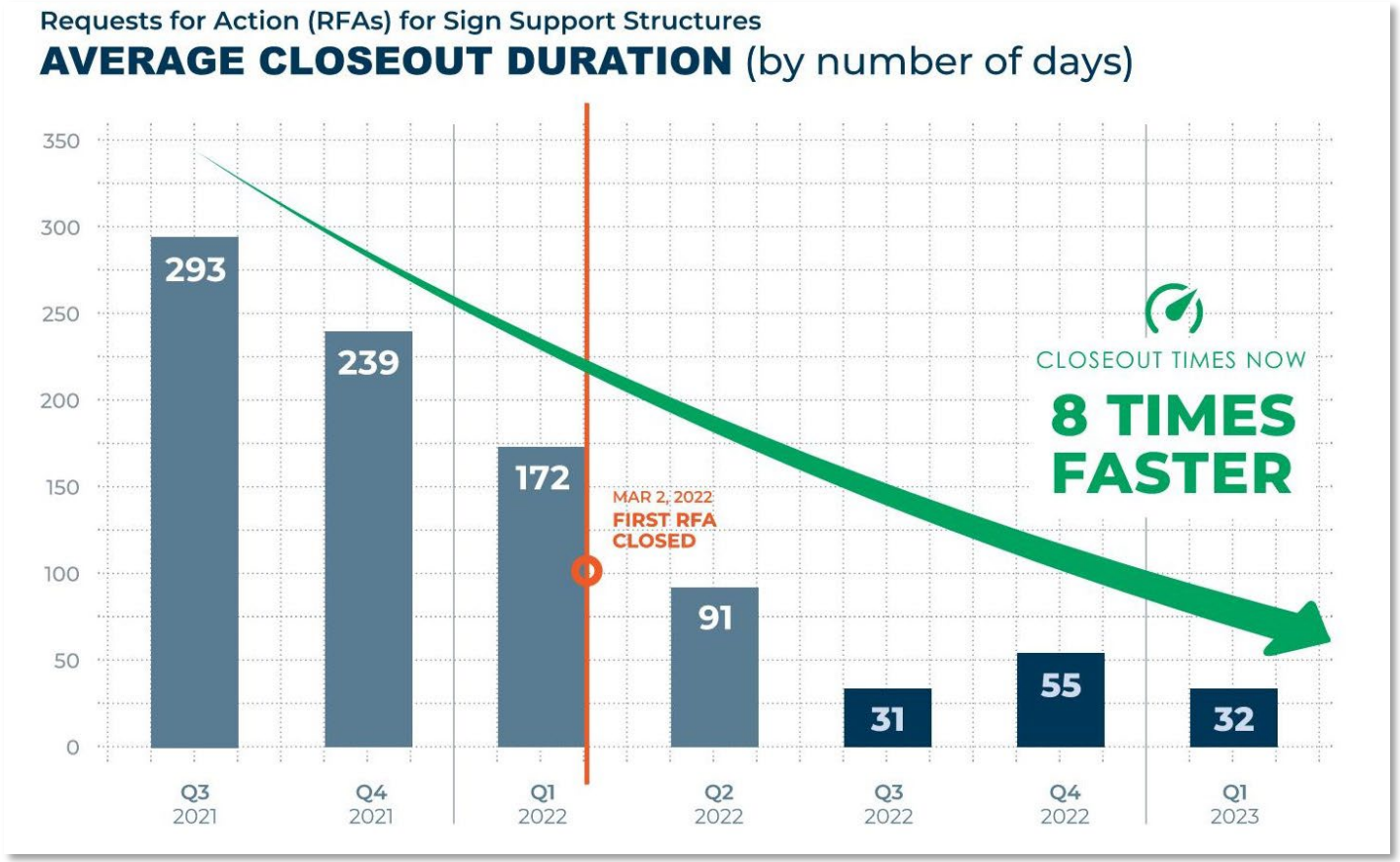
Work Recommendations





ANCILLARY ASSET MANAGEMENT SYSTEM

RFA Resolutions



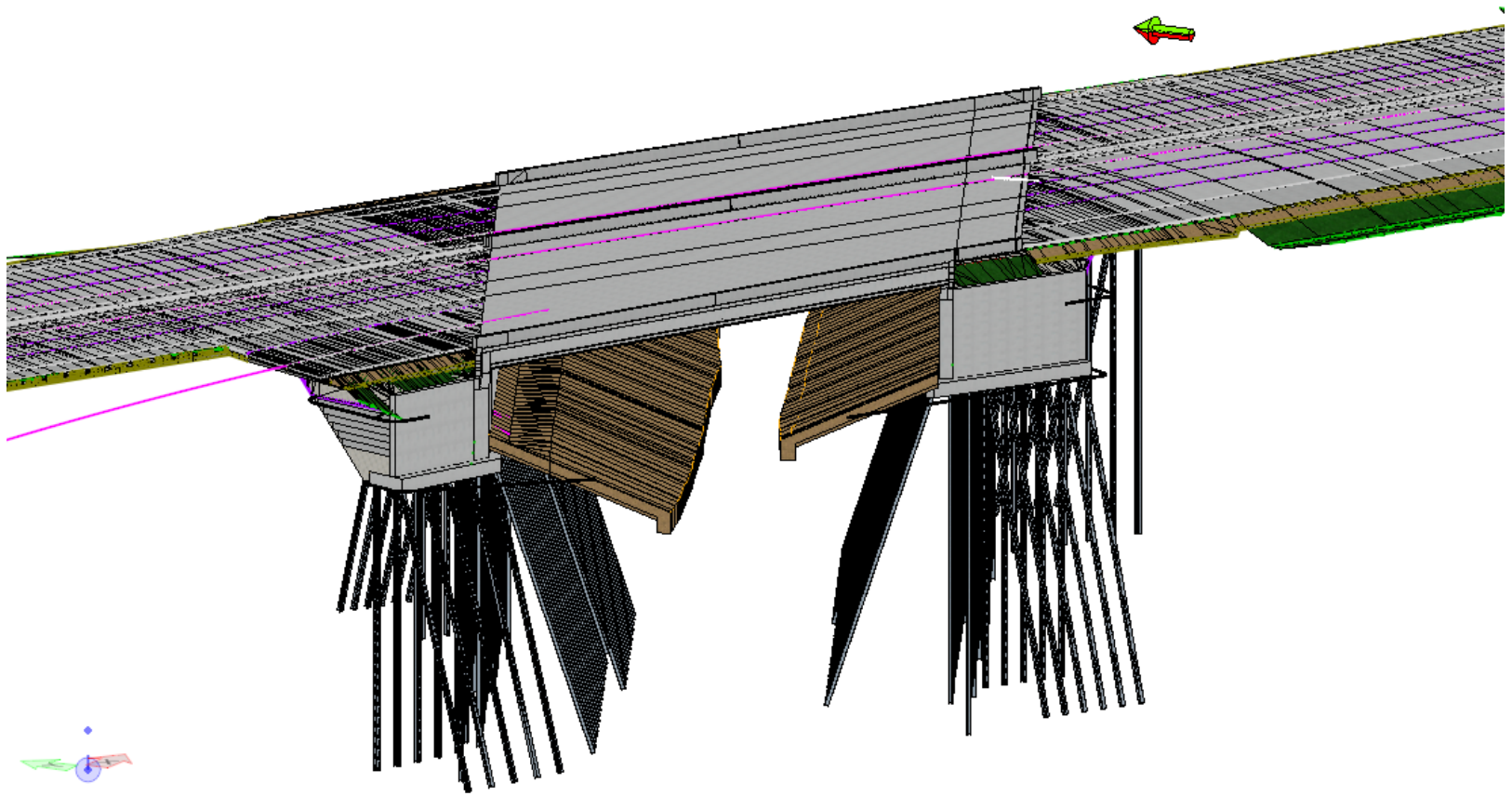
Following the implementation of MDOT's new asset management program, average closeout duration has been **reduced from 9 months to one month.**

Average closeout duration
Q3 2021
293 days

First Request for Action
(RFA) closeout
March 2, 2022

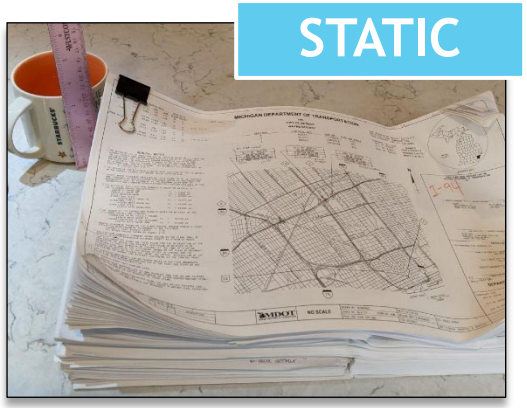
Average closeout duration after first RFA closeout
39 days

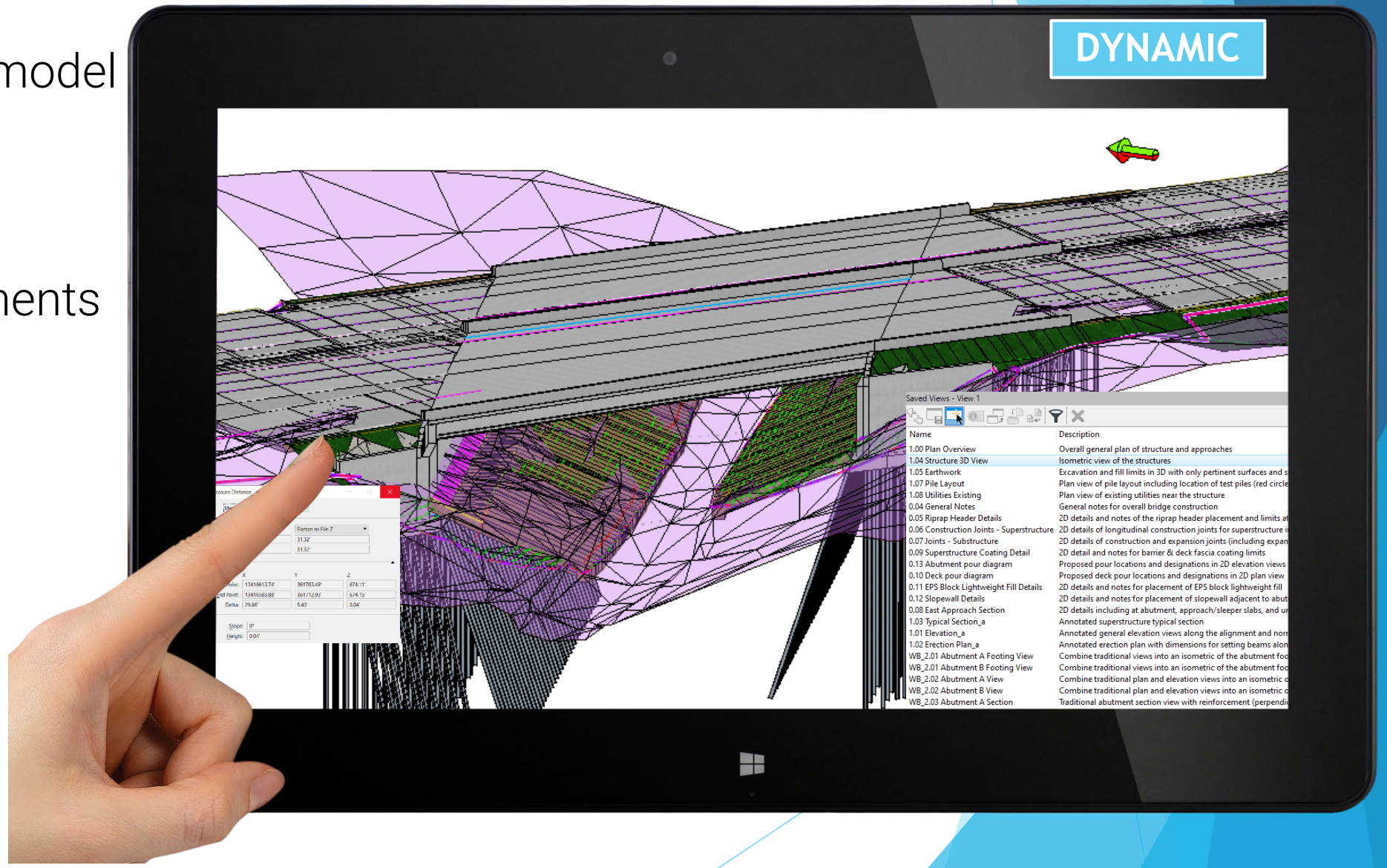
DIGITAL DELIVERY PILOT



CONTRACTUAL MODEL

- Access design from model
- Dynamic Digital File
- Saved Views
- Annotations
- Supplemental Documents





CONTRACTUAL MODEL

- Access design from model
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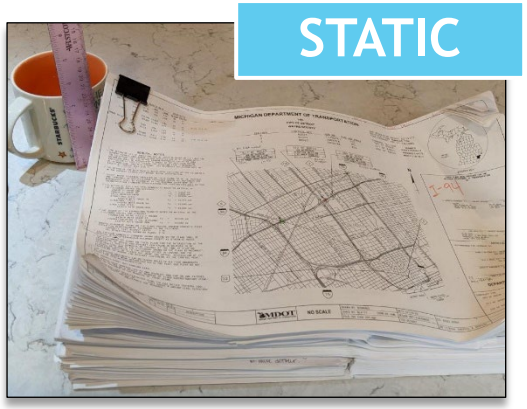
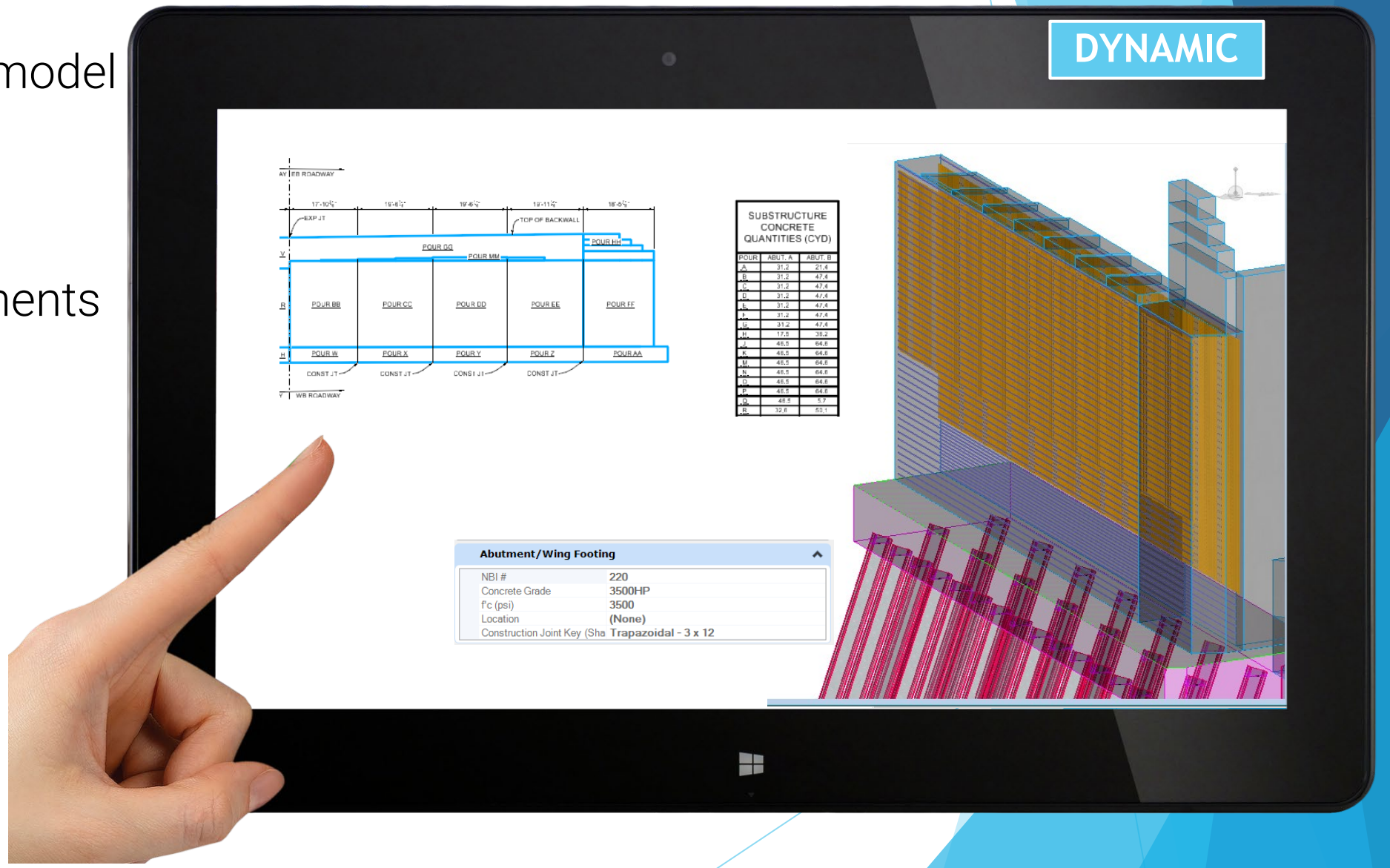
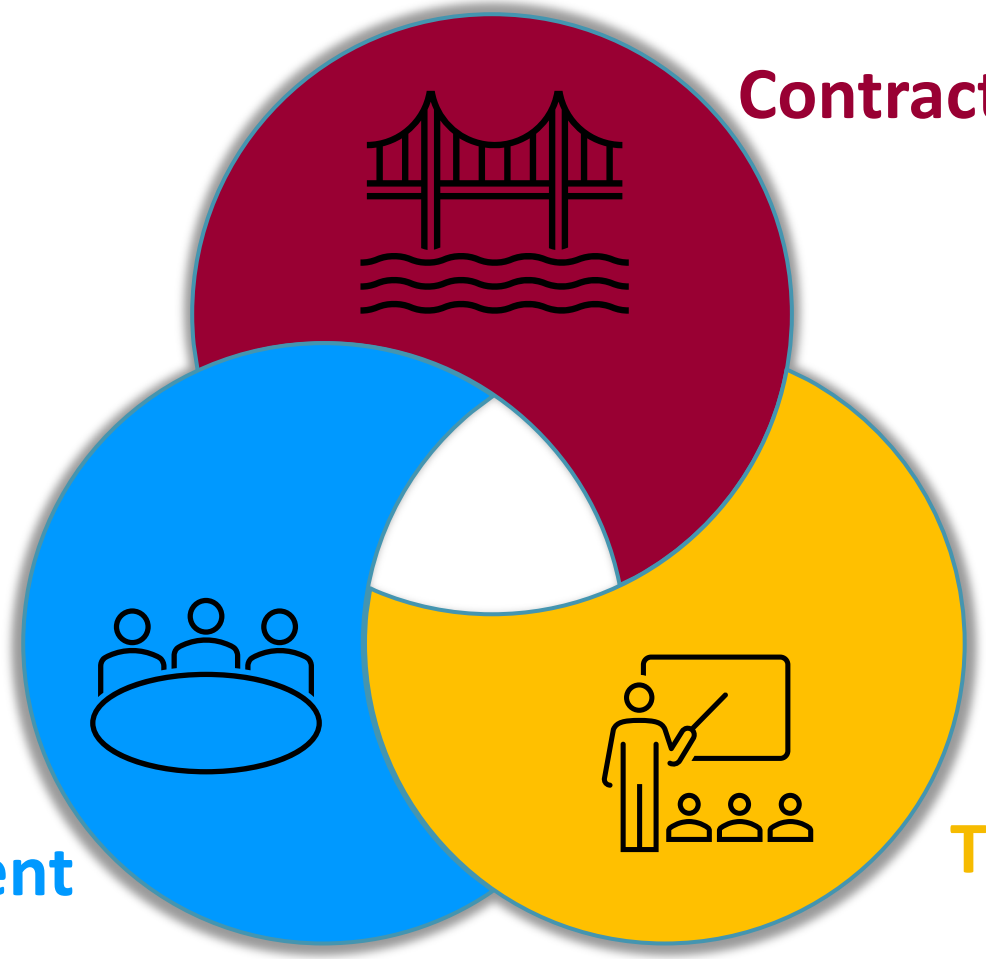
- Saved Views
- Annotations
- Supplemental Documents





Pilot Elements



Contractual Model

Engagement

Training

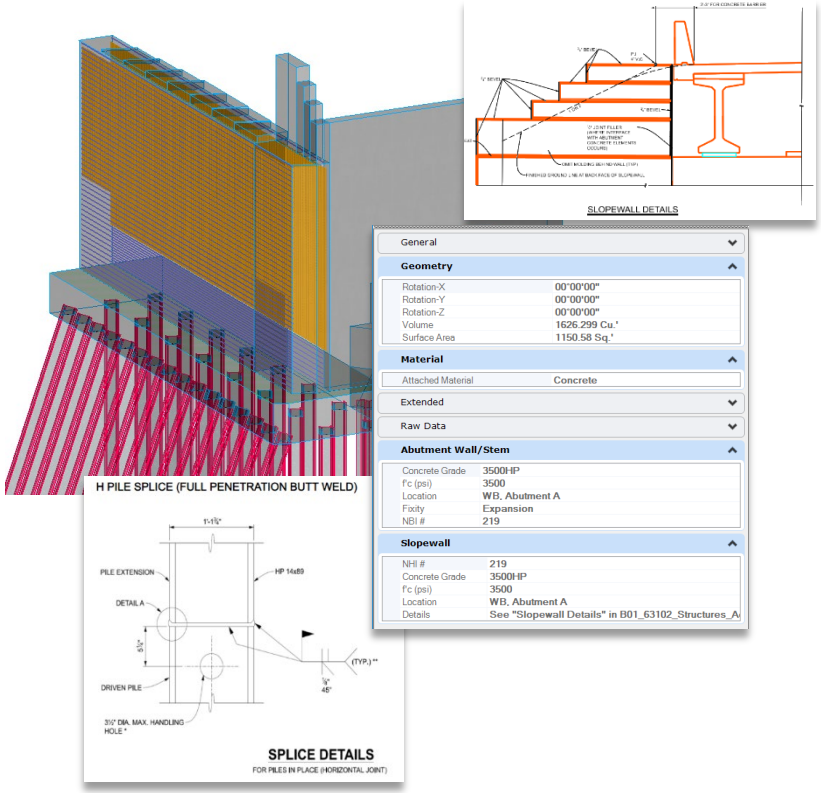
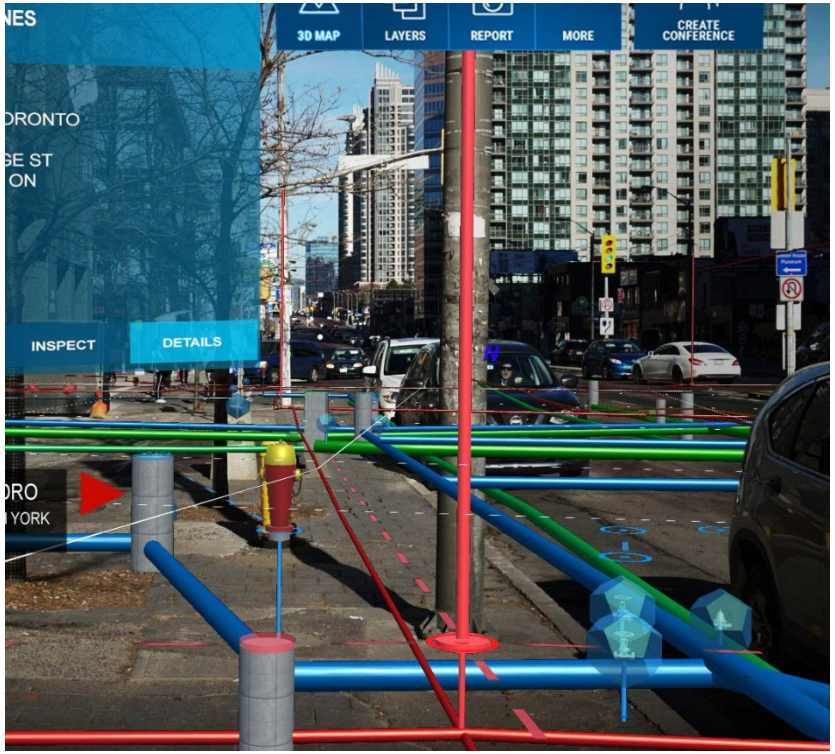


Photo courtesy of Granite Construction



Digital Reality

Physical/Digital World Interaction

Field Connection to Data

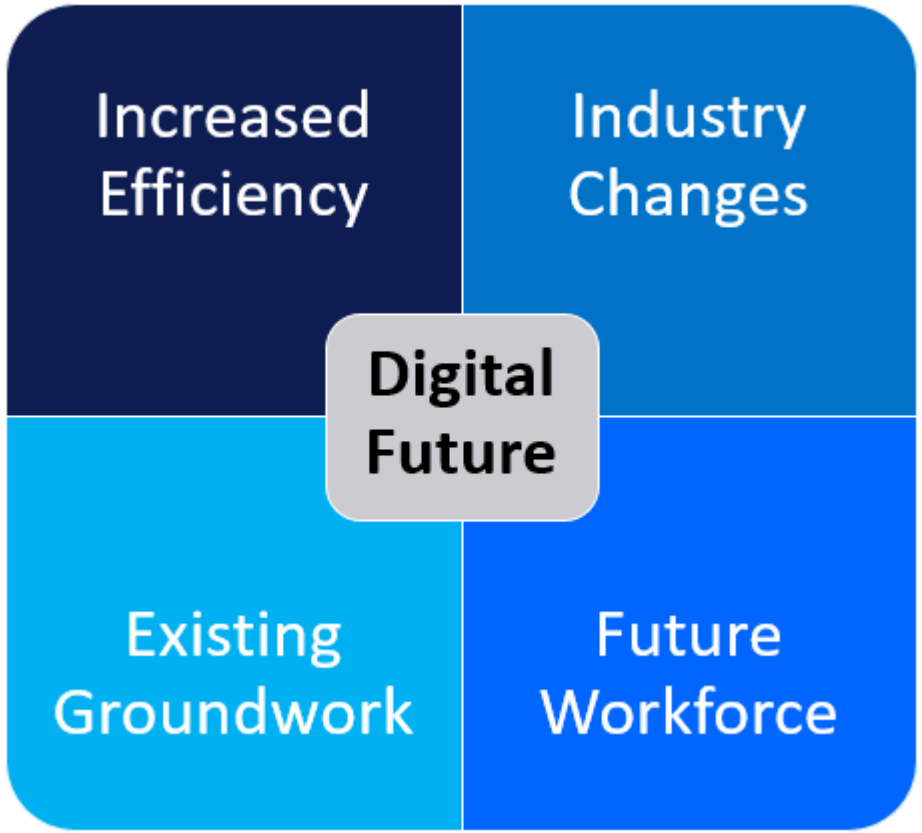
Virtual/Augmented/Mixed Reality

What is the purpose of Construction Plans?

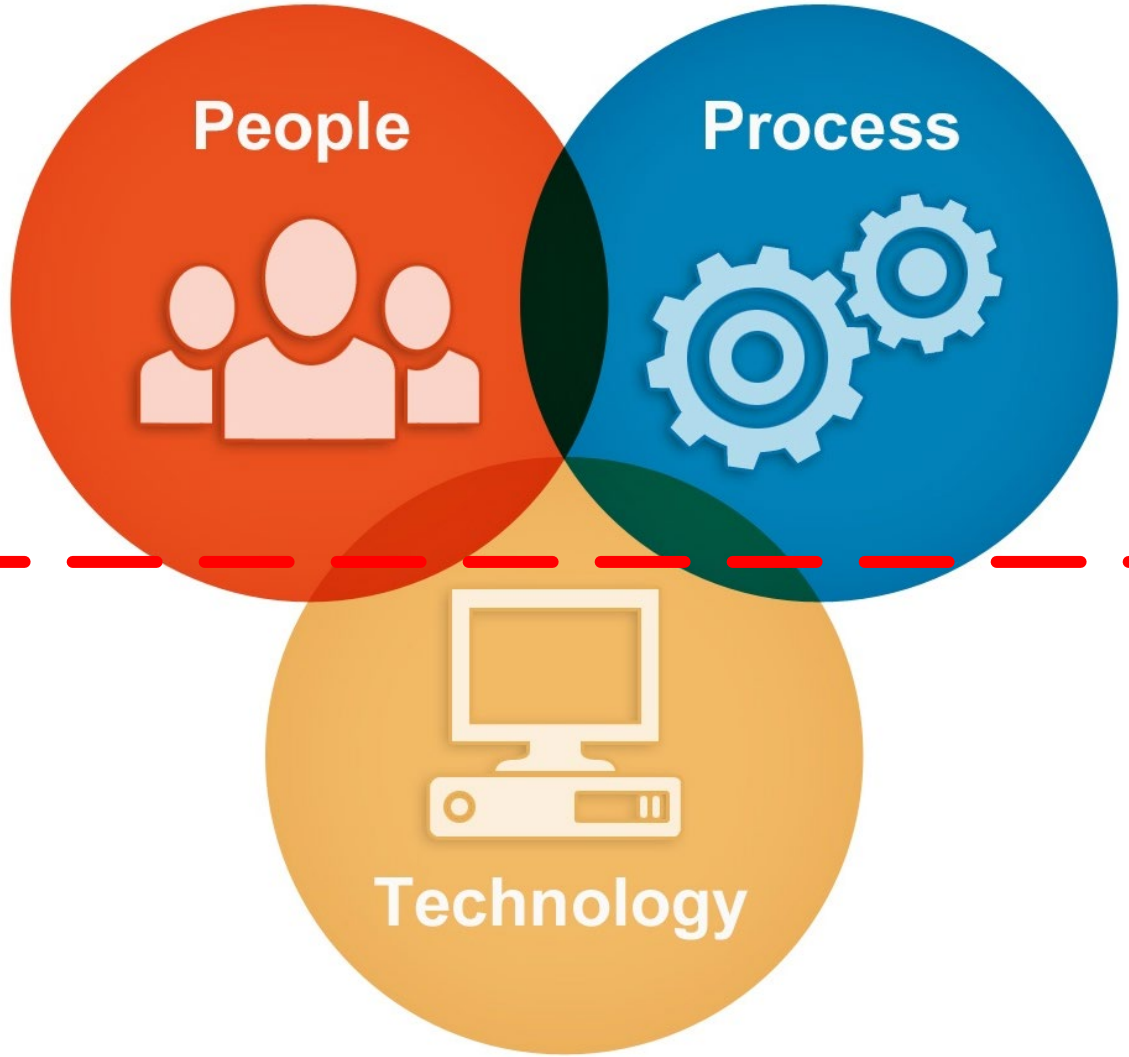
Contractual Models?

GIS Asset Management Systems?

Harnessing the Changes



How does a DOT adapt
& create a Digital Future
that best meets their needs?



- Strategic Plan
- Buy-in
- Priorities
- Change Management
- Training

- Adequate Tools
- Data Standards
- Data Access

MDOT's Digital Vision & Road Map Project

Share the Road Map/Implementation

Develop the Vision & Road Map

Understand the current state of practice & Vision for the future

Clearly define why a vision and roadmap for digital delivery is needed

National Survey Results and Key Takeaways

Lance Parve, WSP

Responding Agencies

Respondent Agencies (Total 18)	
WV	West Virginia Department of Transportation
CO	Colorado Department of Transportation
IL	Illinois Department of Transportation
CA	California Department of Transportation
AR	Arkansas Department of Transportation
AZ	Arizona Department of Transportation
SC	South Carolina Department of Transportation
WI	Wisconsin Department of Transportation
VA	Virginia Department of Transportation
TX	Texas Department of Transportation
MA	Massachusetts Department of Transportation
OK	Oklahoma Department of Transportation
TN	Tennessee Department of Transportation
MN	Minnesota Department of Transportation
MD	Maryland Department of Transportation
RI	Rhode Island Department of Transportation
MI	Michigan Department of Transportation
ME	Maine Department of Transportation

Survey Results: Hardware

P.5 What are the primary survey methods, tools and technologies used in your agency or contractors to geospatially locate, relocate, stakeout, inspect and verify transportation assets/facilities including utilities during design, construction and post-construction?

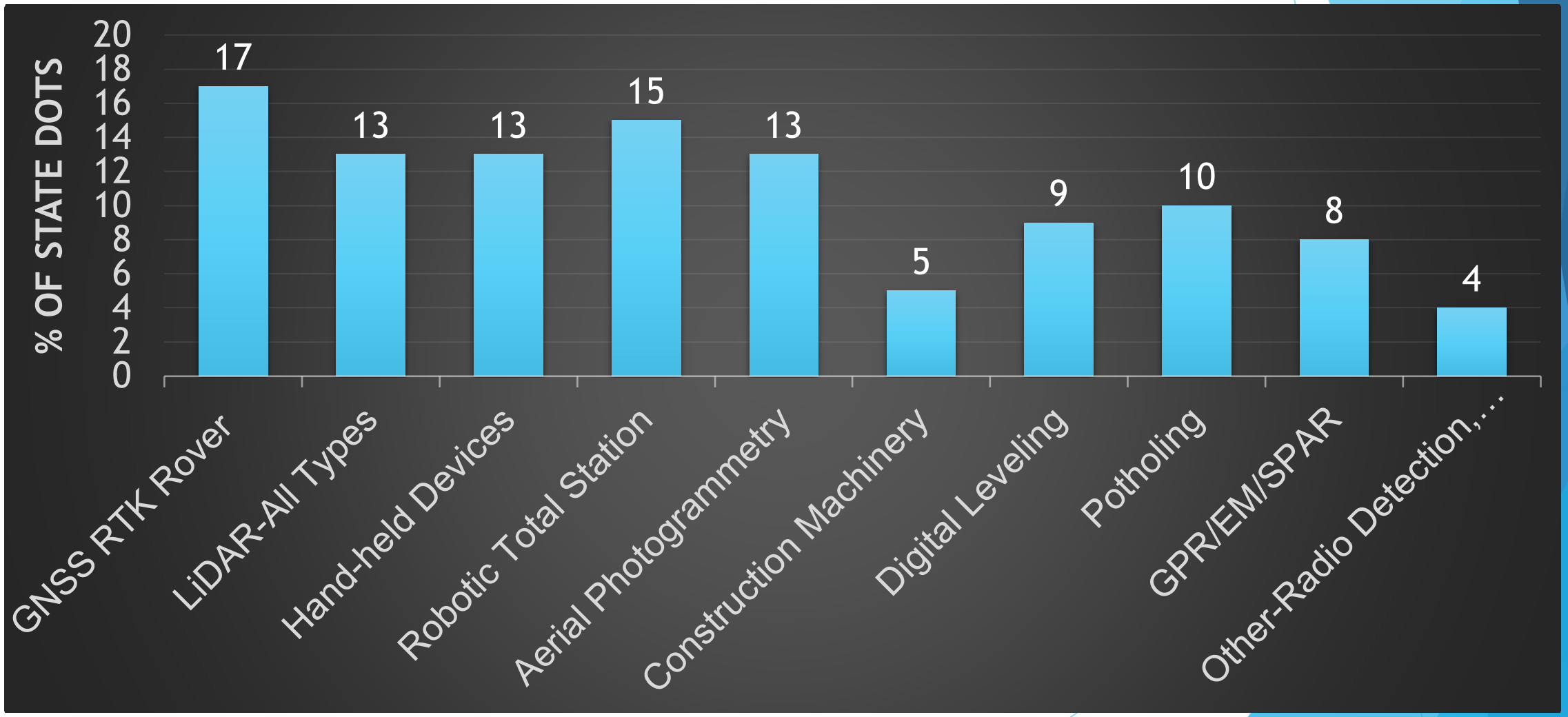
Survey Methods	Number of Responses	Percentage (out of 18 responses)
Robotic Total Station (RTS)	**15**	**83.3%**
Hand-held Survey Devices	**13**	**72.2%**
GNSS/GPS RTK Rovers	**17**	**94.4%**
Terrestrial Static LiDAR	**13**	**72.2%**
Terrestrial Mobile LiDAR	12	66.7%
Aerial UAS LiDAR	8	44.4%
Aerial UAS Imagery	8	44.4%
Aerial Digital Photogrammetry	**13**	**72.2%**
Construction Machinery	5	27.8%
Digital Leveling	9	50.0%
Subsurface Survey-GPR/EM/SPAR 300	8	44.4%
Potholing	10	55.6%
Other (Aerial LIDAR Fixed Wing and Multirotor, GIS mobile applications, Radio detection, Utilizing contractors when it comes to LiDAR)	4	22.2%

Survey Results: Hardware

P.5 What are the primary survey methods, tools and technologies used in your agency or contractors to geospatially locate, relocate, stakeout, inspect and verify transportation assets/facilities including utilities during design, construction and post-construction?

Survey Methods	List of States
Robotic Total Station (RTS)	WV, CO, IL, CA, AR, AZ , SC ,WI, VA, MA, OK, TN, MN, MI, ME
Hand-held Survey Devices	CO, AR, AZ, SC, VA, TX, MA, OK, TN, MN, MD, RI, MI
GNSS/GPS RTK Rovers	WV, CO, IL, CA, AR, AZ, SC, WI, VA, MA, OK, TN, MN, MD, RI, MI, ME
Aerial Digital Photogrammetry	WV, CO, IL, AR, AZ, SC, WI, VA, TX, MA, OK, MN, MI
Terrestrial Static LiDAR	WV, CO, IL, CA, AR, SC, WI, VA, TX, MA, MN, MI, ME

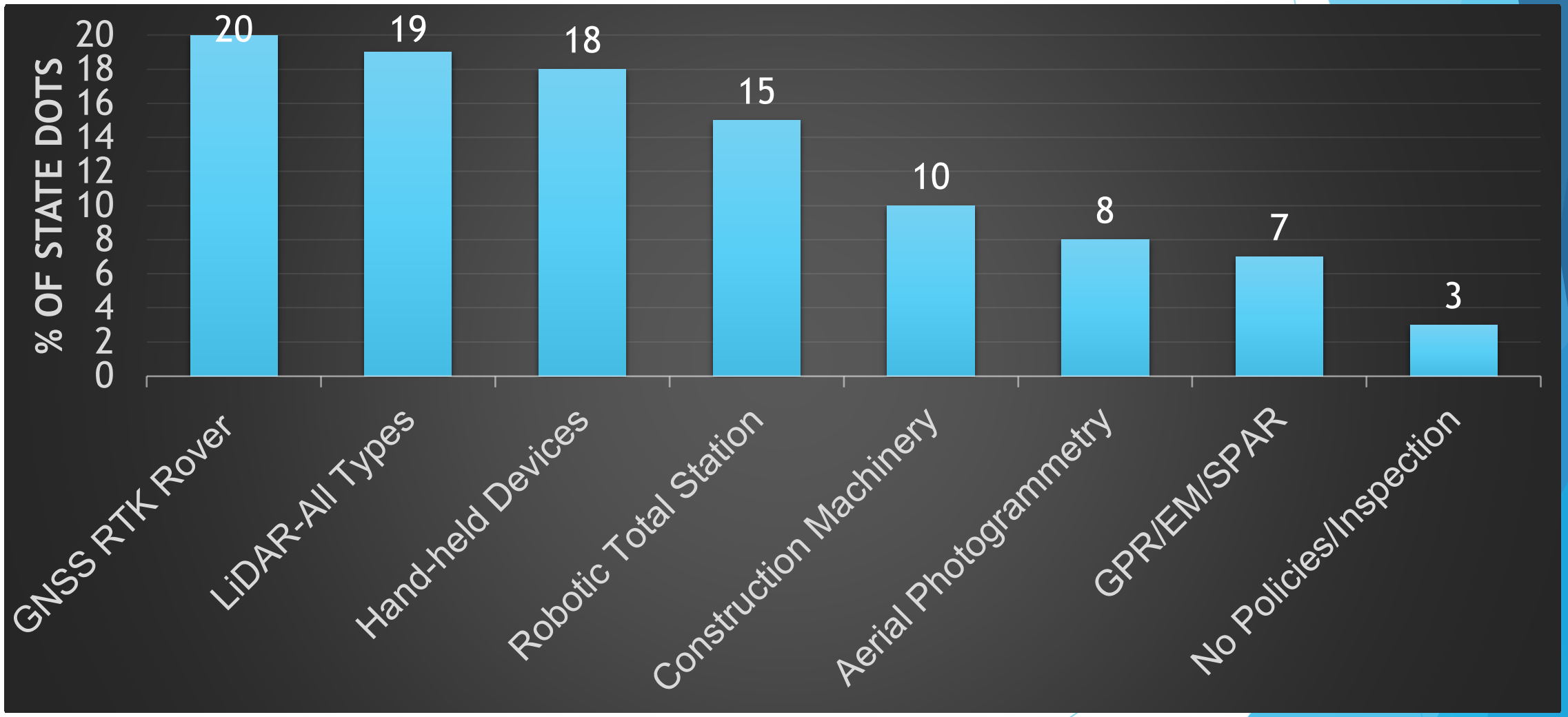
Survey Findings: As-Built Tools/Technologies (18 DOTs)



Source: Research Data collected by Online Survey from 18 DOTs 2023; Suri Sadasivam, *AASHTO Innovation Initiative-GIS and Survey* (2023).

As-Built Results: Hardware

Comparative Findings: As-Built Tools/Technologies (20 DOTs)



Source: Research Data collected by Interviews/Web from 20 DOTs 3/2021; Mallela and Parve, *Transitioning to Digital As-Builts* (2022).

Survey Results: Software

P.6 What are the primary geospatial mapping, surface/subsurface and visualization tools, technologies and application platforms used in the field, mobile, office, cloud and/or enterprise for asset data collection including utilities by your agency or contractors?

Primary Geospatial Mapping	Number of Responses	Percentage (out of 18 responses)
ESRI ArcGIS Desktop, Pro and/or ArcGIS Online (AGO)	**12**	**66.7%**
ESRI ArcGIS Enterprise	**10**	**55.6%**
ESRI ArcGIS Field Maps	5	27.8%
ESRI Collector/Survey 123	7	38.9%
Autodesk Civil 3D/Map3D	4	22.2%
Autodesk BIM360/ACC	0	0.0%
Bentley OpenRoads Designer/Map	**12**	**66.7%**
Bentley iTwins	2	11.1%
Bentley OpenGround (gINT/Keynetix)	2	11.1%
Trimble Business Center (TBC)	**9**	**50.0%**
Trimble SiteVision	2	11.1%
Topcon	5	27.8%
Leica	6	33.3%
Certainty 3D TopoDOT	4	22.2%
PointMan/Transparent Earth	2	11.1%
Exodigo	0	0.0%
Custom Application	1	5.6%
Other (Trimble Access, Carlson Surveying Software and Surveying Equipment, Summit DAT/EM, VrLiDAR)	3	16.7%

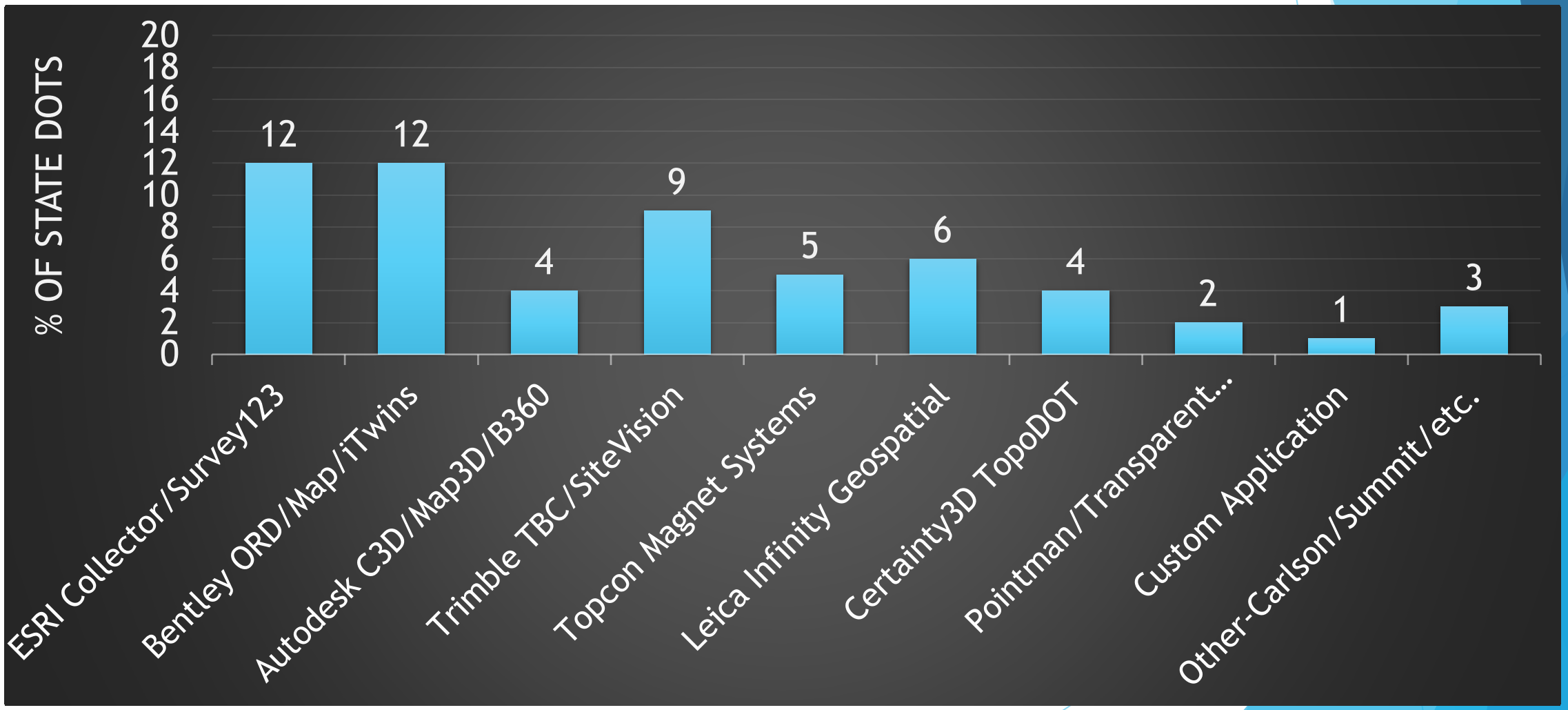
Survey Results: Software

P. 6 What are the primary geospatial mapping, surface/subsurface and visualization tools, technologies and application platforms used in the field, mobile, office, cloud and/or enterprise for asset data collection including utilities by your agency or contractors?

Primary Geospatial Mapping	List of States
ESRI ArcGIS Desktop, Pro and/or ArcGIS Online (AGO)	WV, CO, IL, AR, SC, WI, VA, TX, OK, MN, RI, MI
ESRI ArcGIS Enterprise	CO, IL, AR, AZ, SC, VA, TX, OK, TN, MN
Bentley OpenRoads Designer/Map	CO, IL, AR, AZ, SC, VA, OK, TN, MN, MD, MI, ME
Trimble Business Center (TBC)	CO, IL, CA, AR, AZ, SC, WI, MN, MI

Survey Results: Software

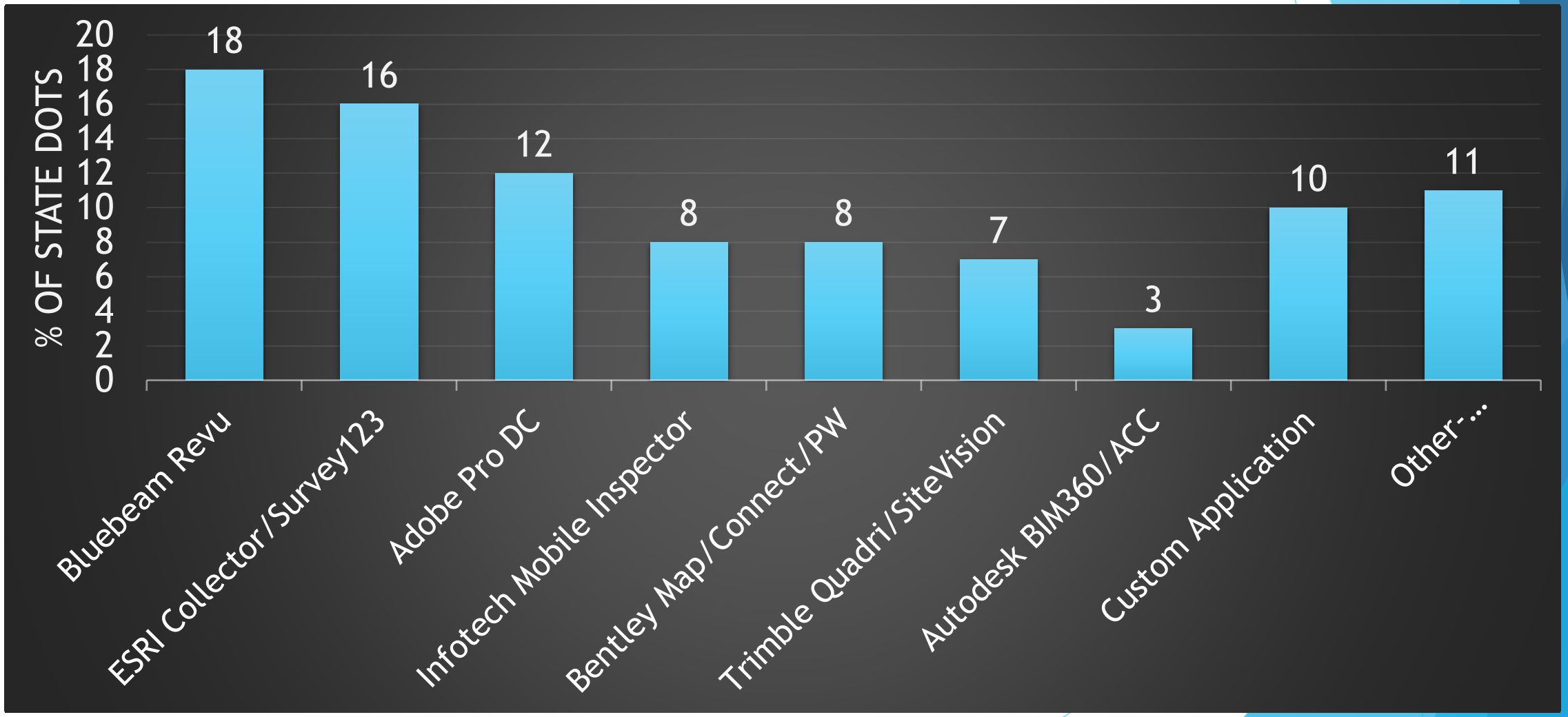
Survey Findings: As-Built Tools/Technologies (18 DOTs)



Source: Research Data collected by Online Survey from 18 DOTs 2023; Suri Sadasivam, *AASHTO Innovation Initiative-GIS and Survey* (2023).

As-Built Results: Software

Comparative Findings: As-Built Tools/Technologies (20 DOTs)



Source: Research Data collected by Interviews/Web from 20 DOTs 3/2021; Mallela and Parve, *Transitioning to Digital As-Builts* (2022).

Survey Results

P.7 What are the primary methods used in project delivery and information management in planning, survey/geospatial data collection, design and construction and post-construction operations/maintenance and asset management in your agency?

Project Delivery Method	Number of Responses	Percentage (out of 18 responses)
Paper/Mylar (Hard Copy)	**9**	**50.0%**
Image (Scan Copy)	**9**	**50.0%**
Document File/PDF (Electronic) to Electronic Document Management System (EDMS)	**15**	**83.3%**
Digital (Model/Asset Objects) to Database Management System/Data Warehouse	8	44.4%
Design CAD Model/Data to GIS/Asset Management Systems	**9**	**50.0%**
Construction Model/Data to GIS/Asset Management Systems	5	27.8%
Survey Model/Data to GIS/Asset Management Systems	4	22.2%
O&M Model/Data to GIS/Asset Management Systems	1	5.6%
CAD/BIM/GIS/Survey Data/Models to Cloud/Web/Hybrid On-premises-Cloud Systems	8	44.4%
Other (MicroStation)	1	5.6%

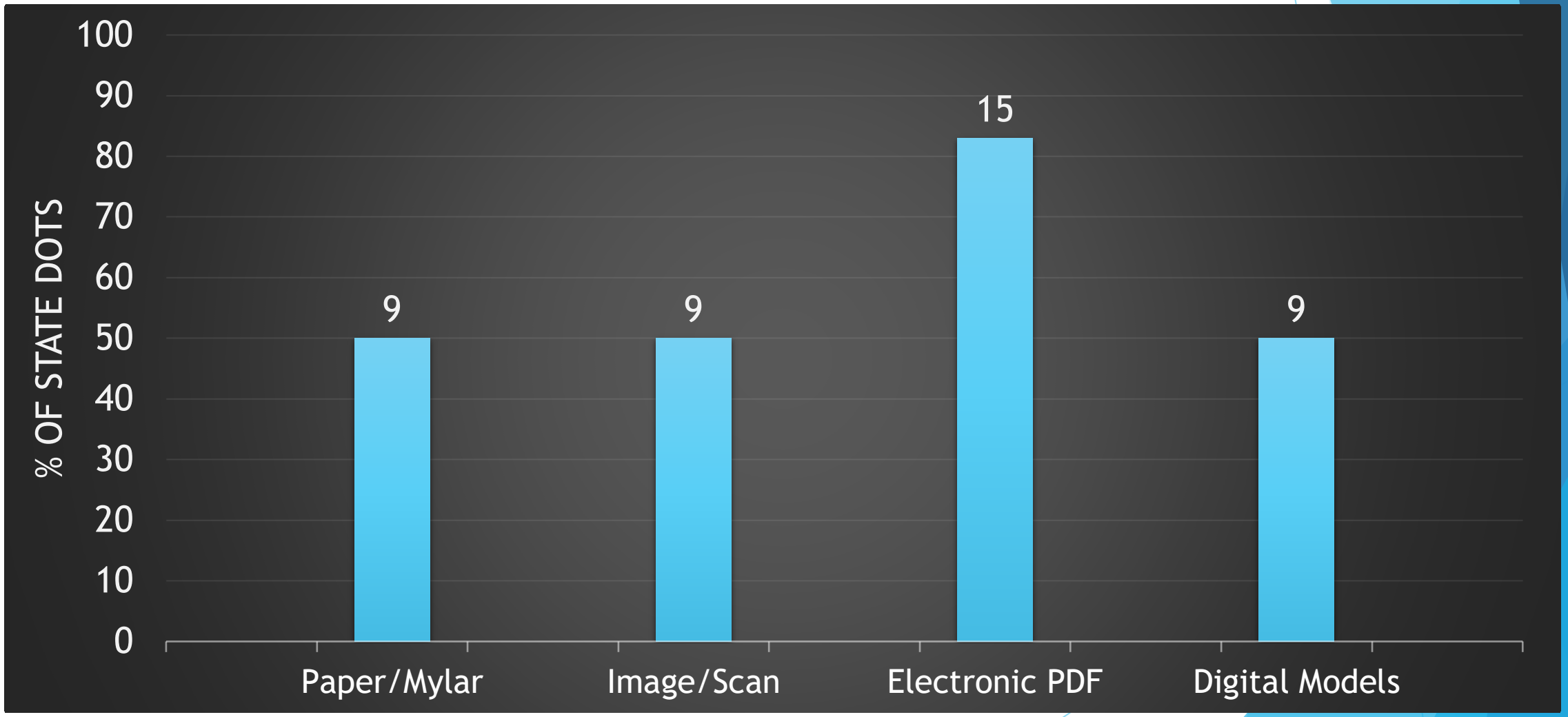
Survey Results

P.7 What are the primary methods used in project delivery and information management in planning, survey/geospatial data collection, design and construction and post-construction operations/maintenance and asset management in your agency?

Project delivery Method	List of States
Paper/Mylar (Hard Copy)	IL, AR, AZ, SC, TX, MN, RI, ME, OK, ME
Image (Scan Copy)	CO, AR, AZ, SC, VA, TX, OK, TN, MN
Document File/PDF (Electronic) to Electronic Document Management System (EDMS)	WV, CO, AR, AZ, SC, WI, VA, TX, MA, OK TN, MN, MI, MD, RI
Design CAD Model/Data to GIS/Asset Management Systems	CO, AR, SC, WI, AZ, VA, MA, MN, MI, OK

As-Built Results: SOP

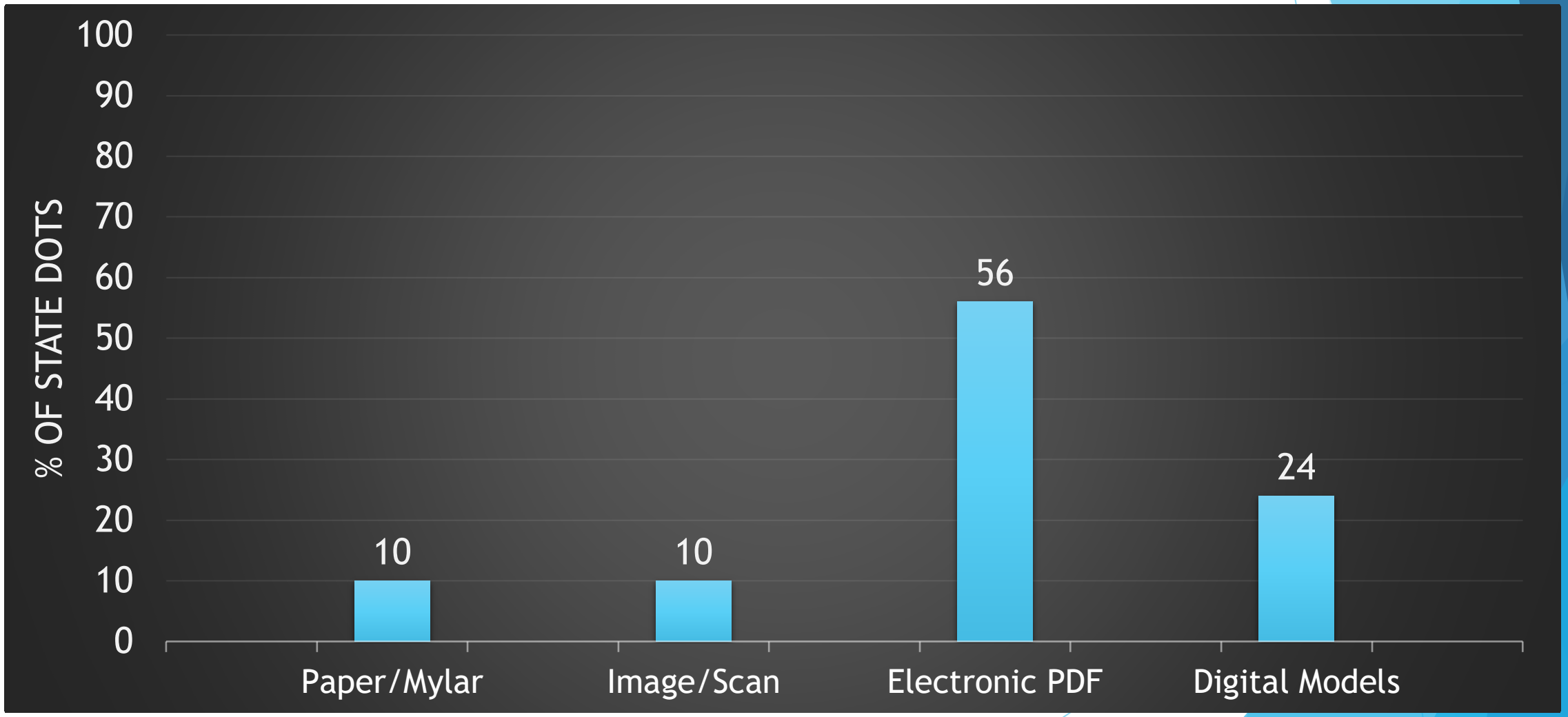
Survey Findings: As-Built State of Practice (18 DOTs)



Source: Research Data collected by Online Survey from 18 DOTs 2023; Suri Sadasivam, *AASHTO Innovation Initiative-GIS and Survey* (2023).

As-Built Results: SOP

Comparative Findings: As-Built State of Practice (50 DOTs)



Source: Research Data collected by Interviews/Web from 50 DOTs 3/2021-12/2022; Mallela and Parve, *Transitioning to Digital As-Builts* (2022).

Survey Results

P.8 What are the key geospatial information deliverables for digital asset data collection involved to improve project delivery for design, roads, pavement, bridges, drainage, environmental, utilities, right-of-way, intelligent transportation systems, traffic/safety, construction, survey, operations/maintenance and asset management for your agency?

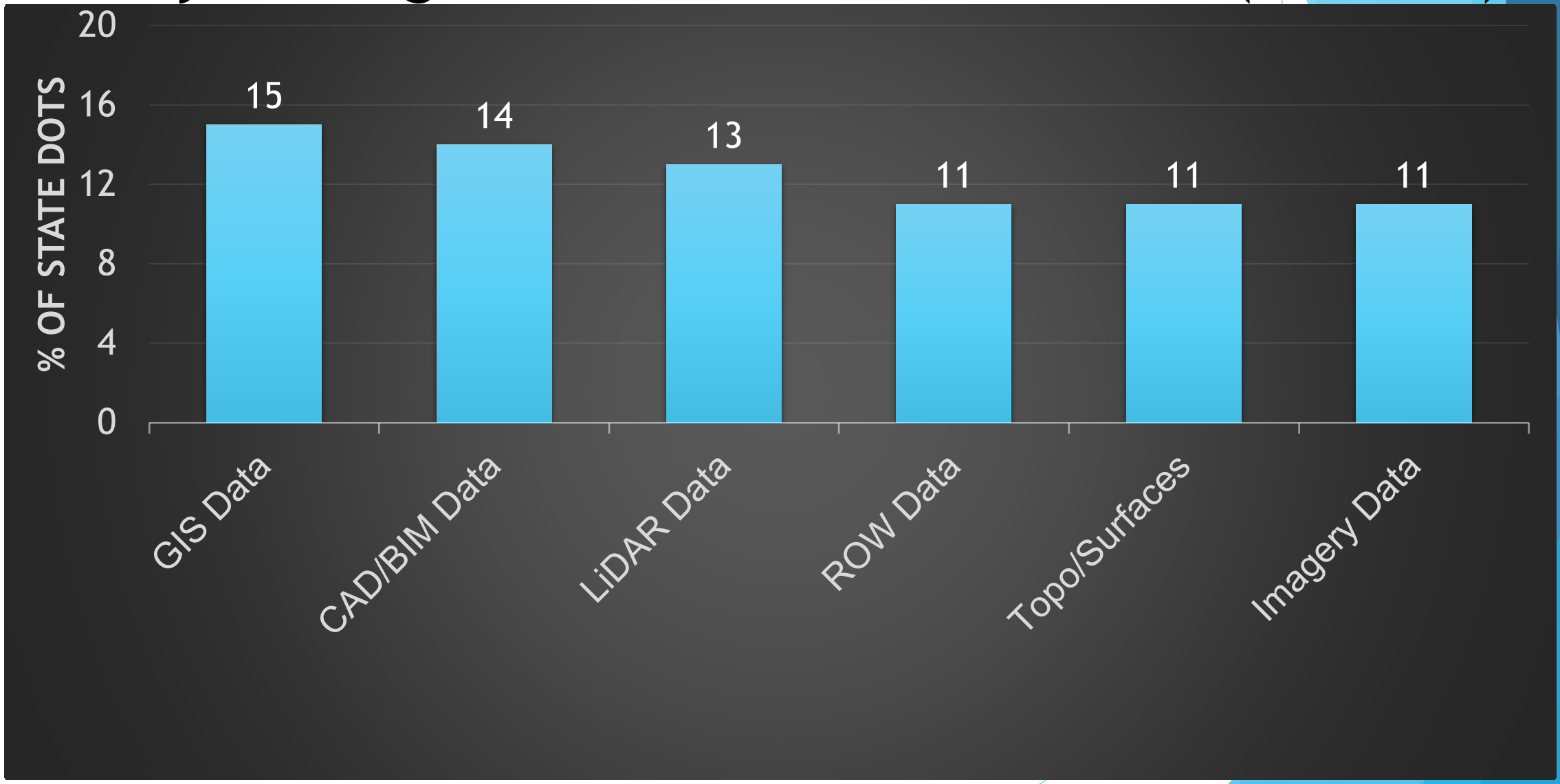
Geospatial deliverables	No of Responses	Percentage (out of 18 responses)
GIS data	**15**	**83.3%**
CAD/BIM data	**14**	**77.8%**
Georeferenced imagery (hi-res, 360, etc.) data	**11**	**61.1%**
LiDAR data	**13**	**72.2%**
Subsurface (GPR, SPAR, etc.) data	8	44.4%
Features data	7	38.9%
Materials/compaction data	7	38.9%
Sensor data	2	11.1%
Environmental data	9	50.0%
ROW data	**11**	**61.1%**
Traffic data	6	33.3%
Inspection data	8	44.4%
Digital maps	9	50.0%
Digital topography/surfaces (DTMs/DEMs)	**11**	**61.1%**
Digital subsurfaces (Utilities/Geotech)	8	44.4%
Reality meshes (combined surfaces/imagery)	5	27.8%
Digital as-builts	8	44.4%
Enterprise facility maps	3	16.7%

Survey Results

P.8 What are the key geospatial information deliverables for digital asset data collection involved to improve project delivery for design, roads, pavement, bridges, drainage, environmental, utilities, right-of-way, intelligent transportation systems, traffic/safety, construction, survey, operations/maintenance and asset management for your agency?

Geospatial deliverables	List of States
GIS data	CO, IL, AR, AZ, SC, WI, VA, TX, TN, MN, MI, OK, MD, RI, MA
CAD/BIM data	WV, IL, AR, AZ, SC, WI, VA, TX, TN, MN, MI, ME, OK, MA
LiDAR data	WN, CO, IL, AR, SC, WI, VA, OK, TX, TN, MA, MN, MI
ROW data	CO, AR, AZ, SC, VA, TN, MN, MI, OK, MD, MA
Digital topography/surfaces (DTMs/DEMs)	WV, CO, IL, AR, SC, WI, VA, MA, TN, MN, MD, RI, MI, ME

Survey Findings: Information Deliverables (18 DOTs)



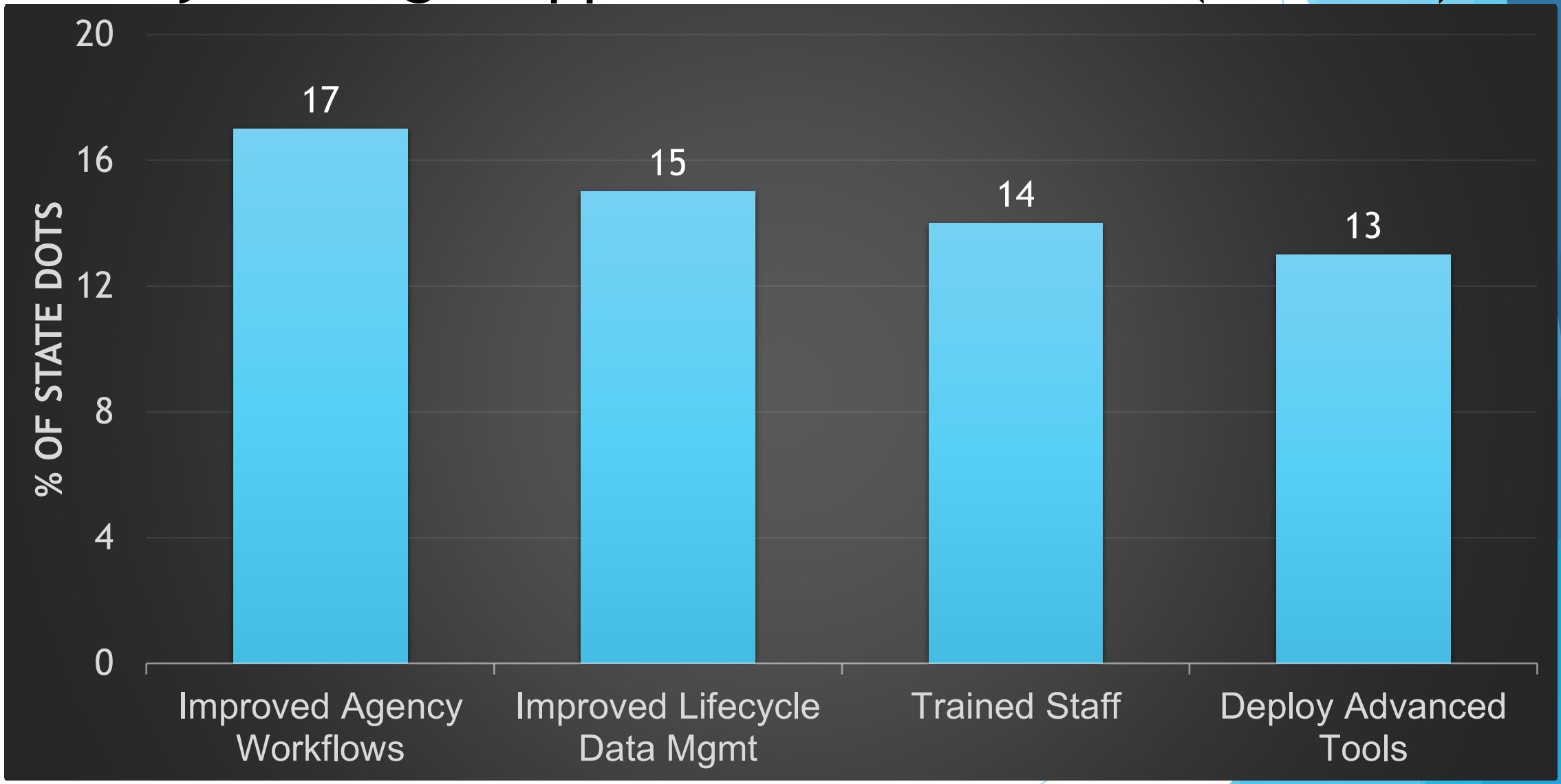
Source: Research Data collected by Online Survey from 18 DOTs 2023; Suri Sadasivam, *AASHTO Innovation Initiative-GIS and Survey* (2023).

Survey Results

P.9 What are the greatest opportunities and benefits to improve digital project delivery and data management for your agency?

Benefits	List of States
Improved agency policies, procedures and workflows	WV, CO, IL, CA, AR, AZ, SC, WI, VA, TX, TN, MN, MI, OK, MD, RI, MA
Improved lifecycle information management	CO, IL, CA, AR, AZ, SC, WI, VA, TX, TN, MN, MI, OK, MD, MA
Experienced and trained staff	WV, CO, IL, AR, SC, VA, TX, TN, MN, MI, OK, MD, MA,ME
Deploying advanced modeling (GIS/CAD) tools/technologies	IL, CA, AR, AZ, SC, VA, TX, TN, MN, MI, OK, MD, MA

Survey Findings: Opportunities/Benefits (18 DOTs)



Source: Research Data collected by Online Survey from 18 DOTs 2023; Suri Sadasivam, *AASHTO Innovation Initiative-GIS and Survey* (2023).

Survey Results

P. 10 What are the biggest barriers, obstacles and challenges to improve digital project delivery and data management for your agency?

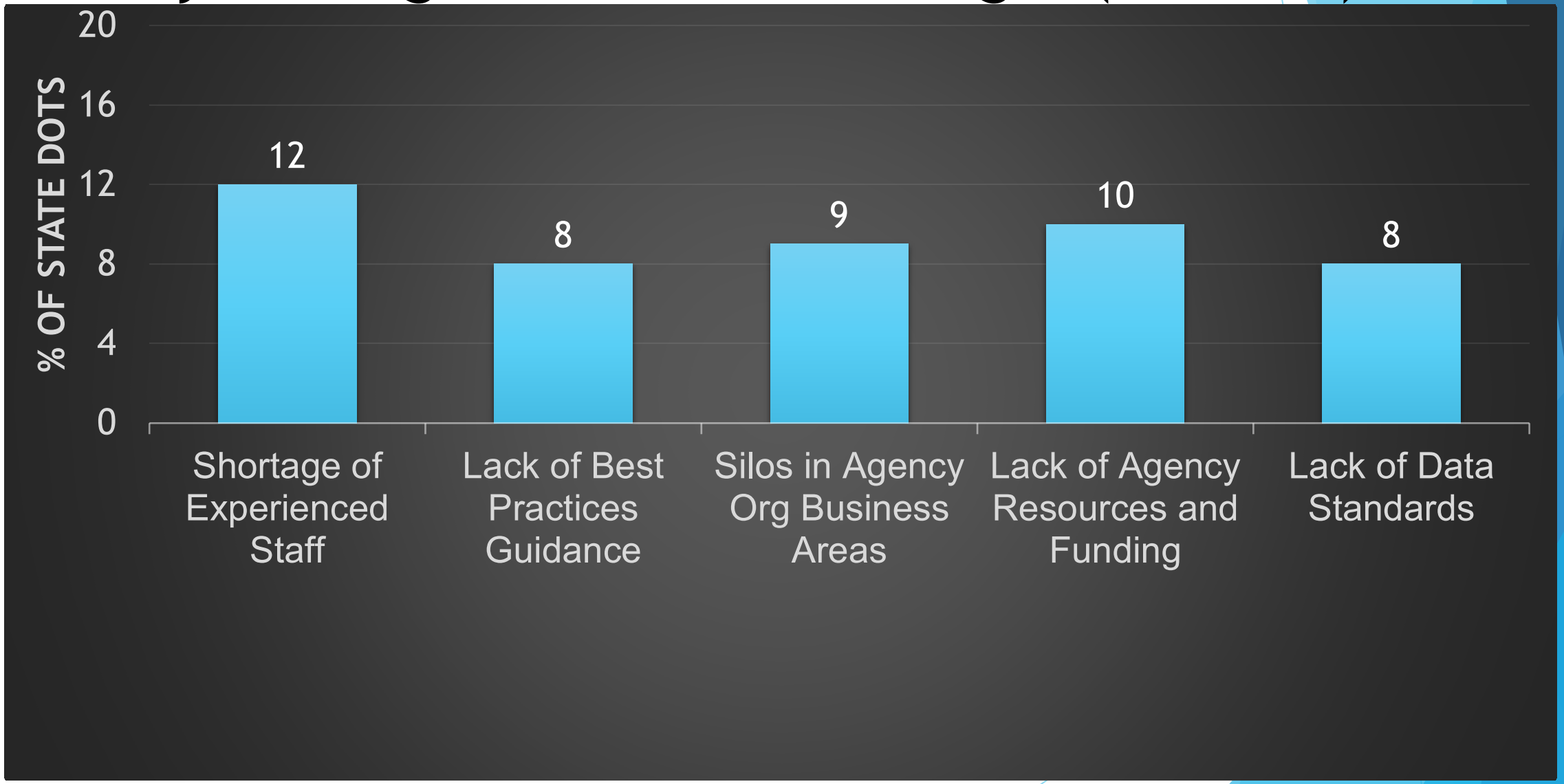
Barriers, obstacles and challenges	Number of Responses	Percentage (out of 18 responses)
Lack of available agency resources and funding	**10**	**55.6%**
Lack of priorities by business areas	6	33.3%
Silos in agency organization business areas	**9**	**50.0%**
Lack of management support	1	5.6%
Lack of clear policies, procedures, contracts and workflows	7	38.9%
Lack of best practices guidance	**8**	**44.4%**
Shortage of technical and experienced staff	**12**	**66.7%**
Lack of advanced survey technologies	4	22.2%
Lack of advanced modeling (GIS/CAD) tools and technologies	3	16.7%
Lack of enterprise information technologies support and cloud access	3	16.7%
Lack of software interoperability	6	33.3%
Lack of software vendor support	2	11.1%
Lack of training for staff	5	27.8%
Lack of data standards	**8**	**44.4%**
Lack of agency innovation	3	16.7%
Lack of tangible benefits and positive ROI	2	11.1%
Lack of agency adapting to change	5	27.8%
Lack of asset lifecycle data governance	4	22.2%

Survey Results

P. 10 What are the biggest barriers, obstacles and challenges to improve digital project delivery and data management for your agency?

Barriers, obstacles and challenges	List of States
Shortage of technical and experienced staff	WV, IL, AZ, SC, VA, TN, MN, MI, OK, MD, RI, MA
Lack of best practices guidance	IL, AR, VA, MN, OK, MA, MN, ME
Silos in agency organization business areas	CO, CA, AZ, WI, TN, MA, MN, OK, MD
Lack of available agency resources and funding	CO, IL, AR, WI, VA, TX, MA, OK, TN, MN

Survey Findings: Barriers/Challenges (18 DOTs)



Source: Research Data collected by Online Survey from 18 DOTs 2023; Suri Sadasivam, *AASHTO Innovation Initiative-GIS and Survey* (2023).

Question and Answer Session

Thank you!

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