Paving the Digital Road: Iowa's E-Construction Evolution and Future

Matthew Miller

E-Construction

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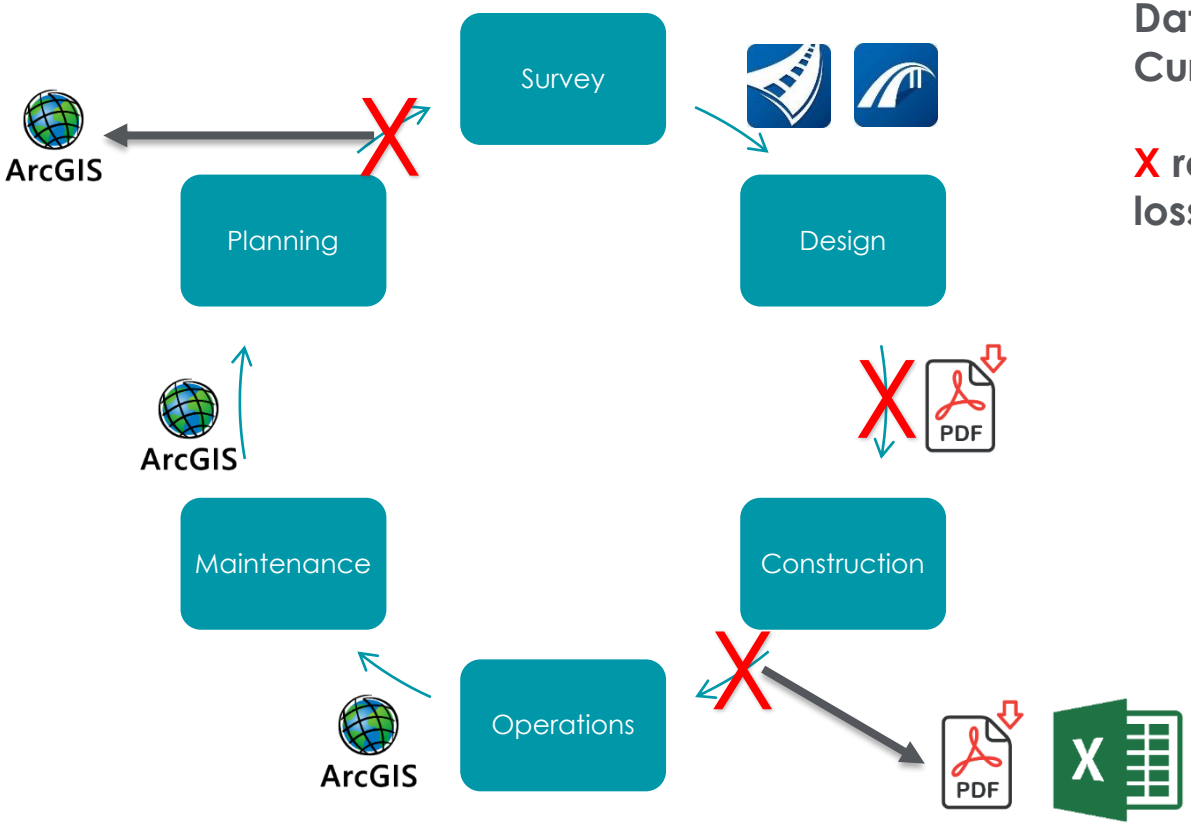

Iowa DOT
Data Life-Cycle
Current State

X represent data loss

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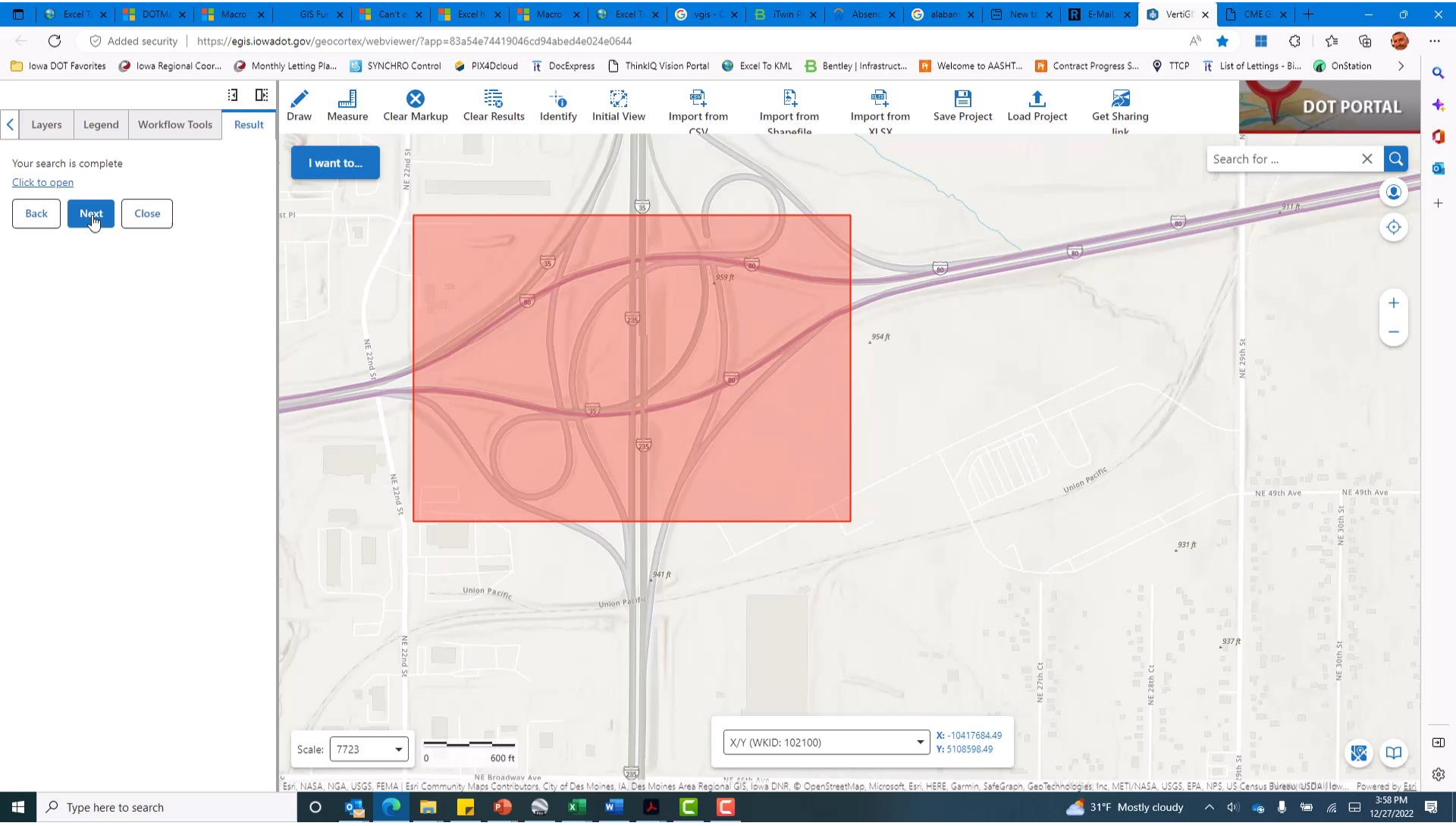

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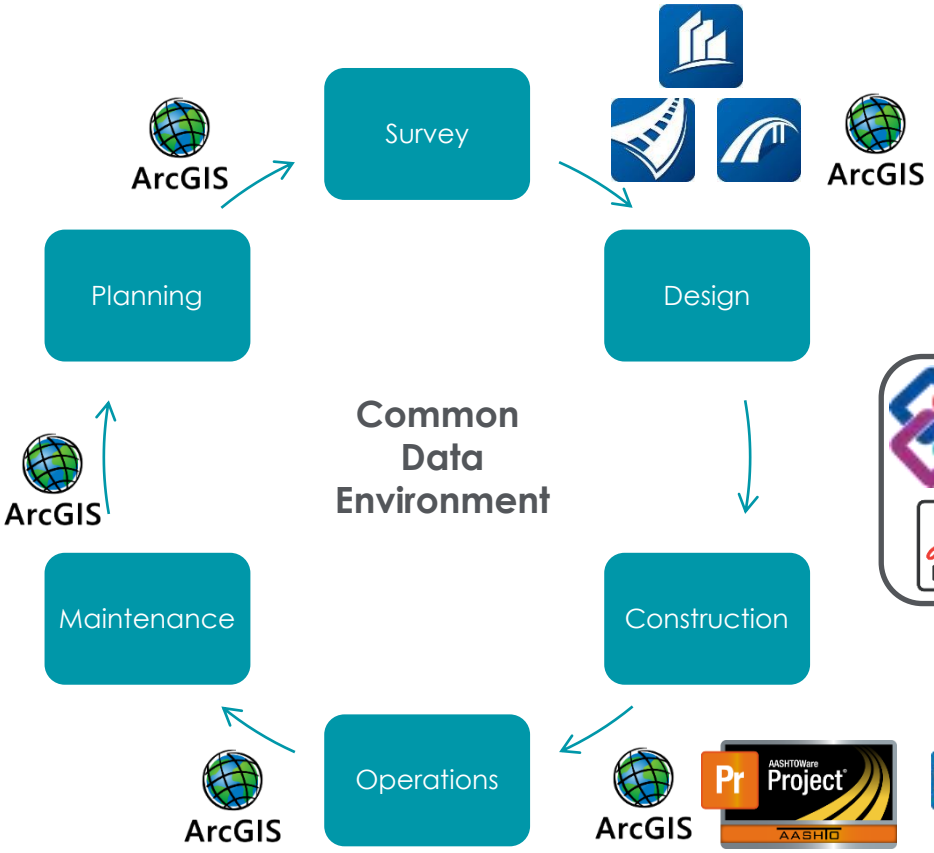
Iowa DOT Future State



Digital Delivery is not a single technology

Initiatives

- E-ticketing
- GIS Maps
- 3D projects
- Drone/LiDAR mapping
- Digital Asbuilts
- Technology pilots

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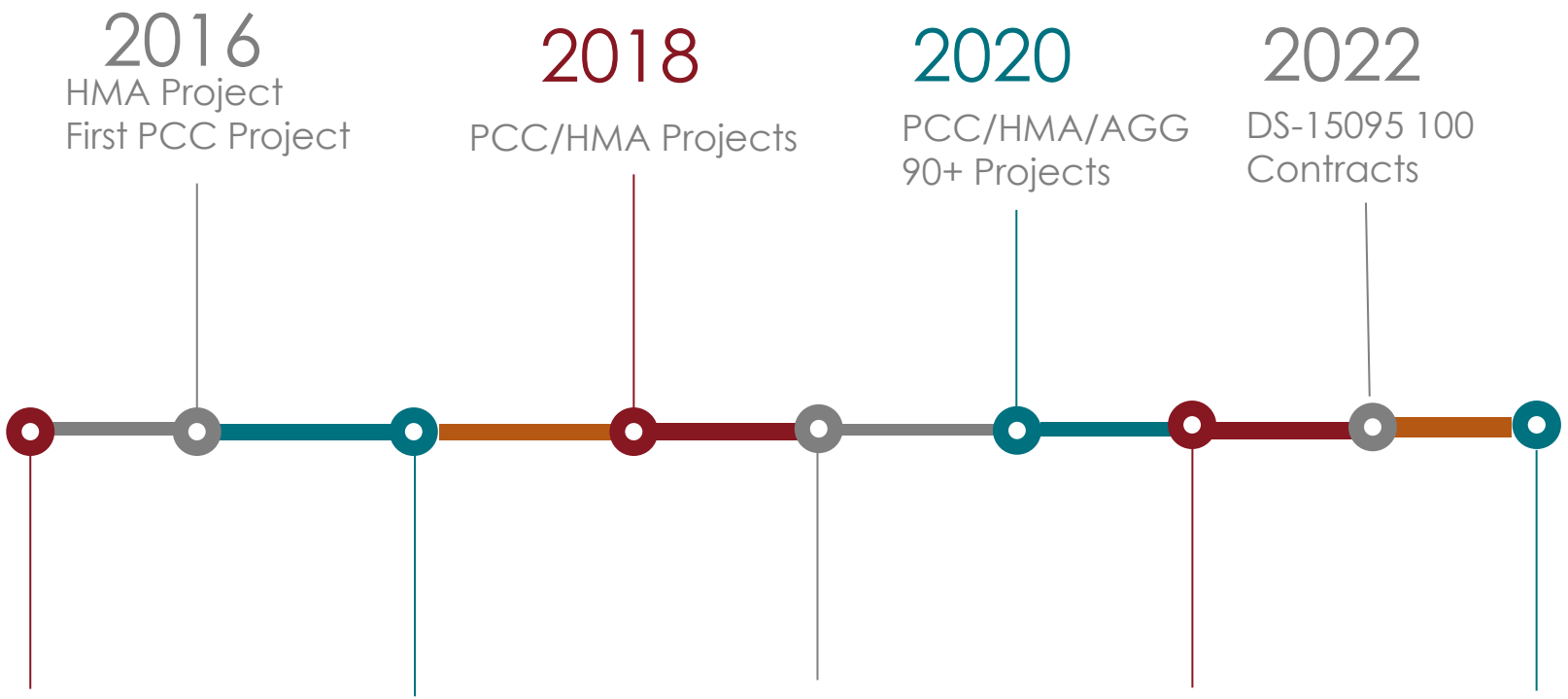
E-ticket timeline



E-ticketing platforms

Information on an HMA E-ticket

1. Date
2. Iowa DOT Project number
3. Contractor
4. Supplier
5. Unique truck ID
6. Plant/Scale
7. Truck status times
8. Type of material
9.-11. Gross/Tare/Net
12. Mix Design number

Information on a PCC E-ticket

1. Date
2. Iowa DOT Project number
3. Contractor
4. Supplier
5. Unique truck ID
6. Plant/Scale
7. Truck status times
8. Wet weights
9. Dry weights
10. Water in Agg
11. Total water
12. W/C ratio
13. Max W/C ratio
14. Allowable water to add.
15. Admixture Retarder and weights.
16. Water reducer and weights.
17. Air entrainment and weights.
18. Special performance admixtures and weights.
19. Concrete fibers.
20. Cementitious material and weights.
21. CPI name and cert number.

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Currently capable of getting 275 lines of data fields on E-ticket

237	Test Data Slump Result 1		2.5
238	Test Data Slump Result 1 Unit of Measure	INH	
239	Test Data Slump Result 2		
240	Test Data Slump Result 2 Unit of Measure		
241	Test Data Material Temperature Result 1		79
242	Test Data Material Temperature Result 1 Unit of Measure	FAH	
243	Test Data Material Temperature Result 2		
244	Test Data Material Temperature Result 2 Unit of Measure		
245	Test Data Ambient Temperature Result 1		
246	Test Data Ambient Temperature Result 1 Unit of Measure		
247	Test Data Ambient Temperature Result 2		
248	Test Data Ambient Temperature Result 2 Unit of Measure		
249	Test Data Humidity		
250	Test Data Humidity Unit of Measure		
251	Test Data Wind		
252	Test Data Wind Unit of Measure		
253	Test Data Efflux		
254	Test Data Efflux Unit of Measure		
255	Test Data Evaporation Rate		
256	Test Data Evaporation Rate Unit of Measure		
257	Test Data Latitude Position		42.0300216
258	Test Data Longitude Position		-93.612787
259	Invoice Code		
260	Load #		1
261	Product Cost Code		
262	Haul Cost Code		
263	Product Unit Cost		
264	Haul Unit Cost		
265	Mix ID		
266	Specific Gravity		
267	Certification Statement		
268	Address	I280	
269	Address 2		
270	City	DAVENPORT	
271	State / Province	IA	
272	Postal Code		
273	Country	US	
274	Instructions		
275	Delivery Option		
276			

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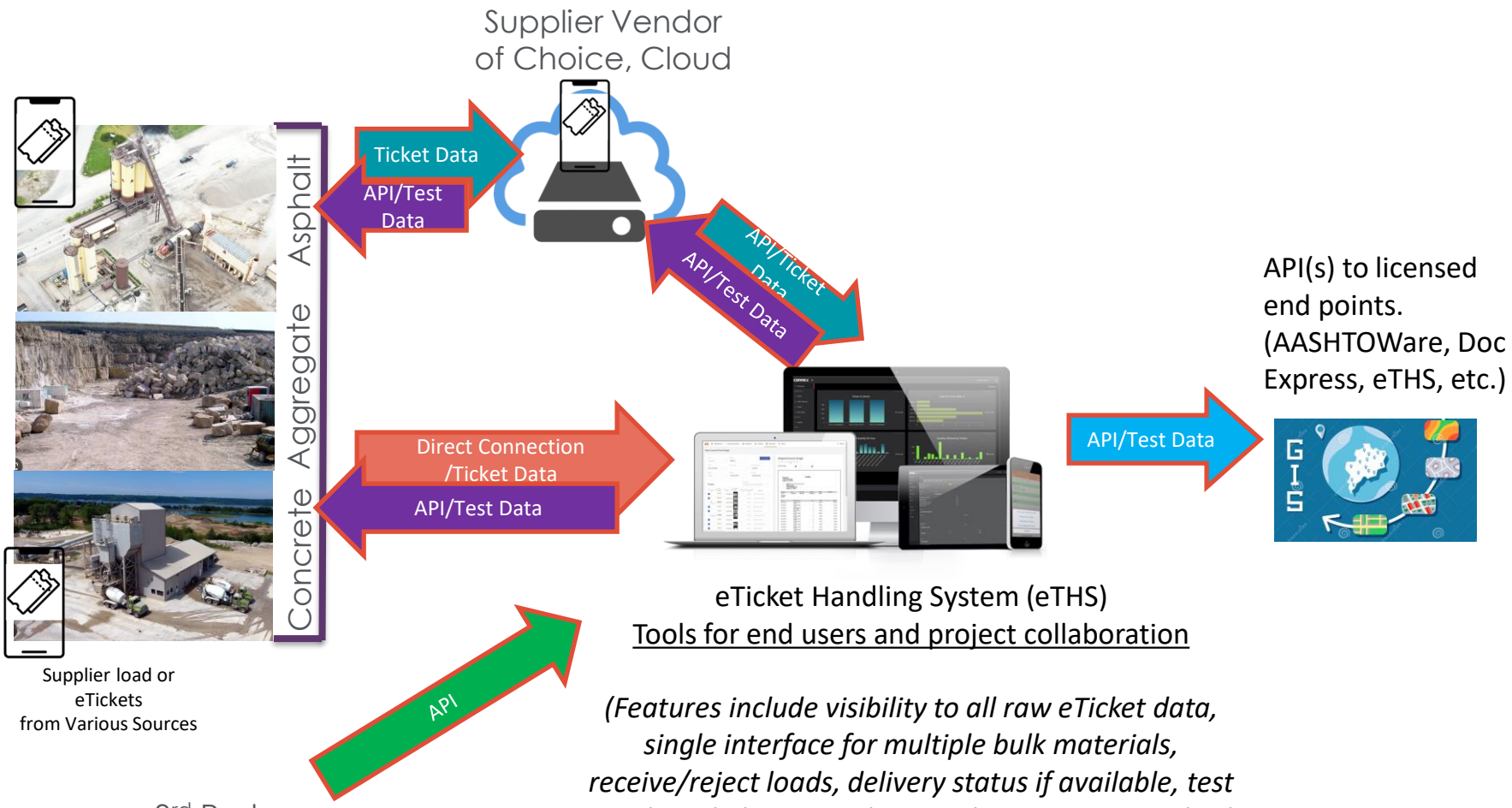

Internet Connection

- Iowa DOT along with Local Systems Bureau was approved for STIC funds to test Cell phone boosters.

Internet Connection

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From: Van Tassel, Todd <Todd.VanTassel@iowadot.us>
Sent: Thursday, January 12, 2023 1:15:11 PM
To: Wilkinson, Cedric <Cedric.Wilkinson@iowadot.us>
Subject: Cell booster test

Cedric,

I stopped at a place on 52 that my cell phone was showing (no service) and tried to get signed into Connex with no luck. I connected to the cell booster and signed into Connex with no issues and it was at the same speed as normal. I did need to go into the settings on my phone to get connected to the booster sometimes. Also for training purpose, the phone goes from no service to showing Verizon internet when you get connected.

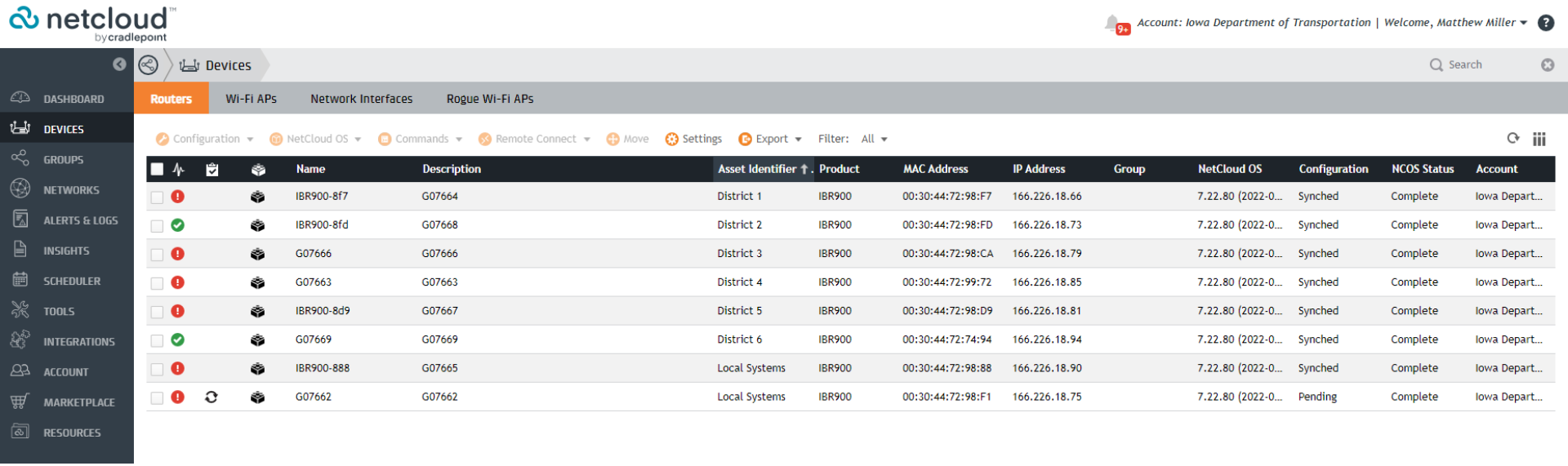
Thanks

TODD VAN TASSEL
HIGHWAY TECH. SENIOR
DAVENPORT CONSTRUCTION OFFICE

iowadot.gov
Office: 563-391-2750
Cell: 563-349-5745
todd.vantassel@iowadot.us

Iowa Department of Transportation
@iowadot

Dashboard for the devices



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Routers > IBR900-8fd

IBR900-8fd

Iowa Department of Transportation • IBR900

G07668

W 1 2

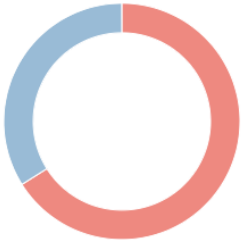
Home | Configuration | Data Usage | Health | Troubleshooting

Summary | Interfaces | GeoView | License | Details

Internal 1200M-B (SIM1) | MC400 1200M-B (SIM1) | MC400 1200M-B (SIM2)

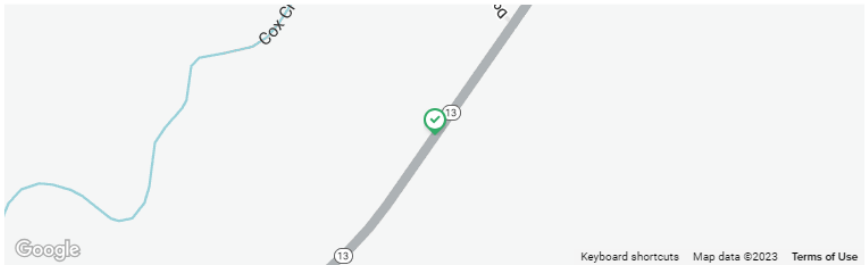
LTE

WAN Usage ⬆ 36.4%



33.9% Total Uptime ⬇ 0.4%

GeoView



Recent Alerts

No data to display

E-Construction

DS-1XXXX

DEVELOPMENTAL SPECIFICATIONS
FOR
PORTABLE POP-UP NETWORK ON
CONSTRUCTION PROJECT

Effective Date
Month 01, 2023

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

1XXXX.01 DESCRIPTION.

A. This developmental specification defines the minimum requirements for portable suitcase pop-up network cases to be used in highway construction sites, equipped with dual SIM 5G mobile connectivity. The network cases shall provide reliable, high-speed wireless connectivity to support construction site inspections through digital means and safety of field staff in support of digital construction technologies.

B. Pop up network case shall include the following minimum requirements:

1. Rugged Case (w/CAT6 port, 12.6V input, power button)
2. DC power cord, Wall charger, Ethernet, & Antenna cables (all pre-wired)
3. Secure Connectivity for Network Access
4. Mobile Dual SIM provider 5G LTE connection with two Wi-Fi radios (5 GHz and 2.4 GHz)
5. 1 Gbps download speed; 150 Mbps upload speed where available
6. 300 feet of expected Wi-Fi Broadcast Range
7. FAA-compliant battery pack with up to 10 hours of life
8. Ability to configure, manage, troubleshoot remotely with cloud management software
9. Multiple Simultaneous Connections
10. Advanced Threat Protection and Cloud-managed security controls
11. Integrated antennas and external CAT6 port with POE.

15095.02 MATERIALS.

See device requirements 15095.03.

15095.03 POP-UP NETWORK DEVICE REQUIREMENTS.

Device shall meet or exceed the following specifications:

Safety Certifications: UL/CUL, CB Scheme, EN60950-1, EN 62368
Material Certifications: WEEE, RoHS, RoHS-2, California Prop 65
Case Specifications: Weatherproofing IP64
Antenna Type: Multi-MIMO
Leads: 2x Cellular, 2x Wi-Fi, 1x GPS
Cellular Type: 4G | CBRS | LTE (617-960MHz / 1710-6000MHz)
Bands: B2 B4 B5 B12 B14 B17 B25 B26 B29 B30 B41 B66 B71 n5 n25 n41 n66 n71 B2 B4 B5 B12 B14 B17 B29 B30 B48 B66 n5 B2 B4 B5 B12 B14 B17 B29 B30 B66
5G NR Bands: n77 n78 n79 n77 n78 n79 n77 n78 n79
Wi-Fi Frequency Range: 2.4GHz - 7GHz (Concurrent)
Isolation 4G 5G Elements: >10dB
Isolation Wi-Fi Elements: >12db
Correlation Co-Efficient 4G/5G Elements: <0.2
Correlation Co-Efficient Wi-Fi Elements: <0.2
Nominal Impedance: 50Ω
Frequency Range: 1562-1612MHz
LNA Gain: 29dB ± 2dB
VSWR: <2.0:1
Out of Band Rejection: >45dB (@ > +/- 100MHz f)
Typical Noise Figure: <-2dB
Notch Filter Rejection: @787MHz 24dB
Operating Voltage: 3-5V DC
Typical Current: 15mA
Antenna Housing: High Impact UV Stable ABS Polymer
Connector Type: SMA
Operating Temp: -40° / +80°C (-40° / +176°F) or better
Battery Specifications:
FAA-compliant Battery Pack (up to 10 hrs. life)
Battery Type Lithium-Ion
Output 12V
Capacity 10,000 mAh
Short-Circuit Protection
Over-Current Protection
Overcharging Protection
Discharge Protection

15095.04 METHOD OF MEASUREMENT.

The Engineer will count the pop-up network devices, furnished to inspection staff, according to this specification, as required by the contract documents.

15095.05 BASIS OF PAYMENT.

A. Payment for each network case will be the contract unit price.

B. Payment is full compensation for furnishing, delivery, and maintaining service to the pop-up network for the duration of the project.

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- Last year for reference…

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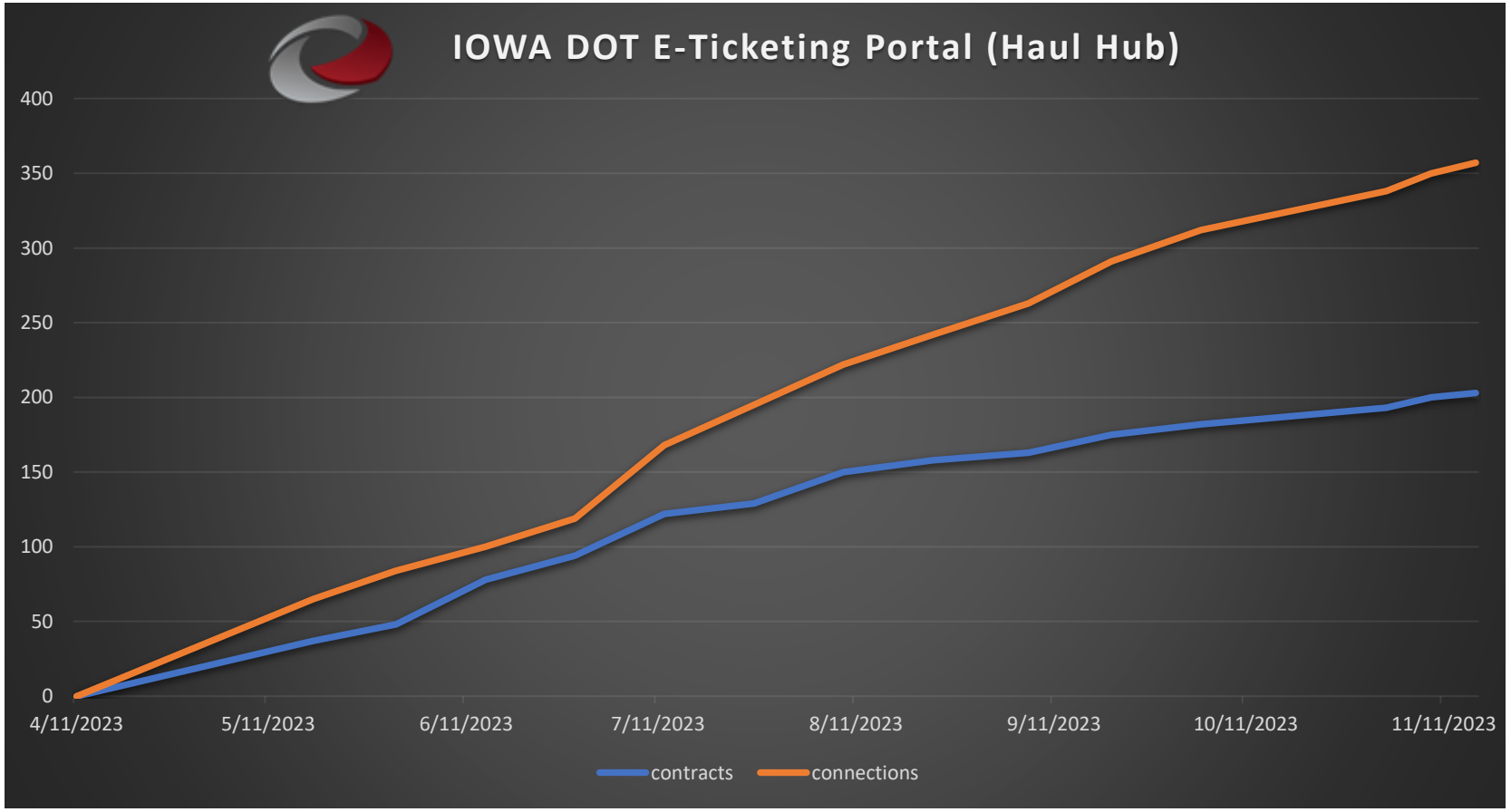

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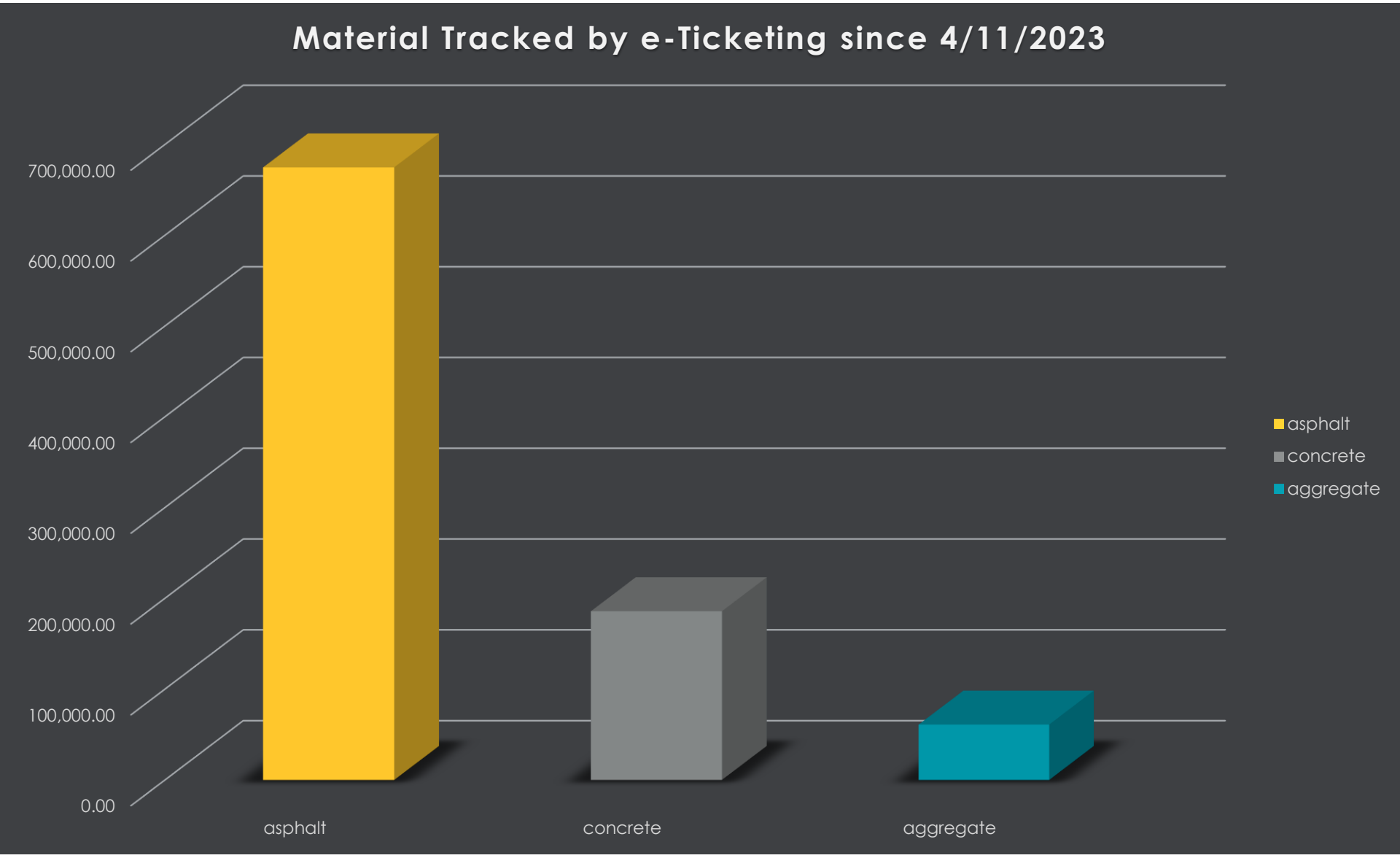

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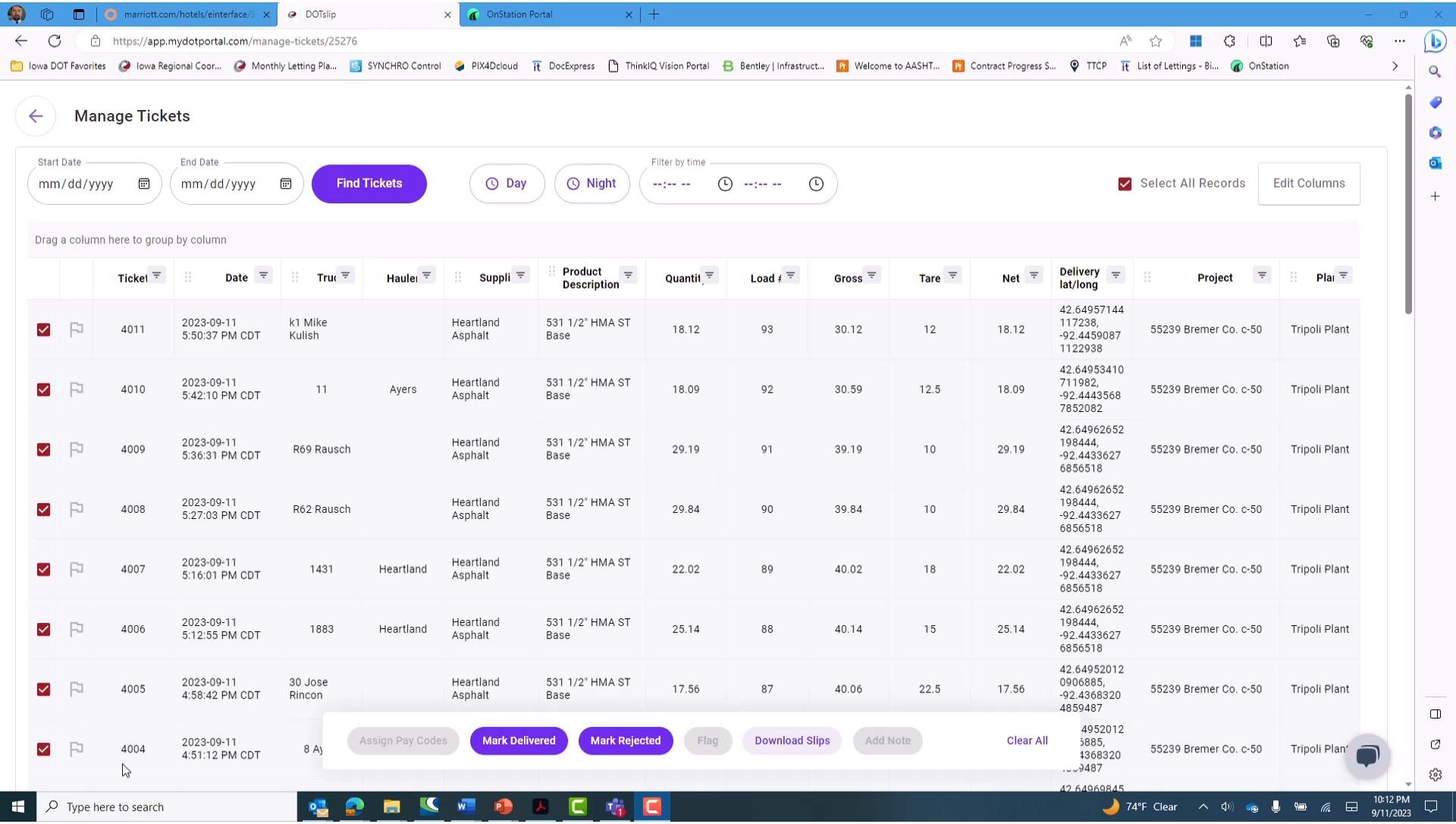

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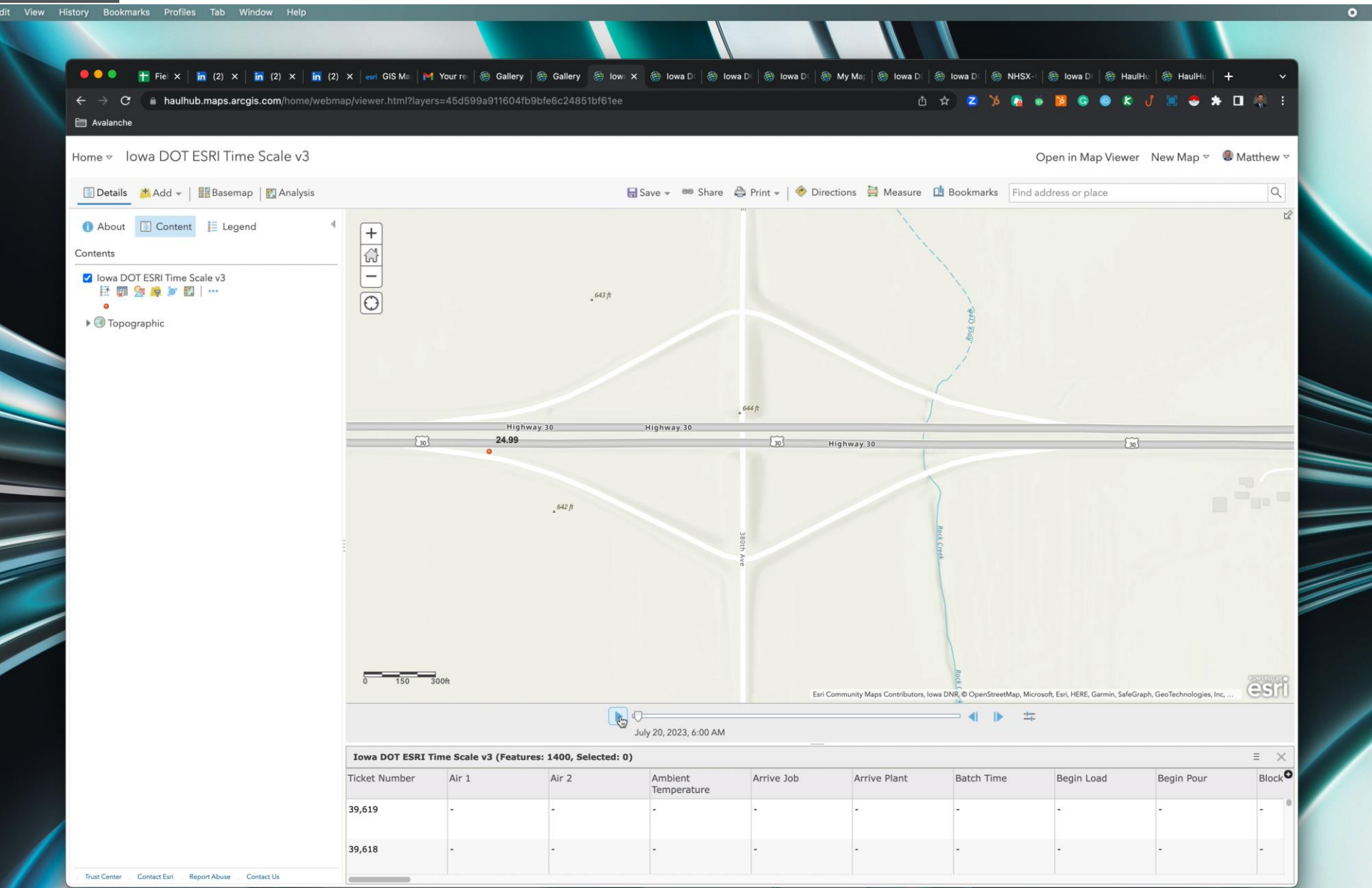

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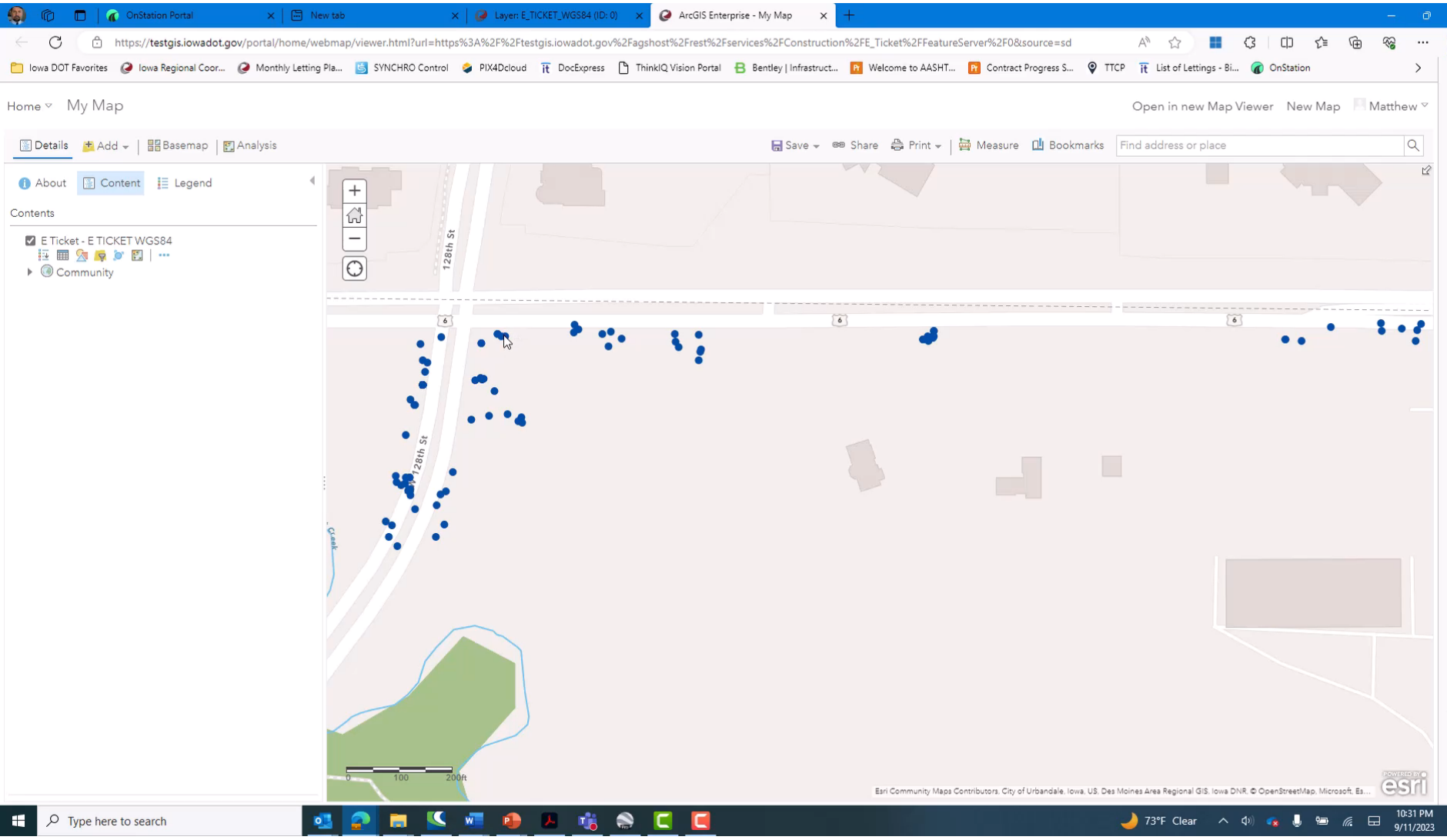

IOWADOT

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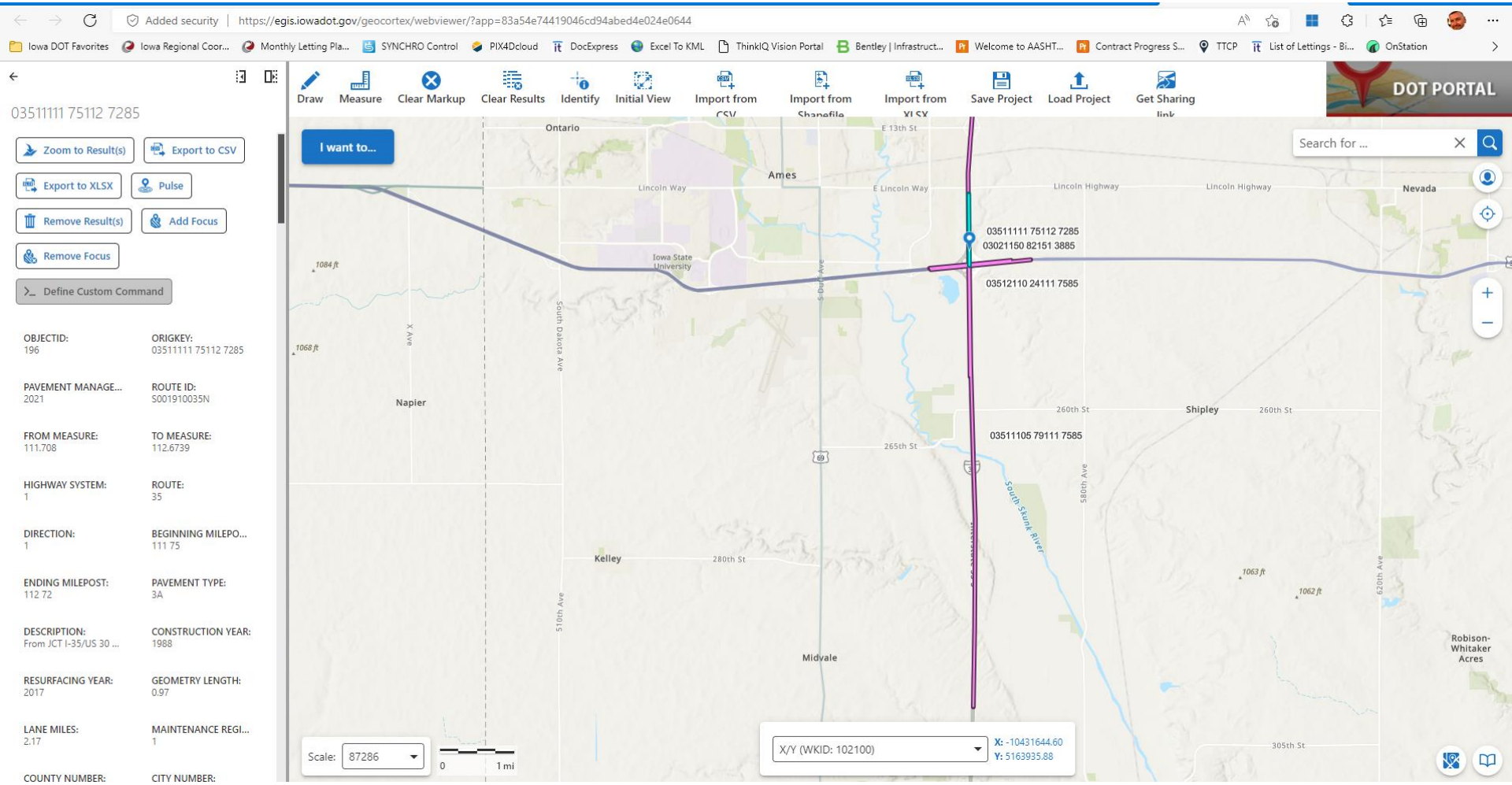
ESRI map for pavement



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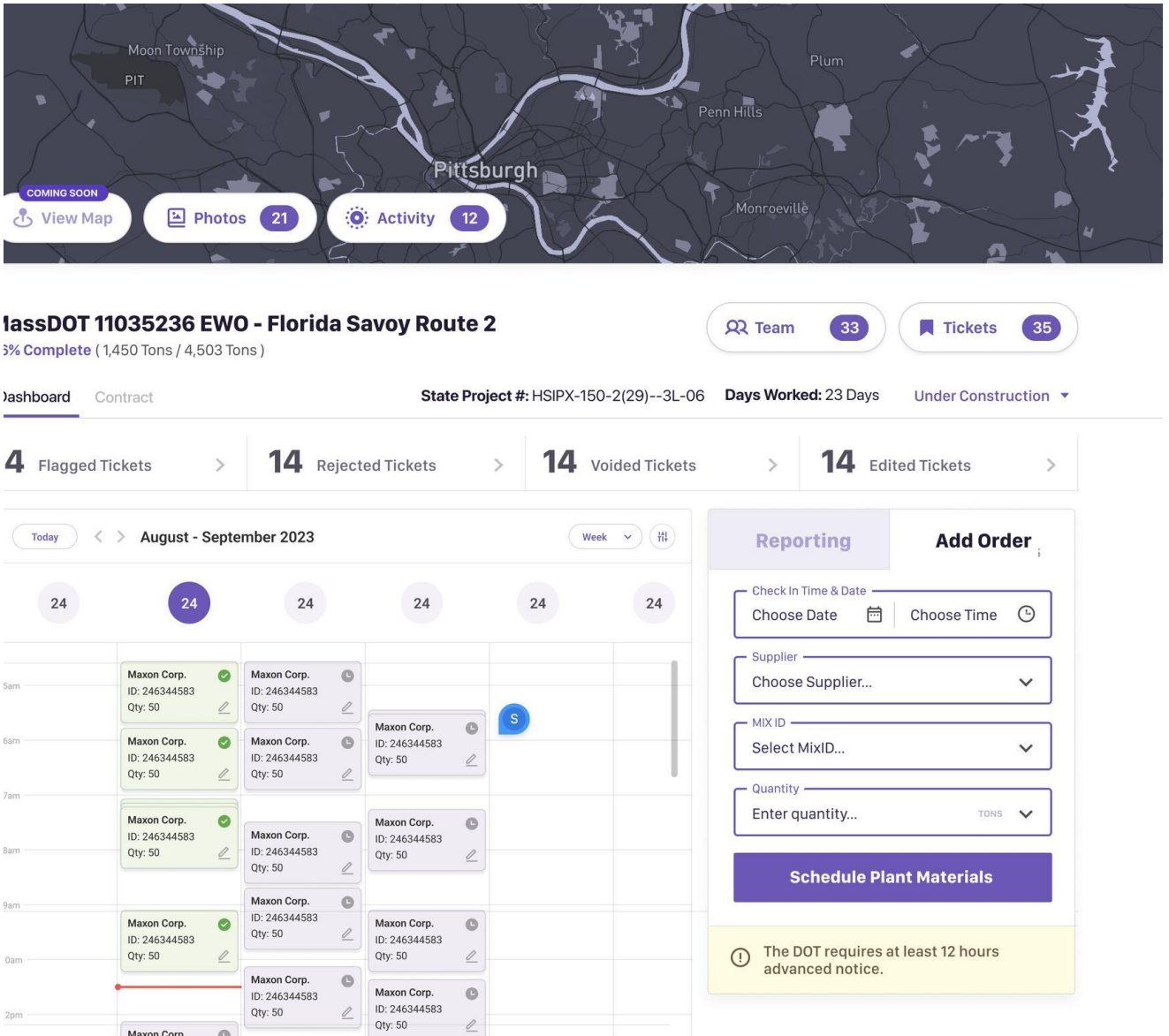

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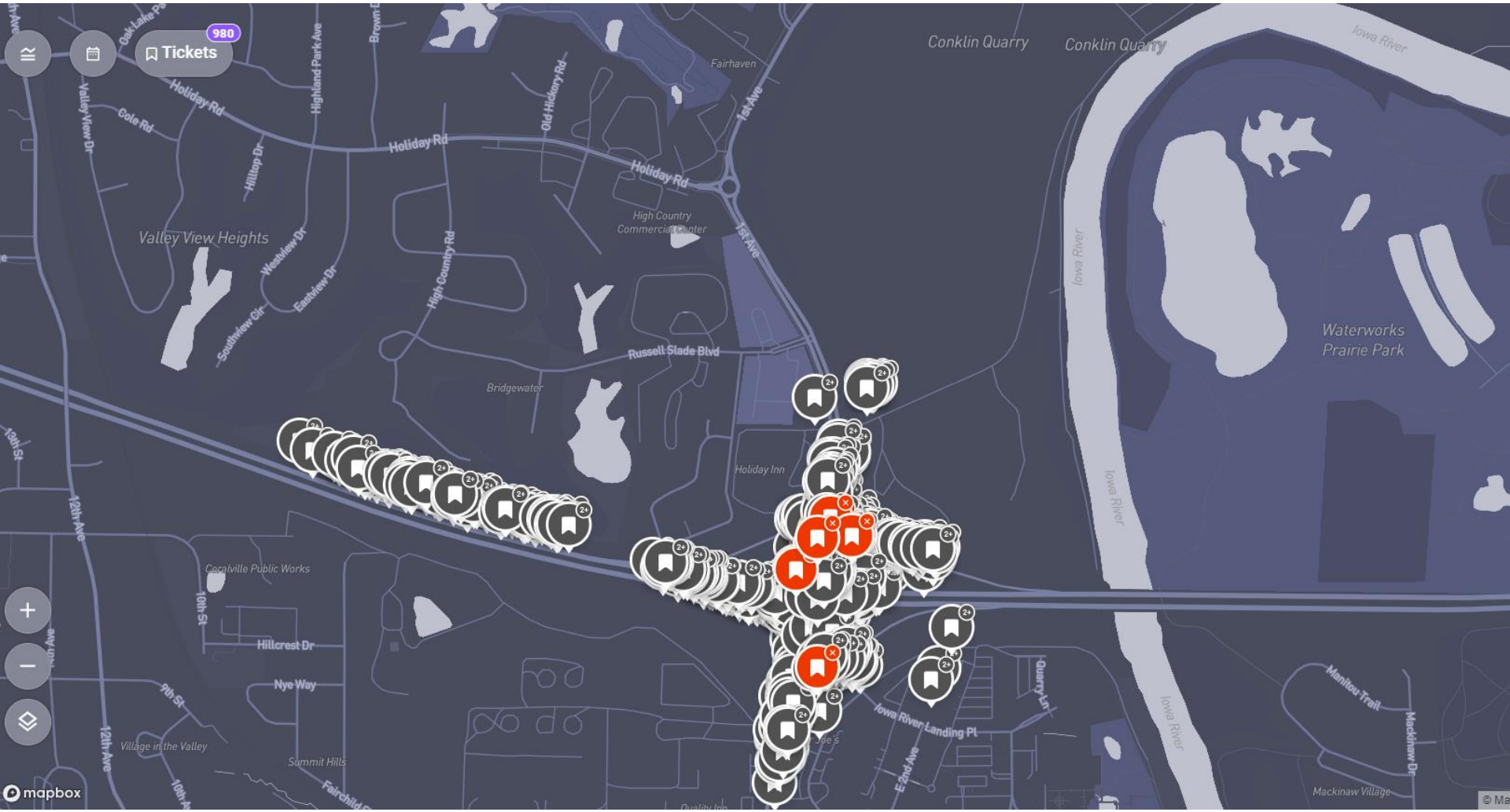

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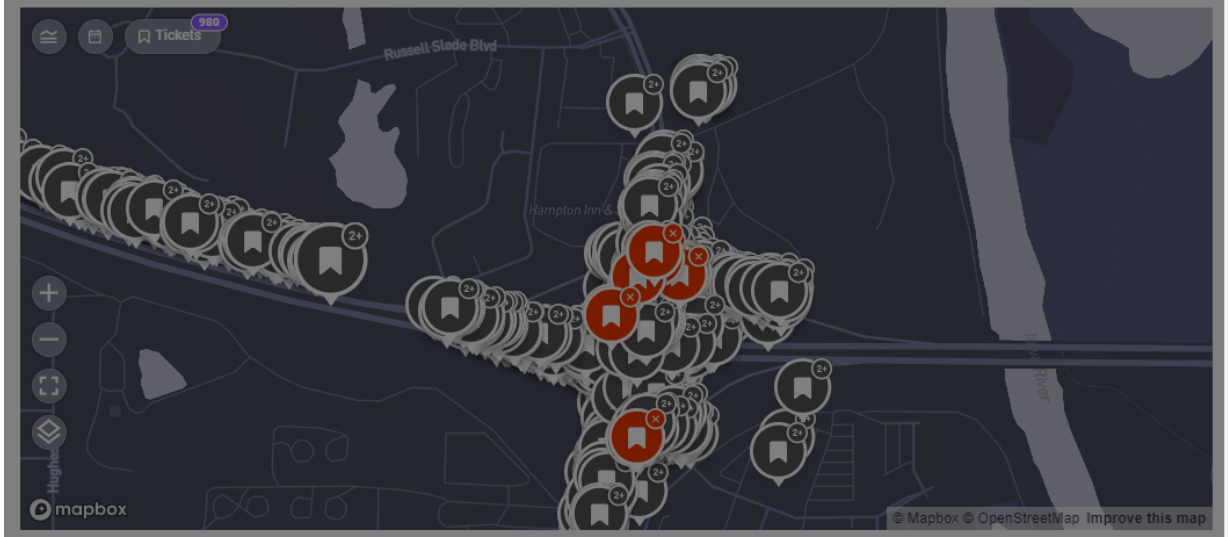

See All Photos

30 Ticket Types

AMOUNT	MATERIAL NAME	NUMBER OF TICKETS	TICKET TYPE
3,471.00	C3 WRC20	321	Ready Mix Concrete
3,360.00	C3 WRC20	348	Ready Mix Concrete
714.00	C-4WR-C20	97	Ready Mix Concrete
579.00	C4 WR C20	78	Ready Mix Concrete
563.00	C-4WR-C20 3/4"	69	Ready Mix Concrete

63354 Download slip

Delivered 11/02/2023 8:35 AM CDT

Mark as Pending | More Actions

Ticket | Audit log | Test results | Map | Photos

Certification Statement

Raw Ticket Data — Hide Details

Plant	1	Created/Printed At	11/02/2023 08:04 AM CDT
Supplier	Streb Construction	Supplier Code	-
Customer Name	Streb	Contract #	IM-080-6(488)242--13-52
Job	I80/1St Ave Interchange	Job #	11
PO #	22-034-2	Connected DOTProject Number	IM-080-6(488)242--13-52 (489) (490) (495)
Hauler	Streb Construction	Truck	109
Product	C-3WR-C20 P	Product Description	C3 WRC20
Product Code	C-3WR-C20 P	Material	-
Allowable Water	306.01	BatchTime	2023-11-02 08:08:36.0
Design Total Water	330	Design_Slump	3
DueTime	2023-11-02 08:05:21	Load ID	6857
Load Total Weight	41,612	Max Allowable Water	306.01
Order Code	381	Water Cement Ratio	0.39
Water To Add	38.60	Load	1
Daily Total	11.00	Weighmaster	-
Net	11.00 Cubic yard	Slump	3.00
Left Plant	11/2/2023 8:07 AM CDT	Arrive Job	

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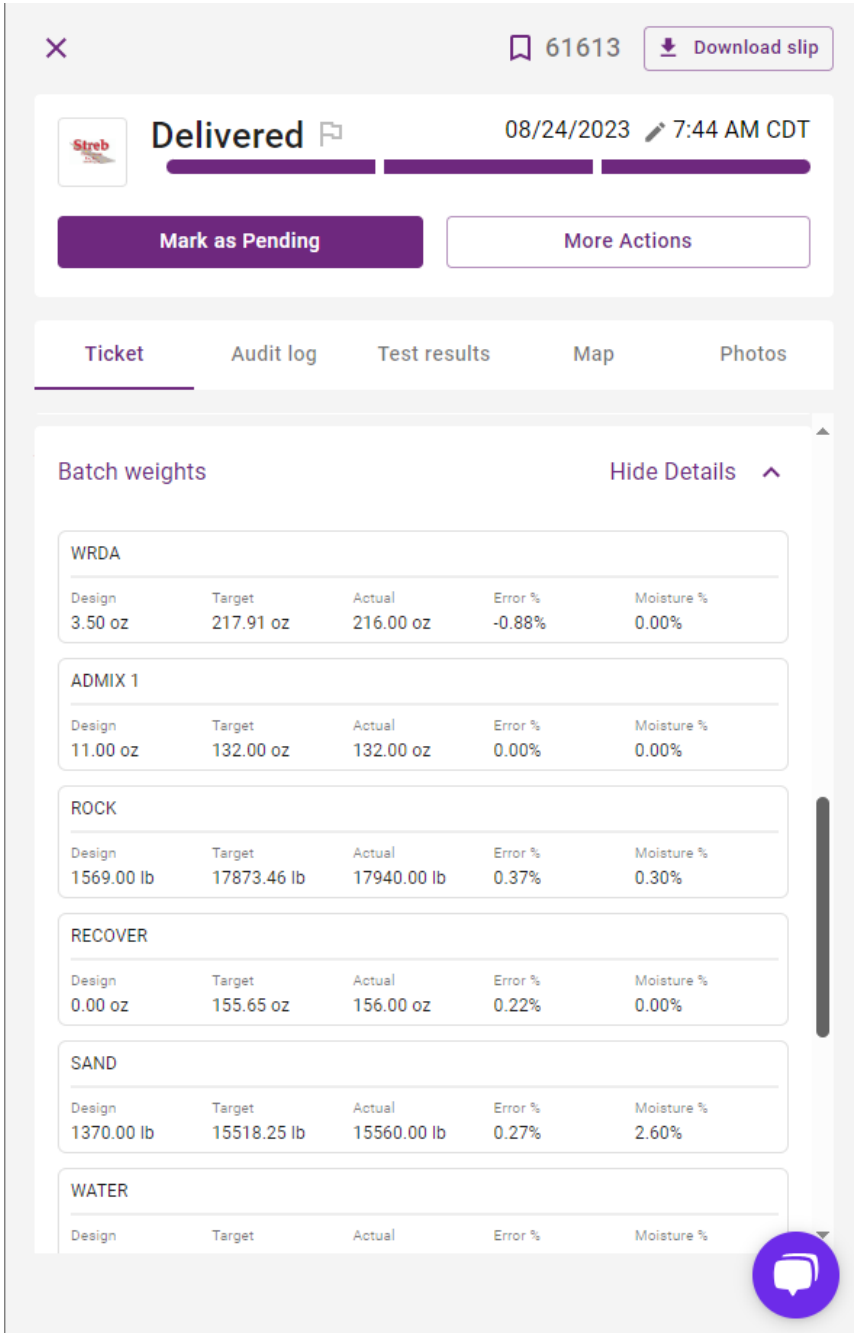

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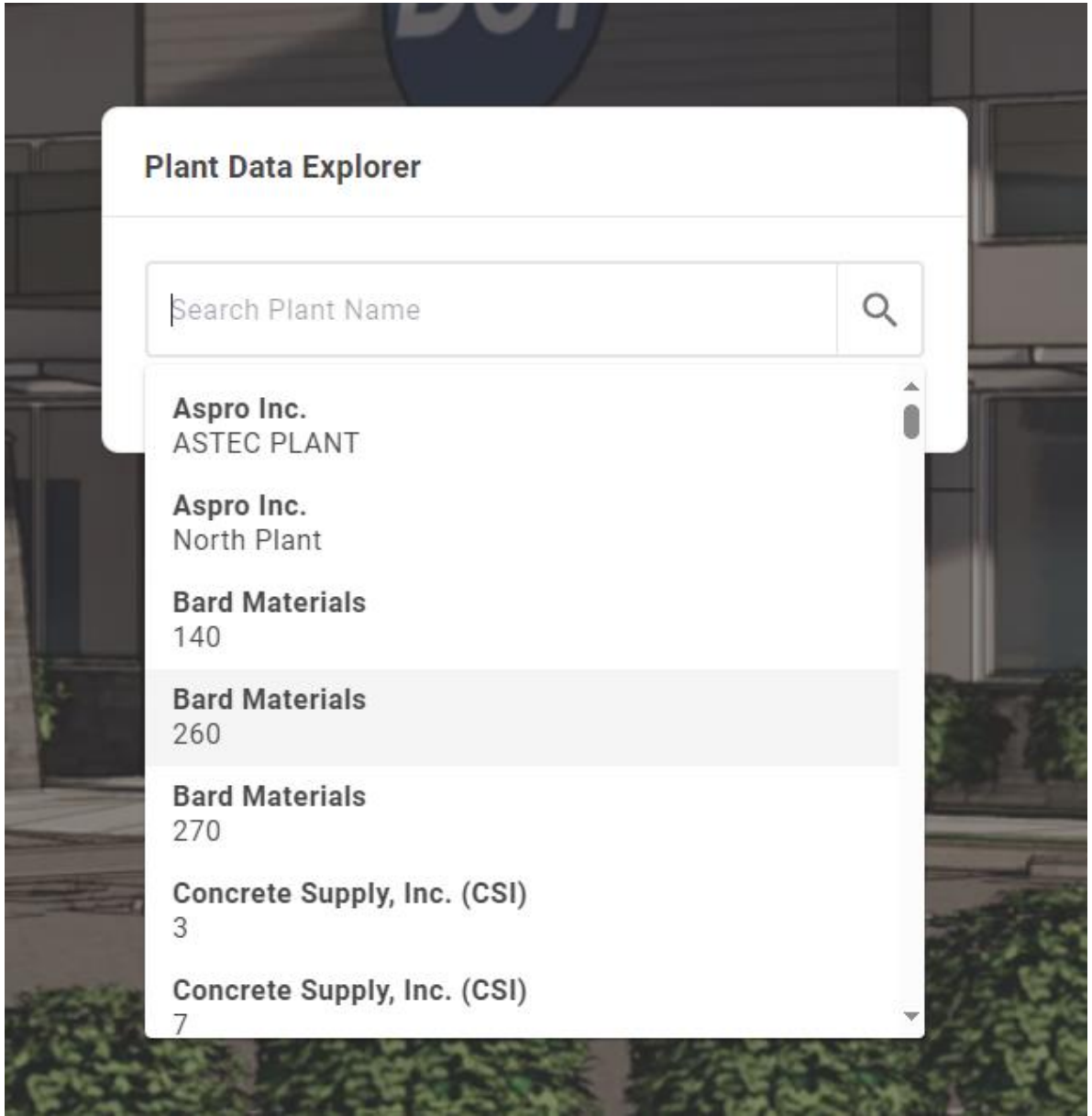

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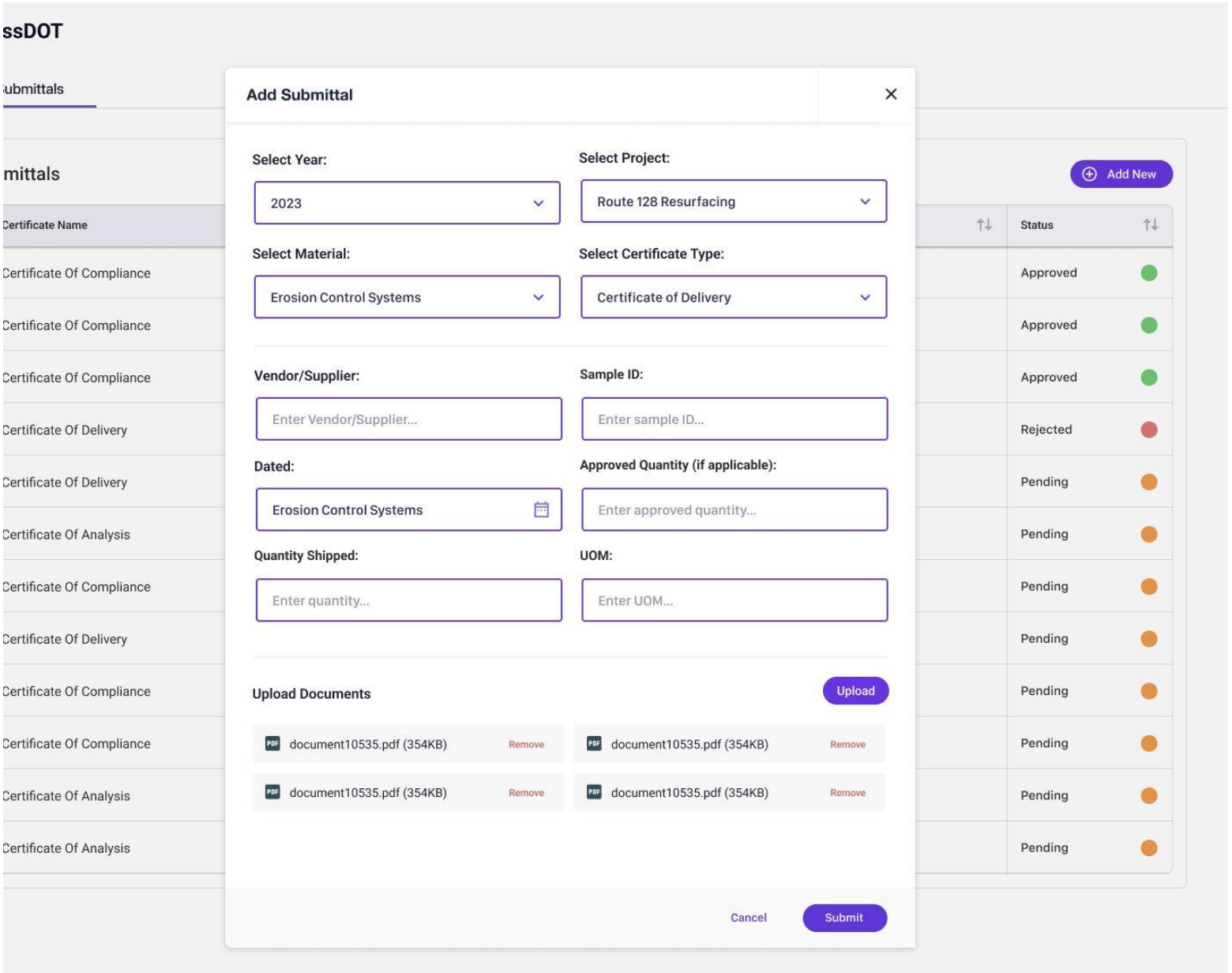
1/18/2023 - 1/18/2024 | Select Time Range

Date ×

		Date	Contrac	Ticke	Product Description	Tru	Haule	Suppl
☐		12-28-2023 (7)						
☐	⚐	12/28/2023 1:18:00 PM CST		3233176	IDOT C-4WR	59634	CSI	Concrete Supply, Inc.
☐	⚐	12/28/2023 12:48:00 PM CST		3233171	IDOT C-4WR	59787	CSI	Concrete Supply, Inc.
☐	⚐	12/28/2023 12:06:00 PM CST		3233163	IDOT C-4WR	59885	CSI	Concrete Supply, Inc.
☐	⚐	12/28/2023 11:20:00 AM CST		3233155	IDOT C-4WR	59898	CSI	Concrete Supply, Inc.
☐	⚐	12/28/2023 10:47:00 AM CST		3233152	IDOT C-4WR	59847	CSI	Concrete Supply, Inc.
☐	⚐	12/28/2023 10:03:00 AM CST		3233142	IDOT C-4WR	59634	CSI	Concrete Supply, Inc.
☐	⚐	12/28/2023 9:23:00 AM CST		3233136	IDOT C-4WR	59898	CSI	Concrete Supply, Inc.
		12-27-2023 (6)						
		12-22-2023 (5)						
		12-21-2023 (5)						
		12-19-2023 (2)						

Mark Delivered | Mark Rejected | Flag

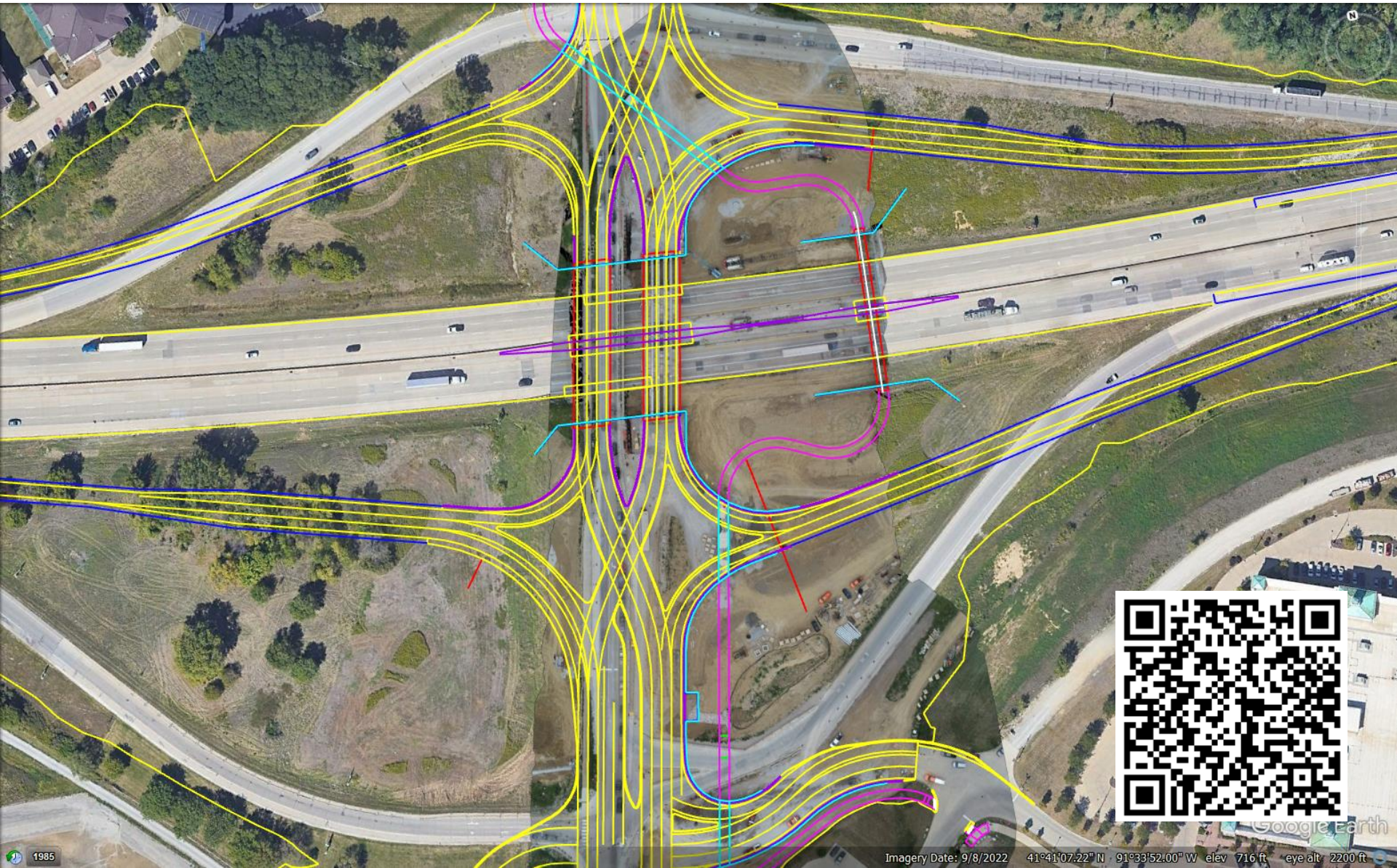
E-Construction



E-Construction

E-Construction

E-Construction



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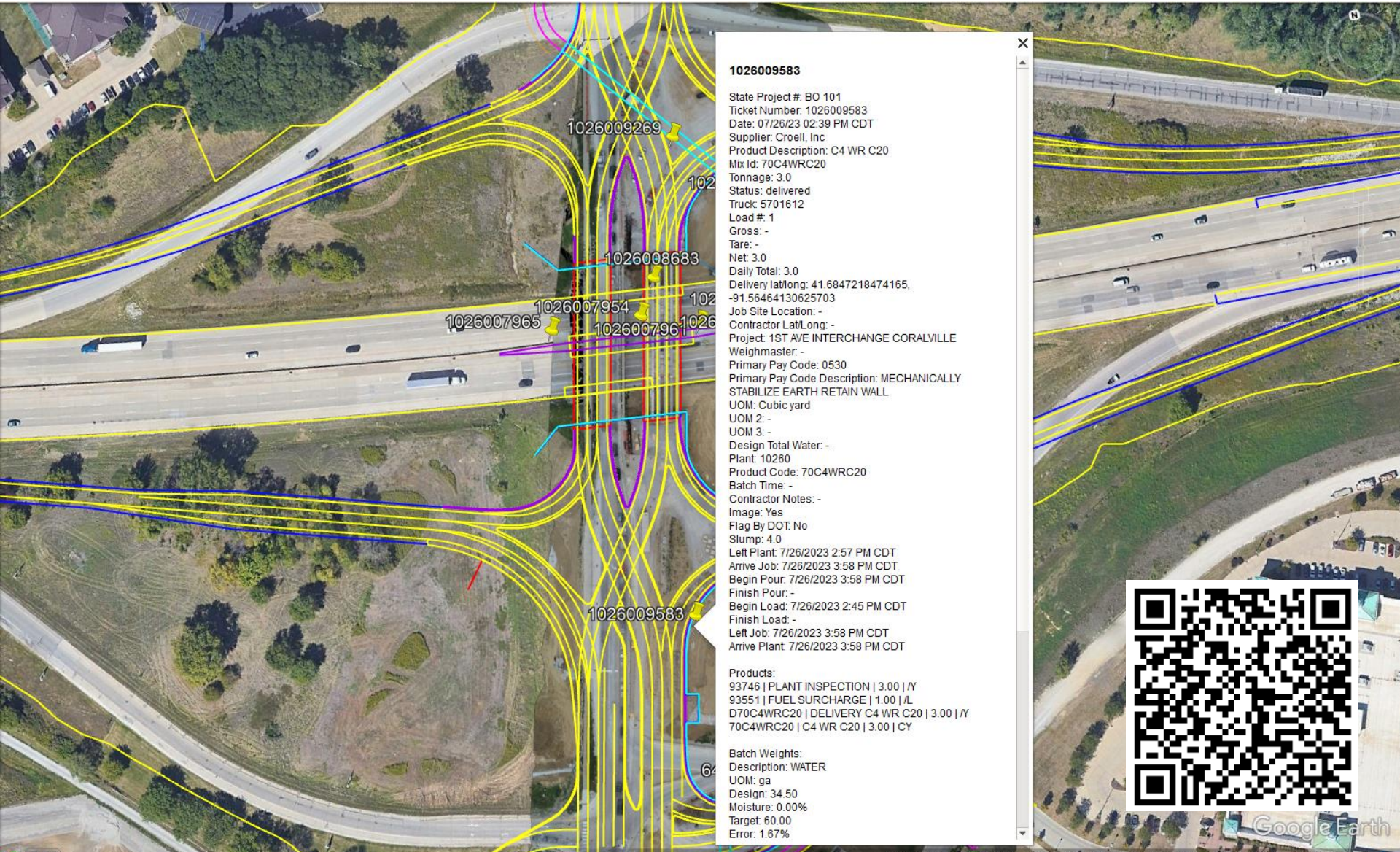
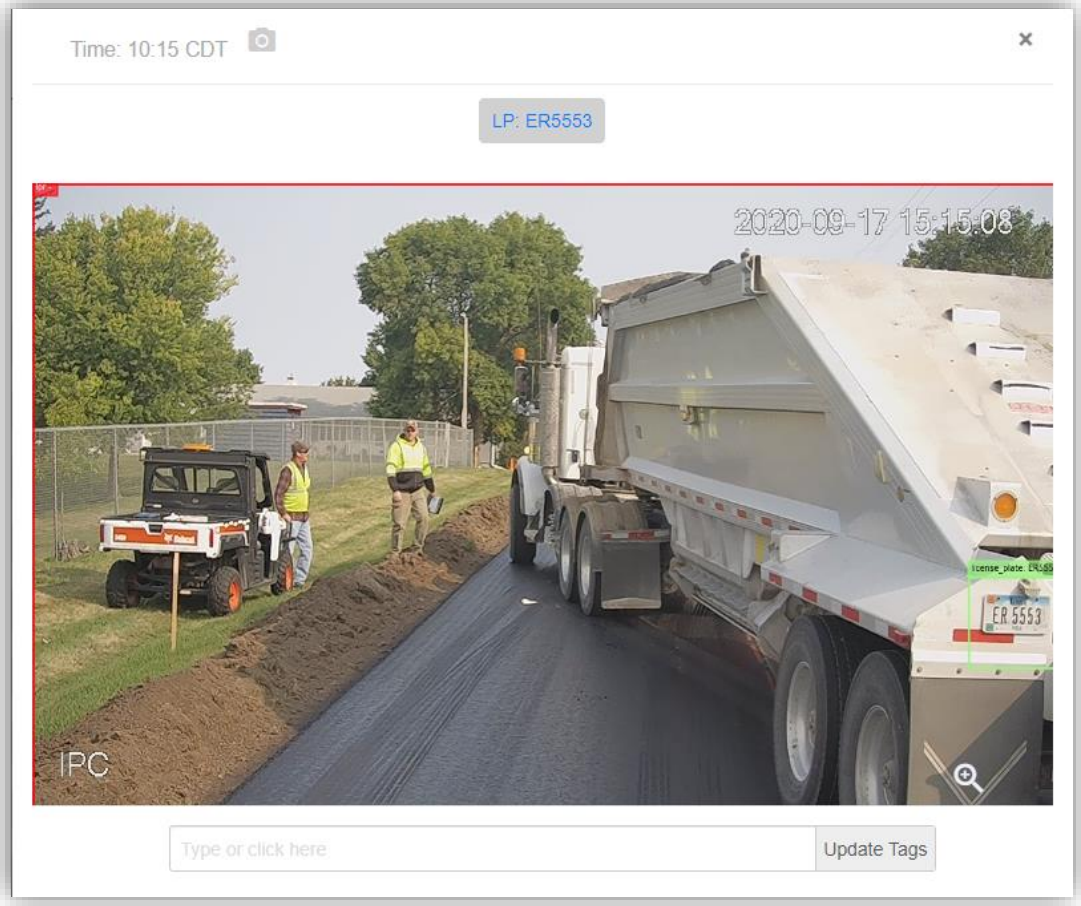


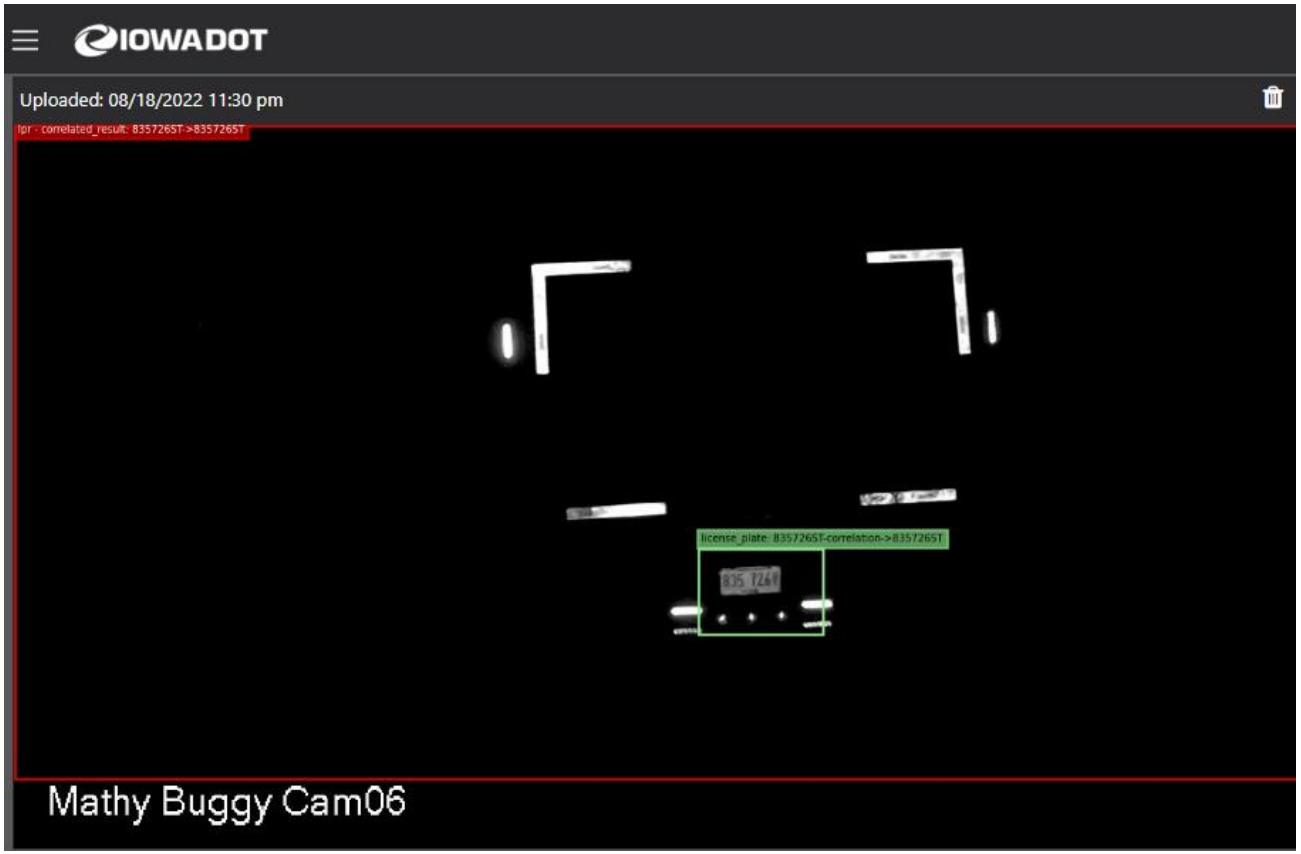
At the Plant


Time: 09:41 CDT
LP: ER5553
license_plate: ER5553
IOWA
ER 5553
POLK
Type or click here
Update Tags

At the Job Site



Night shift job Site



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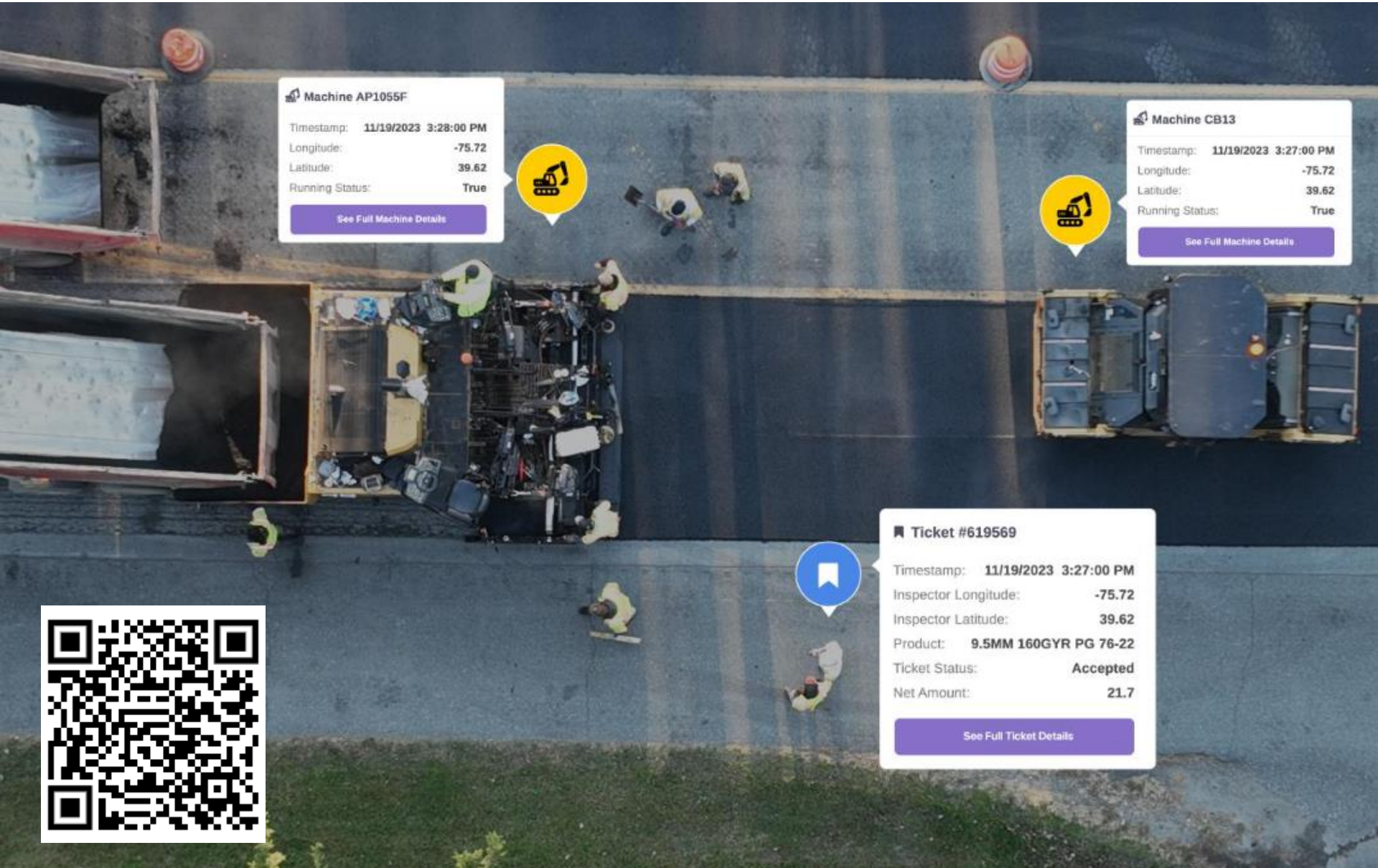
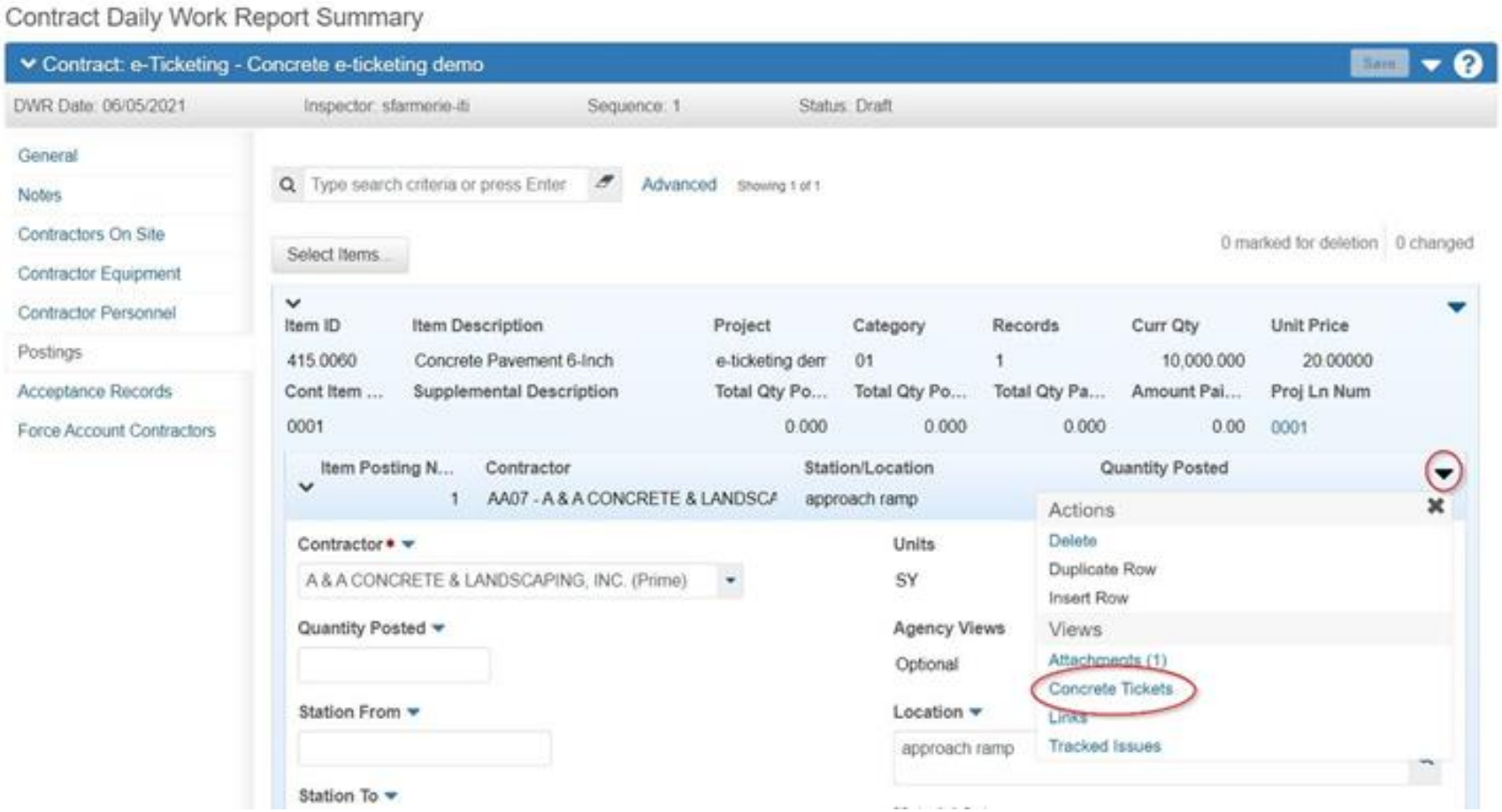


AASHTOware integration



SYNCHRO™

3D model inspection software we are testing.

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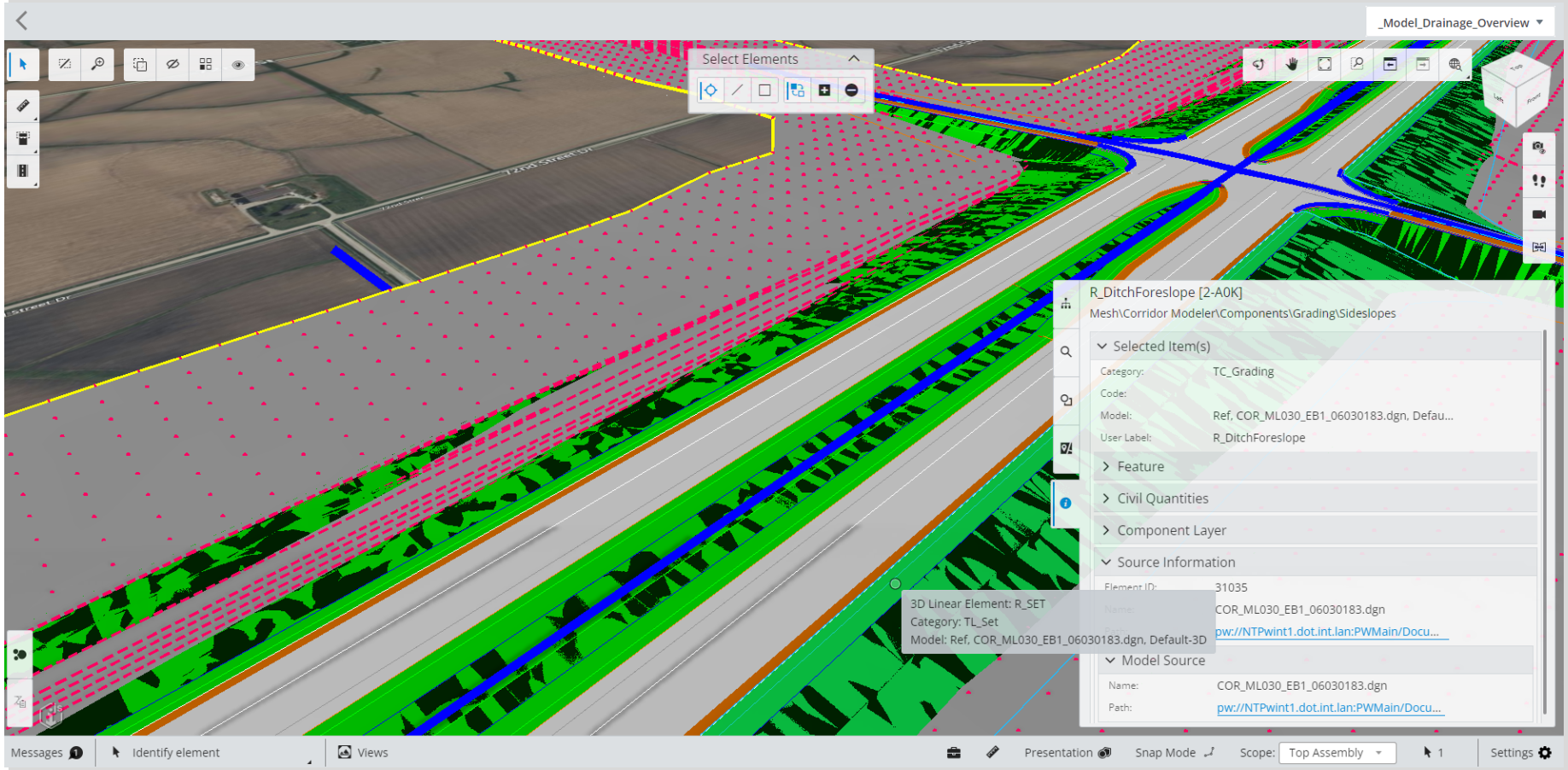

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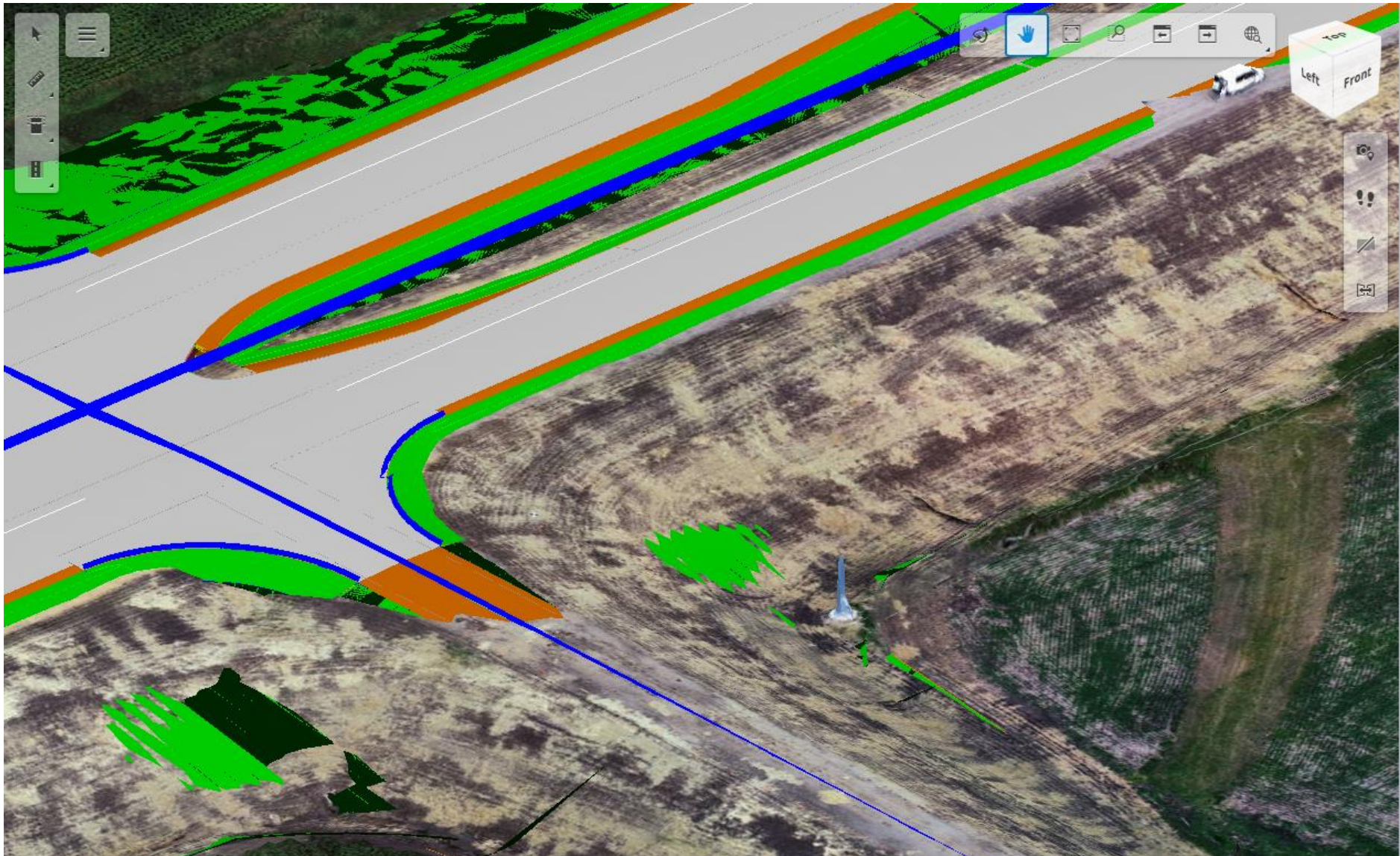

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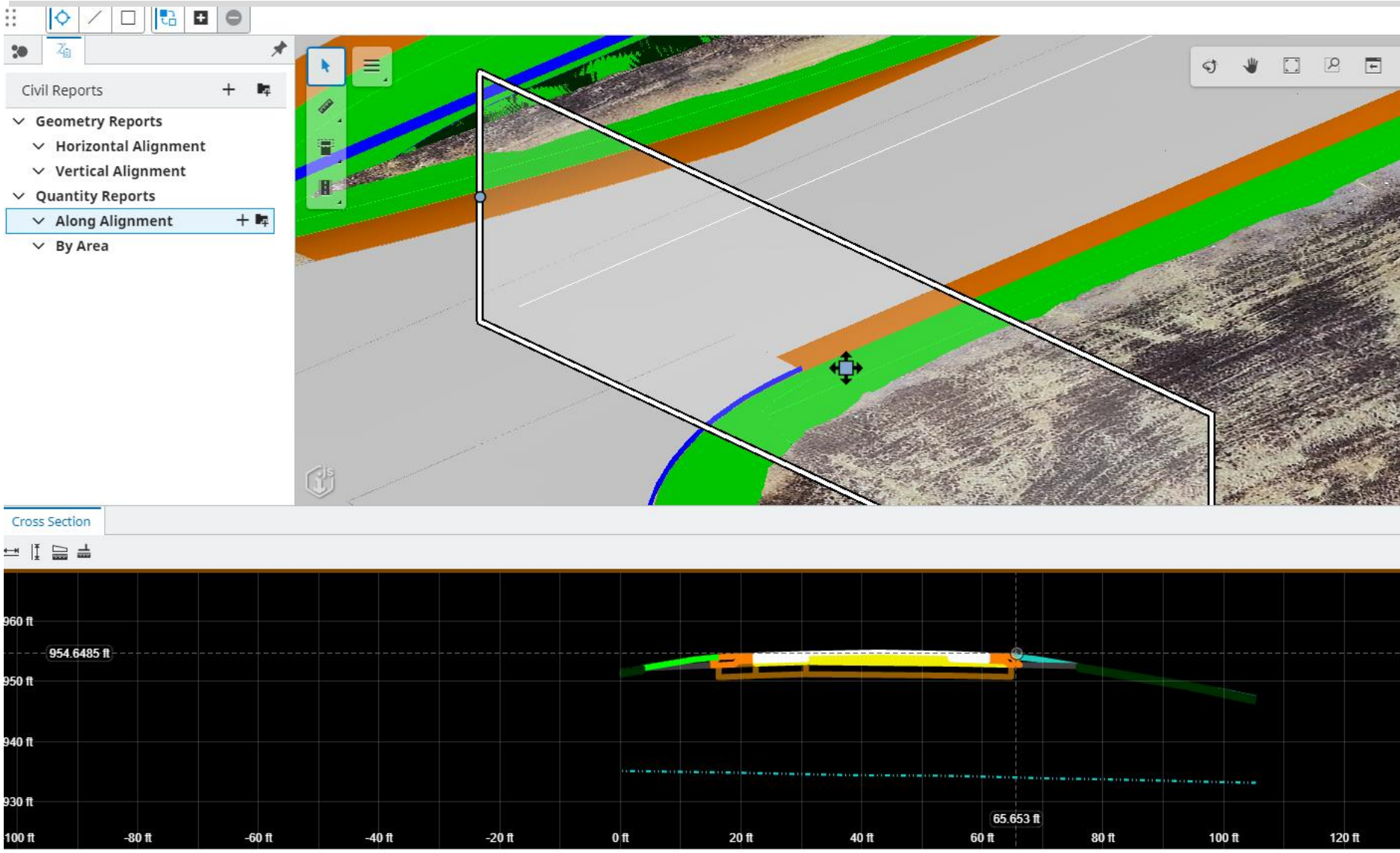

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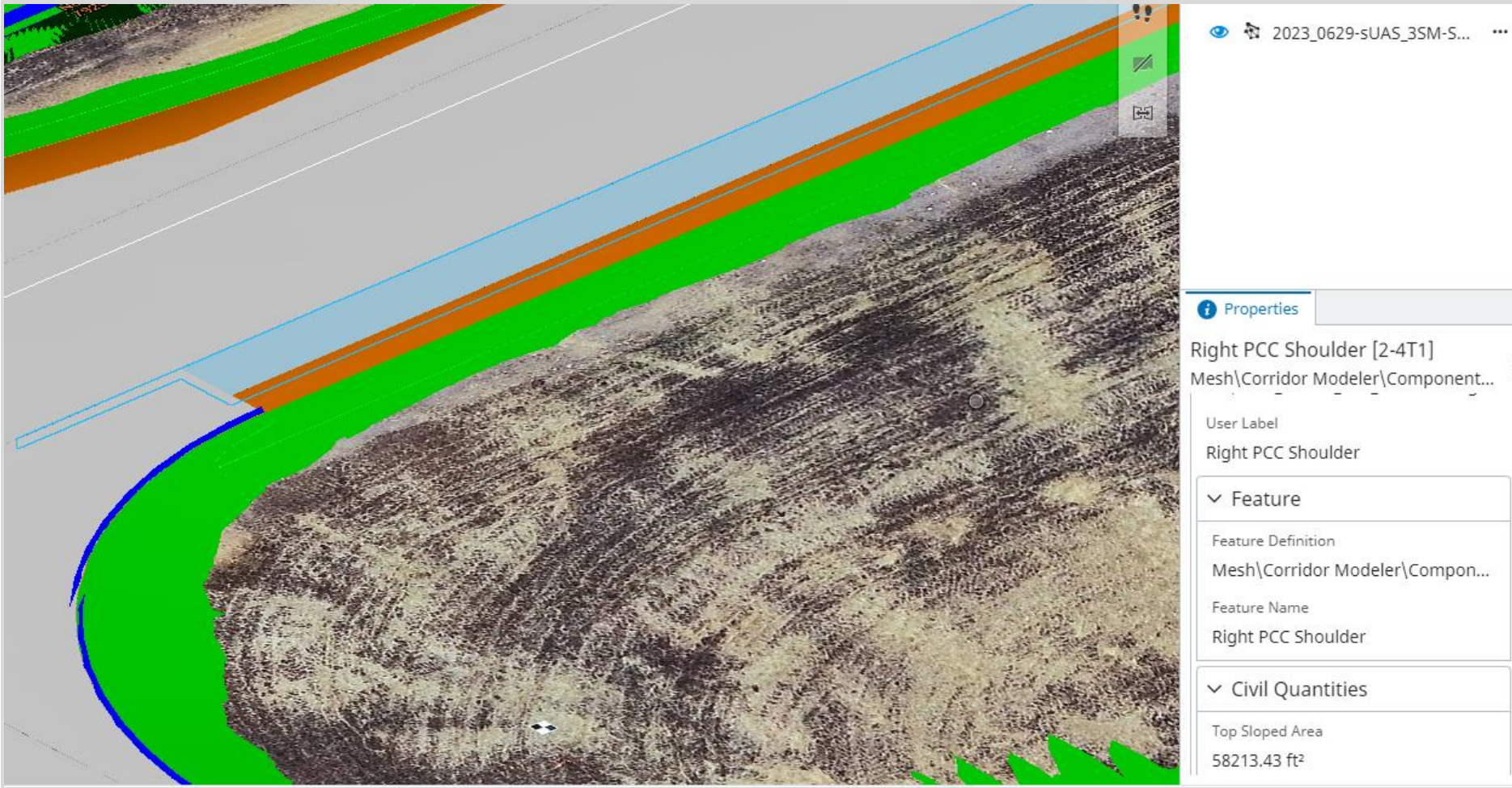

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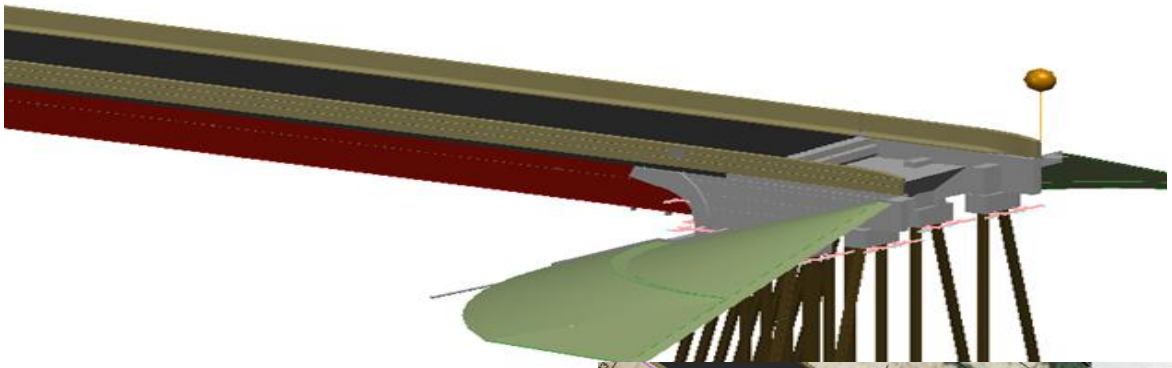

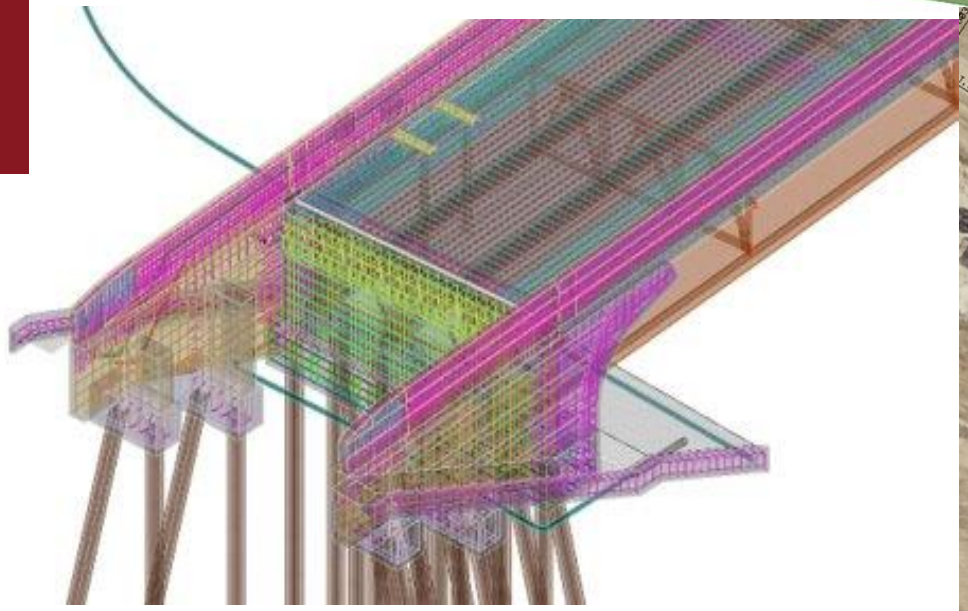

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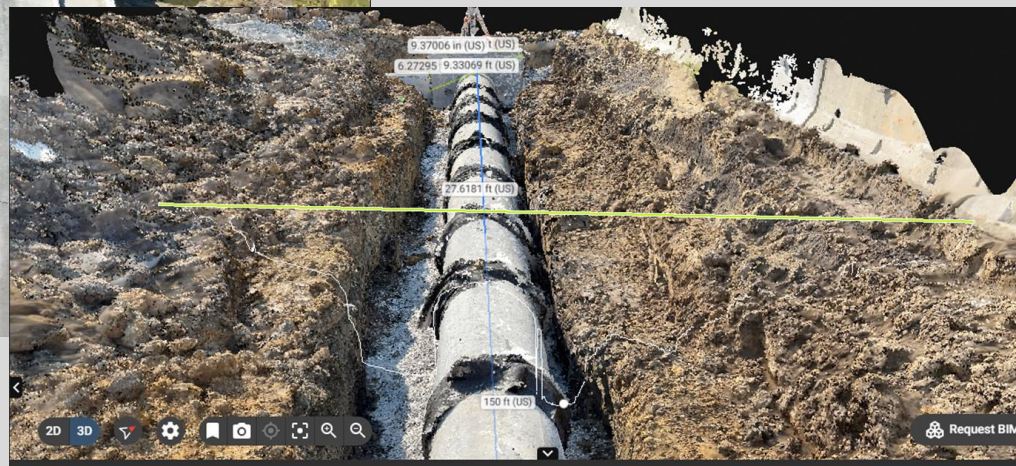

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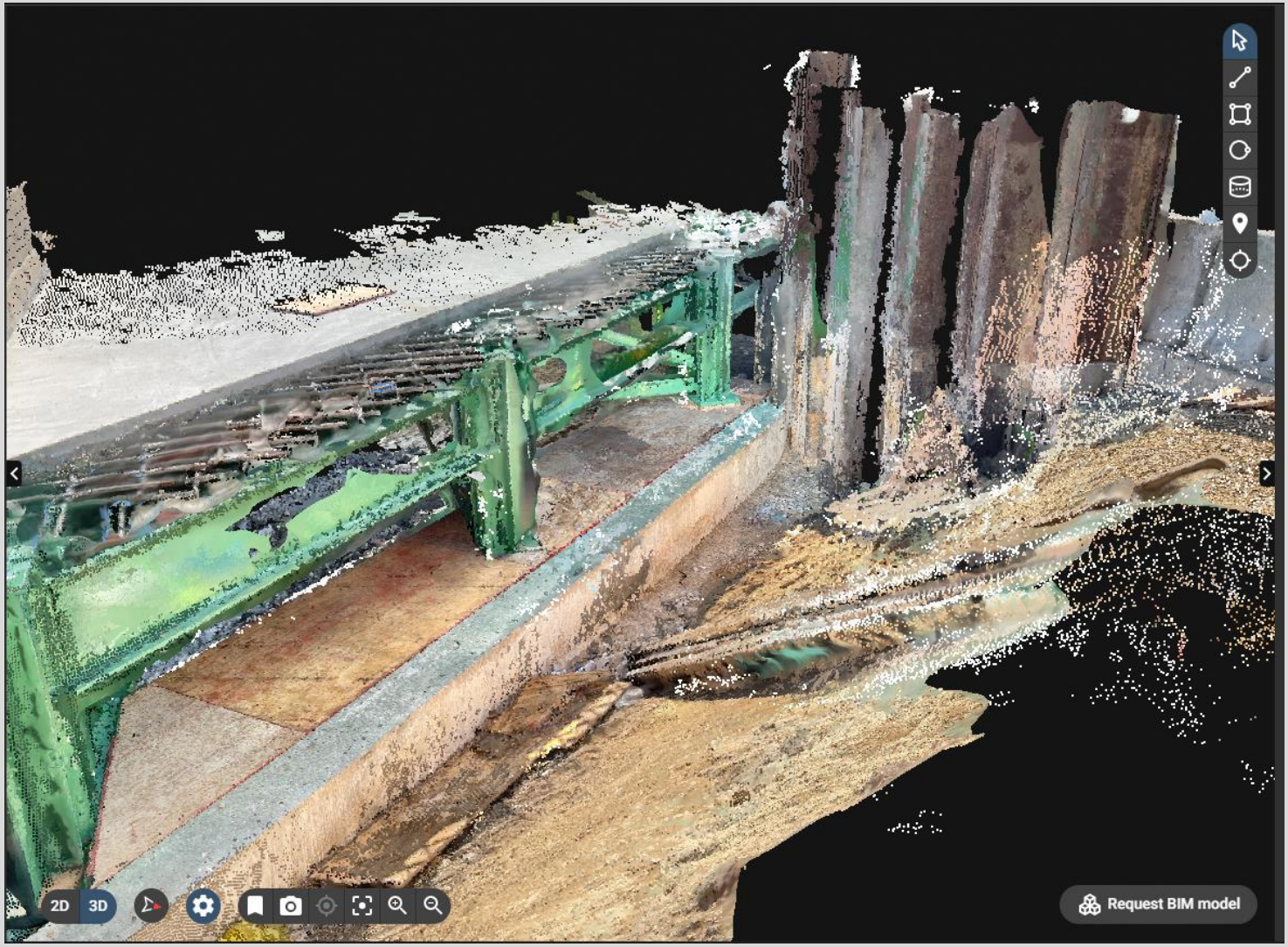
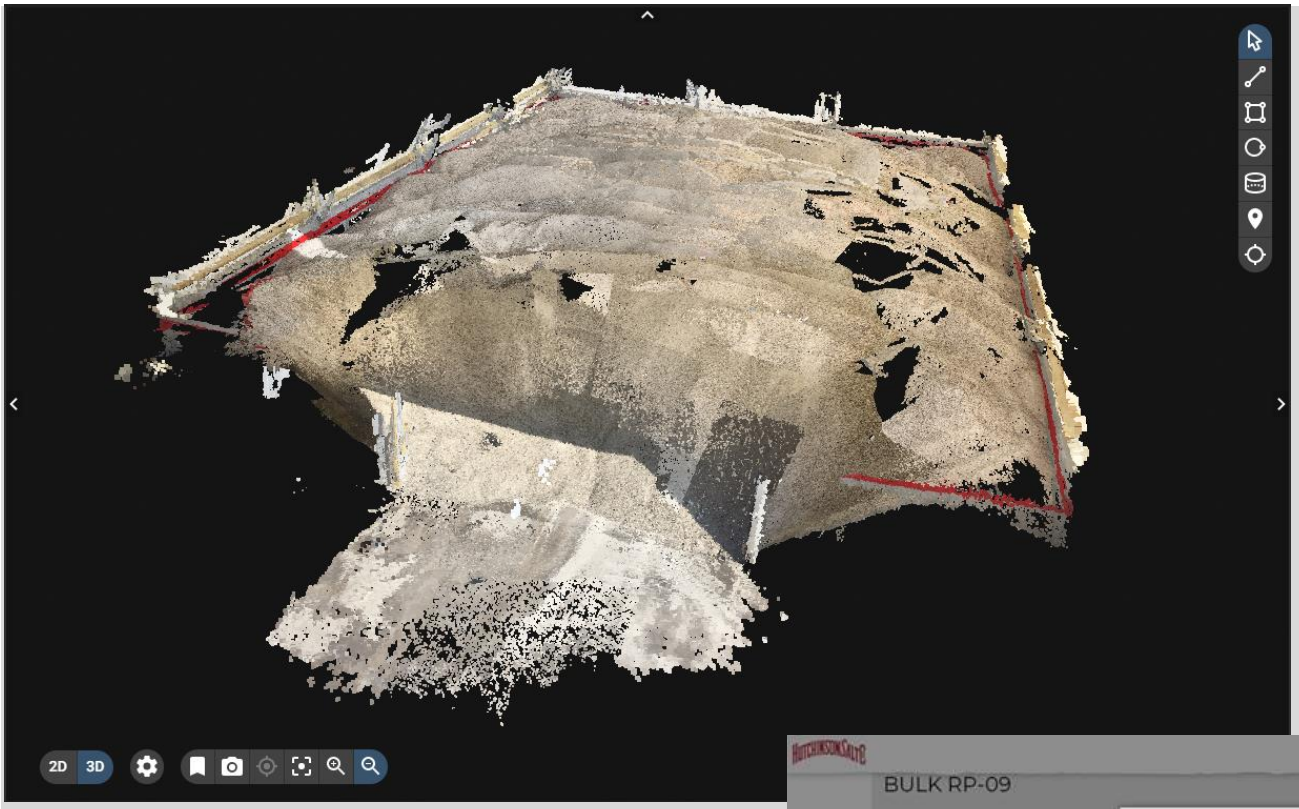
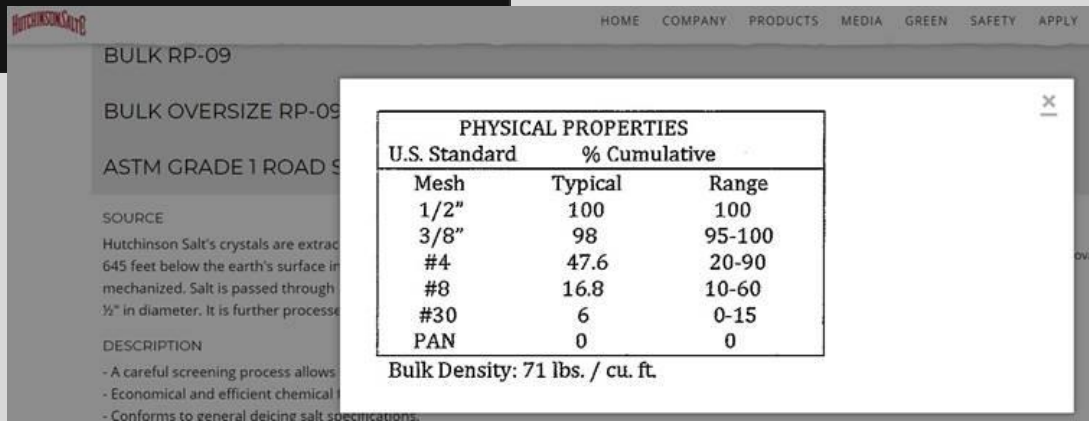


E-Construction





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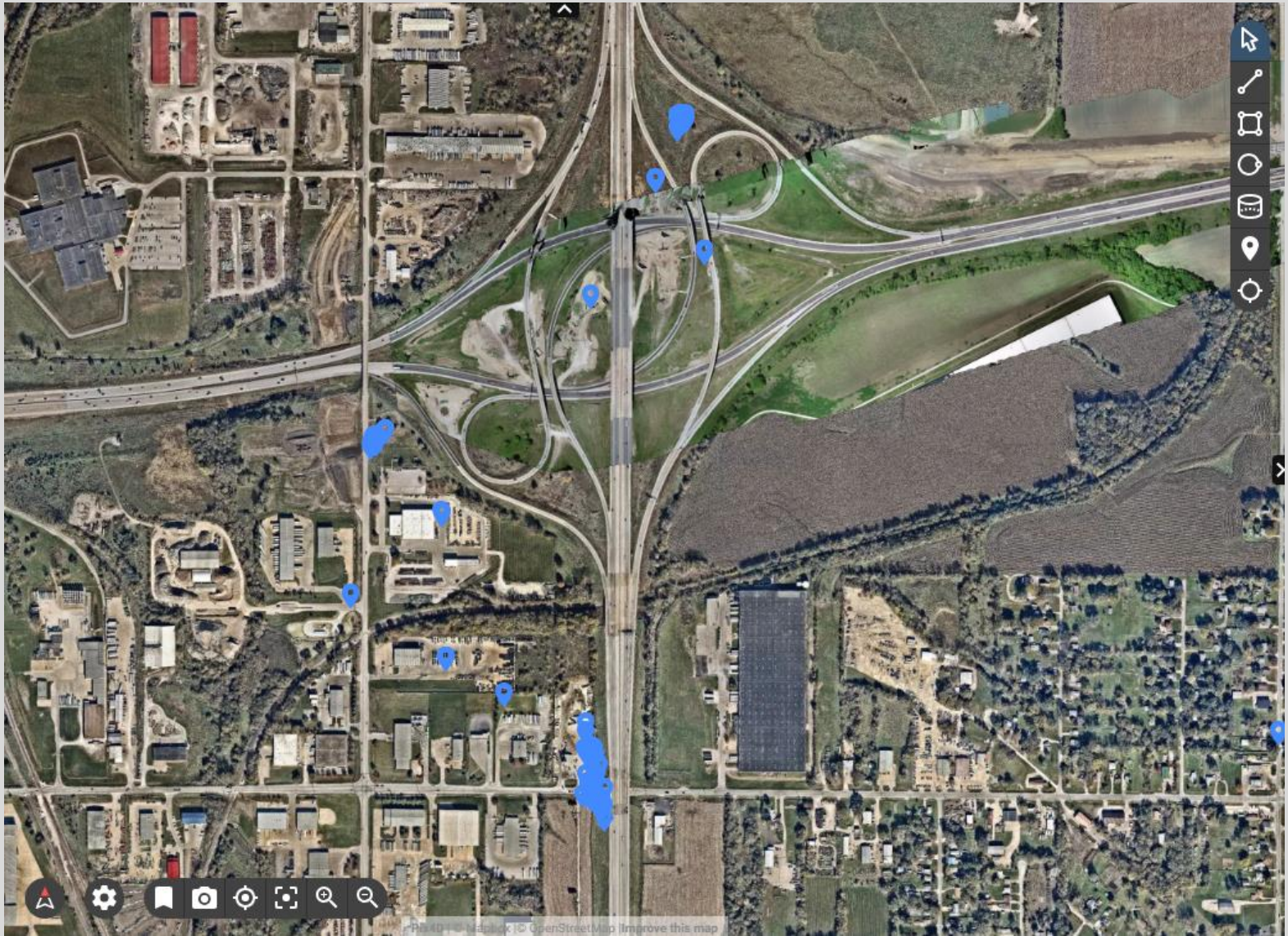

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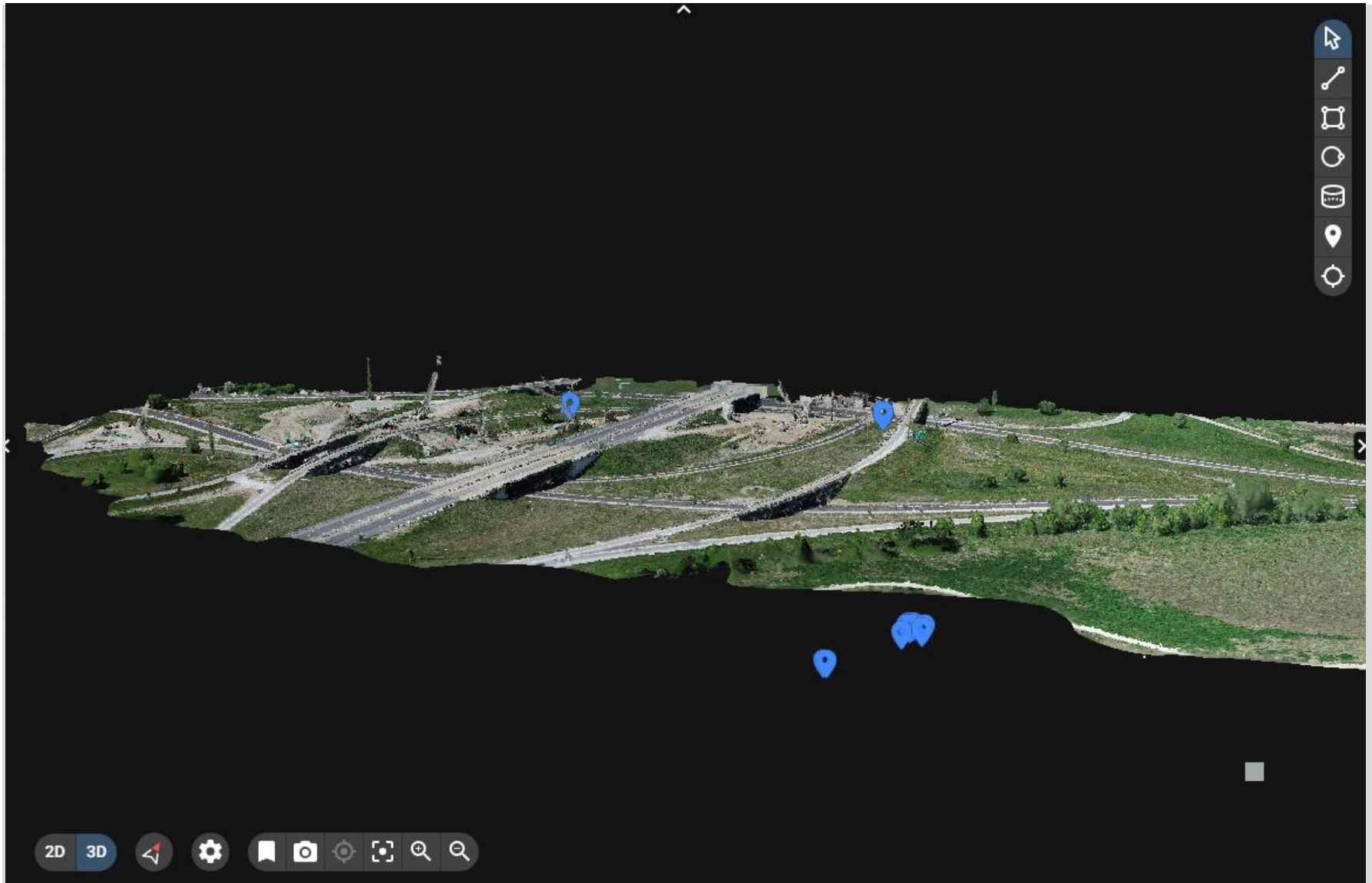
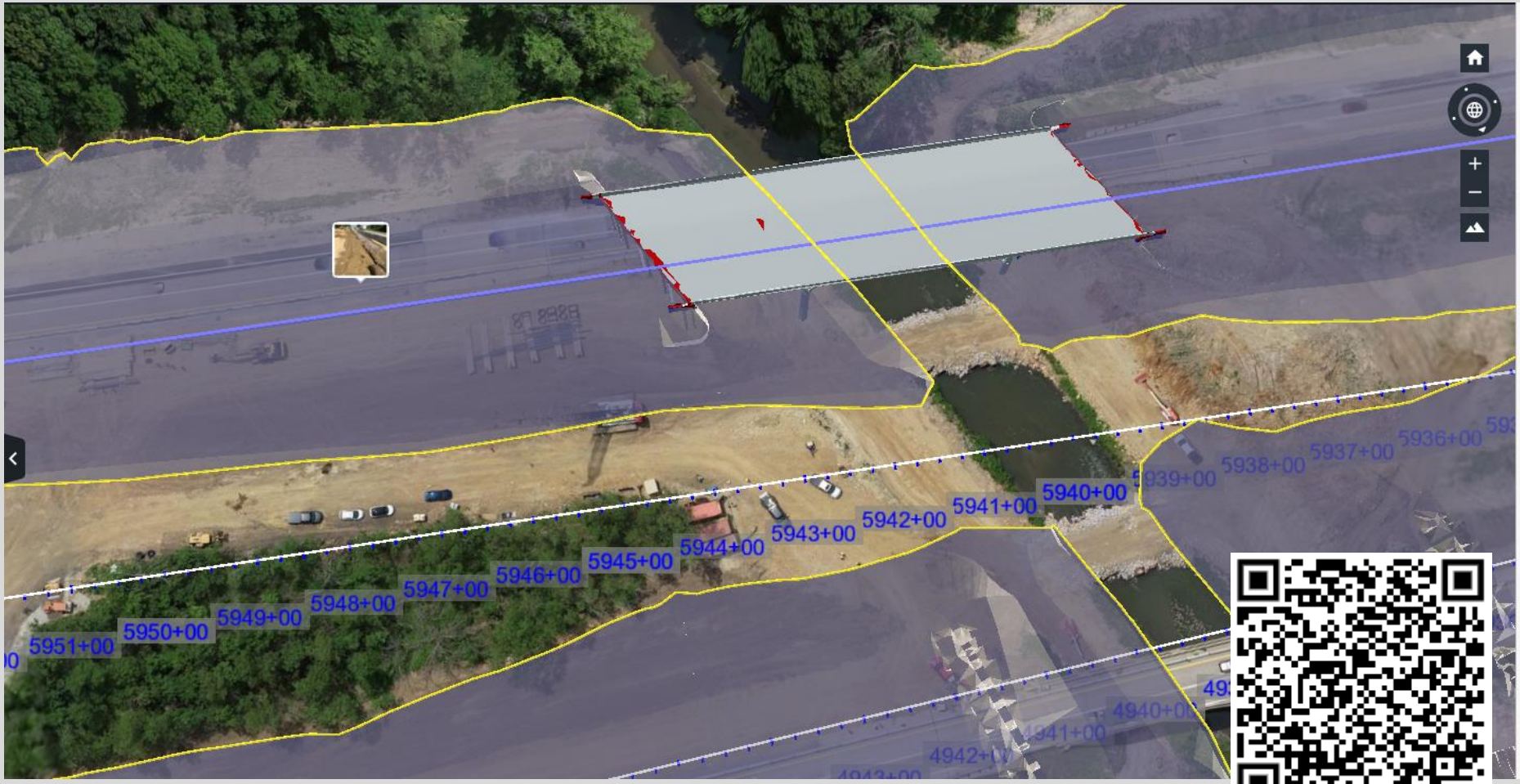


E-Construction

E-Construction

E-Construction



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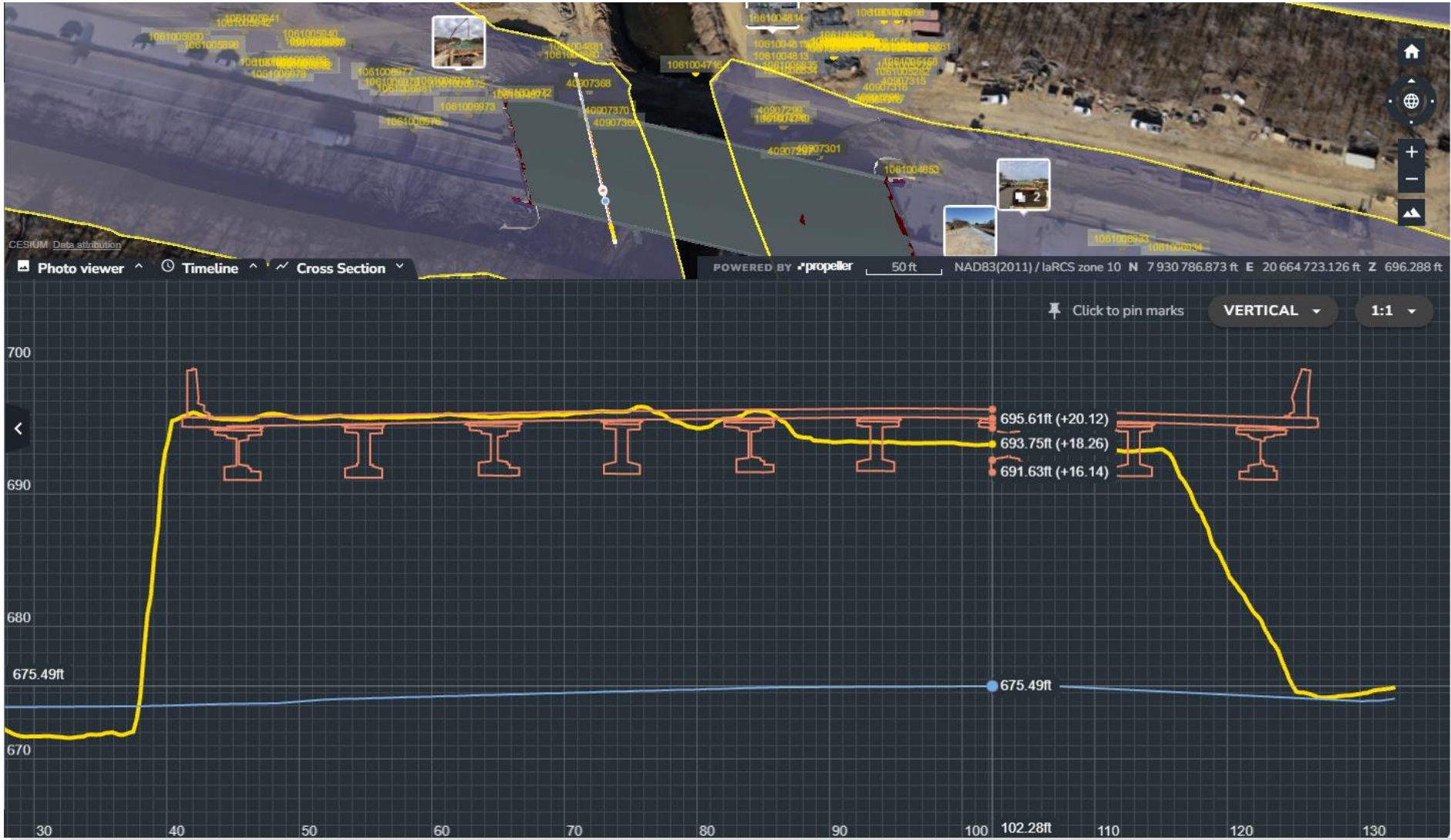
E-Construction



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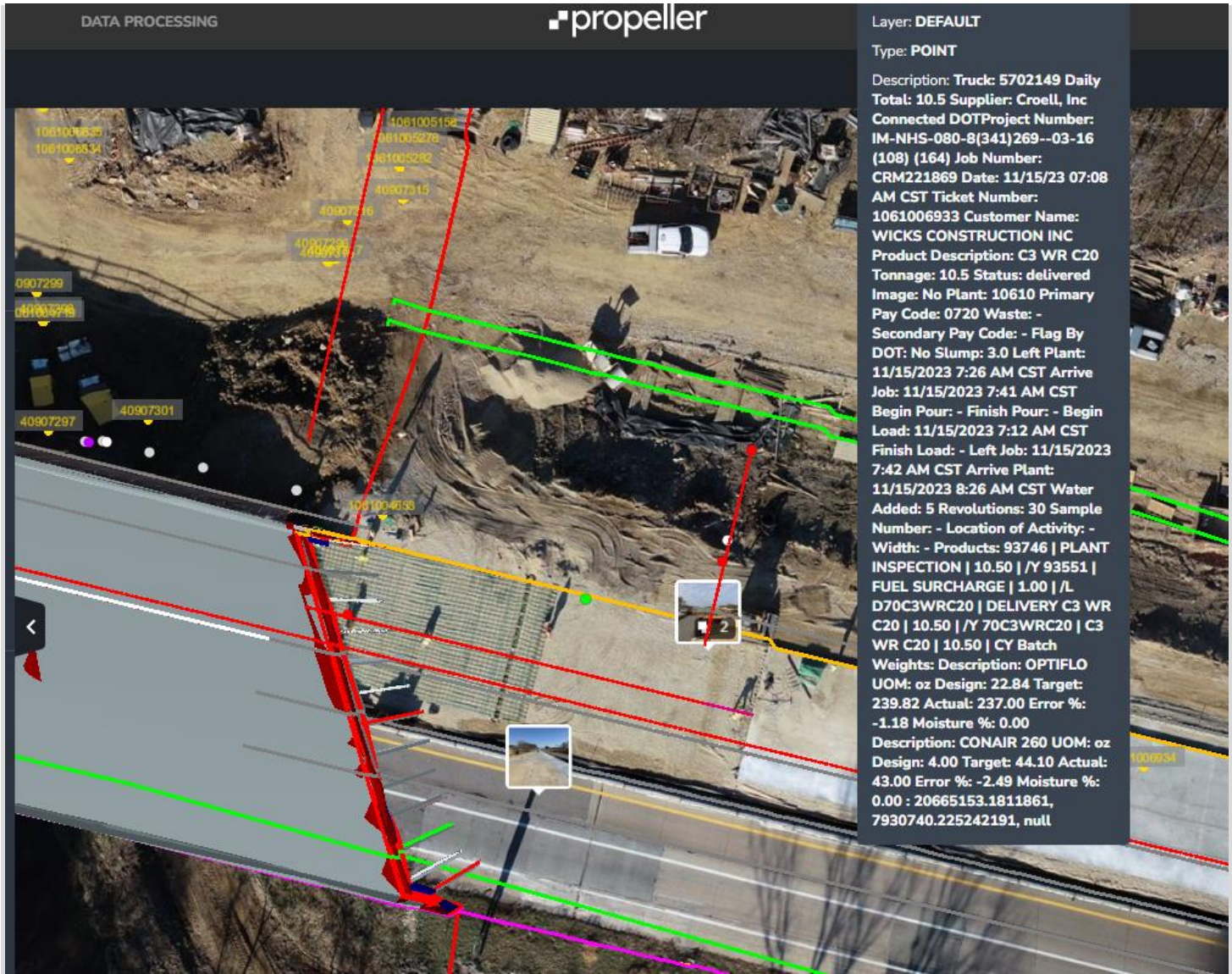


E-Construction

12/12/23, 6:33 PM

52-0807-174

Propeller Measurement report - 52-0807-174 - 14 Sep 2023

1255+38 - Wapsi Ave Seeding

View in Propeller

Map reference / legend	1255+38 - Wapsi Ave Seeding
Created date	Oct 12, 2023
Created by	Andrew Lloyd
Surface Area	133 797 ft²
Horizontal Area	128 687 ft²
Description	Measured by CDW 133,797/4356 = 3.07 Acres Item 0650 Seed and Mulch Seeded 10-15-23 1248 - 1255+50 LT Side Including East of Wapsi Ave

3D model inspection software we are investigating.

E-Construction

https://youtu.be/8TER9NOIbDY

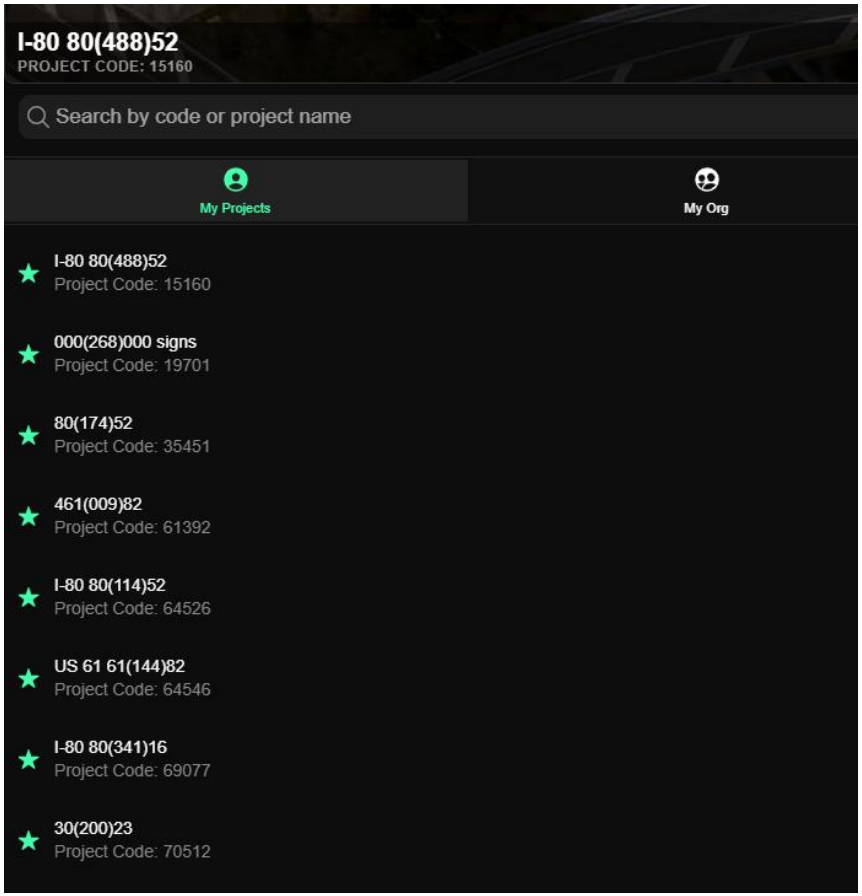
E-Construction

https://youtu.be/nfUdmMWwpZI

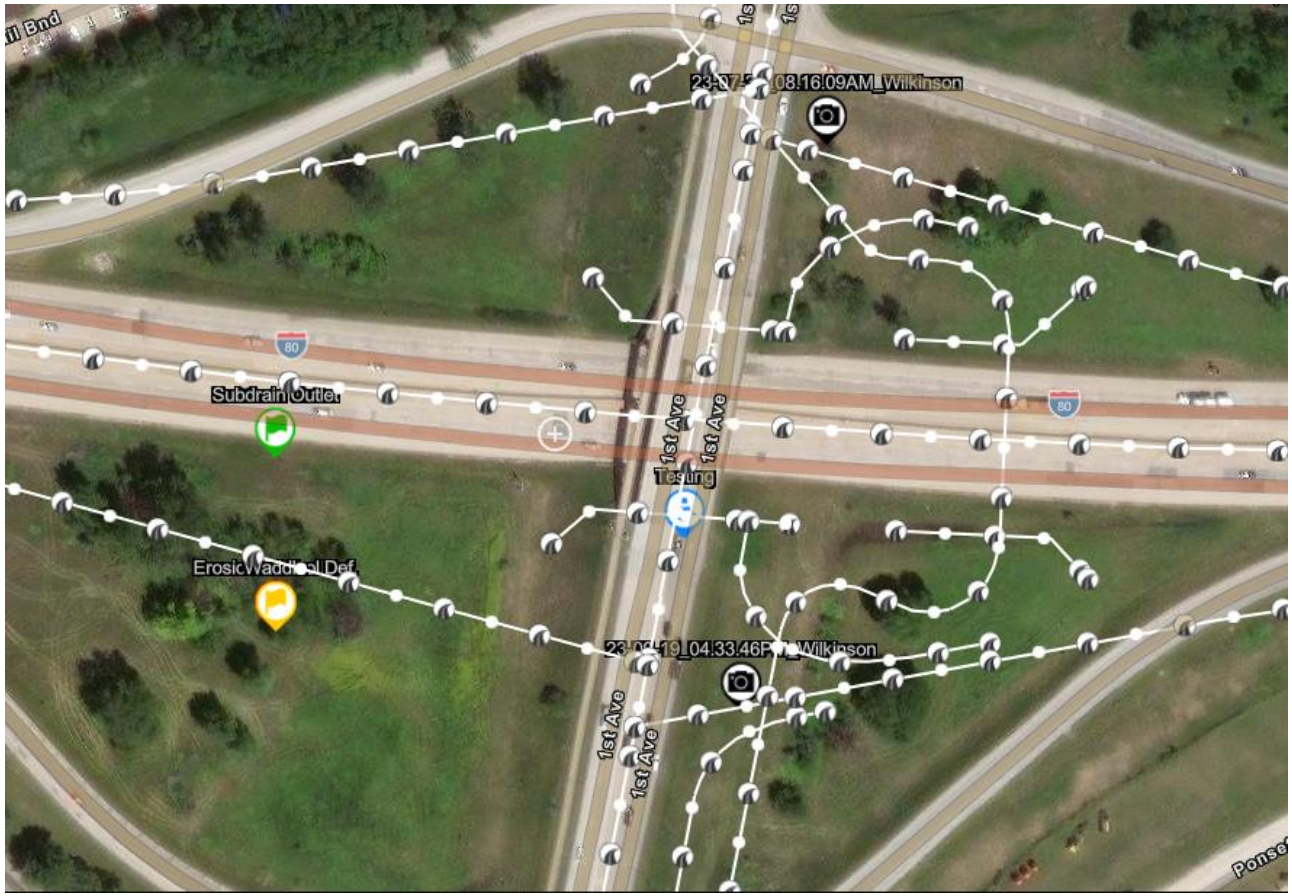
OnStation


5:04
US 98 - CR 457 to CR 30A West (#11925)
106+00
Traffic Contr...
105+00
Junction Re...
Pavement C...
104+00
Staging Area
Core 28
103+00
CR 457
GPS
103+95 CL
STA
LRS
LL
PROJECTS
CHAT
MAP
PLANS
SUPPORT

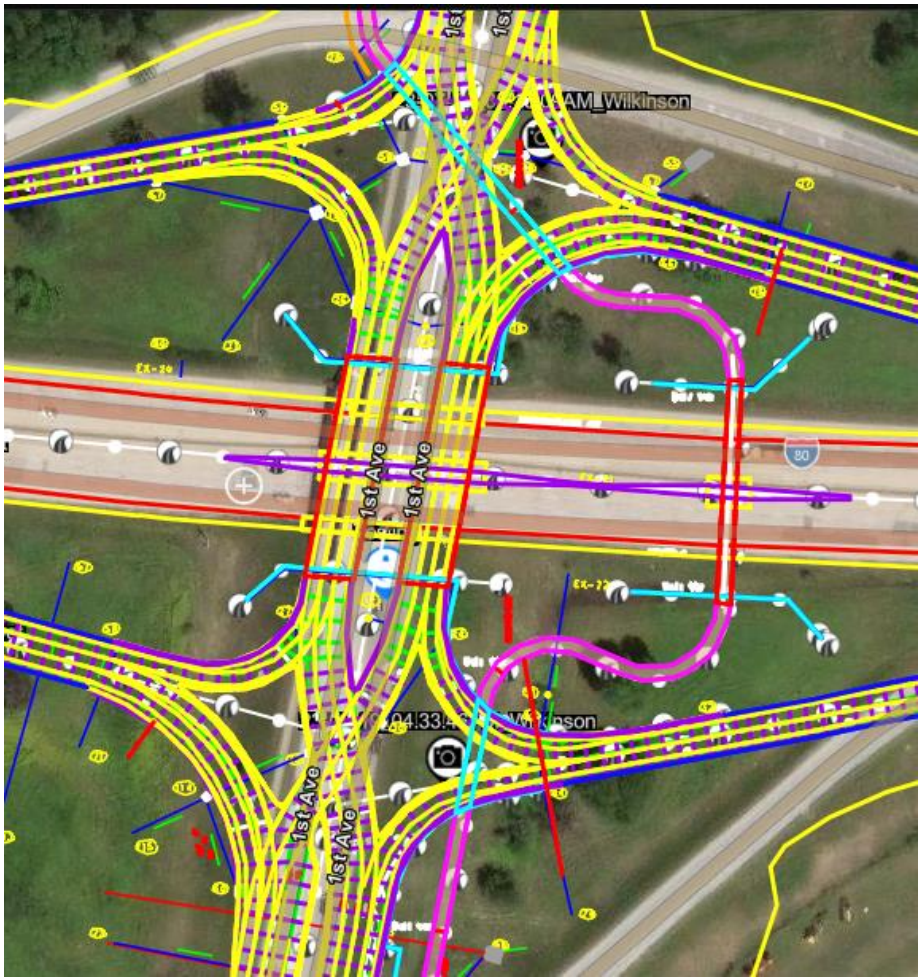
OnStation


I-80 80(488)52
PROJECT CODE: 15160
Search by code or project name
My Projects
My Org
I-80 80(488)52
Project Code: 15160
000(268)000 signs
Project Code: 19701
80(174)52
Project Code: 35451
461(009)82
Project Code: 61392
I-80 80(114)52
Project Code: 64526
US 61 61(144)82
Project Code: 64546
I-80 80(341)16
Project Code: 69077
30(200)23
Project Code: 70512

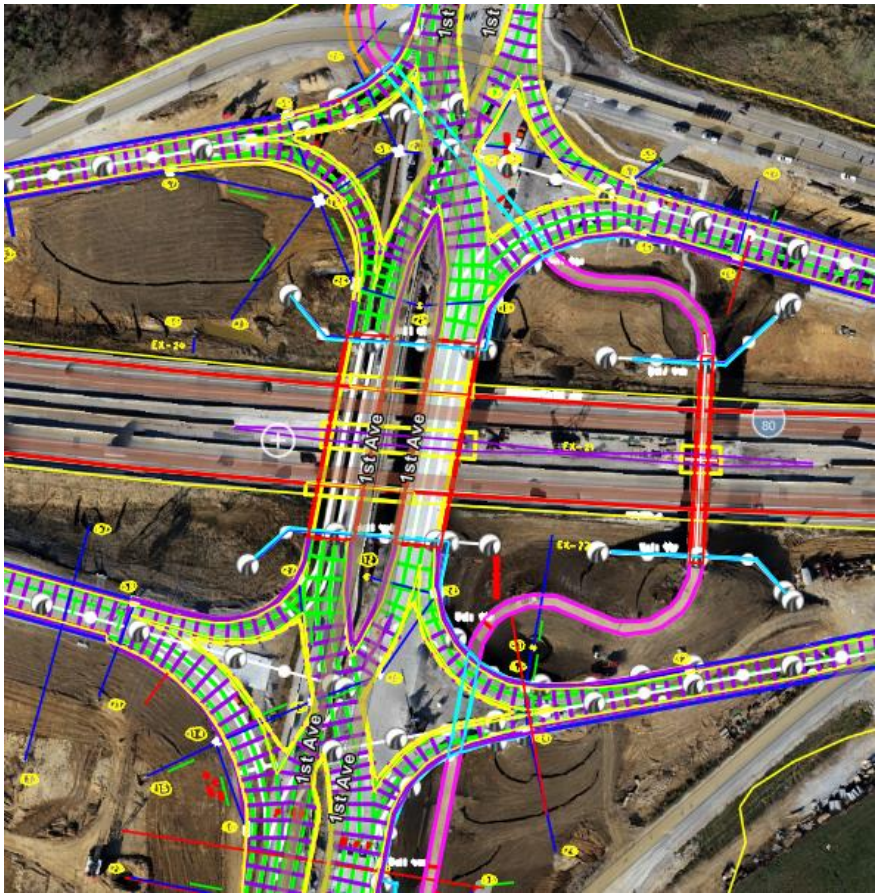
OnStation


08:16.09AM_Wilkinson
Subdrain Outlet
1st Ave
1st Ave
Testing
1st Ave
1st Ave
Wilkinson

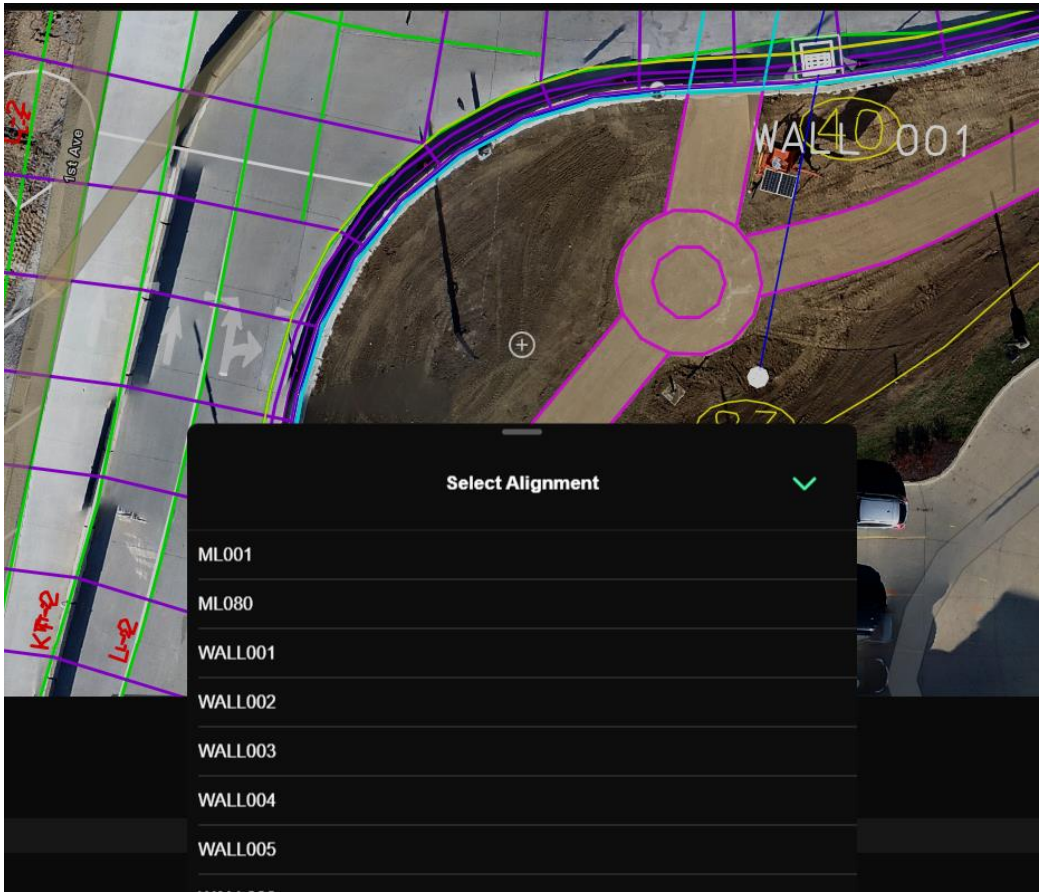
OnStation



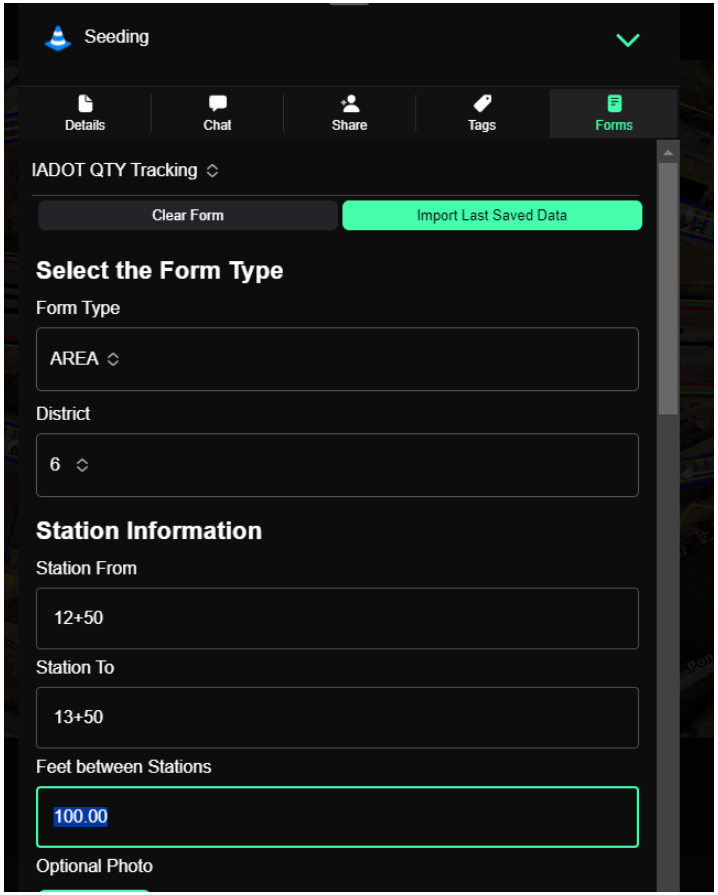
OnStation



OnStation


WALL001
Select Alignment
ML001
ML080
WALL001
WALL002
WALL003
WALL004
WALL005

OnStation


Seeding
Details
Chat
Share
Tags
Forms
IADOT QTY Tracking
Clear Form
Import Last Saved Data
Select the Form Type
Form Type
AREA
District
6
Station Information
Station From
12+50
Station To
13+50
Feet between Stations
100.00
Optional Photo

OnStation


Import Flags to Project
Export Project to GeoJSON
Export Project to KML
Export Project to CSV
Export Project to ESRI GeoJSON

GIS Utilities Developmental Specification

DS-23XXX
(New)

DEVELOPMENTAL SPECIFICATIONS
FOR
GEOSPATIAL MAPPING OF SUB-SURFACE AND UNDERGROUND UTILITIES

Effective Date
November 21, 2023

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

23XXX.01 DESCRIPTION.
The purpose of this specification is to capture as-constructed or as-built geospatial information for subsurface underground utilities including highway lighting and agency communication lines. Asset information shall be recorded and submitted as directed in this developmental specification. It is the intent of the Contracting Authority to capture three dimensional (3D) as-built data within Contracting Authority right-of-way in accordance with the most current version of ASCE 75. As such, ASCE 75 shall serve as a guiding reference for this specification. The DOT has condensed its specific language into this specification for brevity. Clarifications or questions may be answered within Standard ASCE/UESI/CI 75-22. All tables are from *Standard Guideline for Recording and Exchanging Utility Infrastructure Data*, ASCE/UESI/CI 75-22, with permission from ASCE.

23XXX.02 MATERIALS.
GPS Equipment to record geospatial location to 0.1 foot and utilize project Geoid and Iowa Regional Coordinate system or transform to those coordinates. See https://iowadot.gov/iarcs/Home for coordinate system.

Draft Connected Equipment SP

SP-xxxxxx
(New)

IOWA DOT

SPECIAL PROVISIONS
FOR
CONNECTED EQUIPMENT API INTEGRATION FOR ACTIVE WORK ZONE MONITORING

County TBD

Effective Date TBD

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

XXXXX.01 DESCRIPTION.

A. The intention of this specification is to provide a feed of active equipment in a work zone for the purposes of connecting to the Iowa DOT WZDx and Traffic Management Center. This work involves integrating construction equipment, including but not limited to CAT, John Deere, GOMACO, Wirtgen, and similar machines, with a real-time Application Programming Interface (API) that connects directly to the Iowa DOT e-Ticketing portal. This will facilitate the real-time reporting on the following equipment statuses:

1. Equipment ID
2. Engine state
3. Latitude/Longitude
4. Fuel Percentage
5. Cumulative Engine Hours
6. Cumulative Fuel Consumption
7. Heading
8. Speed
9. Created timestamp.
10. Updated timestamp
11. Vibrations

B. The equipment should be capable of connecting to a cloud service using cellular connectivity to ensure real-time updates and accurate monitoring every 5 minutes.

AID Grant

Applied in 2021 – Received notice during 2023 ADCMS grant prep

Key objectives for $1.2 million funding include:

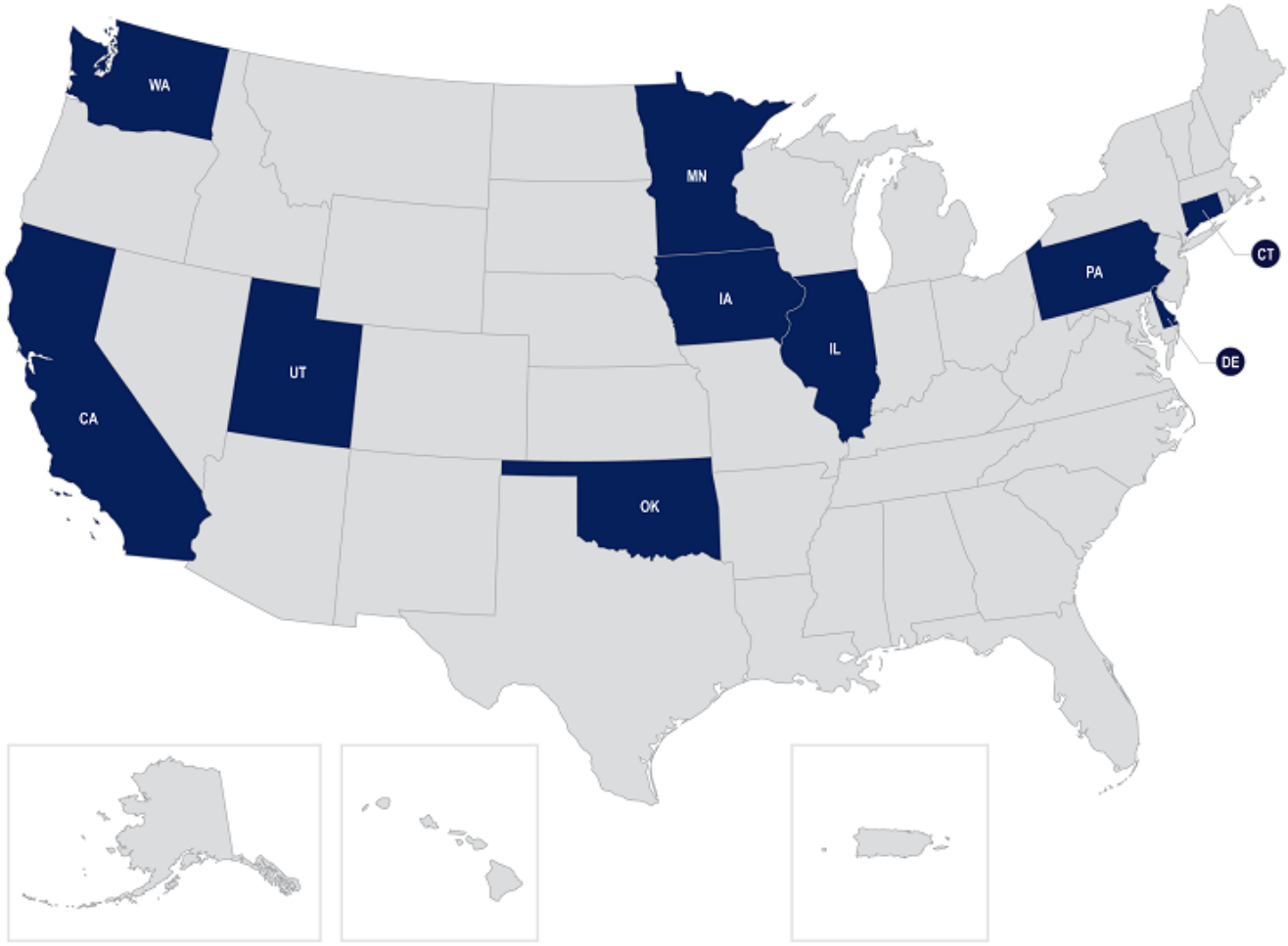
- Detailed digital delivery implementation plan
- Improve asset management by integration of information beyond digital as-builts and geospatial information
- Pilot use cases for digital delivery

ADCMS Grant

Applied for the FY 2022/2023 grant

- Business Data Management Solutions
- CAD to GIS Modeling Strategy – Design to Construction to Operations to Asset Management to Design (1-3 assets)
- Project Design Delivery Solutions – Focus on open-source solutions for bridge design and deliverables

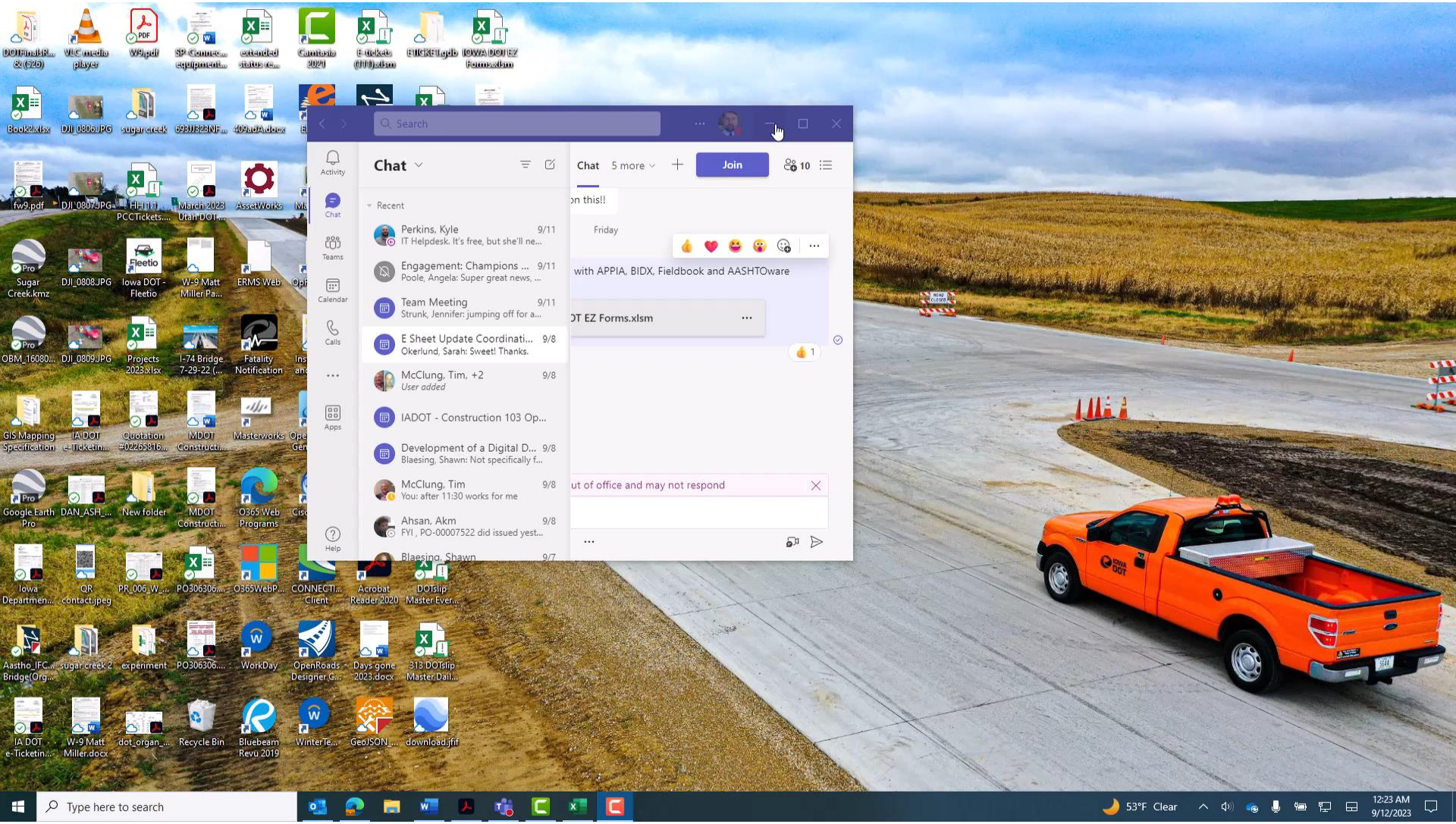
FY22-23 Advanced Digital Construction Management System Grant Recipients



THANK YOU FOR YOUR TIME AND ATTENTION

Matthew Miller
E-construction Program Administrator

E-Construction



E-Construction

E-Construction