

Mapping the Underground



Presented by

Rob Martindale, PLS



COLORADO
Department of Transportation



≡ Colorado Revised Statute (C.R.S.) 9-1.5

How the Legislation Applies to the Excavators and Contractors

Title 9 Safety – Industrial and Commercial
Article 1.5 Excavation Requirements



☰ Main Revisions to C.R.S.9-1.5


- For a subsurface utility engineering (SUE) required project, project owners are required to:
 - **Notify CO 811** via subsurface utility notification. Subsurface utility engineering notification requires utility owners to provide records, field mark, or other information to the design team with in **10 business days**.
 - Project owner provides **stamped plans** depicting utilities at their achieved quality level and attempt to meet or exceed ASCE 38 **Quality Level B** and Quality Level A at potential conflicts with new gravity feed system, OR document reasons why not.
- **811 excavation notice** requires utility to mark within **two business days (not including day of notice)**.
- All new underground facilities must be **electronically locatable** when installed.
- 811 becomes true one call, Tier Two members must become Tier One members.
- Creation of **Underground Damage Prevention Safety Commission**.

☰ What's The Problem

- Poor Data provided by the utility and pipeline companies
- Records are old, outdated, lost or simply never existed
- Any records that do exist are often of inconsistent quality and content
- Records are in different data formats and often incompatible for sharing




**RULES and REGULATIONS
of the
Colorado Department of Transportation**



**PERTAINING TO ACCOMMODATING UTILITIES IN THE
STATE HIGHWAY RIGHTS OF WAY**

2 C.C.R. 601-18



Effective January 14, 2021

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Term #112 Permittee must submit a digital plan and profile to CDOT with the permit number on cover sheet showing all physical off-sets both horizontal and vertical to all existing utilities, face of curb, right of way line and surface elevations to include stationing for all installations prior to any work. This plan must be emailed to the permit project manager and uploaded to the permits portal under the permit number provided. Data collection and documentation requirements shall conform to the attached Special Provisions labeled Term #112 and #116 Special Provisions Section 3.3.4.6.2 and 3.3.4.3 as-constructed/out of service and plan and profile requirements.

Term #116 As-built drawings and digital as-constructed/out of service locations must be submitted to the Departments GIS database under the permit number provided no later than 45 days following completion of work. The submitted data shall be submitted in accordance with the attached Special Provisions labeled Term #112 and #116 Special Provisions Section 3.3.4.6.2 and 3.3.4.3 as-constructed/out of service and plan and profile requirements.



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, 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/2k-Mbmc7z3c>

1.2. **High accuracy equipment requirement:**

Supported GNSS Receivers	Supported Software
Trimble DA3 (Catalyst)	
Trimble R2 (RTK)	Android 7.1
Trimble R3 (current version is R3s)	iOS 12 & U+
Trimble R1B	HTML Web browser
Trimble R12	
Trimble SP5885 (current version is)	
Blue-Rise RTK or Field Receiver RTK	

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Utility Source Data Formats within CDOT Right-of-Way

The Process Flow

The process flow for implementation refers to the roles, responsibilities, procedures, policies and structure of the process for collecting, combining and sharing 3D multi-utility data in a central repository (Transparent Earth). The process provides the framework for addressing issues such as how CDOT permitting can be leveraged to require utility company participation and how the One Call Center can use their existing locate request process to ensure the data repository (Transparent Earth) is kept up to date with new information.

This process also serves as the framework to enable field and office personnel to leverage data from multiple different sources inside the PointMan and Transparent Earth solution.

Data Submitters - DOT, SUE, Utility Company, Designer

Survey Data



SUE Data



GIS Data



CADD Files



Secure 3-D Utility Data Access



Initial Data Collection via Standard Protocols

On-Going Data Collection via Standard Protocols

Transparent Earth & PointMan



Utility Relocates



New Installations



One Call Locates



Future Projects

Data Users - DOT, SUE, Utility Company, Designer

≡ The Solution



Utility Locate Tool



Mobile



GPS Receiver



Cloud



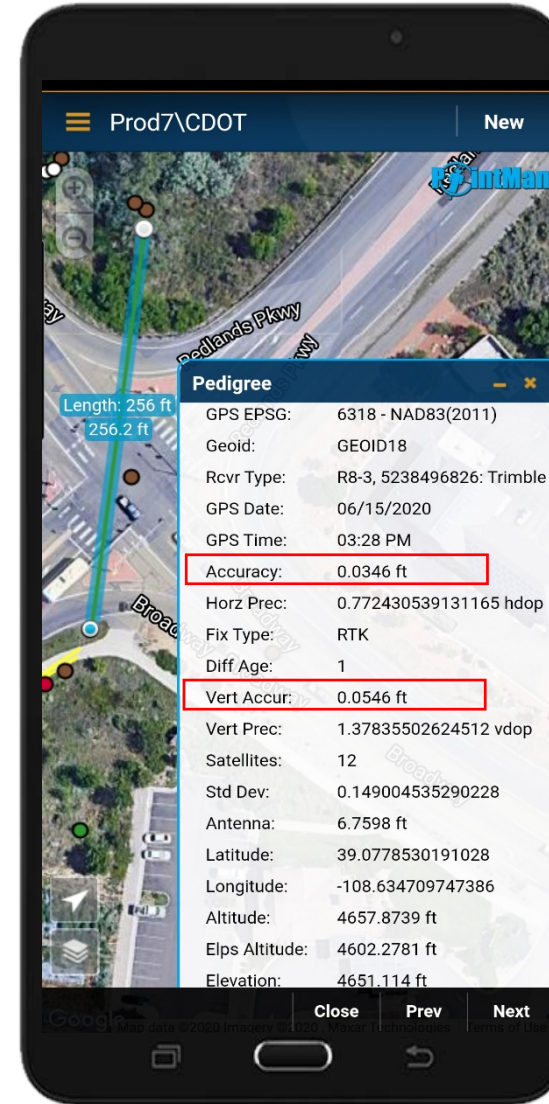
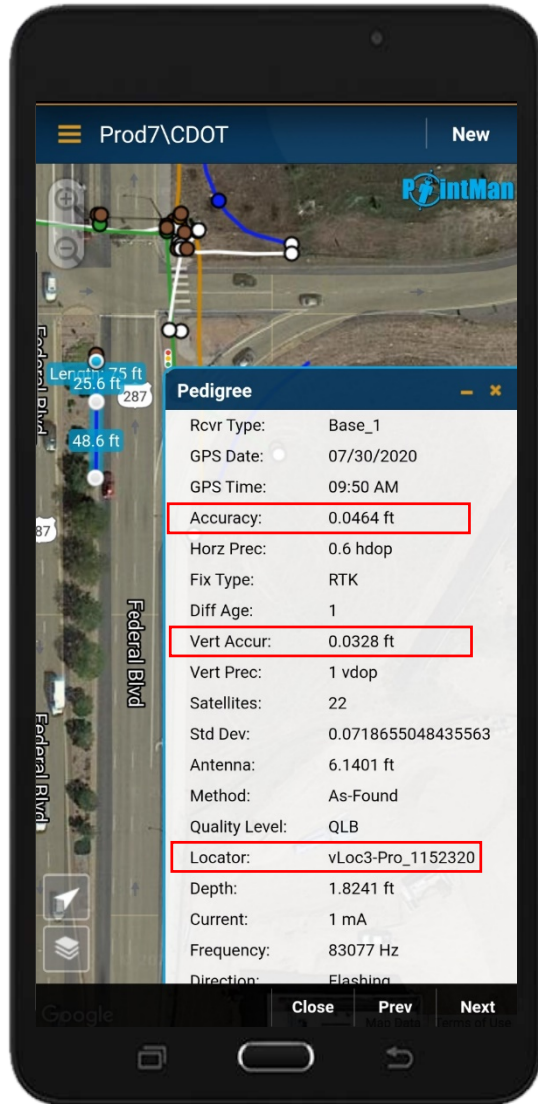
GIS

High Accuracy GIS

Survey



CDOT Accuracy Requirement – 2 cm



High Accuracy GIS Data for Engineering Design

Colorado Department of Transportation

TransparentEarth

Pedigree

Code:	4710
Elps_Altitude:	1619.326 m
Rcvr_Type:	Base_1
GPS_Date:	07/30/2020
GPS_Time:	09:50 AM
Accuracy:	0.0141421351581812 m
Horz_Prec:	0.6 hdop
Fix_Type:	RTK
Diff_Age:	1
Altitude:	1636.214 m
Vert_Accur:	0.01 m
Vert_Prec:	1 vdop
Satellites:	22
Std_Dev:	0.0718655048435563
Antenna:	1.8715 m
Elevation:	1634.3425 m
Method:	As-Found
Quality_Level:	QLB
Locator:	vLoc3-Pro_1152320
Depth:	0.556 m
Current:	1 mA
Frequency:	83077 Hz
Direction:	Flashing

Prod7\CDOT

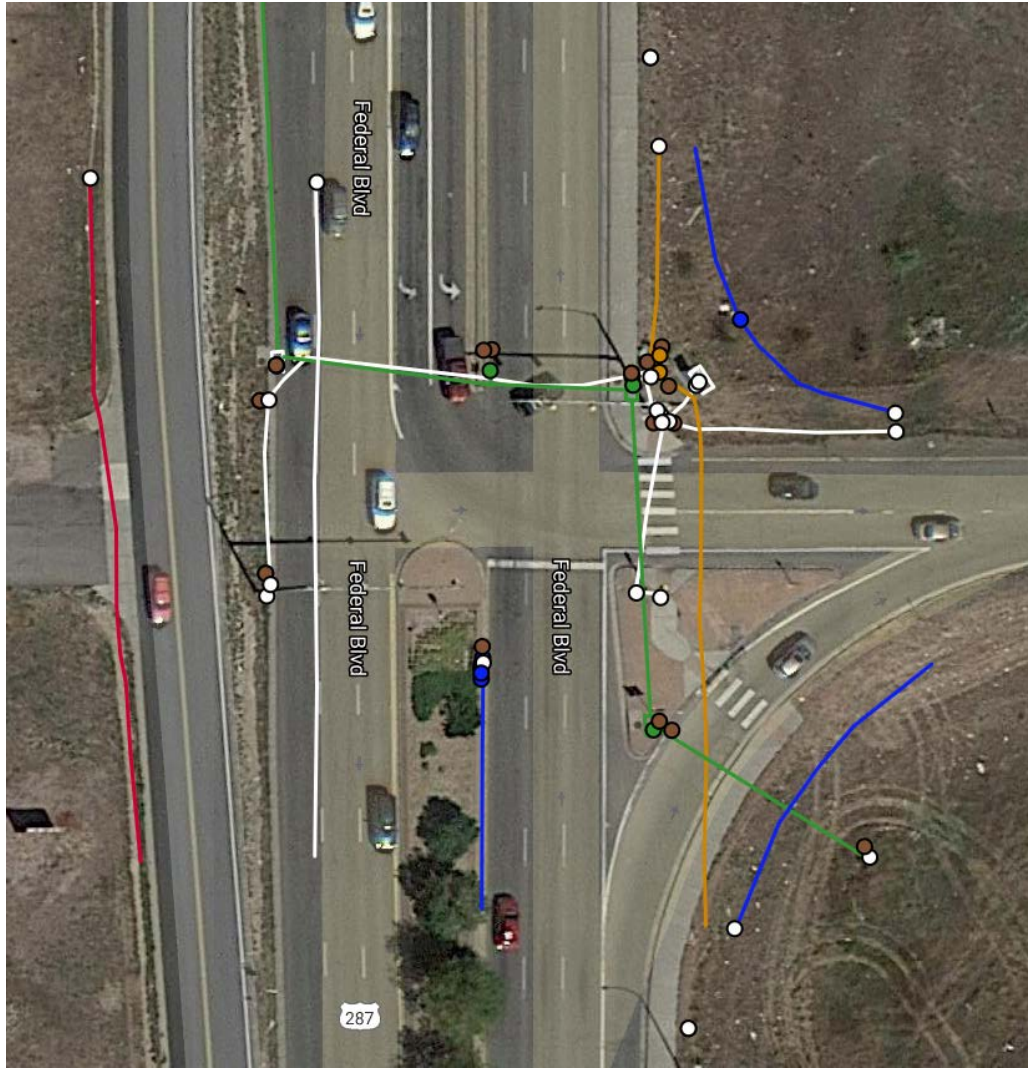
PrintMan

Pedigree

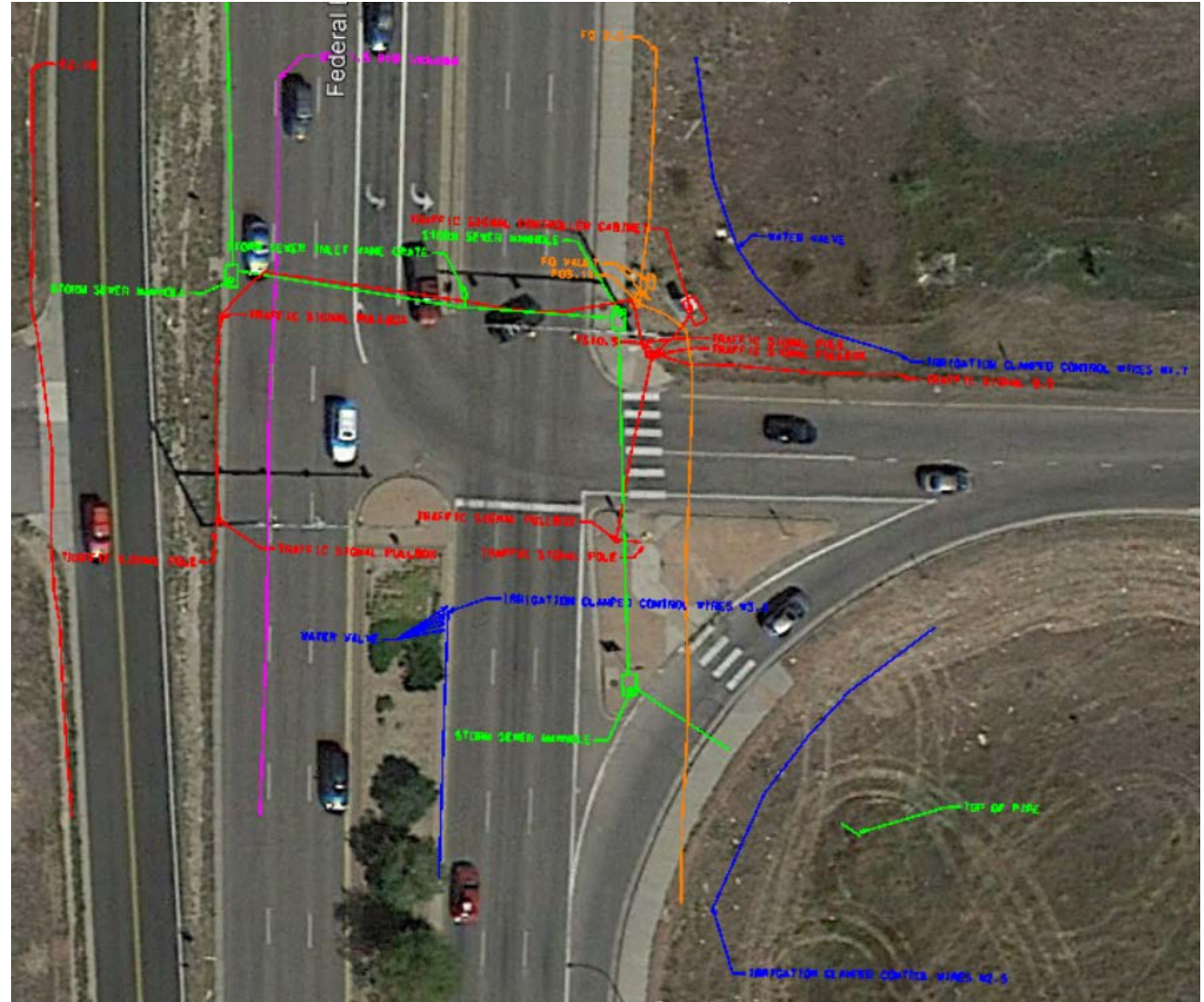
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GPS Date:	07/30/2020
GPS Time:	09:50 AM
Accuracy:	0.0464 ft
Horz Prec:	0.6 hdop
Fix Type:	RTK
Diff Age:	1
Vert Accur:	0.0328 ft
Vert Prec:	1 vdop
Satellites:	22
Std Dev:	0.0718655048435563
Antenna:	6.1401 ft
Method:	As-Found
Quality Level:	QLB
Locator:	vLoc3-Pro_1152320
Depth:	1.8241 ft
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Frequency:	83077 Hz
Direction:	Flashing

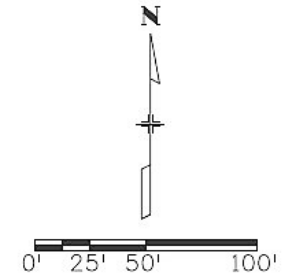
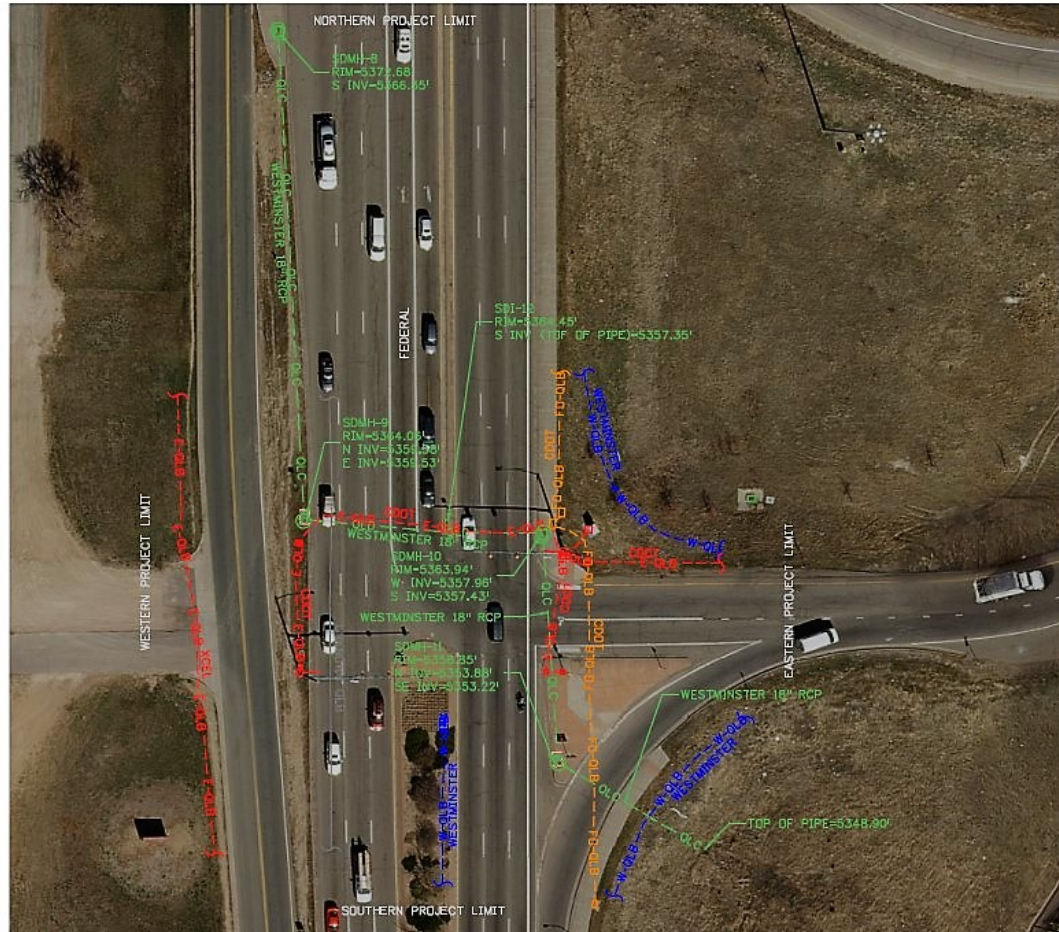
Pre-construction Deliverables

(GIS)



MicroStation (CADD)





THIS DOCUMENT IS SIGNED
AND SEALED TO CERTIFY
COMPLIANCE WITH ASCE 38-02

Print Date: 9/10/2020
File Name: Z11904090.15 ex01SHEET 3.dgn
Horiz. Scale: 1:50 Vert. Scale: As Noted
Unit Information Unit Leader Initials
KCI TECHNOLOGIES

Sheet Revisions		
Date:	Comments	Init.

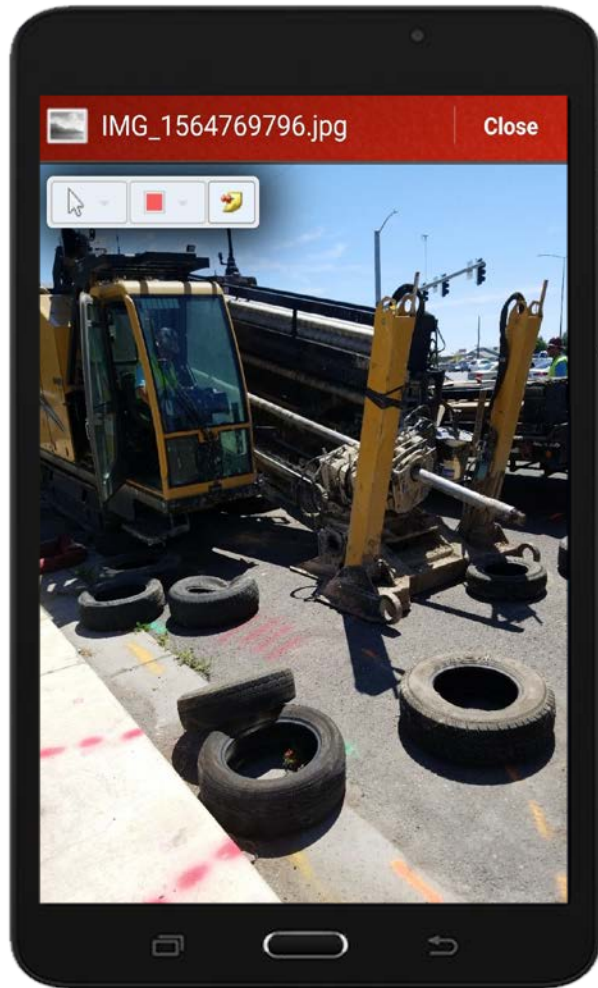
Colorado Department of Transportation
 4670 Holly Street
 Denver, CO 80216-6408 Phone: 303-398-5732 FAX: 303-398-6781
 Region 1


As Constructed
No Revisions:
Revised:
Void:

CANYON & FOLSOM SIGNAL UPGRADES SUBSURFACE UTILITY ENGINEERING PLANS	
Checked by: J. SOWERS	Structure X-XX-XX
Drafted by: D. ENGELSEN	Numbers X-XX-XX
Sheet Subset: S.U.E.	Subset Sheets: 3 OF 3

Project No./Code
SHE 2873-202
23355
Sheet Number

Construction Observation Reporting



 **COLORADO**
Department of Transportation

Construction and Inspection Form

DAILY INSPECTION LOG			
Inspector	UPRR Folder #	City	State
Craft, David	3039-88	Glenwood Springs	CO
Date	Construction Day	SHIFT/BILLING HOURS	
Nov 02, 2018	17	NIGHT / 8.0	
START TIME	END TIME	Miles Driven	
17:30	01:30	7	
TEMP	WIND	PRECIPITATION	
31 - 48F	4mph	0.1"	

DAILY ACTIVITY

1730 do daily paperwork and review SGM surveyors report from last night and inspect the work area from last night.

1800 job briefing with UP EIC Mike Church, Granite Construction crew, SGM surveyors, Your Way safety services and Parsons Engineering

1840 begin excavating for last 2 squished pipes

2100 finished excavating for pipes and cleaning out the storm drain manhole.

2200 1st pipe is set, had to cut out the manhole for next piece of pipe to fix.

2307 last squished pipe section is in place in the storm drain manhole and begin grouting

2340 begin excavating for last storm drain manhole on the west end of the 15" pipe

0045 storm drain manhole set

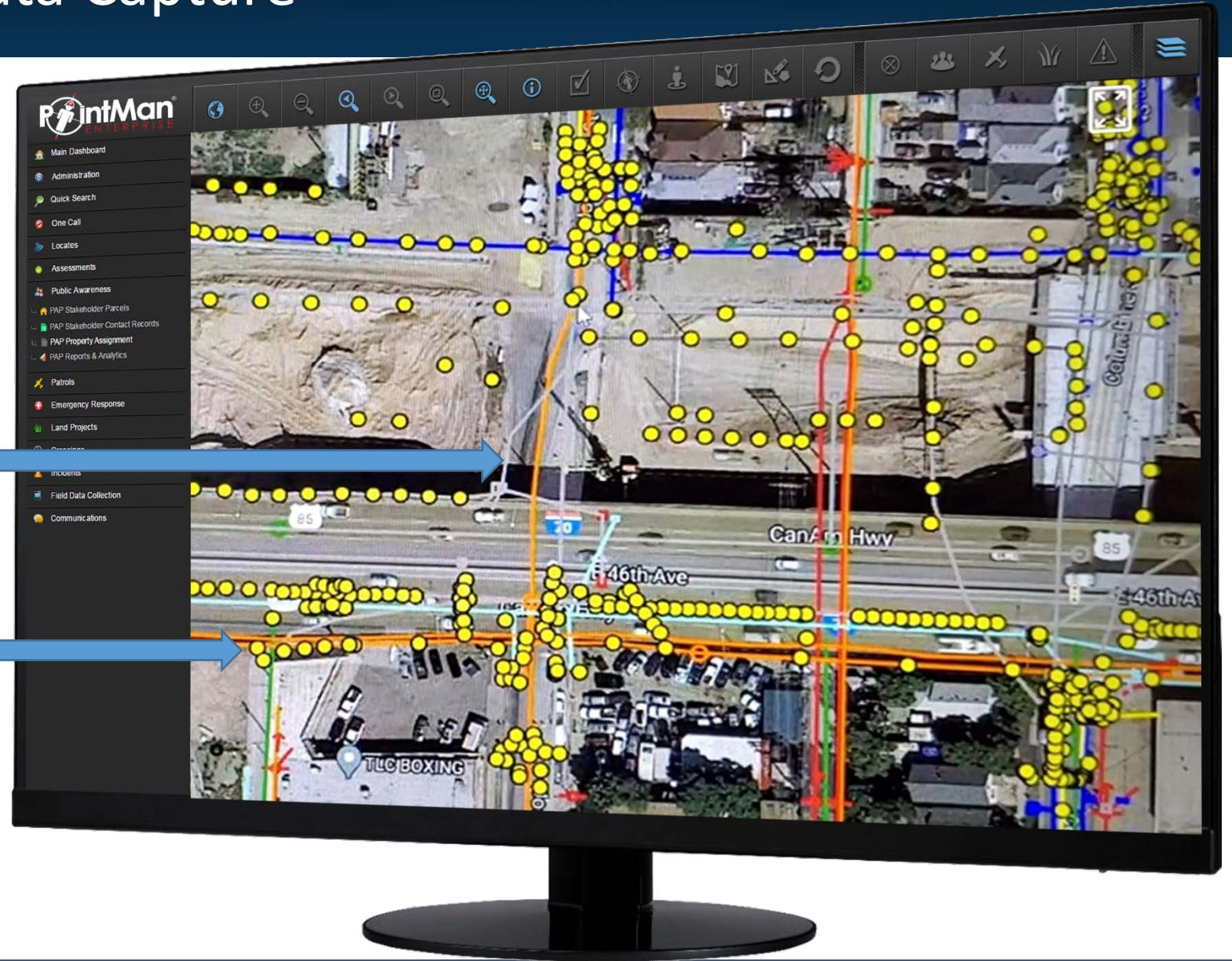
Construction Observation Reporting Photo Record



CDOT Project Level Data Capture

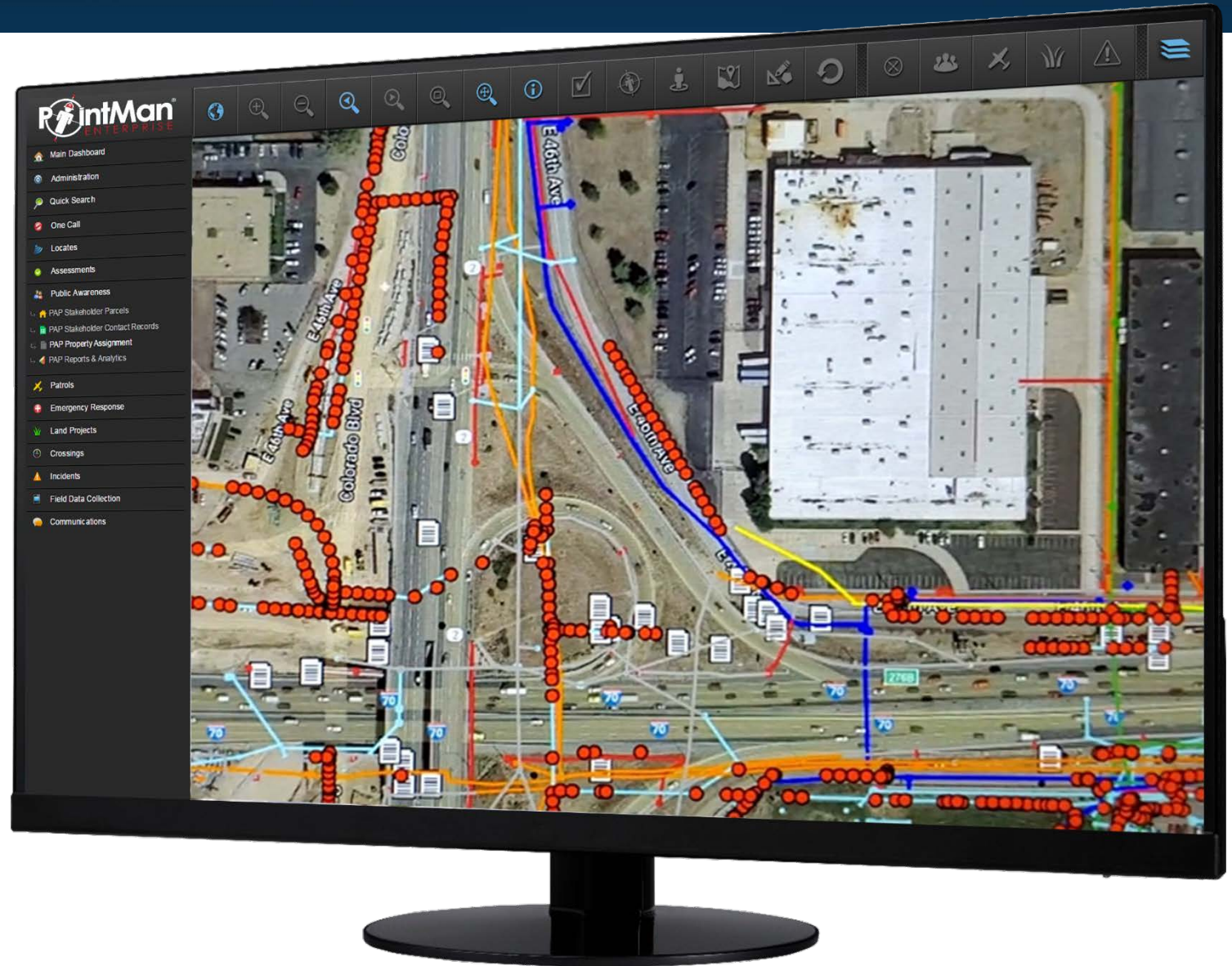
Grey lines indicate relocated, abandoned or removed utilities

14,000 test holes



Utilities and As-built Records

- Red data points indicate new 3-D as-built information. Gaps in data collected are easily identifiable.



CDOT Damage Prevention Protocol

CDOT's custom eLocate Form (API connection to CO811 OneCall Center) Damage prevention forms geospatially available for tracking dig permits within CDOT's mobile application (PointMan). CDOT's contractor feels this technology has saved over 100 utility strikes on this project alone.

The screenshot shows the PointMan mobile application interface. At the top, it says 'Local(PointMan)' and 'New'. Below that is a 'Dig Permit' section with a 'eFORM' label. The form is divided into several sections: 'General Information', 'Locate Service Notification', and 'Pre-Work Checklist'. The 'General Information' section includes fields for 'Location of Excavation: 0 I70', 'Purpose of Excavation: ELEC CONDUIT NEW', 'Start Date: 10/1/2019', 'Expected Completion Date: 10/6/2019', 'Depth: 10'', 'Width: 60'', and 'Length: 4000''. The 'Locate Service Notification' section includes 'Ticket Number: A926702284-00A', 'Date Requested: 9/24/2019 2:5', 'Requested By: HAYLEE RADEKE', and 'Description: FROM S/E MOST INTERSECT LOC E/ APX 2200FT TO INTEI'. The 'Pre-Work Checklist' section has a heading 'Superintendent's & Foreman's responsibility to ensure this section is complete' and a list of 10 questions with 'Yes' and 'No' radio button options.

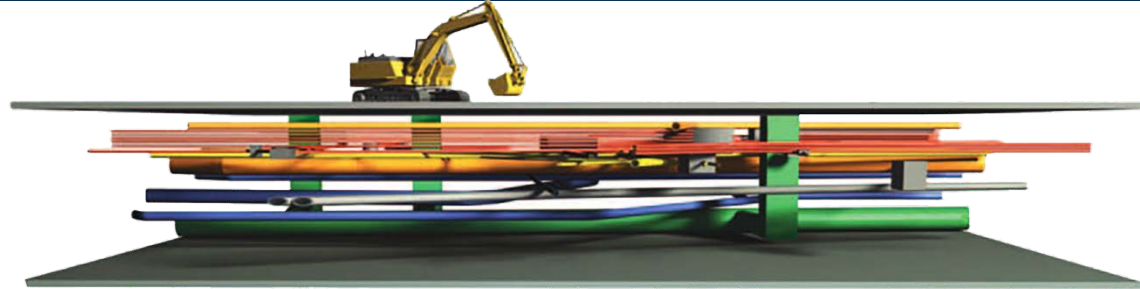


☰ Photos and Sketches

- Take photos to record where the lines were located
- Add any notes using voice-to-text
- Use satellite imagery to provide a sketch of where the lines were located



☰ What is Next?



Leveraging the advancements in technology to provide a 3-dimensional view of the precise location of the buried utilities



≡ Newest Technology



Augmented Reality



Excavation Guidance



Thank you!

Q & A

