AIM Innovation Showcase Application

Sponsor

Nominations must be submitted by an AASHTO member DOT willing to help promote the innovation. If selected, the sponsoring DOT will be asked to present the innovation at the Innovation Showcase during the AASHTO Spring Meeting.

1. **Sponsoring DOT (State):** Connecticut Department of Transportation

2. **Name and Title:** Rabih Barakat – Transportation Division Chief

   Organization: Connecticut Department of Transportation

   Street Address: 2800 Berlin Tpke

   City: Newington

   State: Connecticut

   Zip Code: 06131

   Email: Rabih.Barakat@ct.gov

   Phone: 860-594-3208

Innovation Description (30 points)

The term "innovation" may include processes, products, techniques, procedures, and practices.

3. **Name of the innovation:**

Utilization of ArcGIS Applications for Enhanced Sign Asset Management

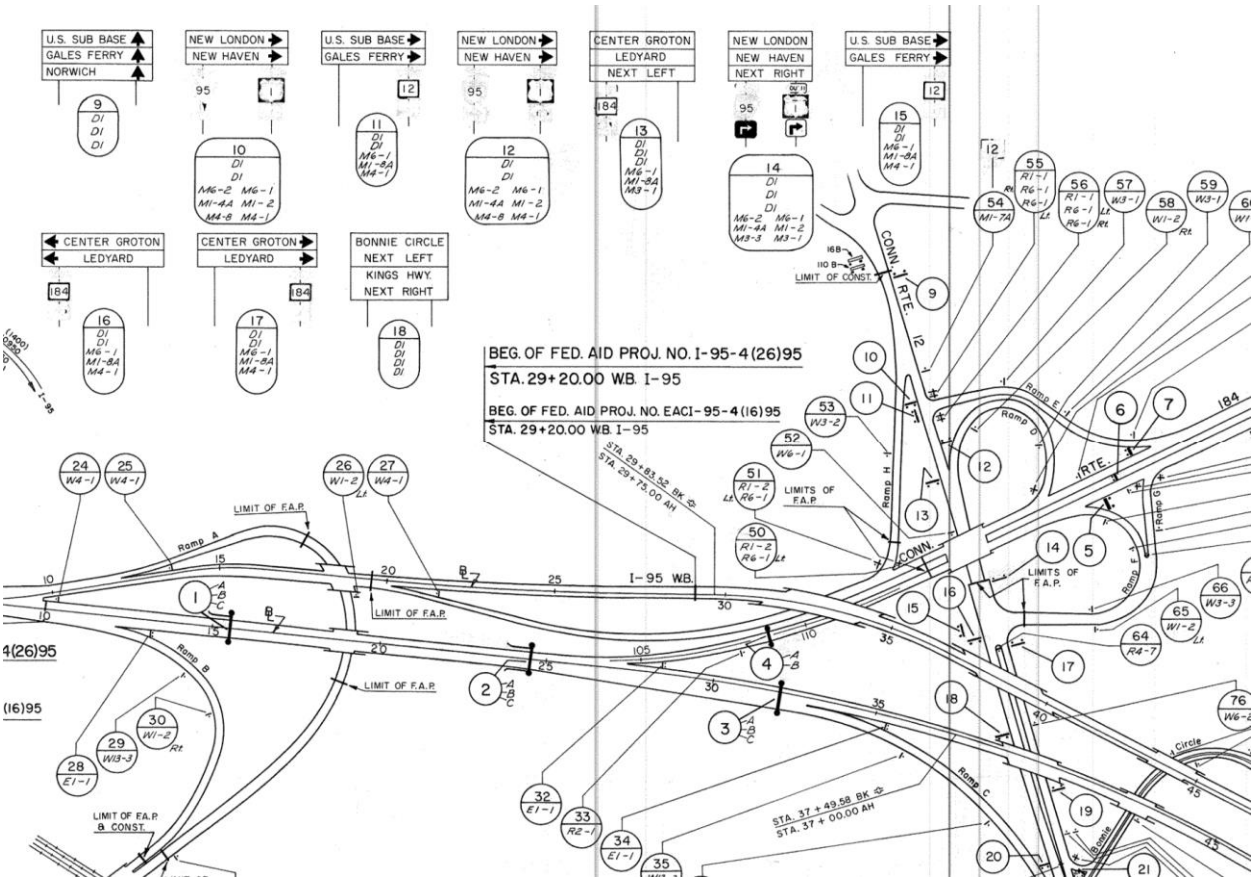
4. **Please describe the innovation.**

CTDOT has implemented the use of ArcGIS applications to revolutionize the design, construction, inspection, and maintenance of sign asset data records across all phases of construction projects. This innovative approach replaces traditional design plans with dynamic geospatial features, seamlessly integrated into web-based and mobile applications. These tools capture detailed attribution for sign supports, assemblies, and panels. By leveraging mobile GPS technology, CTDOT has significantly improved the accuracy of sign placements and asset records. Additionally, comprehensive image and

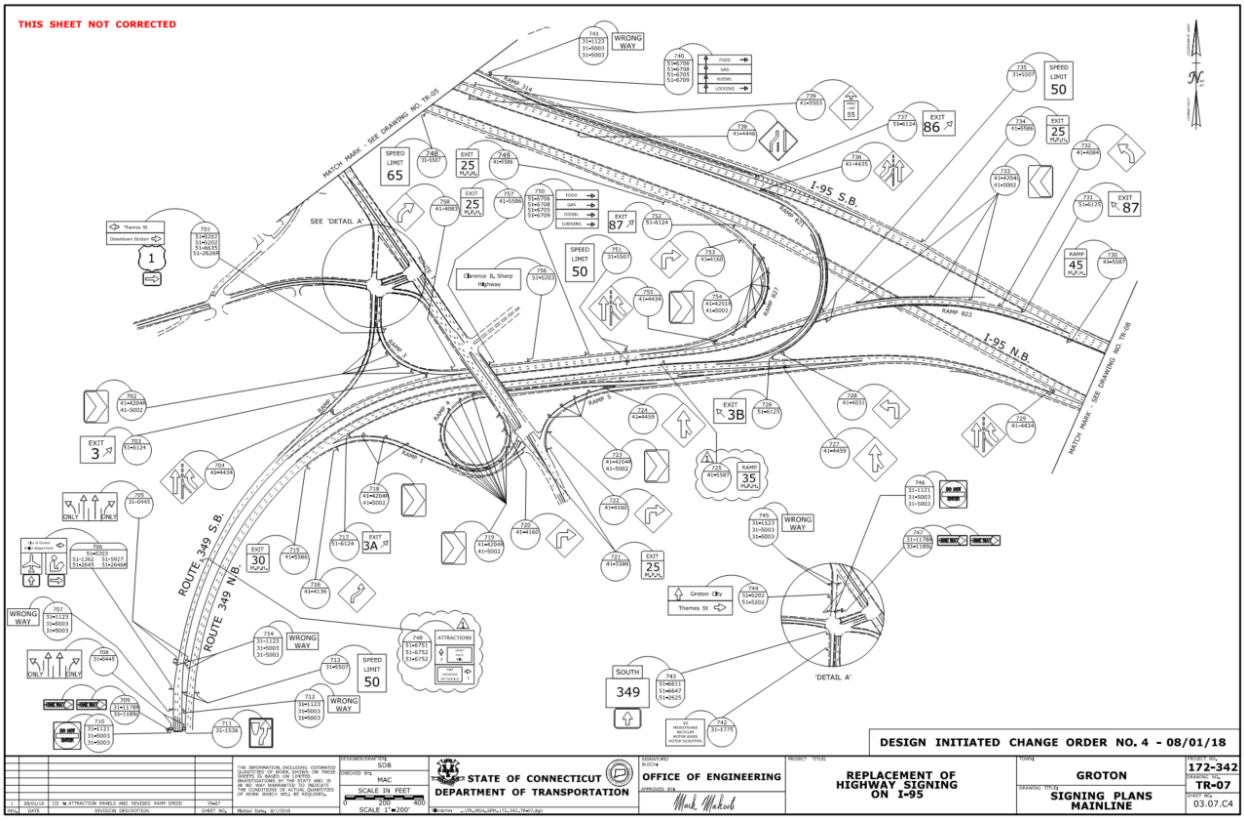
data collection are facilitated throughout the construction process, enabling the CTDOT Asset Steward to effectively monitor each sign's lifecycle. This enhanced methodology not only streamlines operations but also ensures precise and up-to-date asset management.

5. What is the existing baseline practice that the innovation intends to replace/improve?

CTDOT's existing sign replacement practices date back to the 1950s, relying on non-surveyed 200-scale plans that indicate approximate sign locations. These plans feature symbols representing sign types, sizes, and text descriptions. Over the past 75 years, the primary change has been the transition from hand-drafted to CAD-drafted plans. However, at complex interchanges, these plans often become cluttered, making it challenging to follow leader lines that connect sign placement locations to the corresponding sign panel information.



Signing Plans from 1966



Signing Plans from 2016

During construction, Contractors and Inspectors attempt to adhere to these paper plans to install signs accurately in the field. This process is particularly cumbersome in adverse weather conditions, such as wind, cold, or rain, where managing physical plans becomes difficult. After staking sign locations, Engineers conduct time-consuming field reviews to verify that stakes are correctly positioned according to the plans, which requires navigating back and forth between the staked locations and the paper documentation.

This legacy approach not only hinders efficiency but also increases the risk of inaccuracies in sign placement and ultimately impacts overall project timelines while not producing any documentation that can be easily loaded into the Asset Inventory.

6. What problems associated with the baseline practice does the innovation propose to solve?

The primary challenge driving this innovation was the existing methodology's limitations in managing large-scale projects. For our pilot project, which involved removing 2,260 signs and installing 4,542 signs across 11 freeway routes totaling 929 miles, traditional design techniques would have required the creation of approximately 1,000 design plans. This cumbersome approach could have extended the design schedule by a year or more, leading to significant delays and making it nearly impossible to locate the appropriate plans while installing signs in the field. Furthermore, upon project completion, the reliance

on outdated methods prevented us from the ability to capture improved sign inventory data, undermining the effectiveness of the entire process.

To address these challenges, the innovation eliminates the need for traditional design plans altogether. The design phase incorporates a web map that enables the team to pinpoint and specify locations for sign installation and removal. This approach streamlines decision-making by allowing designers to visualize the project and make informed choices without the limitations of paper plans. Once in the field, construction personnel can efficiently locate and install signs using GPS technology on mobile devices. This method not only simplifies navigation but also significantly reduces the potential for errors. Additionally, it facilitates the seamless association of sign data, allowing for efficient input into the inventory system upon project completion.

7. Briefly describe the history of its development.

In 2010, CTDOT initiated the development of a Sign Inventory to comply with FHWA/MUTCD requirements for maintaining minimum retroreflectivity levels on Connecticut's roadway signs. The initial geospatial inventory and data structure were completed by the end of 2018; however, the data collection relied on roadway imagery from 2012/2013. After completing the initial inventory, it became evident that maintaining accurate data would be nearly impossible, given that approximately 200,000 signs required monitoring—resulting in the need to replace about 12,000 signs annually to maintain a state of good repair. To manage this, CTDOT implemented a GPS specification requiring contractors to provide GPS data to the Asset Steward upon project completion. Unfortunately, this approach fell short, with GPS data submitted for only 7% of projects, and many submissions did not adhere to the required data schema. Consequently, the initial inventory data continued to degrade in accuracy.

In 2019, the project described in question 6 began. Designers initially utilized Google Earth and MS Excel to create sign removal and installation data in a tabular format with a geospatial component compatible with the authoritative Sign Inventory. In early 2020, efforts to use a web map on mobile devices encountered challenges due to unreliable cell service in certain areas, leading to slight project delays.

During this time, CTDOT established a new GIS professional position to enhance management of sign asset data. The GIS professional was hired in July 2020, during the remote work phase of the COVID-19 pandemic. Within two weeks of joining, they suggested transitioning the sign inventory to an ArcGIS database and utilizing ArcGIS Collector (now ArcGIS Field Maps) as the mobile tool. After several collaborative meetings with construction inspection personnel, design engineers, and the GIS professional, mobile maps were developed, tested, and successfully implemented.

The design team created detailed documentation, including special installation details, a comprehensive list of removal and installation locations, a sign fabrication summary, a GIS specification, and a mobile app user guide, all to accompany the contract documents, as no standard plans were available. Prior to advertising the project, the design team conducted a virtual presentation for qualified contractors,

explaining the new mobile application that would replace traditional signing plans.

As construction began, the design team provided hands-on support to the contractor and inspection team in the field until they became comfortable using the application. Contractors were required to input data in real-time, noting installation status, any questions regarding specific locations, and uploading photos of the sign's front, back, and base post.

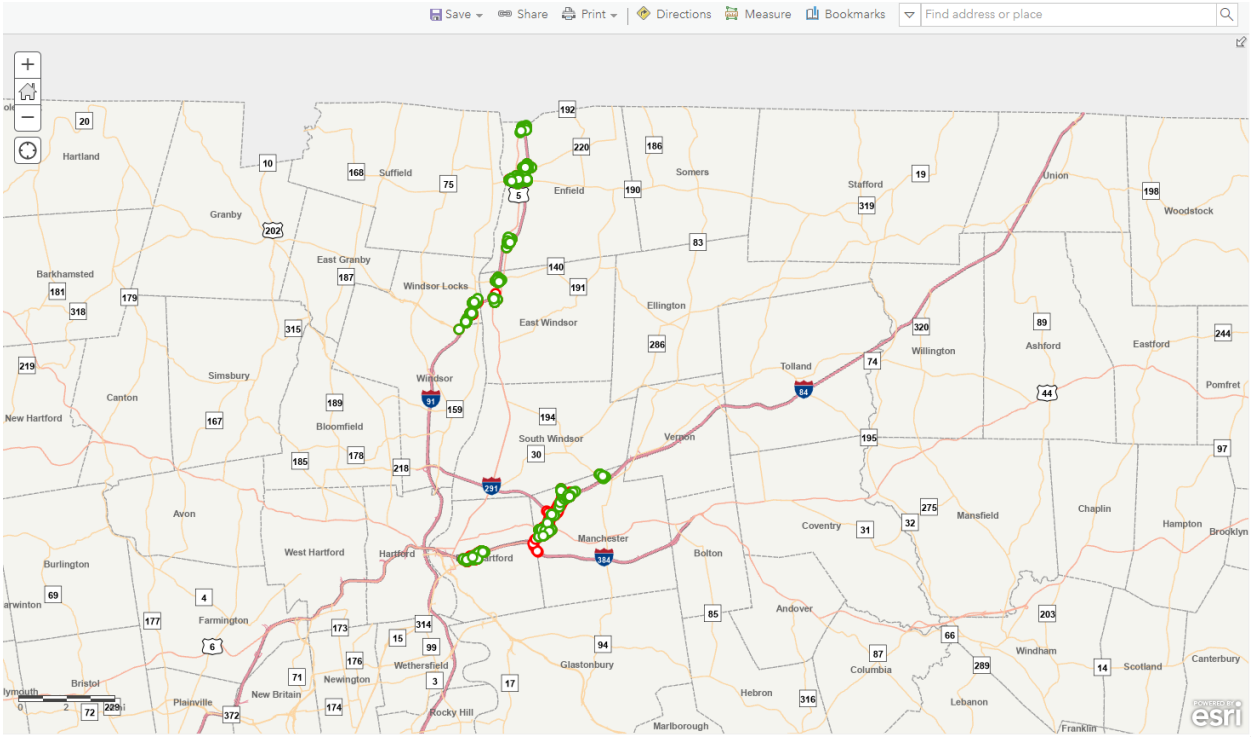
The pilot project was highly successful, fundamentally changing the process for future sign replacement initiatives. In addition to transforming the sign replacement workflow, the final sign data was effectively post-processed, archiving the removal data and integrating installation data into the Sign Inventory—marking a significant advancement in maintaining a high-quality inventory.

CTDOT continues to update and develop the inventory database, along with refining schemas and workflows related to the system.

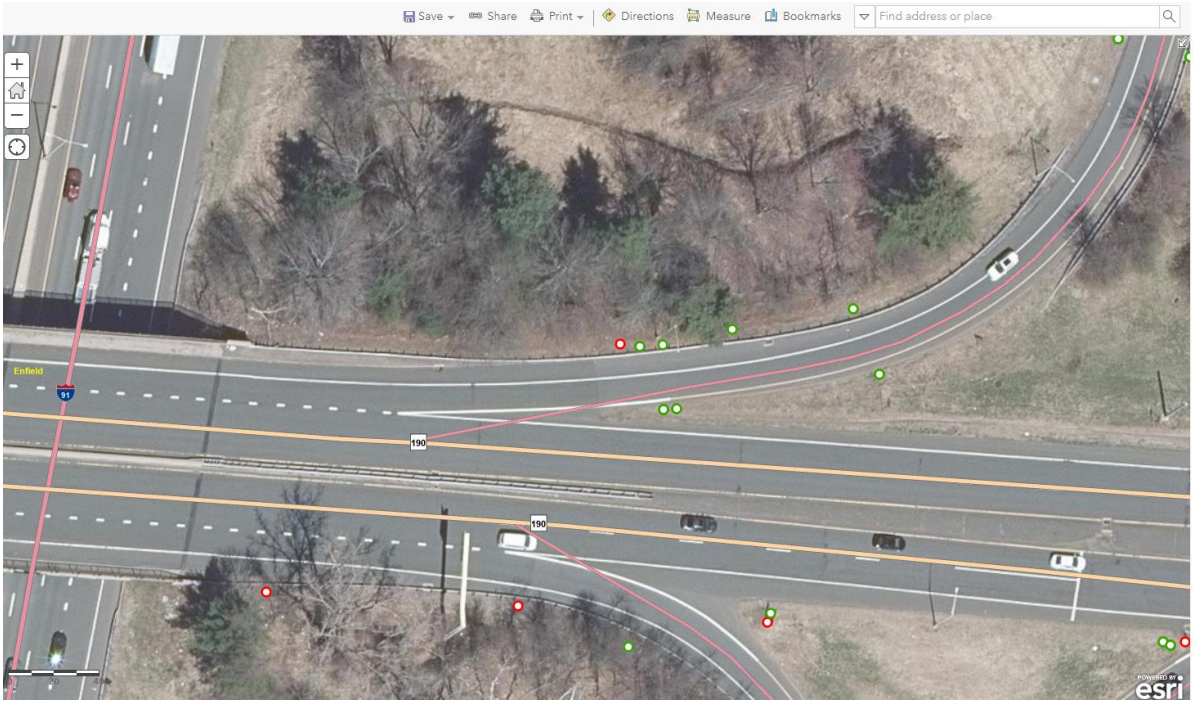
8. What resources—such as technical specifications, training materials, and user guides—have you developed to assist with the deployment effort? If appropriate, please attach or provide weblinks to reports, videos, photographs, diagrams, or other images illustrating the appearance or functionality of the innovation below (if electronic, please provide a separate file). Please list your attachments or weblinks here.

- Training meetings
- User guide (attached)
- Project specific maps w/ detail attachments (samples below)
- GIS specification including project specific location lists (sample below)
- Project specific dashboards (sample below)
- Potential for many other apps

AASHTO INNOVATION MANAGEMENT



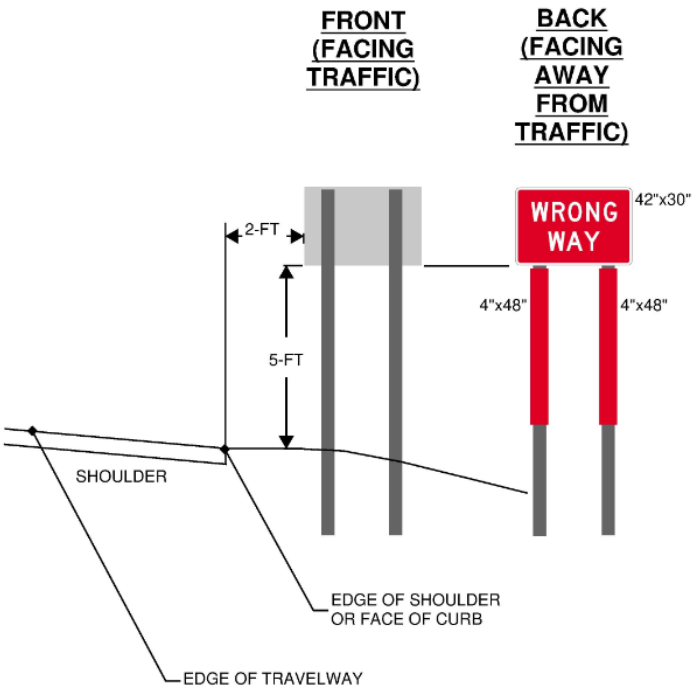
Zoomed Out Design Web Map



Zoomed In Design Web Map

AASHTO INNOVATION MANAGEMENT

ROUTE_ID	91-N-851
ASSEMBLY_STATUS	PLANNED
MOUNTING_TYPE	POST (SHEET)
NUMBER_OF_POSTS	2
STEEL_SIZE	
SIGN_SUPPORT_NUMBER	
POSITION	RIGHT
ELECTRICAL_LOCATION	
LAYER	INSTALL
CATALOG_NUMBER	31-1123
MUTCD_NUMBER	R5-1a
MATERIAL	SHEET
PANEL_THICKNESS	0.1
SHEETING_TYPE	11
PANEL_WIDTH_IN	42
PANEL_HEIGHT_IN	30
PANEL_WIDTH_FT	3.500000
PANEL_HEIGHT_FT	2.500000
PANEL_AREA_SF	
CROWN_NUMBER	
CROWN_WIDTH_IN	0
CROWN_HEIGHT_IN	0
CROWN_WIDTH_FT	0.000000
CROWN_HEIGHT_FT	0.000000
CROWN_AREA	0.000000
TOTAL_AREA	8.750000
BACKGROUND_COLOR	RED
LEGEND_COLOR	WHITE
LEGEND	WRONG WAY



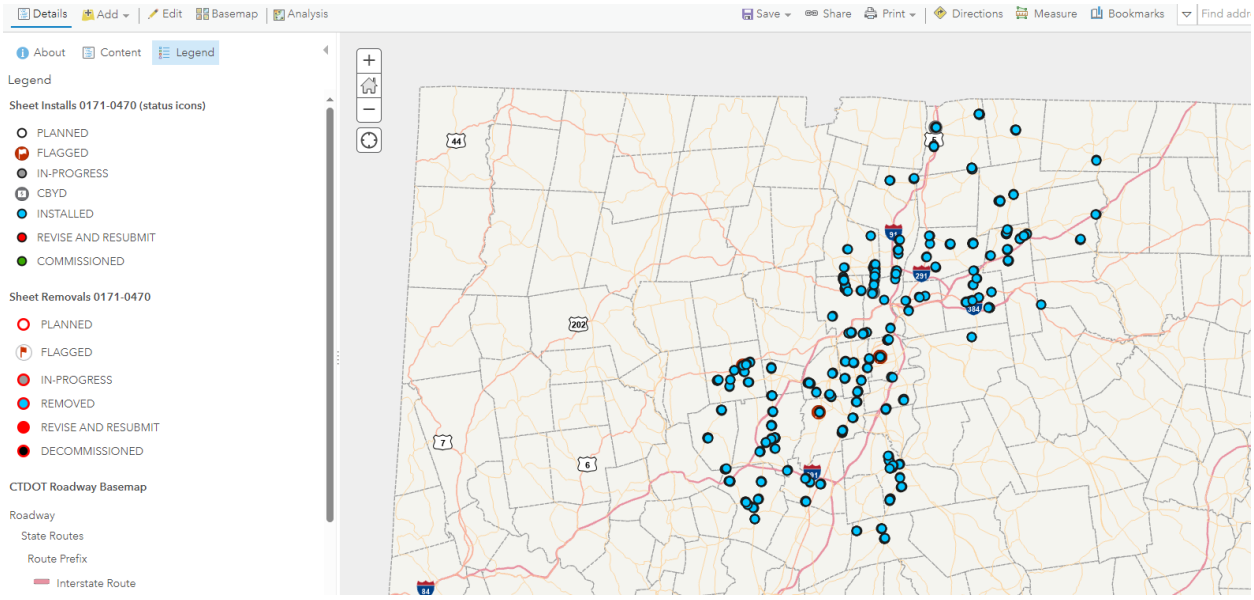
Design Data Attribution List and Sign Assembly Detail Attachment

ASSEMBLY ID	MOUNT TYPE	NUMBER POSTS	ASSEMBLY STATUS	SIGN POSITION	LATITUDE	LONGITUDE	ROUTE ID	CATALOG NUMBER	MUTCD NUMBER	HEIGHT (IN)	WIDTH (IN)	AREA (SF)	PANEL TICKNESS	BACKGROUND COLOR	LEGEND COLOR	MATERIAL	SHEETING TYPE	PANEL STATUS	ACTUAL LEGEND	PANEL DIRECTION
PROJECT_0170-3545_6010001	POST	1	PLANNED	RIGHT	41.719347	-72.278522	6-E	51-6626	M3-2	18	36	4.5	0.08	WHITE	BLACK	SHEET ALUMINUM	IX	PLANNED	EAST	W
PROJECT_0170-3545_6010001	POST	1	PLANNED	RIGHT	41.719347	-72.278522	6-E	51-6635	M1-4	36	36	9	0.08	WHITE	BLACK	SHEET ALUMINUM	IX	PLANNED	US-6	W
PROJECT_0170-3545_6010001	POST	1	PLANNED	RIGHT	41.719347	-72.278522	6-E	51-2606	M6-1	21	30	4.375	0.08	WHITE	BLACK	SHEET ALUMINUM	IX	PLANNED	←	W
PROJECT_0170-3545_6010002	POST	1	PLANNED	RIGHT	41.719529	-72.278503	6-E	31-1536	R4-7	48	36	12	0.1	WHITE	BLACK	SHEET ALUMINUM	IX	PLANNED	KEEP RIGHT (SYMBOL)	W
PROJECT_0170-3545_6010003	POST	1	PLANNED	RIGHT	41.72093	-72.276222	6-E	51-6626	M3-2	18	36	4.5	0.08	WHITE	BLACK	SHEET ALUMINUM	IX	PLANNED	EAST	W
PROJECT_0170-3545_6010003	POST	1	PLANNED	RIGHT	41.72093	-72.276222	6-E	51-6635	M1-4	36	36	9	0.08	WHITE	BLACK	SHEET ALUMINUM	IX	PLANNED	US-6	W
PROJECT_0170-3545_6010004	POST	1	PLANNED	RIGHT	41.721248	-72.275722	6-E	51-5104	D10-2a (CT)	48	12	4	0.08	GREEN	WHITE	SHEET ALUMINUM	IX	PLANNED	MILE MARKER EAST US-6 MILE 88	W
PROJECT_0170-3545_6010005	POST	2	PLANNED	RIGHT	41.721255	-72.275708	6-E	31-1564	R4-3	60	48	20	0.1	WHITE	BLACK	SHEET ALUMINUM	IX	PLANNED	SLOWER TRAFFIC KEEP RIGHT	W
PROJECT_0170-3545_6010006	POST	2	PLANNED	RIGHT	41.721479	-72.275151	6-E	51-2020	I-2 (CT)	36	48	12	0.08	GREEN	WHITE	SHEET ALUMINUM	IX	PLANNED	Coventry INCORPORATED 1712 TOWN LINE	W
PROJECT_0170-3545_6010007	POST	2	PLANNED	RIGHT	41.721961	-72.273272	6-E	31-5510	R2-4a	96	48	32	0.125	WHITE	BLACK	SHEET ALUMINUM	IX	PLANNED	SPEED LIMIT 65 MINIMUM 40	W

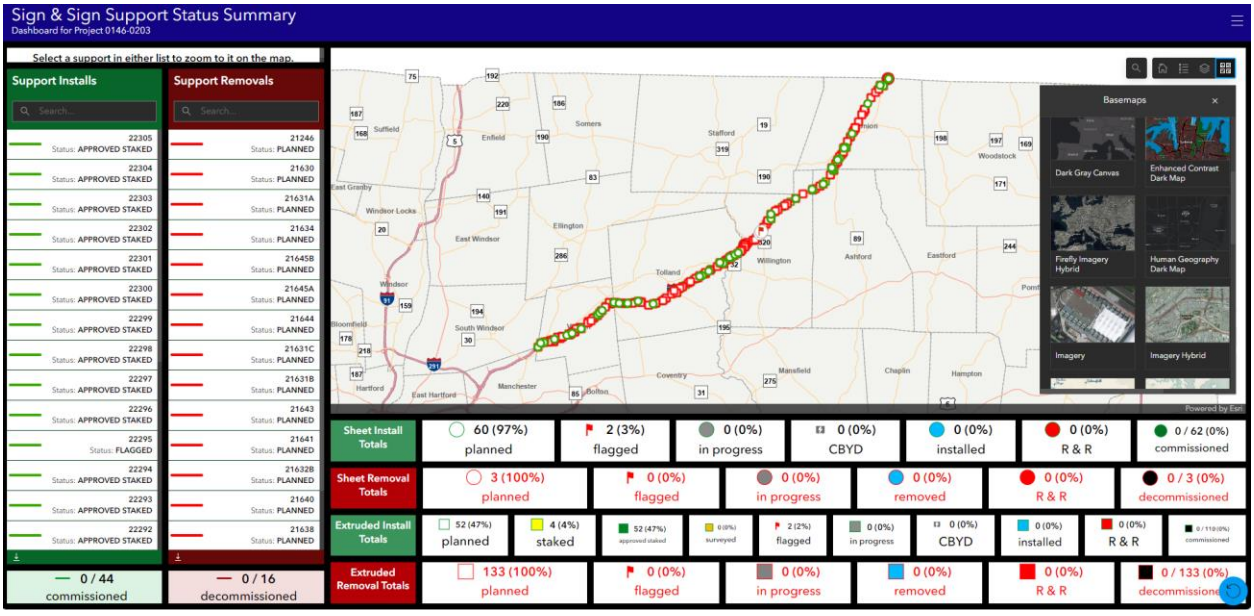
Sample Location List for Project Specifications

AASHTO

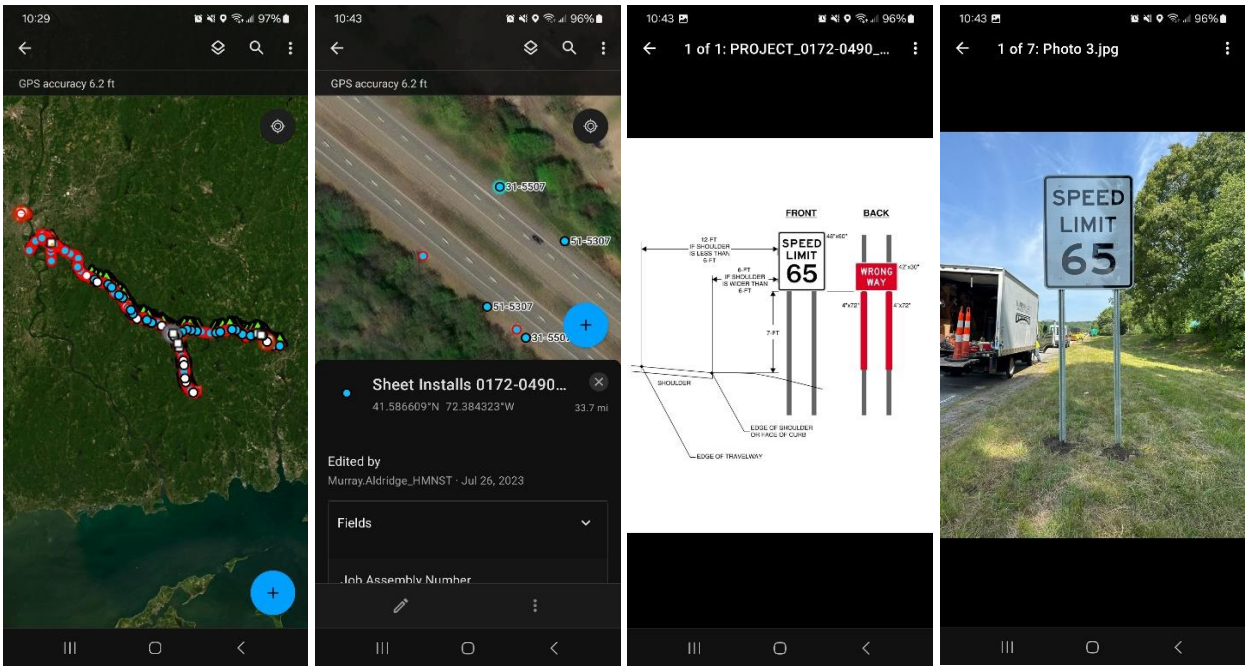
INNOVATION MANAGEMENT



Contractor or Inspector Web Map – for Office Use



Construction Project Status Dashboard



Construction Mobile Application Views

State of Development (10 points)

Innovations must be successfully deployed in at least one State DOT. The AIM selection process will favor innovations that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.

9. How ready is this innovation for implementation in an operational environment? Please select from the following options. Please describe.

☐ Innovation is fully functional and yet to be piloted.

☐ Innovation has been piloted successfully in an operational environment.

☒ Innovation has been deployed multiple times in an operational environment.

☐ Innovation is ready for full-scale implementation.

Since 2020, CTDOT has been implementing the new process, which has facilitated the construction of 18 sign replacement projects, replacing a total of 29,162 signs and supports. Currently, there are approximately 30,000 signs in various design projects that are leveraging this new approach.

CTDOT is managing 125 individual users across design, construction, and inspection, categorized as follows:

- CTDOT Designers
- CTDOT Inspectors/Consultant Inspectors
- Eight (8) Design Consultant Firms
- Eight (8) Construction Contractors

10. What additional development is necessary to enable implementation of the innovation for routine use?

To get to a full-scale implementation, CTDOT is working on the following:
1. Additional GIS professional staff
2. Related inventory tables for the CTDOT Sign Shop to improve material inventory
3. Related inventory tables for the CTDOT Specific Service Sign program
4. Related inventory tables for the CTDOT Maintenance Districts to have an inventory of materials each maintenance district has in stock
5. Implementation of use with CTDOT Maintenance staff for work orders, permits, and sign knockdowns
6. A revised data schema moved onto CTDOT servers for more control and security

11. Do you have knowledge of other organizations using, currently developing, or showing interest in this innovation? ☒ Yes ☐ No

If so, please list organization names and contacts.

*The Department's below attended an AASHTO Committee of Design meeting where they saw a presentation that briefly touched on this innovation and expressed interest in learning more.

Organization	Name	Phone	Email
Nebraska Department of Transportation	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.
Pennsylvania Department of Transportation	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.

Potential Payoff (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over baseline practice.

12. Identify the top three benefits your DOT has realized from using this innovation. Describe the type and scale of benefits of using this innovation over baseline practice. Provide additional information, if available, using quantitative metrics, to describe the benefits.

Benefit Types	Please describe:

Improved Quality	Data quality has greatly improved, resulting in more precise and detailed project designs than ever before. The app offers turn-by-turn directions using the mobile device's GPS. Additionally, the requirement for pictures has led to better compliance with sign installation standards.
Improved Operation Performance	More sign replacement projects have been completed than ever before. Contractors are leveraging the new tools to enhance installation efficiency, resulting in increased requests for similar projects. Change orders are now tracked on separate layers that can be easily toggled on and off, eliminating the hassle of sifting through multiple plan sets or revision blocks to identify updates. The new process enhances sign retroreflectivity, making regulatory, warning, and guide messages more visible to motorists. This increased visibility helps reduce the likelihood of road user conflicts and supports better compliance with Federal standards and guidelines. Overall, these improvements contribute to safer roadways for everyone.
Improved Asset Performance	In the past, tracking asset performance would have demanded a massive team dedicated full-time to the task. The new process creates that same level of support by seamlessly integrating into individuals' existing responsibilities, rather than increasing their workload. This shift has enhanced Sign Inventory data starting in the design phase and continuing through the entire construction project lifecycle, while also allowing designers to easily access information on completed tasks without needing to consult the project inspector.

Provide any additional details below:

CTDOT has launched a secondary road sign replacement program utilizing the new process and consultants to ensure a state of good repair. Previously, specific projects for secondary road signs had never been undertaken, which allowed many signs in the system to fall into disrepair. To date, five projects have been completed under this initiative, resulting in the replacement of 6,026 signs. Additionally, several more projects are currently in the design phase, which will replace another 27,488 signs.

Before this process was implemented, CTDOT had very few accurate installation dates in the Sign Inventory due to issues with its initial creation and maintenance. The new process now captures essential information, including the official approval dates for sign installations, the type of sheeting used, and the cardinal direction each sign faces. This data will help asset stewards better understand the typical asset lifecycle, taking into account age, sheeting type degradation, and sun fading, ultimately leading to more informed decision-making over time.

Design costs appear to have significantly decreased as well, largely due to the reduced effort needed to create base plans. Traditionally, base plans were time-consuming to produce and added little value to the overall project, though they are essential in CAD-based design. In contrast, the GIS environment offers numerous readily available basemaps, allowing projects to commence much more quickly and saving considerable time.

For instance, the CTDOT has observed notable differences when comparing horizontal curve sign replacement projects. Prior to implementing GIS, four of these projects designed by consultants had an average PE/CN ratio of 79.33%. In comparison, the four projects designed using GIS yielded an average PE/CN ratio of 49.42%, marking a substantial improvement that aligns more closely with the in-house design PE/CN ratios, which are below 10%.

Although there isn't enough data to confirm it definitively, it seems there may also be time savings during construction. This could result from the reduced time needed to identify each sign placement, potentially lowering the overall project costs.

Deployability (30 points)

The AIM selection process will favor innovations that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.

13. What challenges and/or lessons learned should other organizations be aware of before adopting this innovation?

When planning your geospatial data, it's essential to consider who will be using it and how, particularly at the conception stage. Understanding your audience and their specific information needs will enable you to design and structure your data more efficiently. Establishing a clear set of data standards can also minimize the need for extensive quality assurance and quality control (QA/QC) processes. Additionally, incorporating GIS specifications into project guidelines will help ensure that contractors and consultants have a baseline level of familiarity with the tools and applications they'll be using. This proactive approach will streamline workflows and enhance collaboration, ultimately leading to more effective project outcomes.

14. Please provide details of cost, effort, and length of time expended to deploy the innovation in your organization.

Cost: The cost is highly dependent on state specific software/hardware contracts, size of the state, and inventory needs/desires. Below is a listing of what CTDOT has invested in to build this process.

Software (contact vendor for pricing): ESRI ArcGIS licenses for all users; Safe Software FME (Feature Manipulation Engine); PDF editing software to help with creating attachments

Hardware (pricing dependent): computers capable of handling large volumes of data for the GIS professionals, designers don't need anything special; Mobile devices – current tablets and/or cell phones that run on either Android or iOS (windows devices don't integrate with the apps)

Staffing: GIS professional positions (CTDOT built the process with one GIS professional but has since added a second. Currently one works full time maintaining data, creating project specific maps for Contractors/Inspectors, handling inquiries, and working with new users. The other is working full time to enhance the process as described in Question 10. CTDOT would like to add more GIS professionals to continue expanding the efforts in order to handle additional projects and enhance other assets); Design Engineer (CTDOT built this process with one Design Engineer who understood the design and construction component of a sign replacement project); Asset Steward (CTDOT's asset steward worked with and oversaw the GIS professional and Design Engineer to build the new process. The asset steward should have a strong understanding of data needs, the design process, and the construction process)

Initial pilot project cost: $250,000 (Cost includes staff expenditures to design the project and develop the new process. The construction expenses were comparable to those of a sign replacement project using the previous method.)

Level of Effort: Typically a process change is difficult to make especially when the process has been in place for 50-75 years. Initial effort for the Asset Steward, Design Engineer, and GIS professional was significant, but it gets easier as users begin to adapt. Level of effort for the users is low as the application can make it so the user only sees what matters to them and they can only edit what matters to them with significant improvements to their old paper workflow.

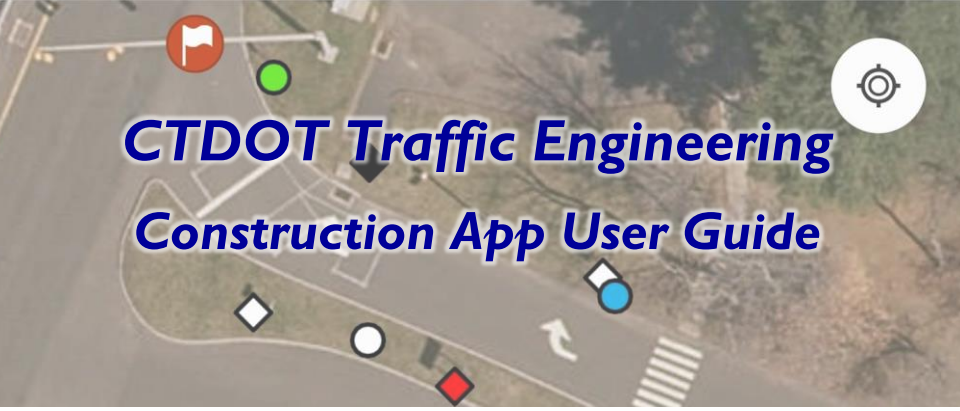
Time: The initial pilot project took two years to design and develop the new process, with the construction phase completed in four months. Most of the process changes were implemented in the three months following the hiring of the GIS professional. Note - an initial inventory is helpful but not necessary to use this process.

15. To what extent might implementation of this innovation require the involvement of third parties, including vendors, contractors, and consultants? If so, please describe. List the type of expertise required for implementation.

CTDOT currently uses ESRI ArcGIS software and servers. We are in the process of continuing to use ArcGIS while hosting the data on CTDOT servers.

Many project designs are now carried out by Engineering Design Consultants, with construction managed by private General Contractors and inspections conducted by a mix of CTDOT Inspectors and Construction Consultant Inspectors.

The only new addition to the team is the GIS Professionals, as all other CTDOT Design Engineers, Consultants, Contractors, and Inspectors have previously worked on similar projects but used the old process for design and construction.



CTDOT Traffic Engineering
Construction App User Guide

Introduction

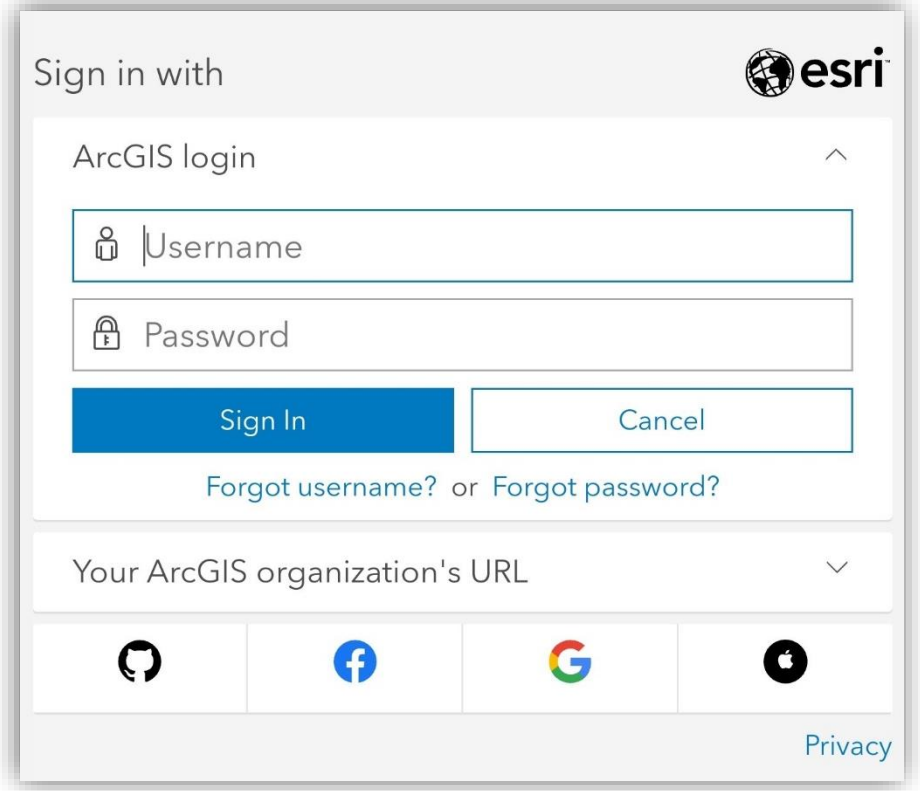
This document is prepared to serve users as a quick start guide by showing the basic functionalities of the ESRI Field Maps App for use by DOT Contractors. ESRI Field Maps allows easy viewing, collecting, and editing of GPS-based location data. This data is synchronized with maps created through Arc Online that are used for analysis and report building on a

desktop computer. Shown below is an example of the ESRI Field Maps map view.

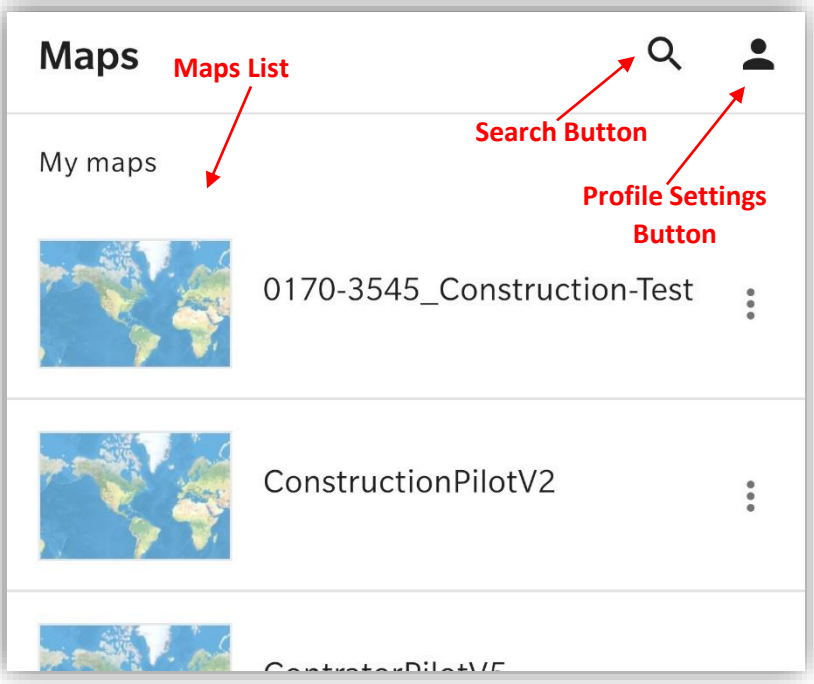
I. Installing and Signing In

1. Installation is best completed when connected to wi-fi but can be done on a mobile data network if necessary. First, open the app you use to download other apps onto your phone. For Android this will most likely be the Play Store and for iPhones (iOS) this will be the App Store. Screenshots in this app are taken of the Android version of Field Maps and may show some slight differences to what is found in the iOS version.
2. In the store app, search for “ArcGIS Field Maps”, the correct app will most likely be the first result.
3. Tap Install, and sign into your DOT account for your phone if necessary. A progress bar should appear for the installation.
4. Once completed, you should be able to find the ArcGIS Field Maps icon in your app tray. Tap the icon to open the app.

5. When you first open the app, you will reach a screen that looks something like this (above). You want to choose the option shown in white here, “Sign in with ArcGIS Online”.


Sign in with
esri
ArcGIS login
Username
Password
Sign In
Cancel
Forgot username? or Forgot password?
Your ArcGIS organization's URL
Privacy

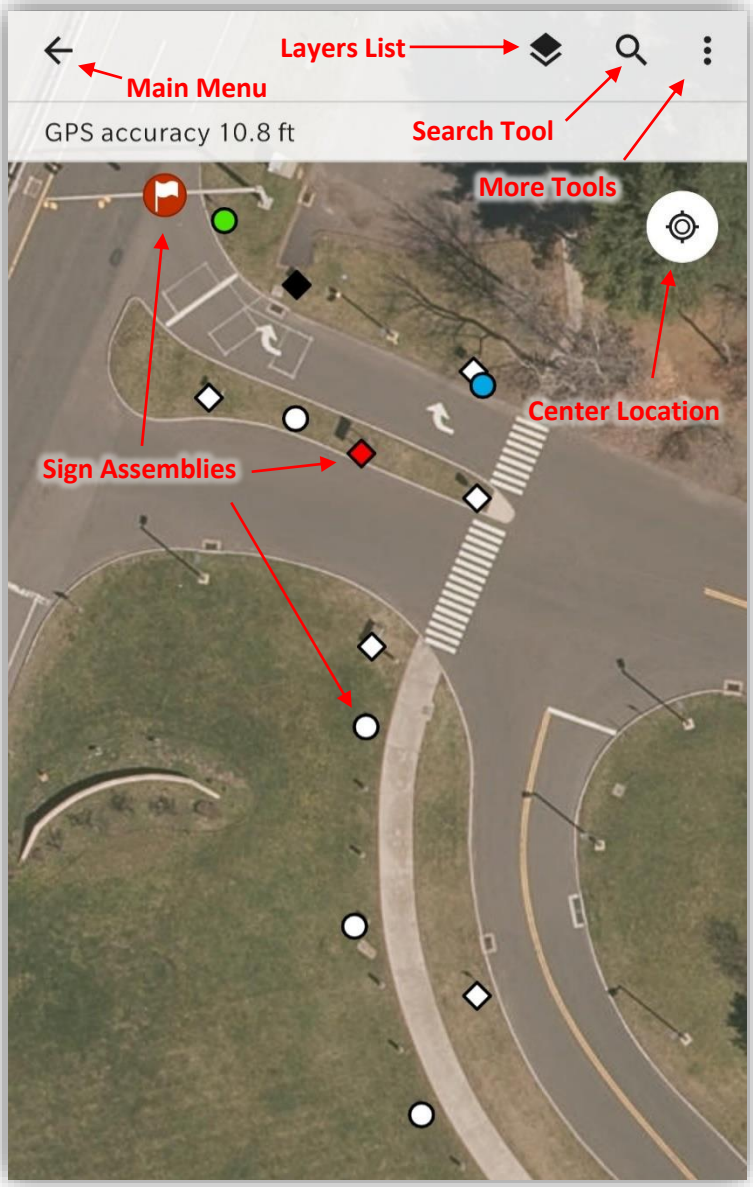
6. Next you will find yourself on the log in screen (above). Enter your ArcGIS online username and password and tap “Sign In”. In most cases, usernames are formatted as Firstname.Lastname_CTDOT. The password was chosen by the user when you first logged on.



7. Next you should reach the main menu (above) which Consists of a list of maps owned by or shared to your Arc account, a search button, and a profile settings button. Now you’re signed in and ready to start using Field Maps.

II. Map Interface

From the Field Maps main menu (section I, step 7), tap on a map from the list to open in the map view (below).



Button Descriptions:

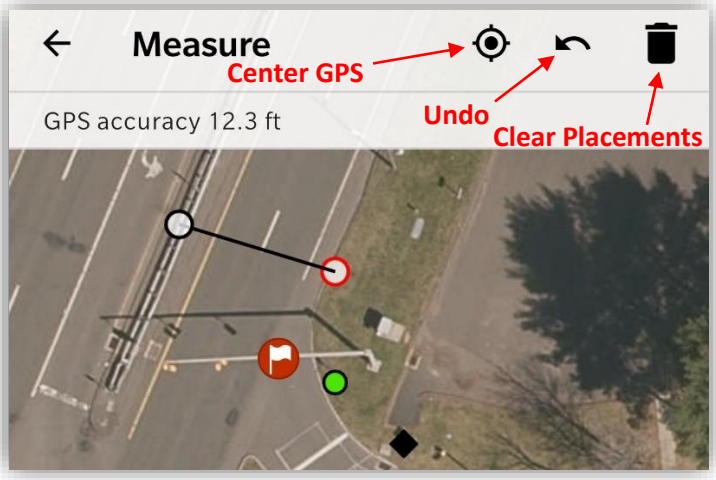
- Main Menu: The left arrow icon in the top left of the screen will bring you back to the main menu.
- Layers List: The icon of two overlapping diamonds will bring up a checklist of layers in the map. Tapping the text will zoom your map view to the full extent of that layer. Tapping the check box will toggle visibility for that layer on your map.

- Search Tool: The magnifying glass icon will bring up a search bar where you can search assembly ID numbers to locate specific assembly locations.
- More Tools: The three dots icon will bring up a selection of more map tools. These include:
  - Basemap: Selects the background image for the map. The base map can be changed back and forth as desired. “Imagery” is the default and recommended base map.
  - Bookmarks: Lets you quickly zoom to bookmarks created by the map author or “my places” saved by the user. Saving locations to “my places” will be explained later in this guide.
  - Legend: Shows an image of each kind of assembly symbol and a text description of what each shape/color combination means for quick reference. An in-detail explanation of each item on the legend will appear later in this guide.
  - Measure: Allows the user to measure a distance or an area by placing points on the map. Using the measure tool is explained below this section.
- Center Location: Tapping this button will center the map view on your current GPS location.
- Sign Assemblies: Tapping on an individual sign assembly will bring up the data attributes of assemblies at that location. If more than one assembly is present (For instance, an assembly removal and an assembly installation at the same location.) it will present you with a list of assemblies at the selected location first. Tap on the desired assembly in the list to view its attributes.

Using the Measure Tool:

1. From the map view, tap the three dots in the top right-hand corner and tap ‘Measure’ from the dropdown.
2. In the bottom left dropdown, you can pick if you’d like to measure an area or a line. Note that changing this setting will clear any measuring placements currently on the screen.

3. In the bottom right dropdown, you can pick the units you'd like to see the results in.
4. In the top right there are three buttons (shown below). The far-left button centers the map view on your current GPS location. The middle button will undo your last measuring placement. The far-right button will clear all measuring placements.



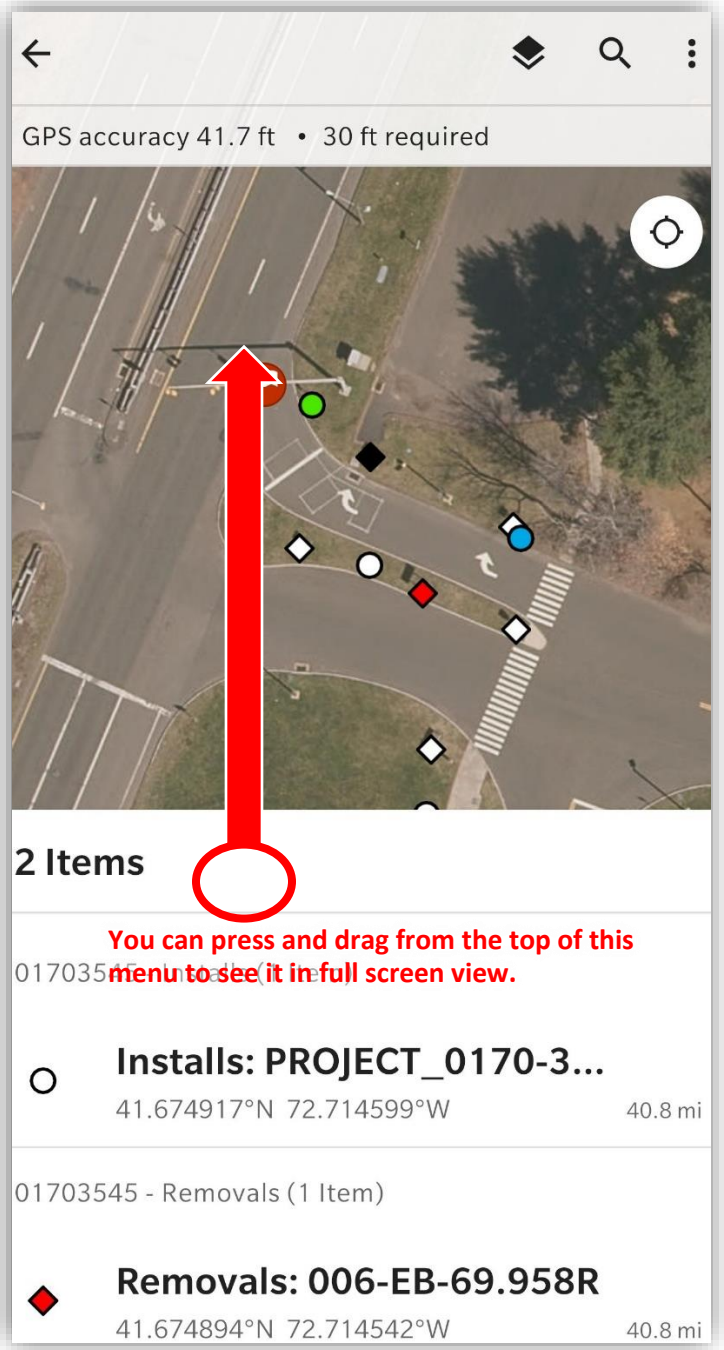
5. To begin measuring, tap on the map view to create a measuring placement. When measuring a line, it will begin measuring when you have made more than one placement. For areas, it will begin measuring when you have made more than two placements. You can create as many placements as you like to create more complex areas and lines. The distance or area is shown in the bottom left-hand corner.

6. Remember to press the trash can in the top right to clear your placements before starting your next measurement.

III. Viewing Attributes

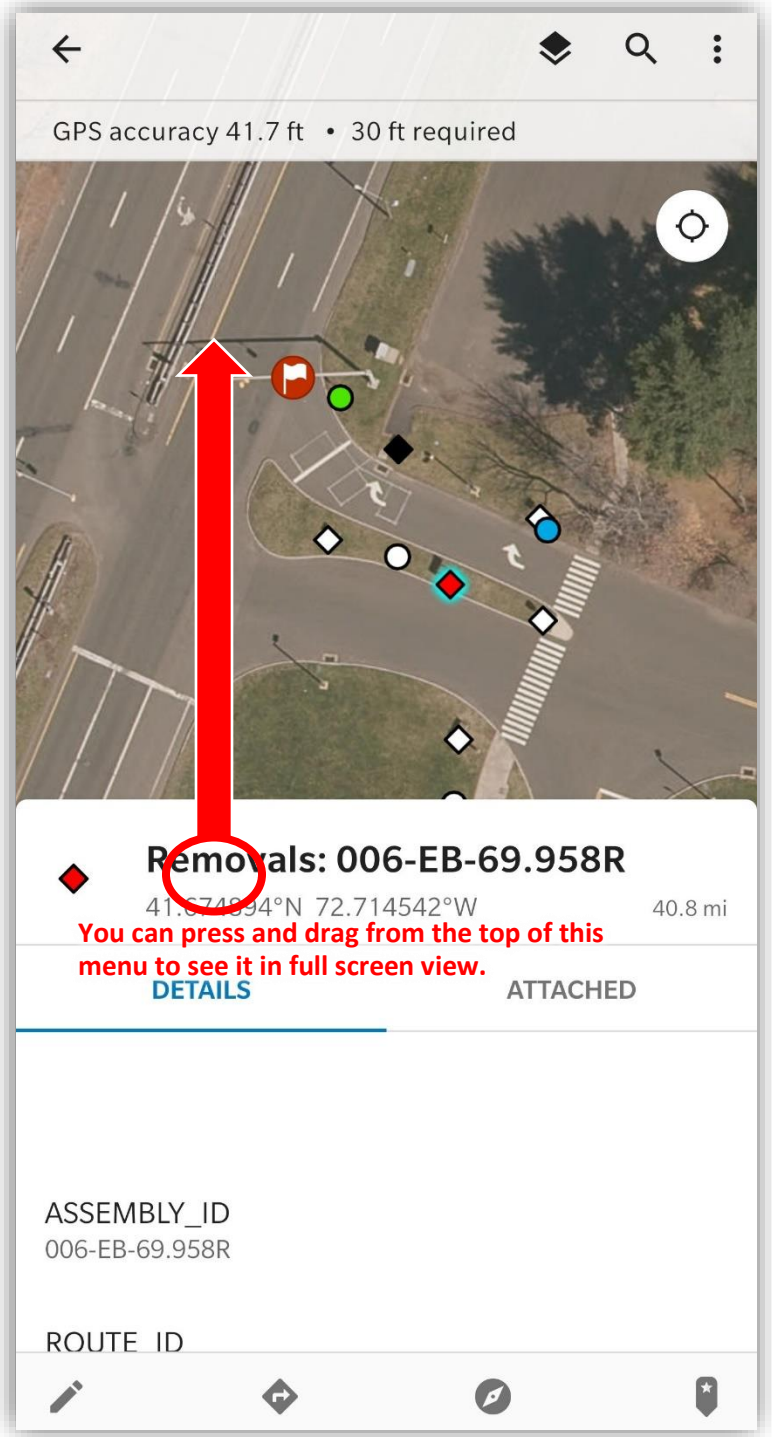
1. First, tap a data point on the map that you wish to view the attributes of. If more than one point is present around where you tap on the map, it may bring up a list of options as seen in the

screenshot below. Tap on the desired assembly to open the attributes list.

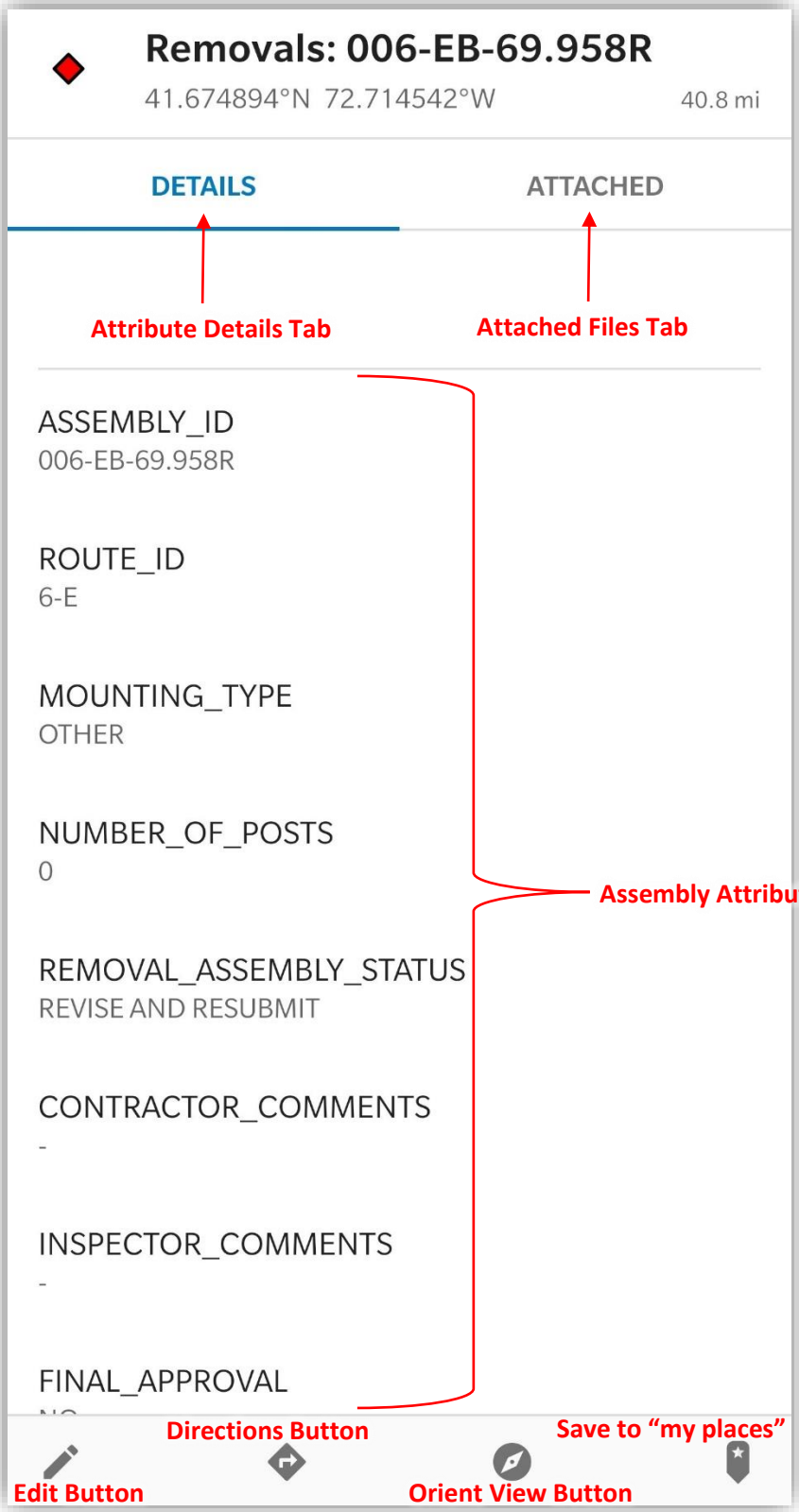


2. When you first open the attribute details window, it will open in the bottom half of the screen. Press and drag from the top of the menu to the top of your phone screen to

expand the window to full screen view, as seen in the image below.



3. With the attribute details window in full screen view, we can get a better look at all the assembly attributes visible through the Field Maps app.



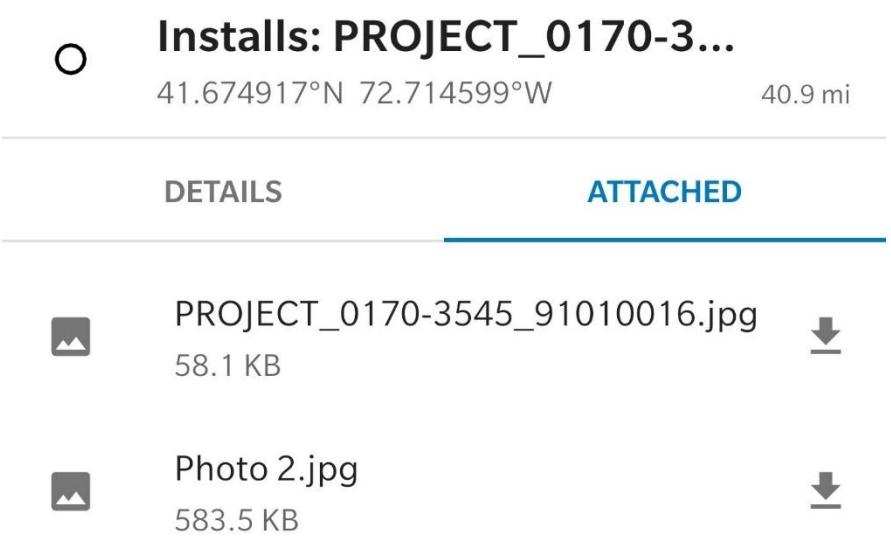
Button Descriptions:

- Attribute Details Tab: The default view when you open this window, this tab displays all the attributes associated with the selected assembly.
- Attached Files Tab: The alternate view of this window that displays any files or photos associated with the selected assembly. Attaching photos to an assembly will be explained later in this guide.
- Assembly Attributes: A list of all the attributes associated with the selected assembly. Attributes can only be viewed from the current screen.
- Edit Button: Opens the attribute editing view. Editing attributes will be explained in detail later in this guide.
- Directions Button: Opens your phone's default GPS app (usually Google Maps or Apple Maps on iOS) with directions guiding you to the GPS location of the selected assembly.
- Orient View Button: Minimizes the attribute window and shows your GPS location in relation to the selected assembly in the Field Maps map view.
- Save to "my places": Saves the selected assembly location as a bookmark in the "my places" tab of the bookmarks window. Bookmarks will be explained later in this guide.

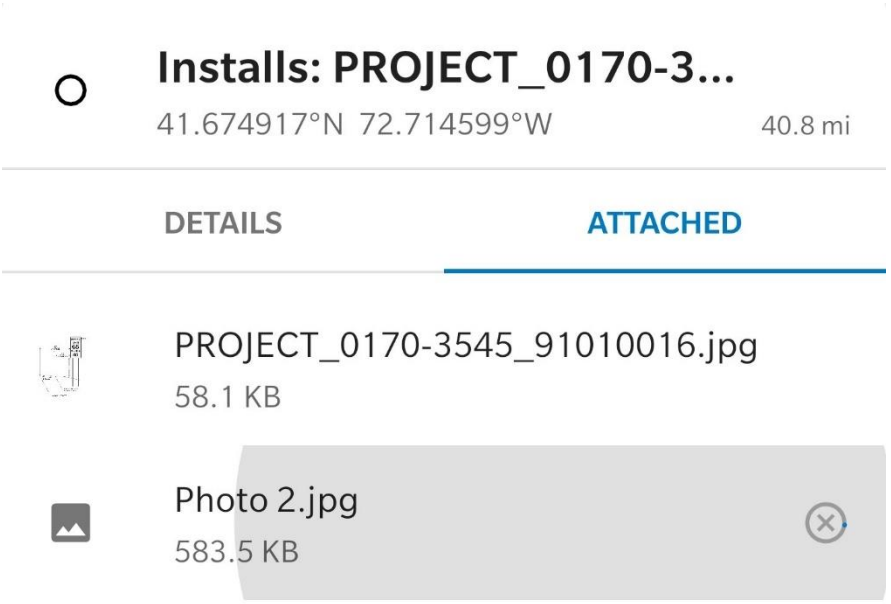
Attribute Descriptions:

- ASSEMBLY_ID: Unique identifying code for each assembly.
- ROUTE_ID: Route ID associated with the assembly.
- MOUNTING_TYPE: Type of sign assembly support.
- NUMBER_OF_POSTS: Number of posts used on the assembly.
- POSITION: Position of the assembly in relation to the roadway. **(installs only)**
- REMOVAL_ASSEMBLY_STATUS: Progress status of an assembly being removed.
- INSTALL_ASSEMBLY_STATUS: Progress status of an assembly being installed.
- CONTRACTOR_COMMENTS: Text field for Contractors to write comments about an assembly.
- INSPECTOR_COMMENTS: Text field for inspectors to write comments about an assembly.
- FINAL_APPROVAL: Inspector's final approval of an installation or removal.

IV. Viewing Attached Images

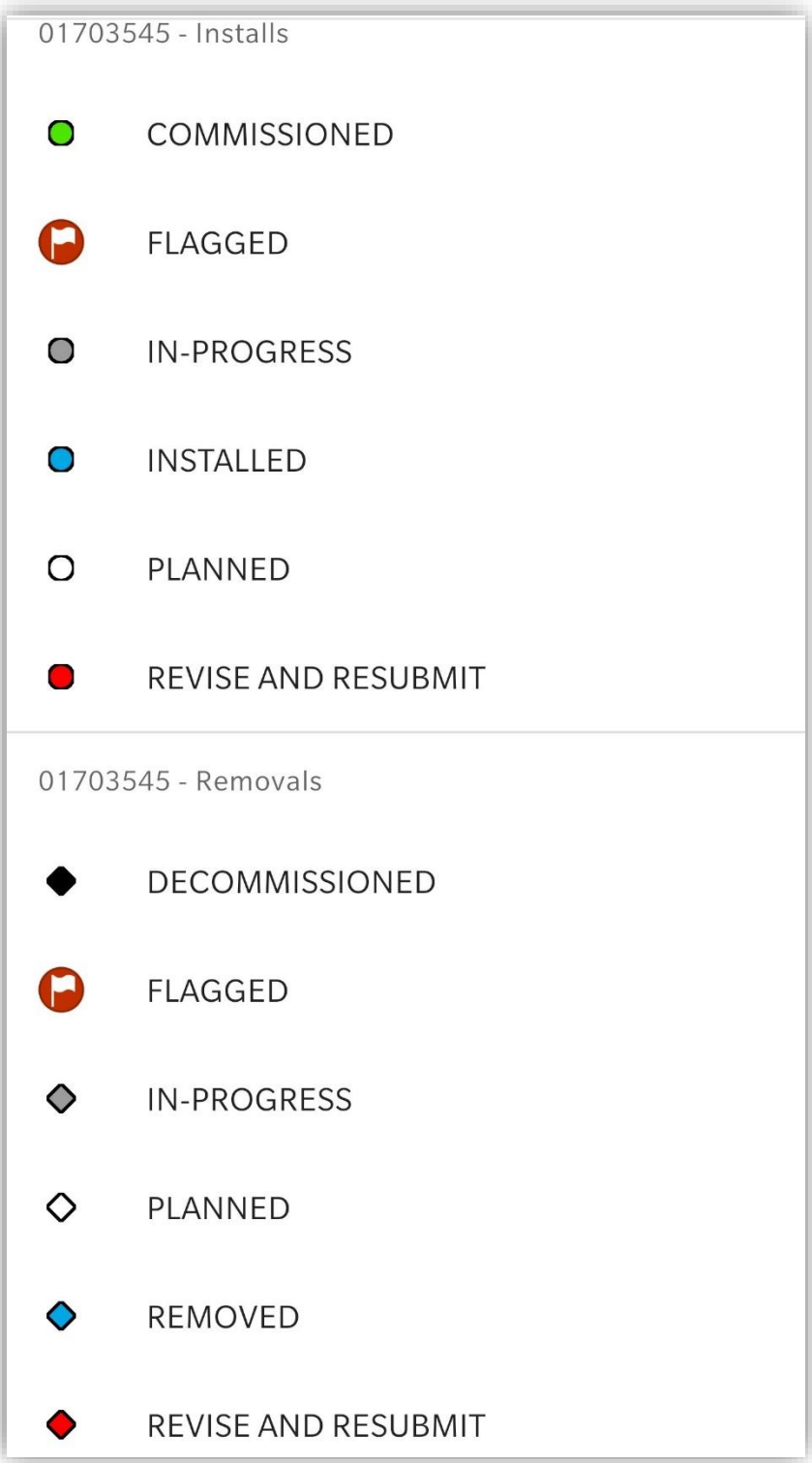


To view the images attached to an assembly, tap the "ATTACHED" tab. Here you will see a list of all attachments associated with the assembly, as shown above.



To open an image, you first have to tap once on the image to download it to your phone. In the screenshot above, Field Maps is downloading "Photo 2.jpg". You can tell when the download is finished when the thumbnail is visible to the left of the image. In the screenshot above "PROJECT_0170-3545_91010016.jpg" is ready to be opened. Tap on the image again to view it.

V. Legend Details



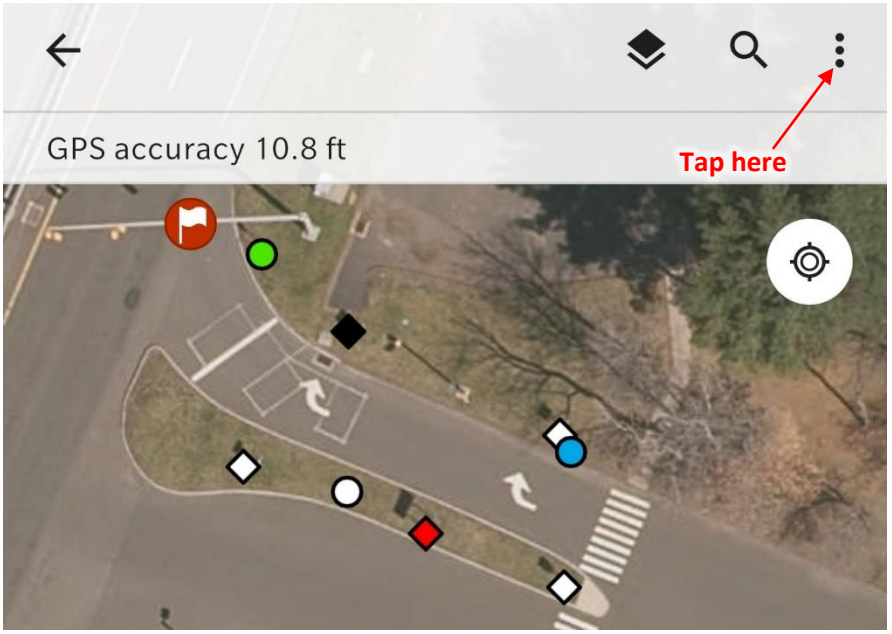
Above is the Field Maps legend for the assembly points in the Construction app. In this map, assembly install locations are represented by colored circles and assembly removal

locations are represented by colored diamonds. The color of the symbols correlates with the assembly status field.

Status Descriptions:

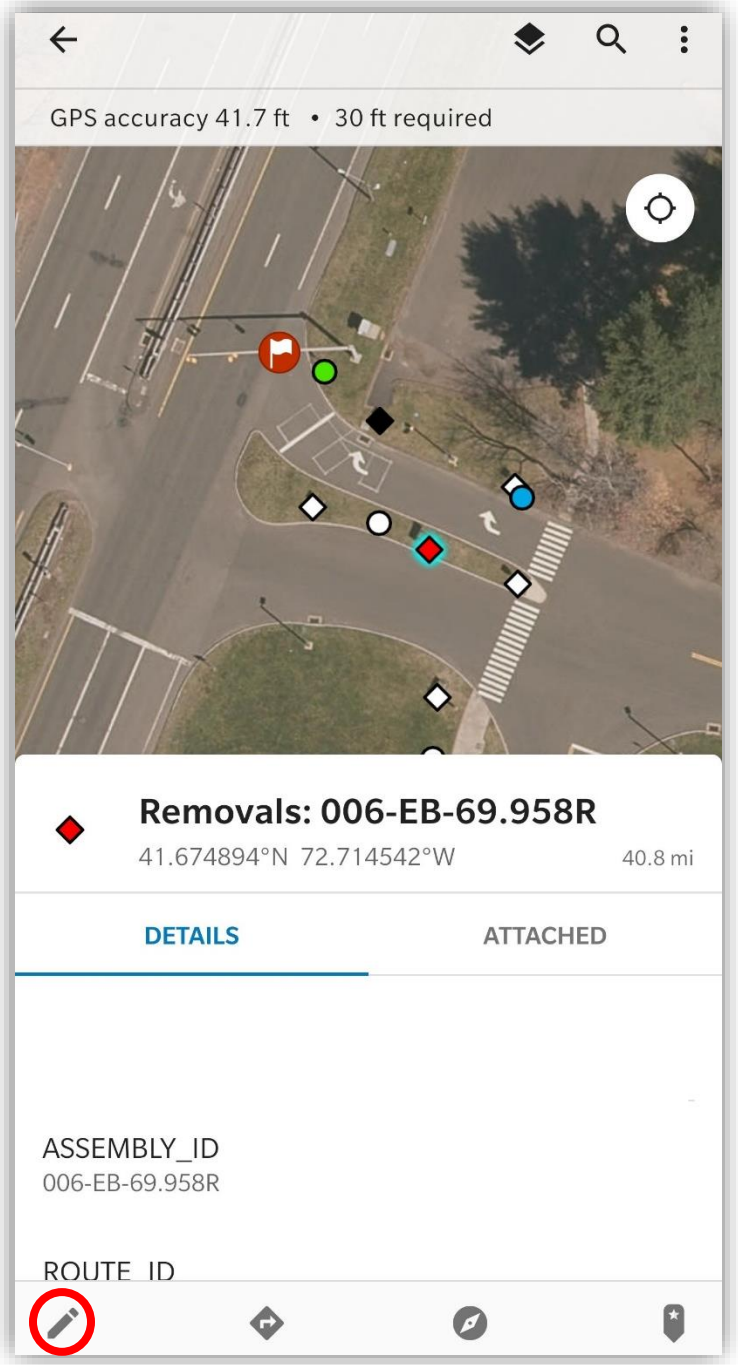
- Planned: The assembly included in the project to be removed or installed.
- Flagged: This assembly requires discussion between the Contractor and Inspection teams.
- In-Progress: Contractor has begun but not completed installation or removal of sign(s) at this location.
- Installed/Removed: All work at the location is complete and all required pictures have been captured and ready for review by the Inspection team.
- Revise and Resubmit: Work items related to the location are required to be fixed. **(Contractor should view the Inspector Comments field for details or contact the Inspection team for further instructions.)**
- Commissioned/Decommissioned: Work has been completed and all parties have accepted the work. **(Note- final acceptance by the Department is verified under Final_Approval attribute in case this status is set by mistake)**

You can view this legend in the Field Maps app at any time. Follow instructions in the two images below to open the legend.

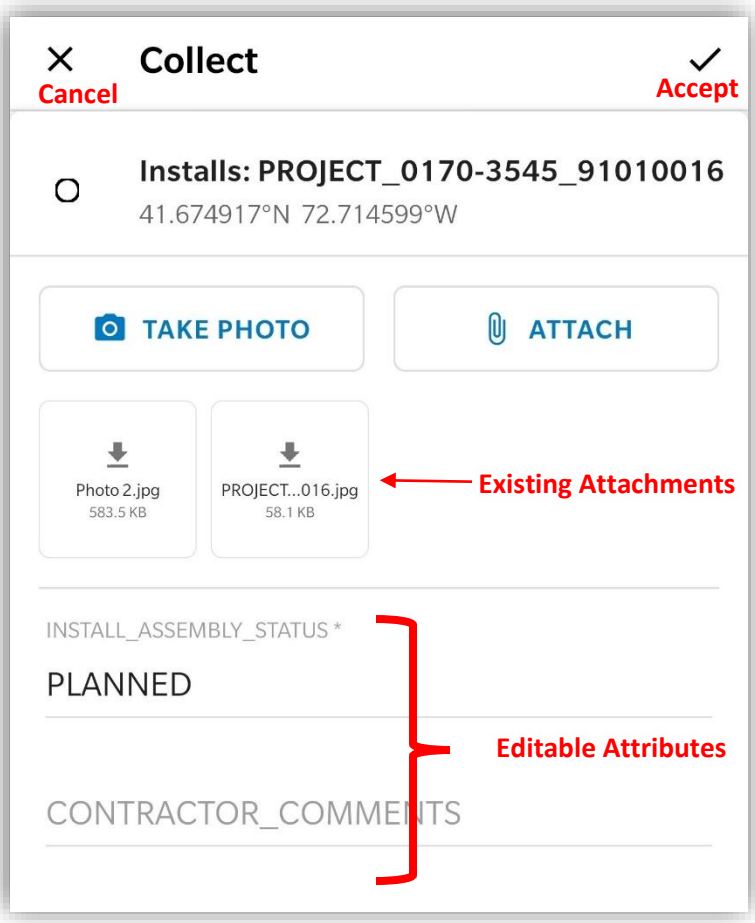


VI. Edit Attributes and Attachments

1. To edit an assembly attribute, tap on the assembly point you wish to edit the attributes of to bring up the attribute details window.



2. Next, tap the Edit button in the bottom left to open the editing window, as shown in the red circle above.



3. To edit an attribute, tap on the line next to the attribute name, and begin typing or choose from the domain list if applicable. For the construction app, comment fields will allow you to enter text while the assembly status field uses a drop-down domain list. Tap the check icon in the top right frequently as you work so you do not lose any changes.
4. Attaching an image to the assembly can be done in two ways. The easiest option will be to choose “TAKE PHOTO” from the editing window. If Field Maps asks for permission to access your camera, microphone, and phone storage choose to allow it.
5. The Field Maps camera will open and allow you to take a picture. After you take a picture, tap the check icon to attach the image, the X icon to cancel, or the circular arrow icon to take a new picture instead.
6. If you want to remove or rename an attachment, press and hold on the attachment in the editing window (shown above, where the image says “Existing Attachments”) and

you will see the option to “Rename”, “Remove” (delete), or

“Save Image” (this will save a copy of the attachment to your device. **(Note: After removing an attachment, once the check icon is tapped to save changes, the attachment cannot be re-added without taking a new picture. If you accidentally remove an attachment, tap the X icon to cancel your edits and replace the attachment. Please keep in mind this will also undo any unsaved edits, including new attachments.)**

7. The other option to add an attachment is to upload and existing image from your phone. To do so, tap “ATTACH” from the editing window.
8. At the bottom of the screen tap “Photo gallery” to browse files from your phone. Tap on the picture you want to add it.
9. When you are done attaching images, be sure to tap the check icon in the top right to accept and save your changes.

VII. Using Offline Areas

Offline areas allow you to view a selected map area (as well as the data that already exists there) when you have poor or no internet connection. Downloading offline areas is useful when working in areas that may have spotty cell reception. They allow you to collect new data that you can sync to the online database when you return to an area where you have internet access. Offline areas can include very large files, so it is recommended that you begin downloading them connected to wi-fi and well ahead of when you intend to use them.

1. Navigate to the Field Maps main menu, where you can browse the map list (Section I, step 7).
2. Find the map you wish to use an offline area on and tap the three dots to the right of that map. From the dropdown, tap ‘Add Offline Area’.

Important note: once you download an offline area for a Field Maps app, you will only be able to use that map offline until the offline areas are synced and removed. Ensure you download all areas you will be working in, even if you may have cell coverage in some areas.

3. Now you will be taken to a map view on the selected map. There will be a square in the center of the screen for

choosing the area you want to download. Zoom into your area of interest.

4. When you have the proper area selected wholly within the box, tap the “DOWNLOAD AREA” button at the bottom of the screen. If your work area is very large, you may need to download more than one area to ensure coverage.
5. You will see your area listed with a progress circle on the right. Tap the x in the progress circle if you want to cancel the download. You can also tap the back arrow in the top left to begin downloading more offline areas if necessary.
6. Back on the main menu, your map will now say “offline areas” underneath the map name. To use the offline area, click on the map to view a list of available areas, and choose one to start working. The data will work as usual if you don’t cross the boundaries of the offline area.

It is good practice to ensure that your offline areas are working before you leave cell reception. To do so, set your phone to airplane mode and attempt to open the map again. This will simulate being out in the field where there is no available reception.

7. On the list of offline areas, you can tap the three dots to the right of each area to rename, remove, or sync map areas from the dropdown.
8. The sync button in the dropdown is used after completing work in an offline area. When you return to an area with internet connection (best on wi-fi), click sync to upload your new data set the server. If you forget this step, no one will be able to see your changes except for you.
9. Once you are done syncing, you may tap the dropdown again, and choose ‘remove’ next to each offline area to return to using the online version of the map.