



# InSPIRE

Innovation Summit for  
Preparedness & Resilience

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Riding the Data Highway: GIS Use  
in Transportation

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# Meet the presenters



Eric  
Wilson



Eddy  
Shipman



Raquel  
Bensadoun



James  
Nenaber



Finn  
Swingley

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# Objective

Participants will learn how NCDOT is utilizing GIS to increase efficiencies for post-incident damage reporting to FEMA, and how communities are leveraging mobile mapping capabilities from HERE to support all phases of a disaster.

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# Agenda

- 1:00– 1:05 Introductions and Welcome (5 mins)
- 1:05 – 1:35 NCDOT (30 min)
- 1:35 – 2:05 HERE (30 min)
- 2:05 – 2:15 Questions/Wrap-up/Closing





**NORTH CAROLINA**  
Department of Transportation



## GIS Disaster Monitoring & Recovery

NCDOT GIS Unit:

Eric Wilson, GIS Manager

Edward Shipman, Application Development Supervisor

Raquel Bensadoun, Geospatial Services Supervisor

Grateful Acknowledgements:

Joshua Kellen, PE, Jaimie Nevins

Massiel Perez





**Division of Aviation**

**Ferry Division**

**Division of Highways**



**DIT-T**

Web Services



EBS

# GISU Supported Products

## TIMS Services

### SMO ASSIST Dashboard

SMO deploys Survey123 survey to field workers to collect and report all storm related damages and repair estimates.

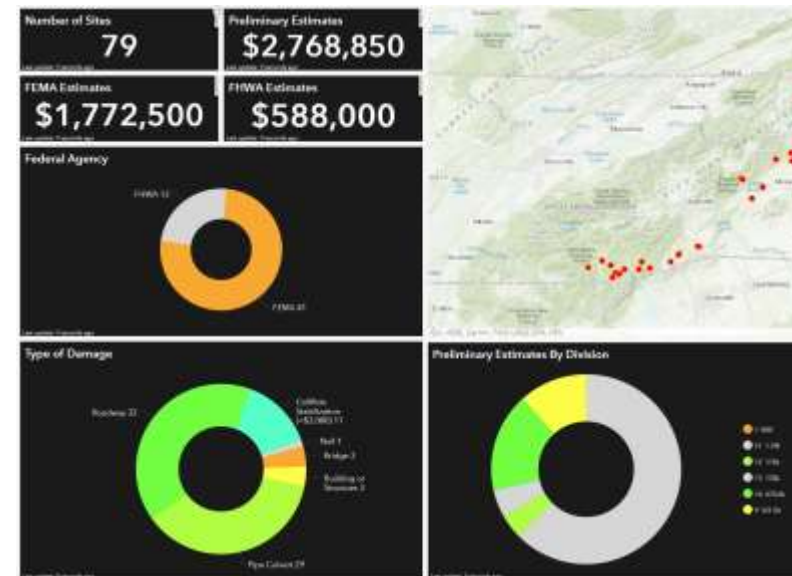
The dashboard uses that survey data to compile metrics and also create a total monetary estimate for Federal Emergency support.

### Damage Assessment Image Viewer

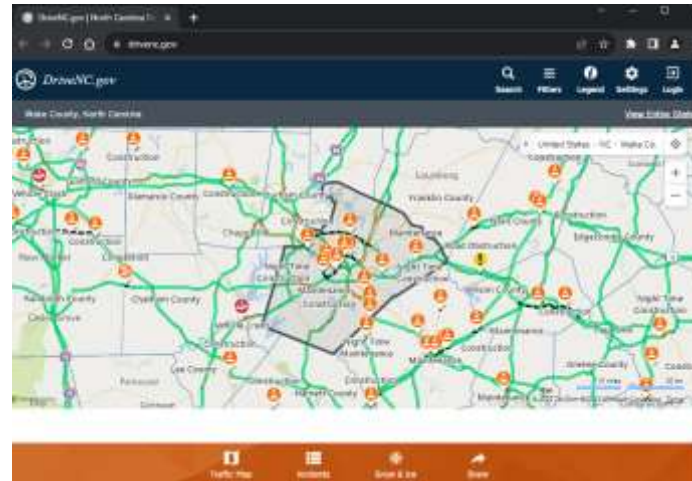
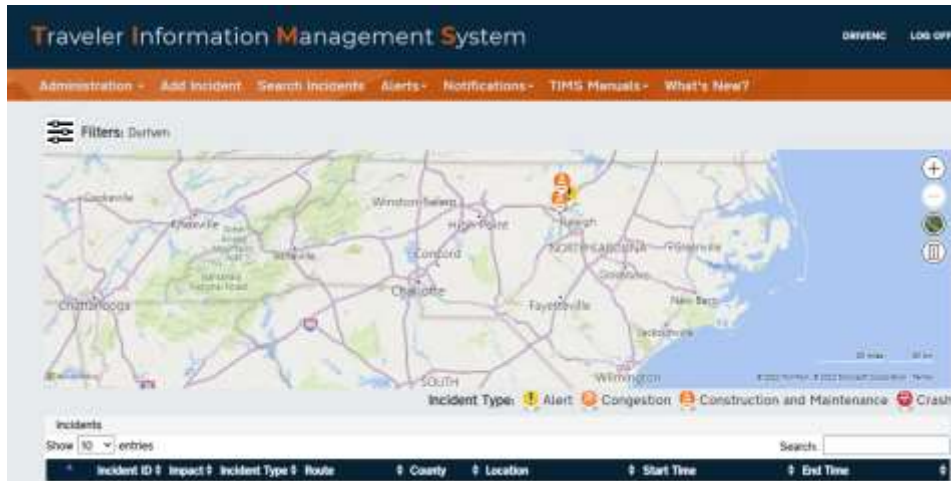
Generated from SMO ASSIST survey to quickly view pictures captured by NCDOT field crews

### Drone SharePoint Viewer Products

Web application created by Aviation for UAS drone images of larger scale damaged areas.



# TIMS Traveler Information Management System



[drivenc.gov](http://drivenc.gov)

```
[{"id": 881547, "latitude": 36.0547482384327, "longitude": -79.886796739849, "commonName": "", "reason": "Crash", "severity": 3, "direction": "W", "location": "In Greensboro / Mile Marker 3rd Heading West", "lastUpdate": "2023-11-08T21:45:26Z", "road": "I-40", "routeId": 10000040, "isDetour": true, "feet": -999, "inches": -999, "bridgeInvolved": false, "innerZone": false, "fatality": false, "hazardous": true, "crossStreetPrefix": "", "crossStreetNumber": 10, "crossStreetSuffix": "", "crossStreetCommonName": "", "eventId": 1, "event": "Construction", "severity": 2, "direction": "S", "location": "In Charlotte / Mile Marker 3.0 to 2.4 Inner Loop", "lastUpdate": "2023-11-08T21:27:27Z", "road": "I-277", "routeId": 10000277, "isDetour": false, "caution": true, "lanesClosed": 2, "lanesTotal": 3, "widthLimit": -999.0, "widthLimit": -999.0, "heightChange": false, "feet": -999, "inches": -999, "bridgeInvolved": false, "innerZone": false, "fatality": false, "hazardous": true, "crossStreetPrefix": "I", "crossStreetNumber": 277, "crossStreetSuffix": "E", "crossStreetCommonName": "", "eventId": 1, "event": "Construction", "severity": 3, "direction": "W", "location": "In Charlotte / Mile Marker 3rd Heading West", "lastUpdate": "2023-11-08T21:45:26Z", "road": "I-40", "routeId": 10000040, "isDetour": true, "feet": -999, "inches": -999, "bridgeInvolved": false, "innerZone": false, "fatality": false, "hazardous": true, "crossStreetPrefix": "I", "crossStreetNumber": 277, "crossStreetSuffix": "E", "crossStreetCommonName": "", "eventId": 1, "event": "Construction", "severity": 2, "direction": "S", "location": "In Charlotte / Mile Marker 3rd Inner Loop", "lastUpdate": "2023-11-08T21:20:18Z", "road": "I-277", "routeId": 10000277, "isDetour": false, "caution": true, "lanesClosed": 1, "lanesTotal": 2, "widthLimit": -999.0, "widthLimit": -999.0, "heightChange": false, "feet": -999, "inches": -999, "bridgeInvolved": false, "innerZone": false, "fatality": false, "hazardous": true, "crossStreetPrefix": "I", "crossStreetNumber": 277, "crossStreetSuffix": "E", "crossStreetCommonName": ""}]
```

TIMS API

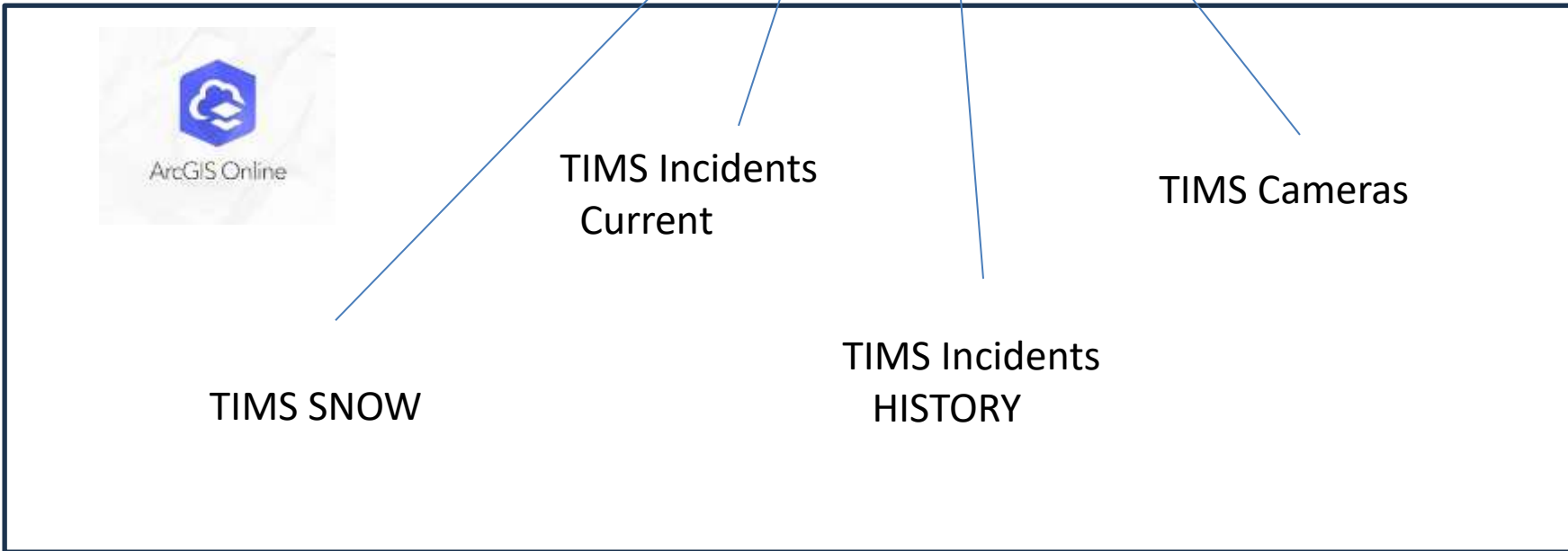


```
[{"id":682194,"latitude":35.8047482184327,"longitude":-79.8865386738689,"comment":"","reason":"Crash","severity":3,"direction":"N","location":"In Greensboro / Mile Marker 234 Heading West","lastUpdate":"2023-11-08T21:45:26Z","road":"I-40","routeId":100000440,"isDetour":1,"feet":599,"inches":599,"bridgeInvolved":false,"inworkZone":false,"fatality":false,"hazardous":0,"crossStreetPrefix":"","crossStreetNumber":0,"crossStreetSuffix":"","crossStreetCo..."}, {"id":682195,"latitude":35.228187,"longitude":-80.82068,"comment":"","reason":"Double left lan...","severity":2,"direction":"E","location":"In Charlotte / Mile Marker 3.9 to 2.8 In...","lastUpdate":"2023-11-08T21:27:17Z","road":"I-277","routeId":10000277,"isDetour":1,"isClosed":2,"lanesTotal":1,"weightLimit":999.0,"widthLimit":999.0,"heightChange":0,"feet":599,"inches":599,"bridgeInvolved":false,"inworkZone":false,"fatality":false,"hazardous":0,"crossStreetPrefix":"","crossStreetNumber":1,"crossStreetSuffix":"","crossStreetComm..."}, {"id":682196,"latitude":35.229811,"longitude":-80.82963,"comment":"","reason":"","severity":1,"direction":"","location":"","lastUpdate":"2023-11-09T02:00:00Z","road":"I-277","routeId":10000277,"isDetour":1,"isClosed":1,"lanesTotal":1,"weightLimit":999.0,"widthLimit":999.0,"heightChange":0,"feet":599,"inches":599,"bridgeInvolved":false,"inworkZone":false,"fatality":false,"hazardous":0,"crossStreetPrefix":"","crossStreetNumber":1,"crossStreetSuffix":"","crossStreetComm..."}]
```

Functional



Azure Functions



TIMS Incidents Current

TIMS Cameras

TIMS Incidents HISTORY

TIMS SNOW

# TIMS Incidents Dashboard

## NCDOT Current DriveNC/TIMS Incidents Dashboard

Event: All Events

Create Date: 11/8/2023 and before

### Filter

*Use the buttons, check boxes, and dropdowns to filter the map, charts, and counters.*

Division:

1	2	3	4	5	6	7
8	9	10	11	12	13	
14						

County:

All Counties

Severity:

Low Impact

Medium Impact


High Impact

Route Type:

Interstate

Select more than one option in all filters.

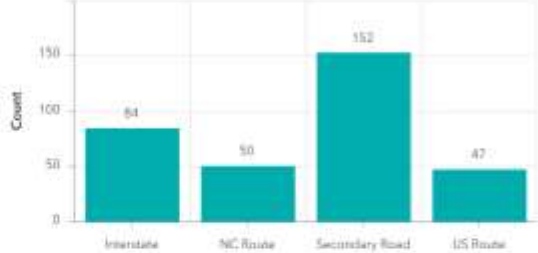
14  
Primary Closures
108  
Closures
333  
Total



The DriveNC/TIMS Incidents data contains the general location of and details about current incidents that can affect travel on roads maintained by the North Carolina Department of Transportation. Concurrent route incidents are listed only once on the highest-order route. For assistance using the app, download the [User Guide](#).

This data is updated every 5 minutes.

### Route Type



Route Type	Count
Interstate	84
NC Route	50
Secondary Road	152
US Route	47

Route Type
Road Condition
Incident Type
Severity

### Primary Closures

*Click on an incident to zoom to it.*  
*Click on it again to zoom to the state.*

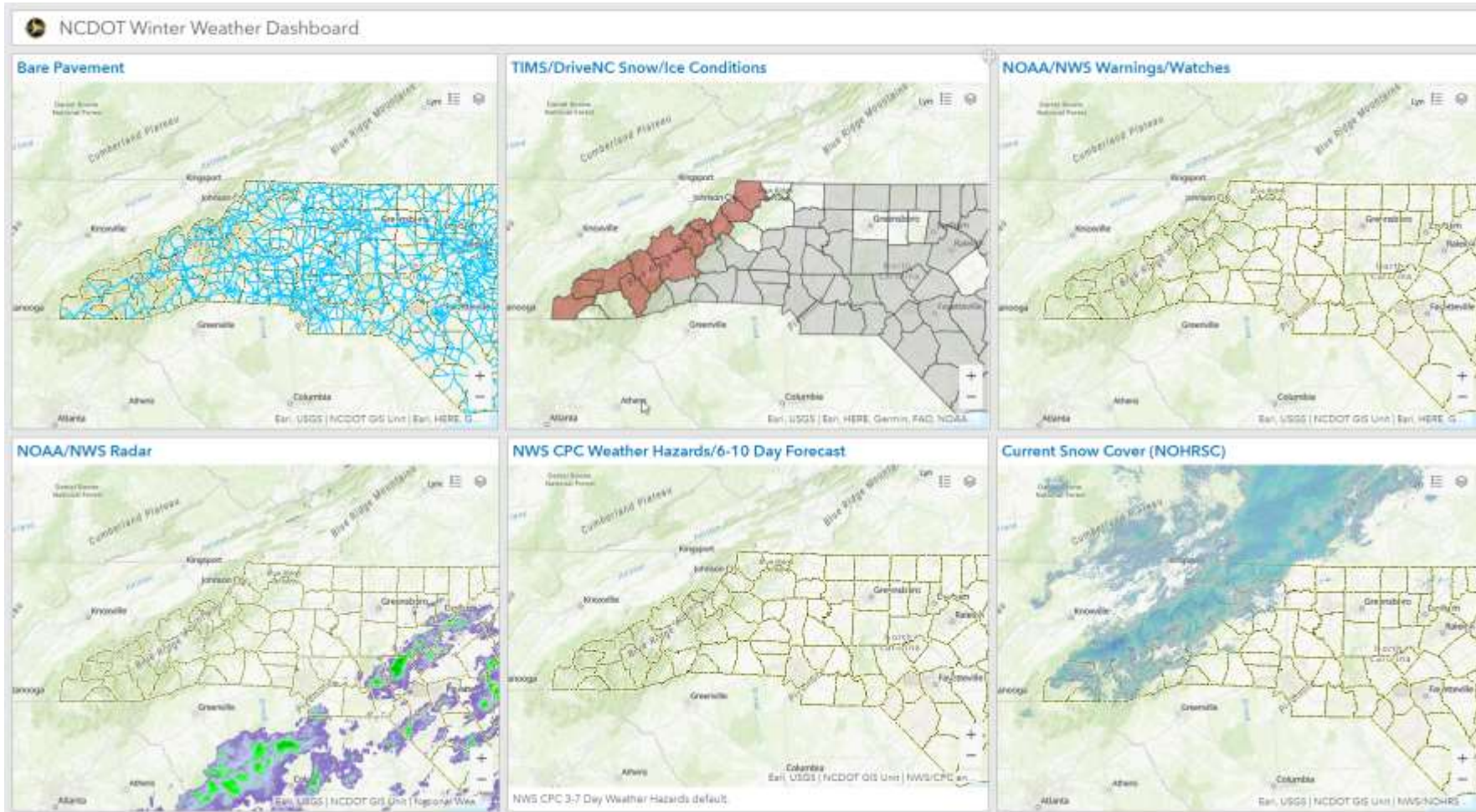
**Incident: 681480** - Road Closed  
Road Obstruction  
NC-59 (I), Near Fayetteville / Both Directions  
Fayetteville, Cumberland County, Division 6

The road is closed near Queensdale Drive.

11/8/2023, 5:02 AM - 11/9/2023, 3:00 PM

**Incident: 680831** - Road Closed with Detour  
Construction  
NC-97 (Boulder Neck Rd.), Near Edenton / Both Directions

# Adverse Weather Dashboard Incorporating Snow/Ice



**Layers**

**Get started**  
You can explore maps, add layers, and more without signing in. To save your work, sign in before creating your map.  
[Learn more about Map Viewer](#)

**NCDOT\_TIMS Cameras**

**Add**

**NCDOT\_TIMSCameras: I-95 SB @ mm 97**

Zoom to

Latitude	35.52
Link	<a href="#">View</a>
Location	I-95 SB @ mm 97
Longitude	78.29
Status	OK

1 of 1,000

**Properties**

Use the selector above to switch between layers in the map.

**Information**

**Symbology**

**NCDOT\_TIMSCameras**

**Appearance**

Blending

Normal

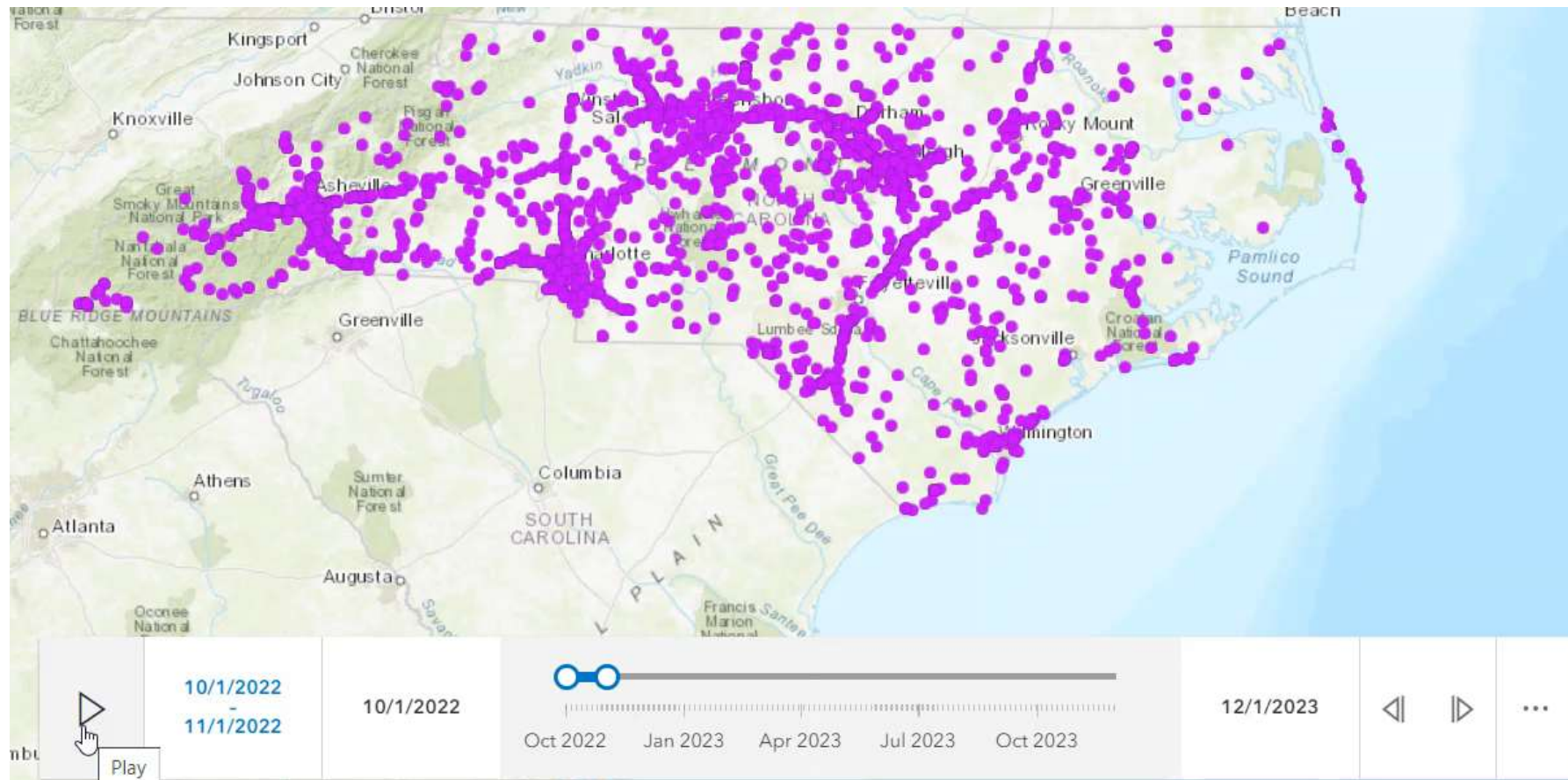
Transparency

0%

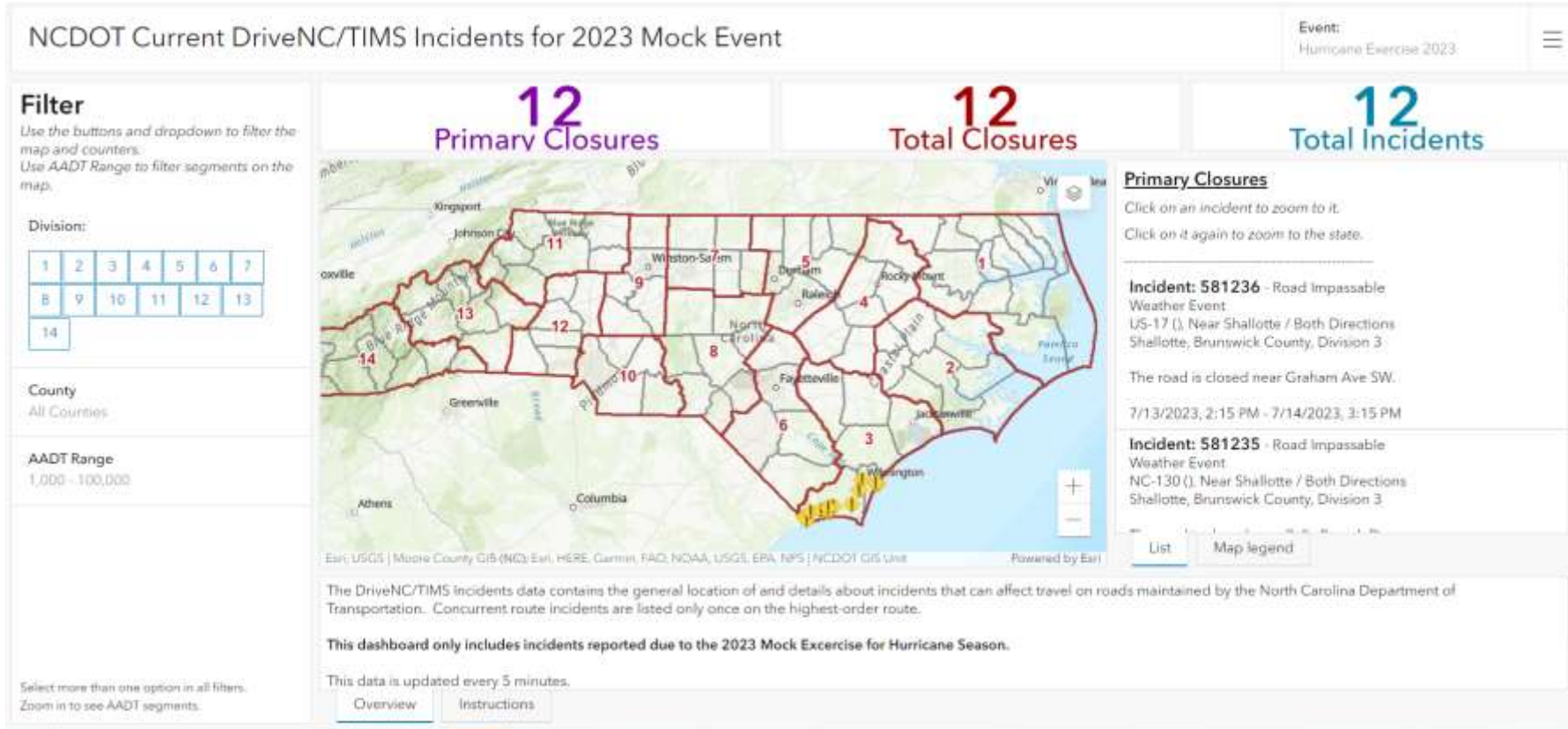
## TIMS Cameras



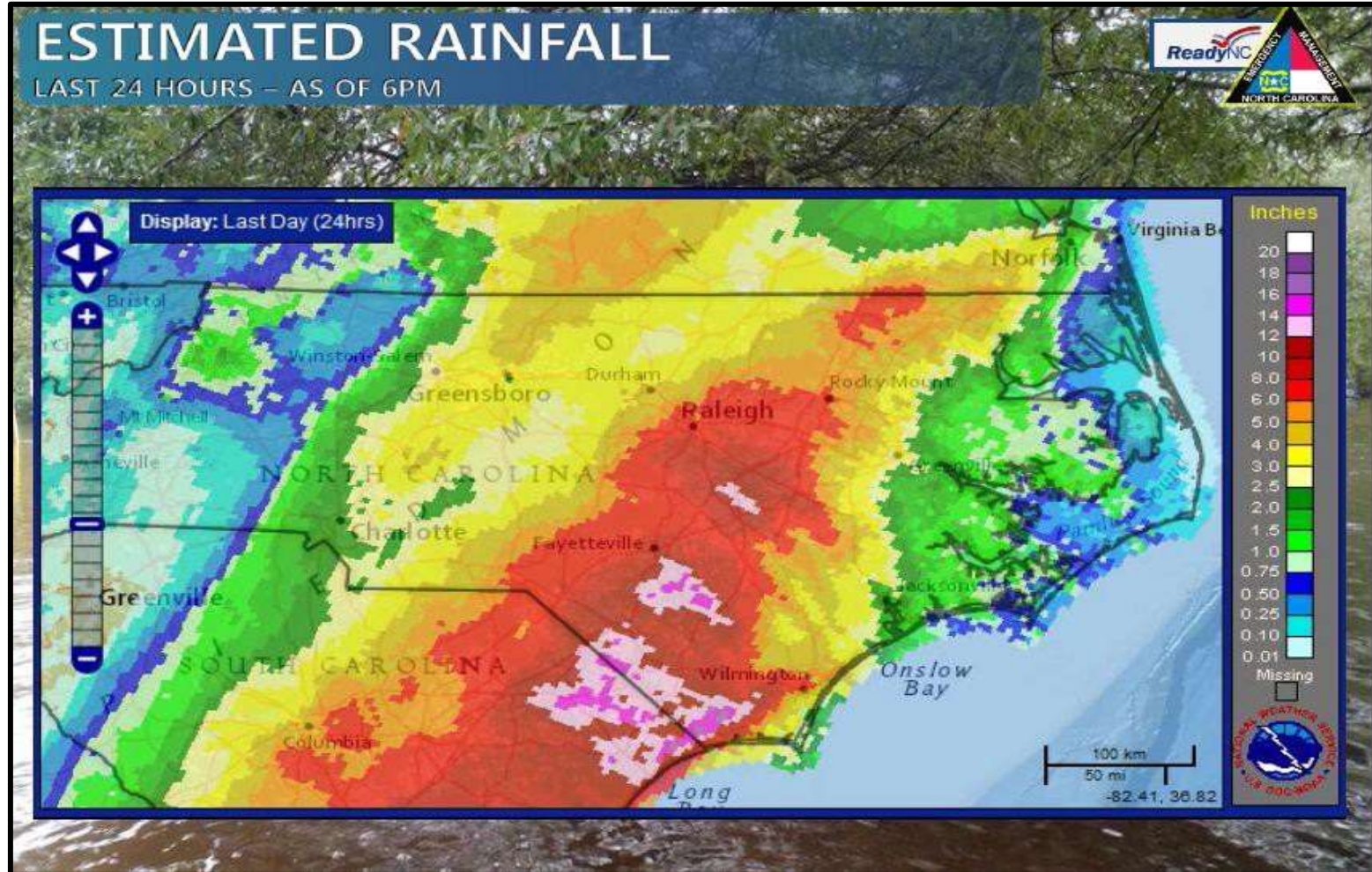
# TIMS Incidents History



# TIMS Incidents Dashboard



*The Precursor: Hurricane Matthew (October 2016)*



## *The Precursor: Hurricane Matthew*

- Over 1,760 Incidents
- Over 2000 Identified FEMA Sites
- Over 700 Identified FHWA Sites
- Price tag of ~\$200 million





*Starting with the end in mind: Financial Recovery*



FEMA



- Damage Description:  
Including Dimensions
- Scope of Work
- Pictures
- Engineer's Estimate
- Environmental Permits
- Hydraulic Recommendations
- GPS Coordinates
- Location Map
- Timesheets
- Equipment Logs
- Material Receipts/Purchase Orders
- Contracts
- Etc.



*Starting with the end in mind: Financial Recovery*

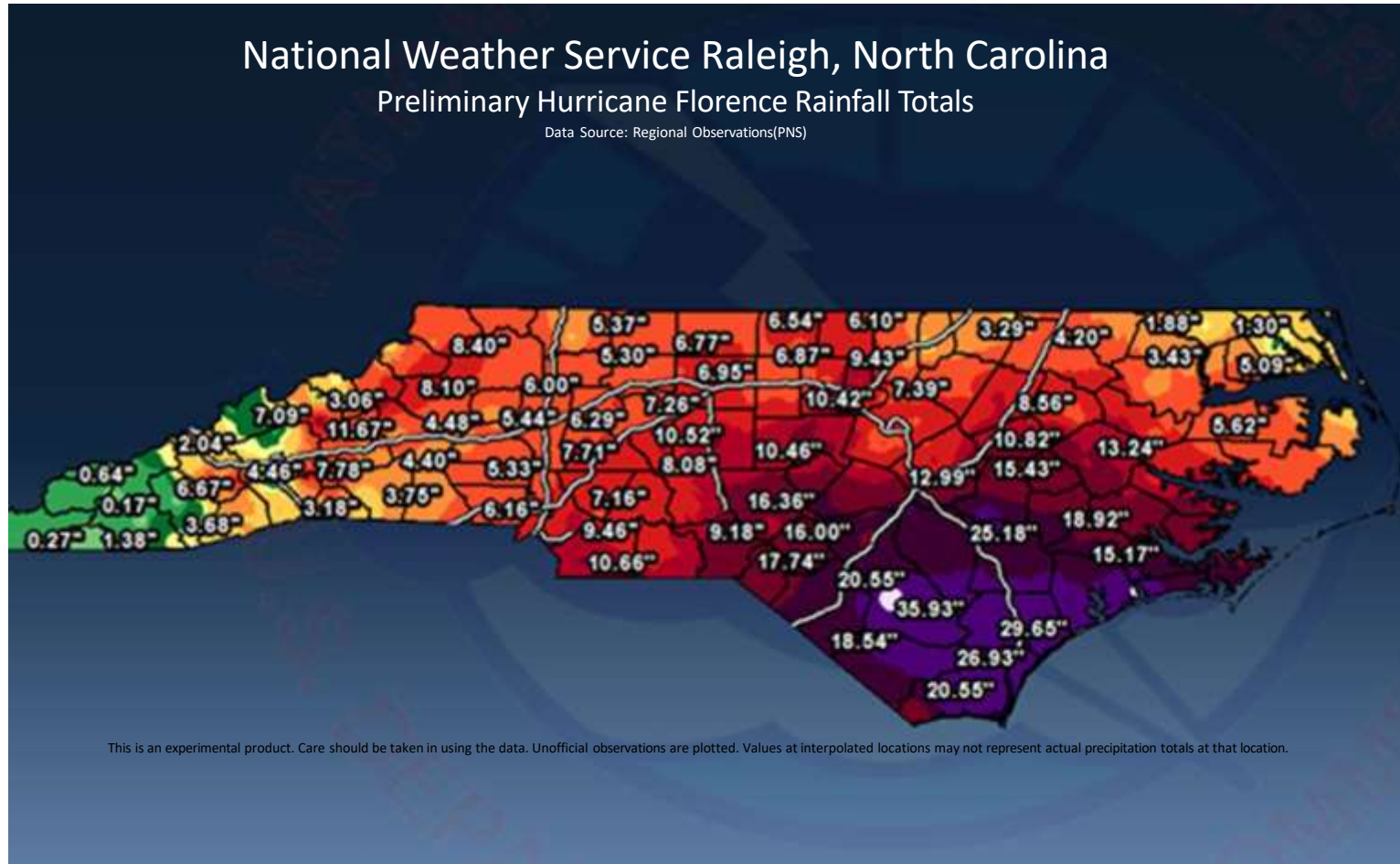
The image shows a screenshot of the ASSIST application interface, which is a web-based form for reporting site damage. The interface is composed of several overlapping windows, each with a blue header bar containing the word "ASSIST" and a close button (X). The main form is titled "Application for Site Specific Information Storage and Tracking".

The form contains the following fields and sections:

- Date of Inspection:** A date picker showing "Monday, March 1".
- Route Number:** A text input field with a red asterisk.
- Name of Damage:** A text input field with a red asterisk.
- Phone Number:** A text input field with a red asterisk.
- Site Number:** A text input field with a red asterisk.
- Division:** A text input field with a red asterisk.
- County:** A text input field with a red asterisk.
- Site Location:** A map showing a location in North Carolina with coordinates 35°47'N 78°58'W.
- Type of Site Damage:** A dropdown menu with options: roadway, bridge, box culvert, pipe culvert, building or structure.
- Diameter of Pipe:** A text input field with a red asterisk, labeled "(measured in inches)".
- Length of Pipe:** A text input field with a red asterisk, labeled "(measured in feet)".
- Number of barrels:** A text input field with a red asterisk, labeled "How many barrels are affected?".
- Headwalls:** A section with a red asterisk and a radio button for "Yes".
- Signs and Guardrail:** A section with a red asterisk and radio buttons for "Yes" and "No".
- Utilities:** A section with a red asterisk and radio buttons for "Yes" and "No".
- Damage Photo 1:** A section with a red asterisk and a camera icon, labeled "Provide an image of the overall damage to the site.".
- Damage Photo 2:** A section with a red asterisk and a camera icon, labeled "Provide a second image of the overall damage to the site.".
- Optional Photos:** A section with a red asterisk and radio buttons for "Yes" and "No", labeled "Do you have more photos to upload?".
- Preliminary Estimate:** A section with a red asterisk and a text input field, labeled "Provide a windshield estimate of the amount needed to repair the damage.".

The bottom right corner of the form has a blue bar with a white checkmark icon, indicating that the form is ready to be submitted.

*Deployment: Hurricane Florence (September 2018)*



*Deployment: Hurricane Florence (September 2018)*

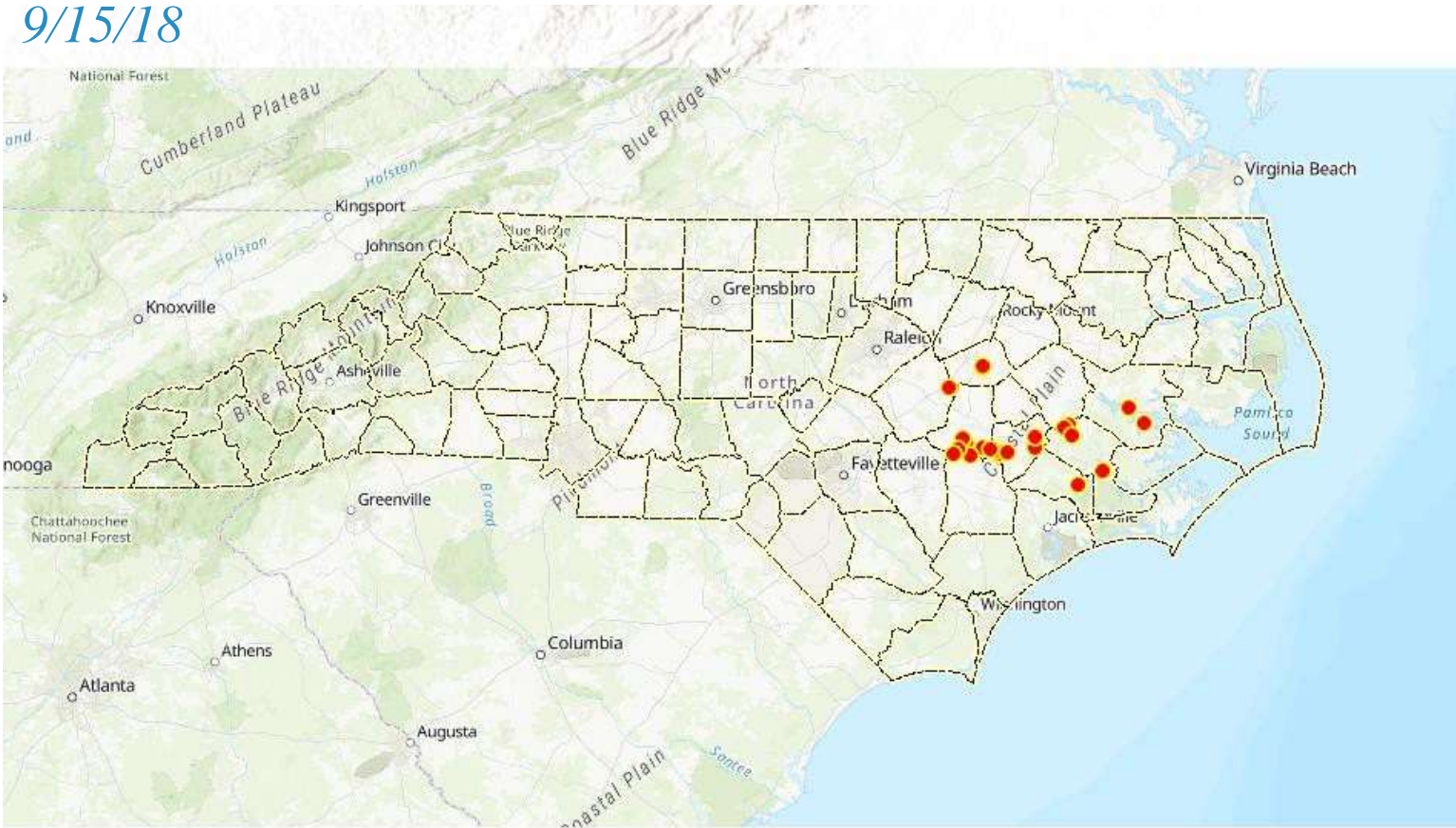


- Over 2,500 Incidents
- 2,642 Identified FEMA Route Sites
- 853 Identified FHWA Route Sites
- Price tag of ~\$250 million



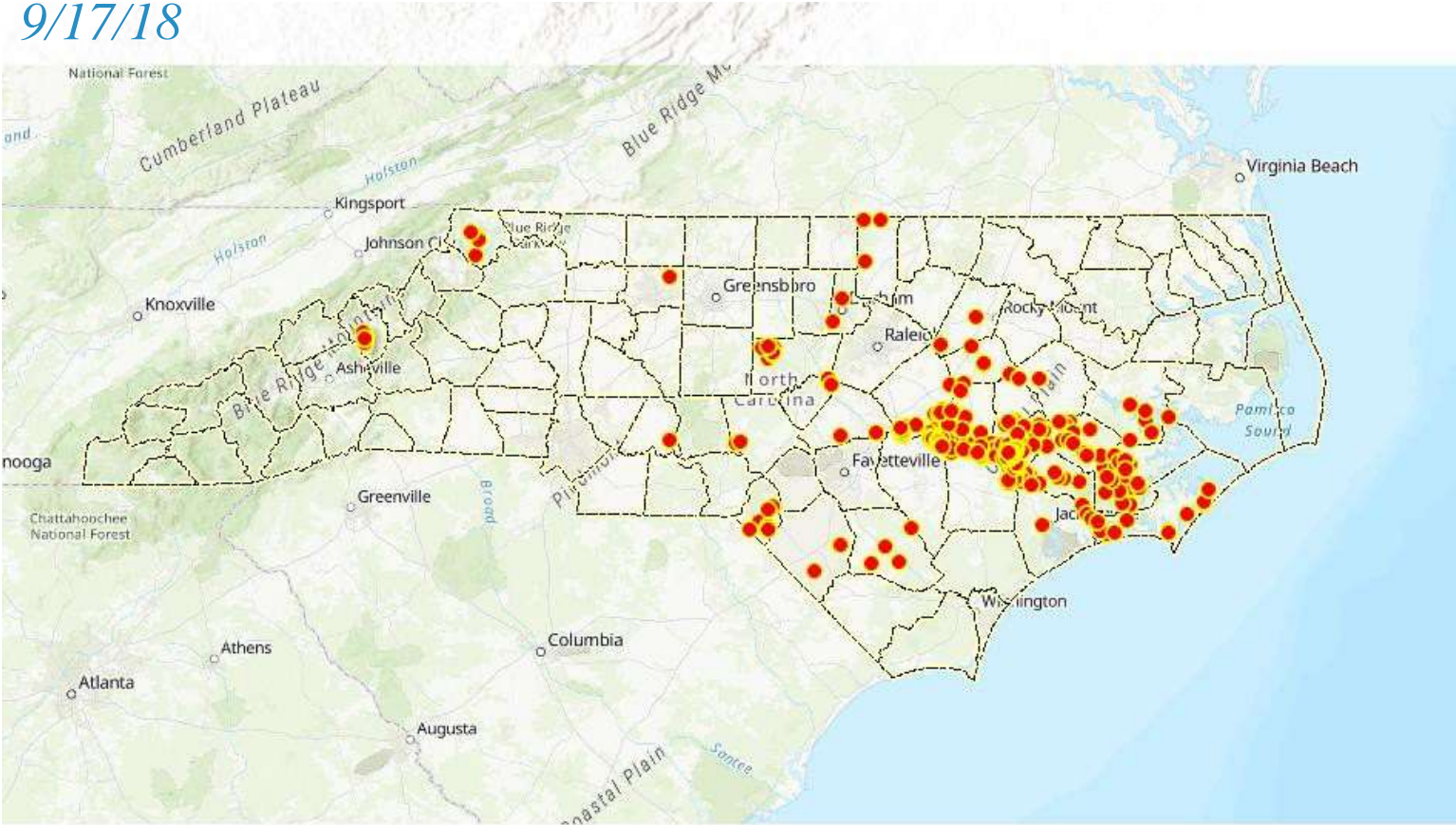
# Deployment: Hurricane Florence (September 2018)

9/15/18



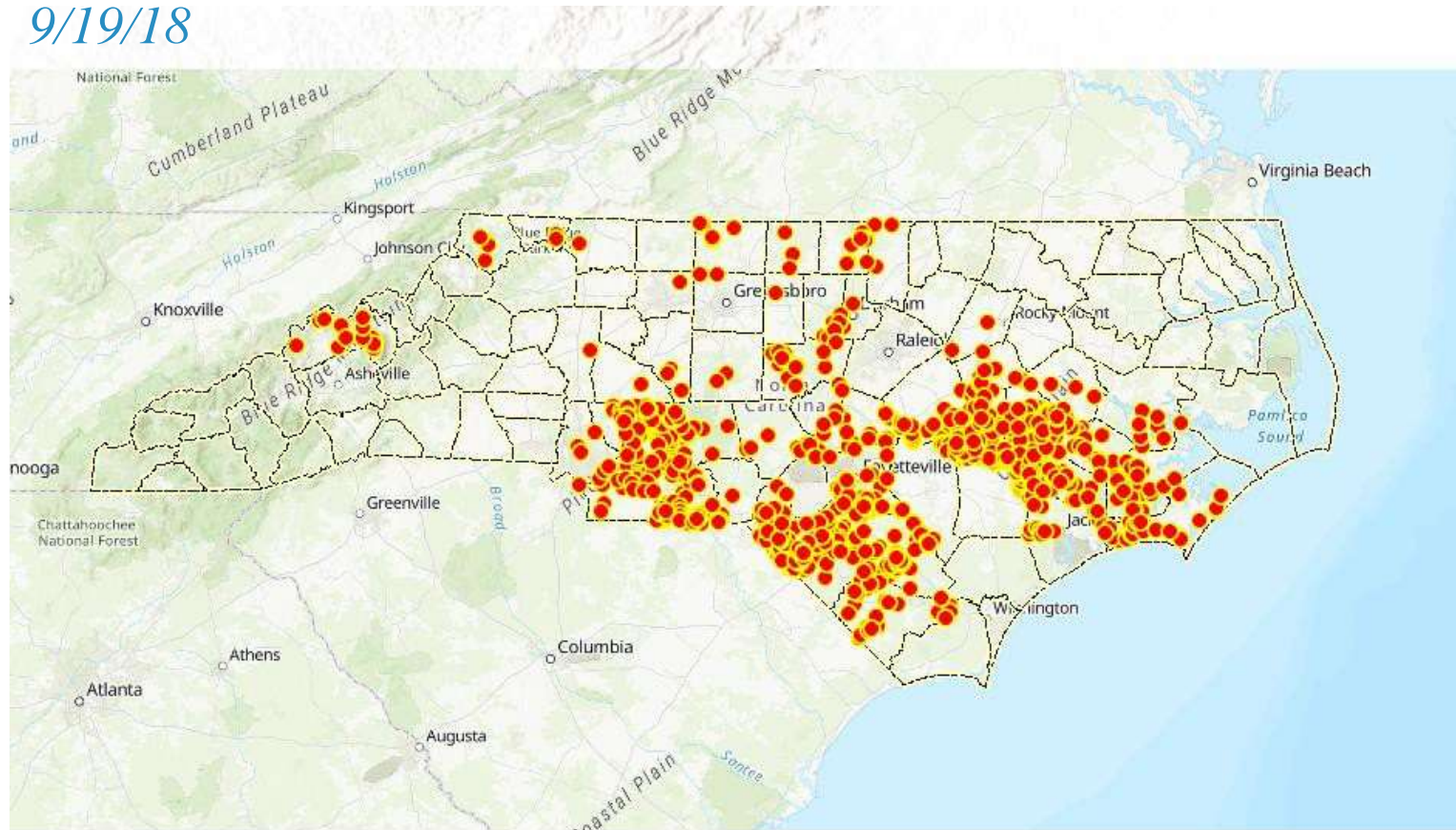
*Deployment: Hurricane Florence (September 2018)*

9/17/18



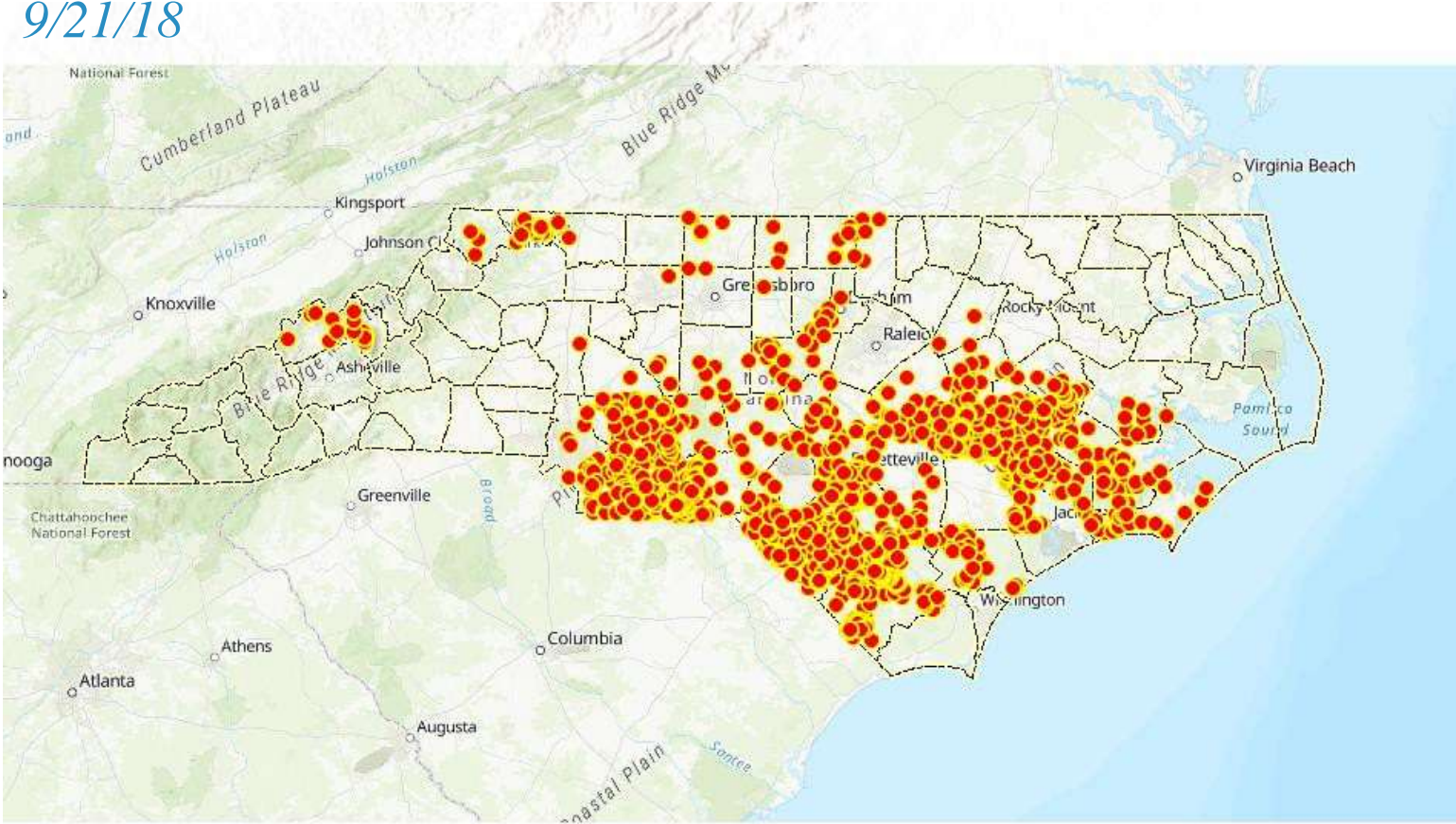
## Deployment: Hurricane Florence (September 2018)

9/19/18



*Deployment: Hurricane Florence (September 2018)*

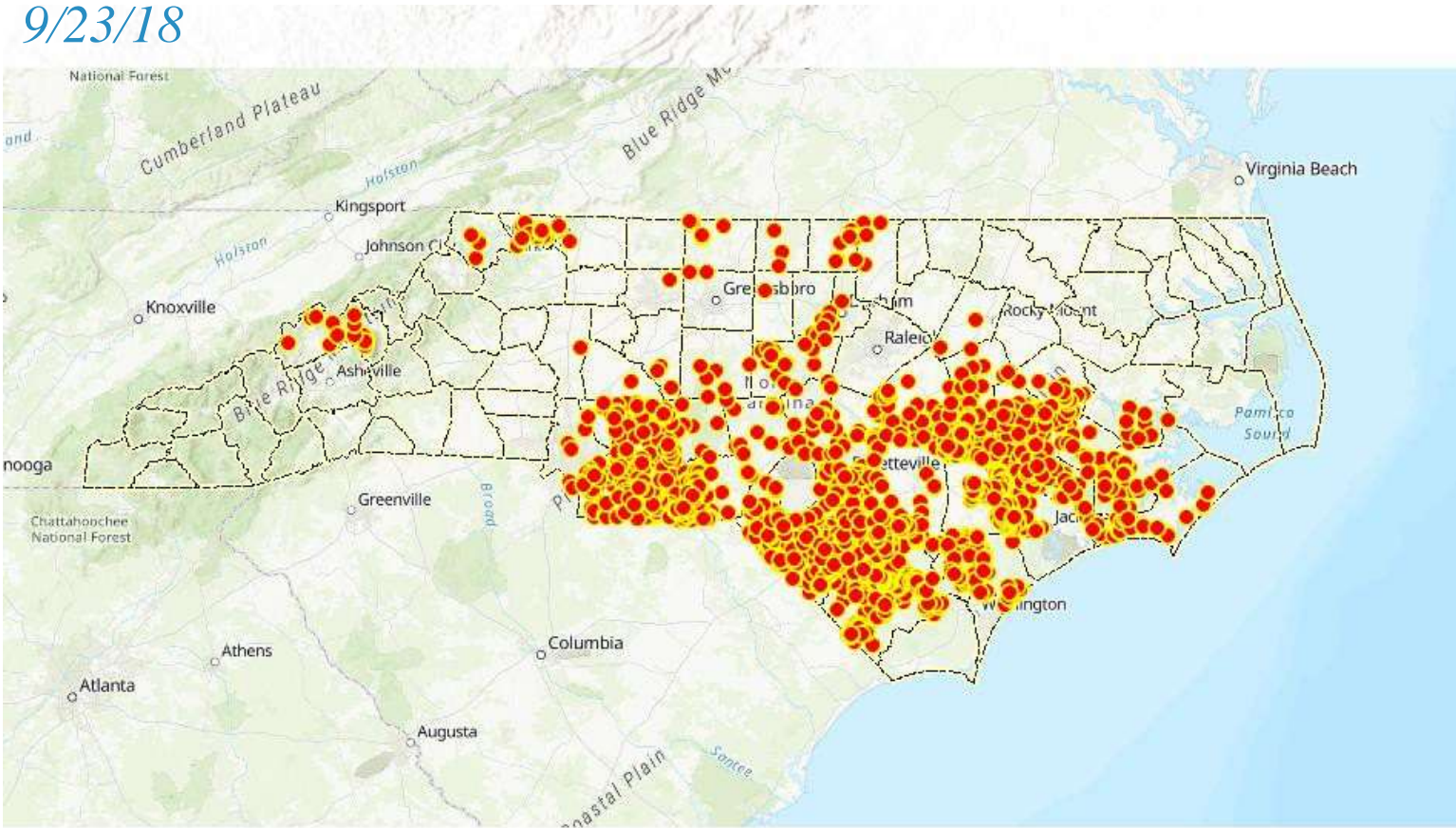
9/21/18





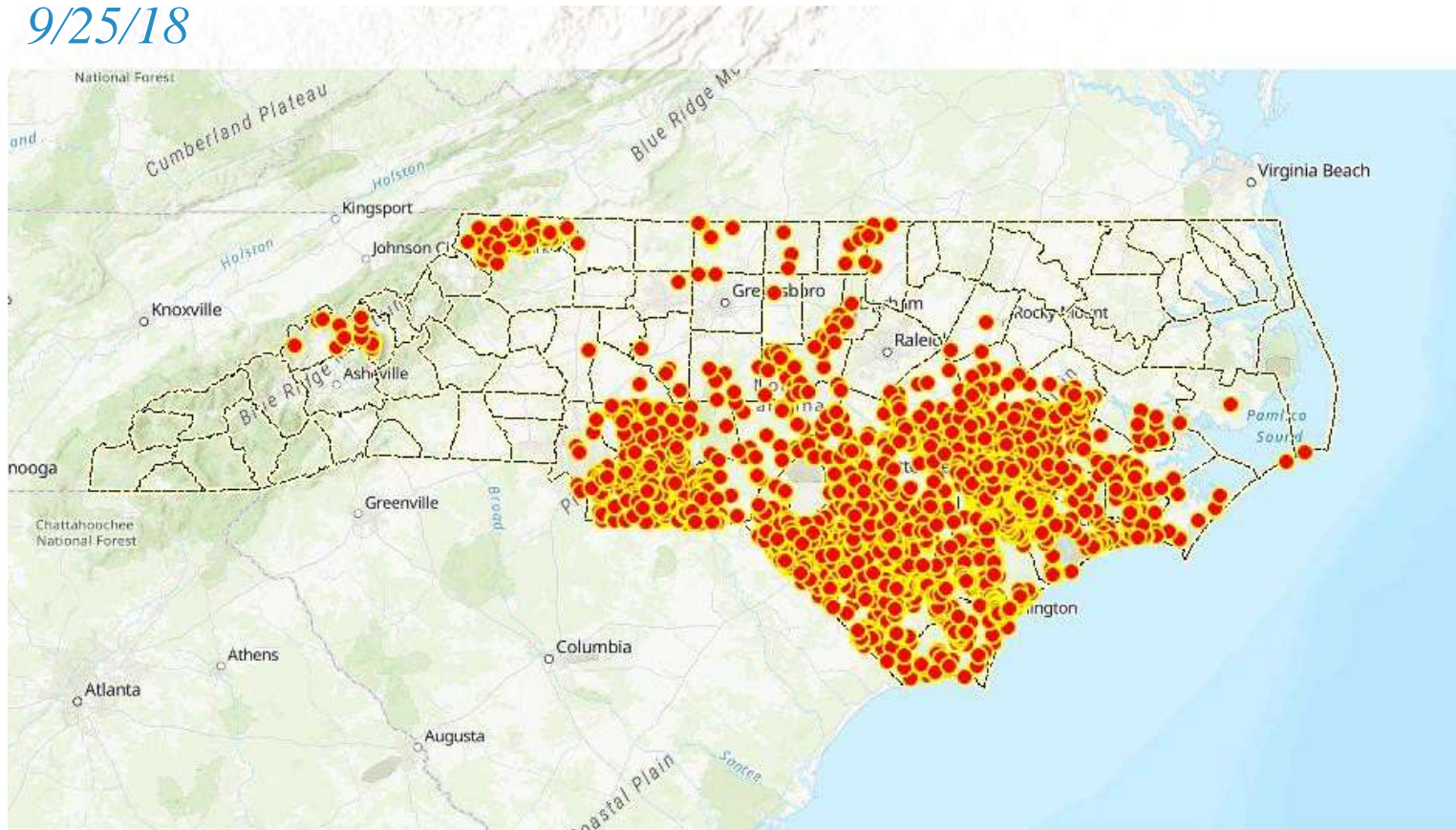
# Deployment: Hurricane Florence (September 2018)

9/23/18



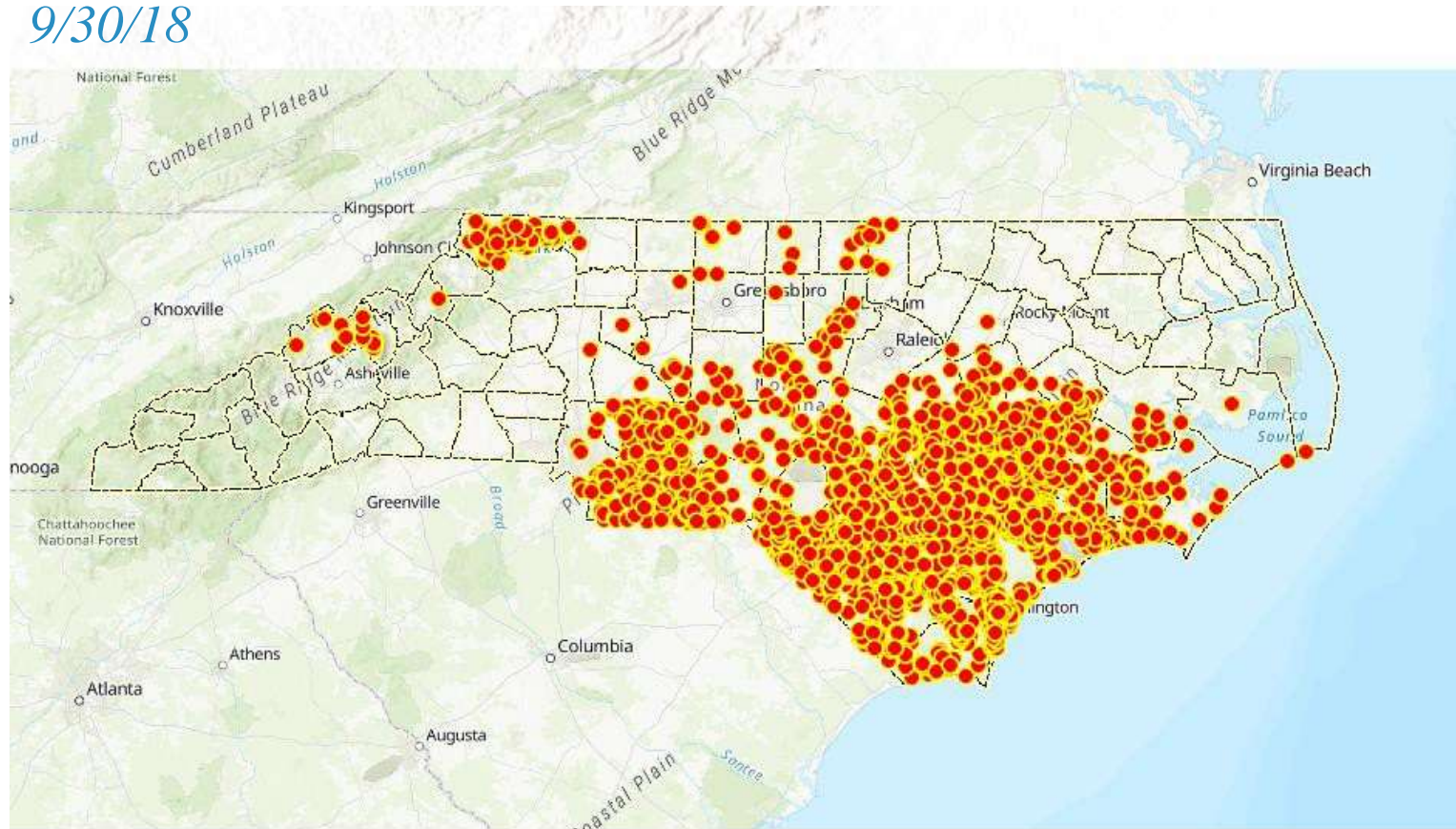
## Deployment: Hurricane Florence (September 2018)

9/25/18

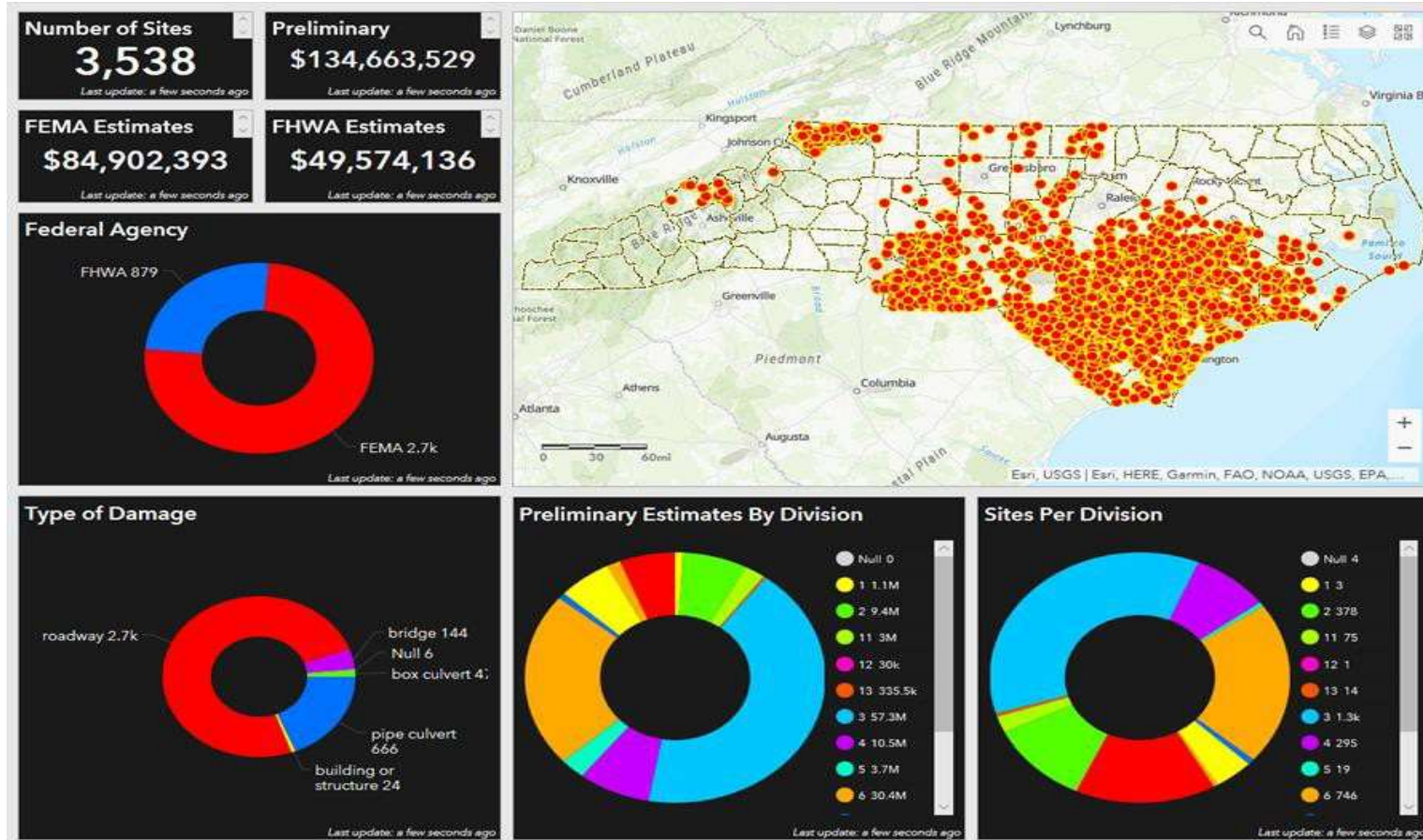


## Deployment: Hurricane Florence (September 2018)

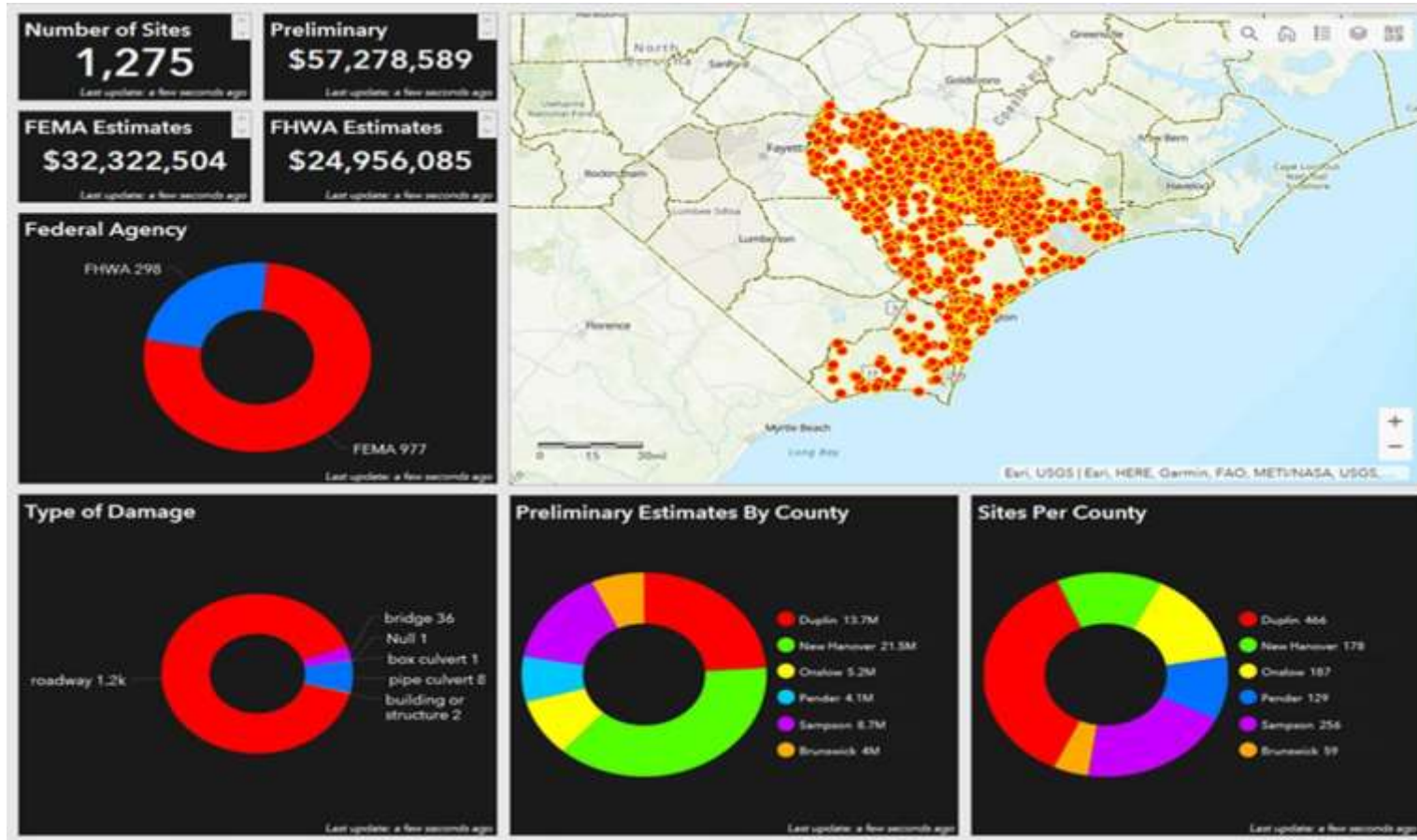
9/30/18



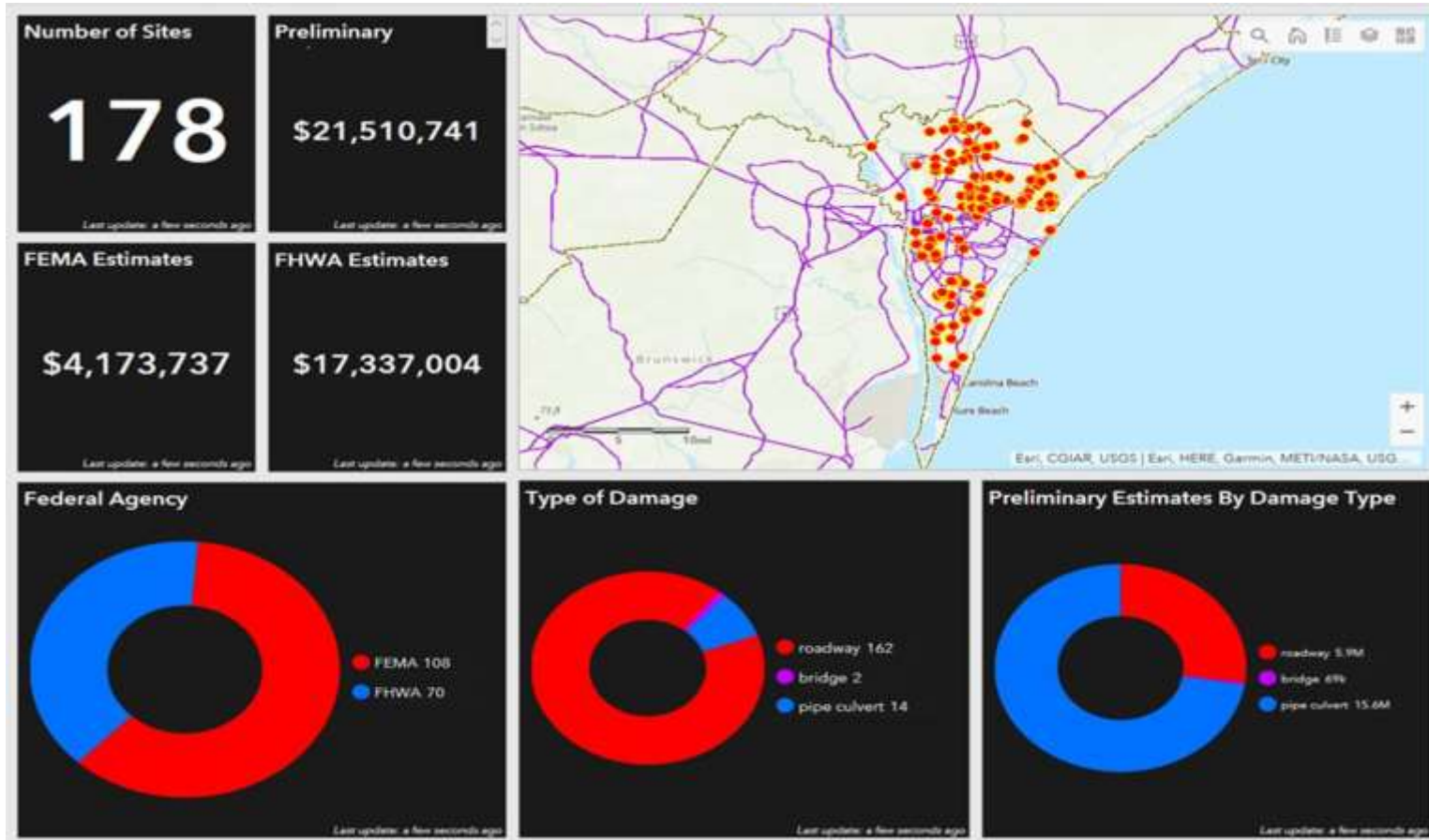
# Outcomes



Outcomes



# Outcomes



## Outcomes



FEMA



- Damage Description:  
Including Dimensions
- Scope of Work
- Pictures
- Engineer's Estimate
- Environmental Permits
- Hydraulic Recommendations
- GPS Coordinates
- Location Map
- Timesheets
- Equipment Logs
- Material Receipts/Purchase Orders
- Contracts
- Etc.



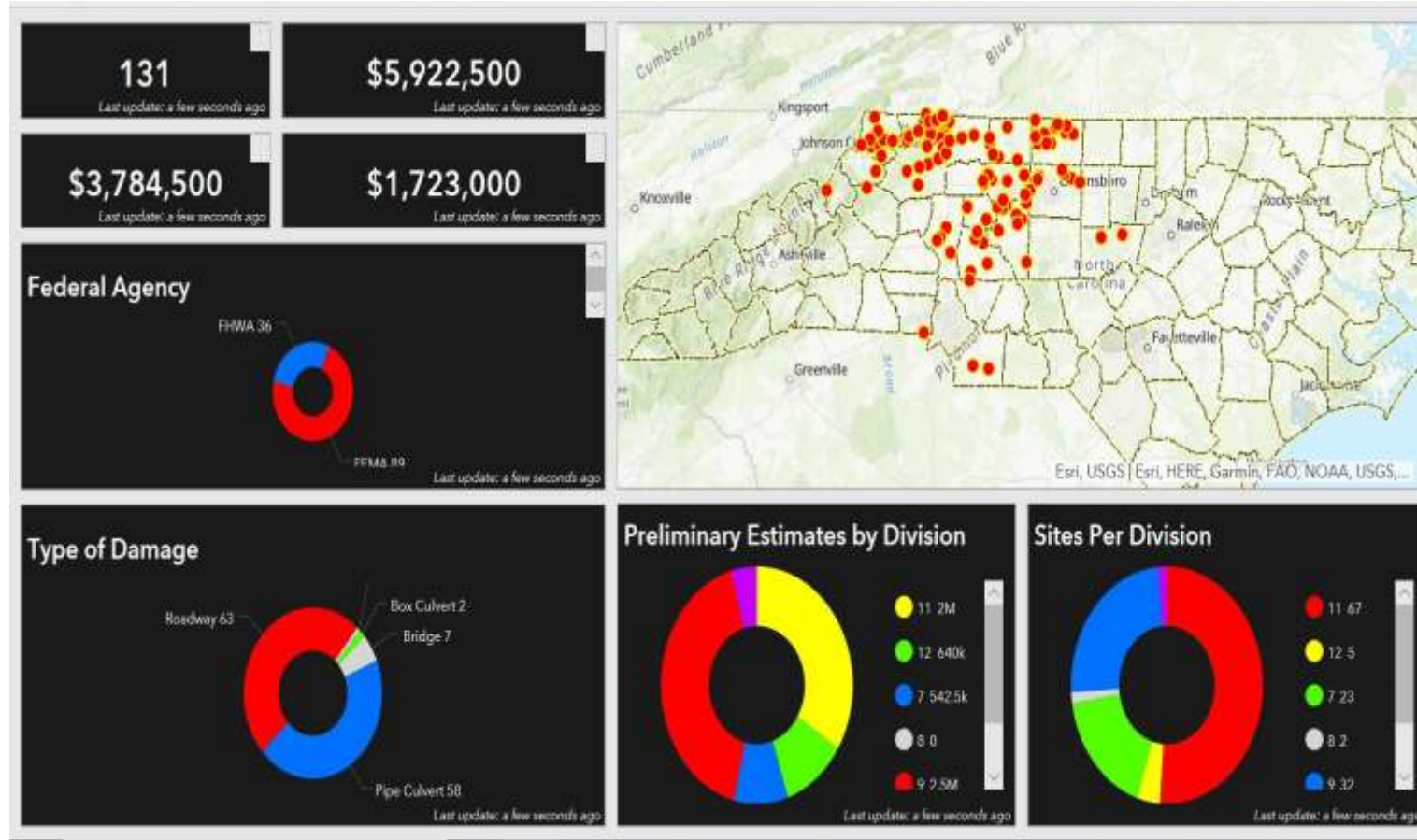
## Outcomes

- ✓ • Damage Description:  
Including Dimensions
- ✓ • Scope of Work
- ✓ • Pictures
- ✓ • Engineer's Estimate
- ✓ • Environmental Permits
- ✓ • Hydraulic Recommendations
- ✓ • GPS Coordinates
- ✓ • Location Map
- Timesheets
- Equipment Logs
- Material Receipts/Purchase Orders
- Contracts
- Etc.

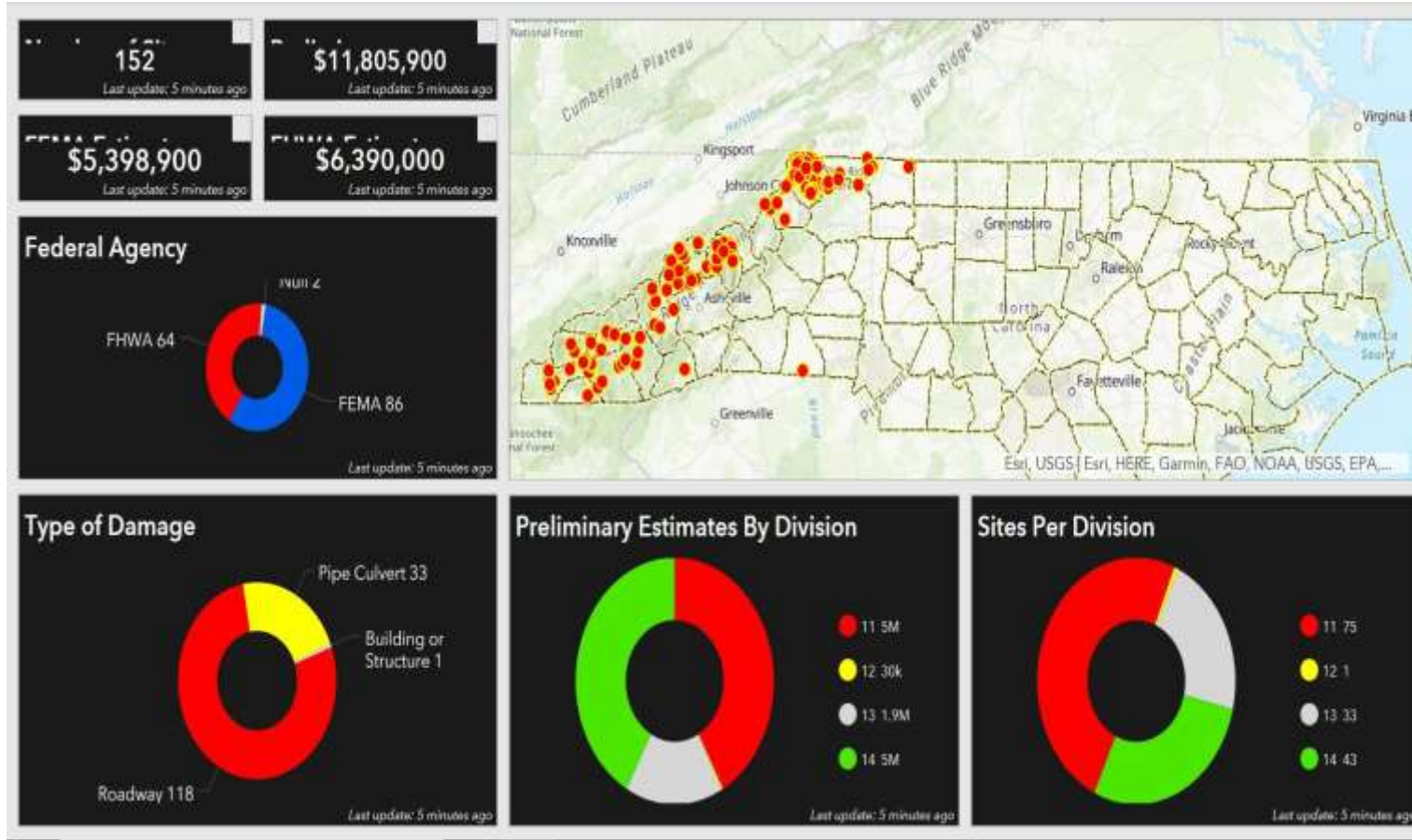




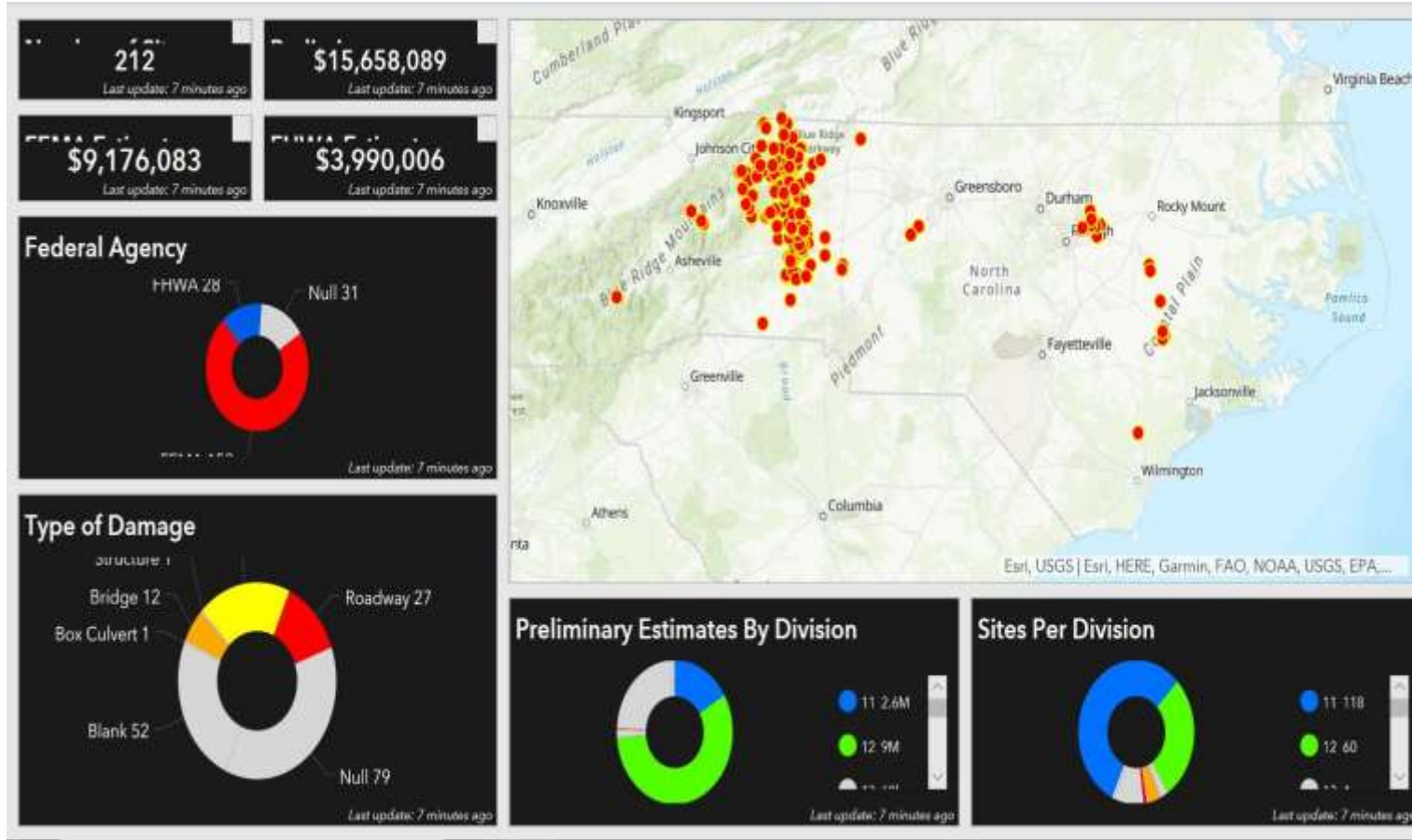
## Usage (Hurricane Michael)



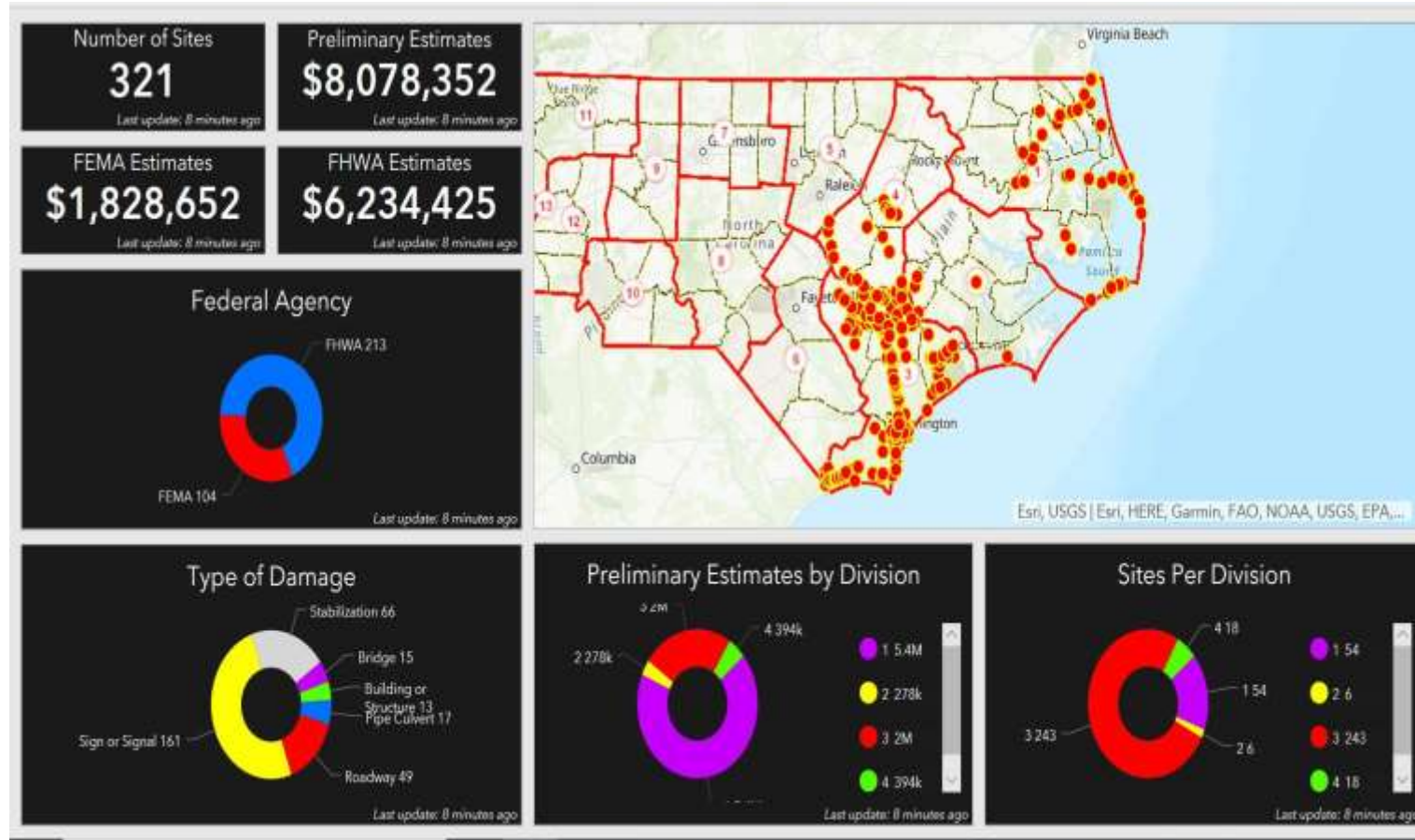
## Usage (2019 February Rains)



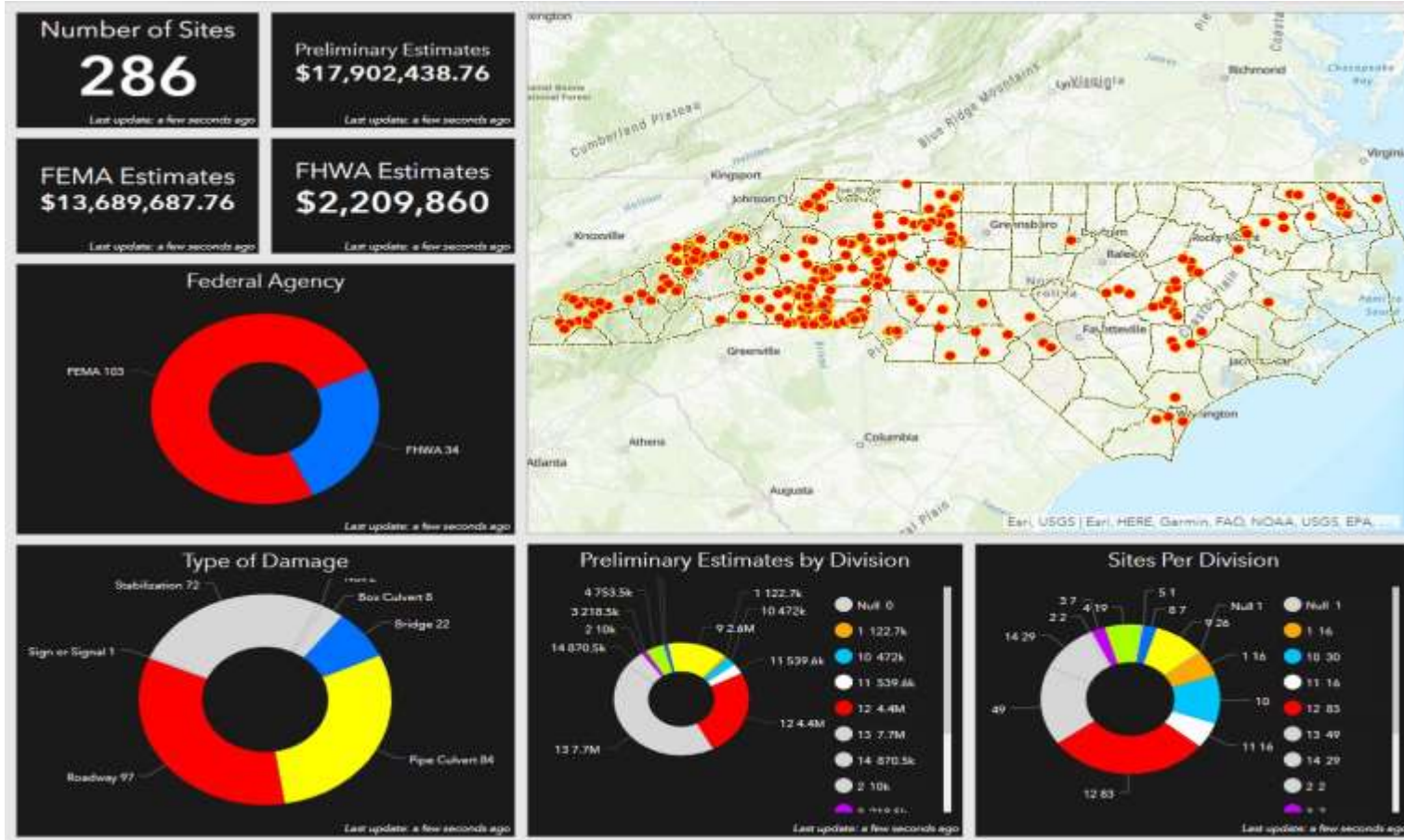
Usage (2019 June Rains)



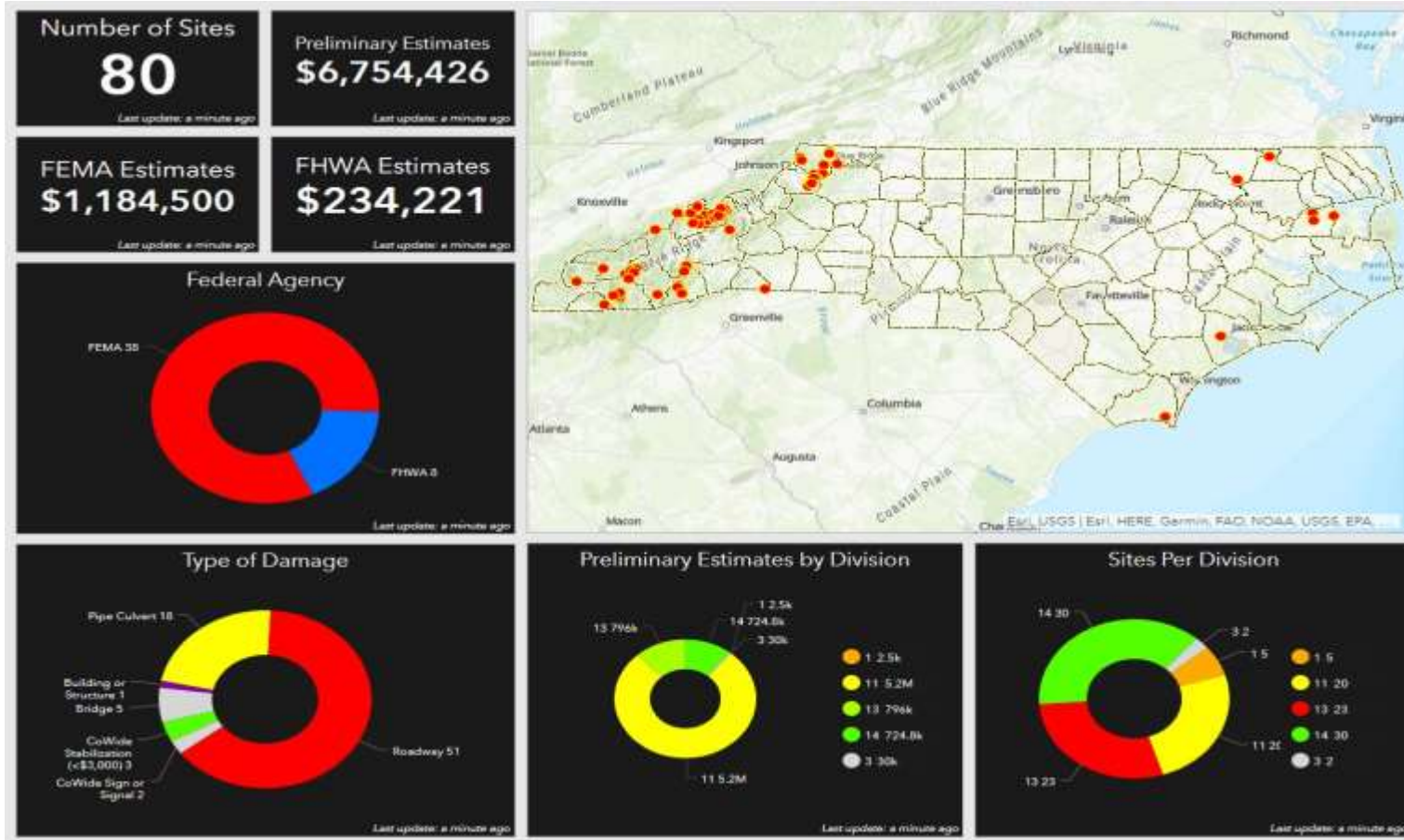
## Usage (Hurricane Dorian)



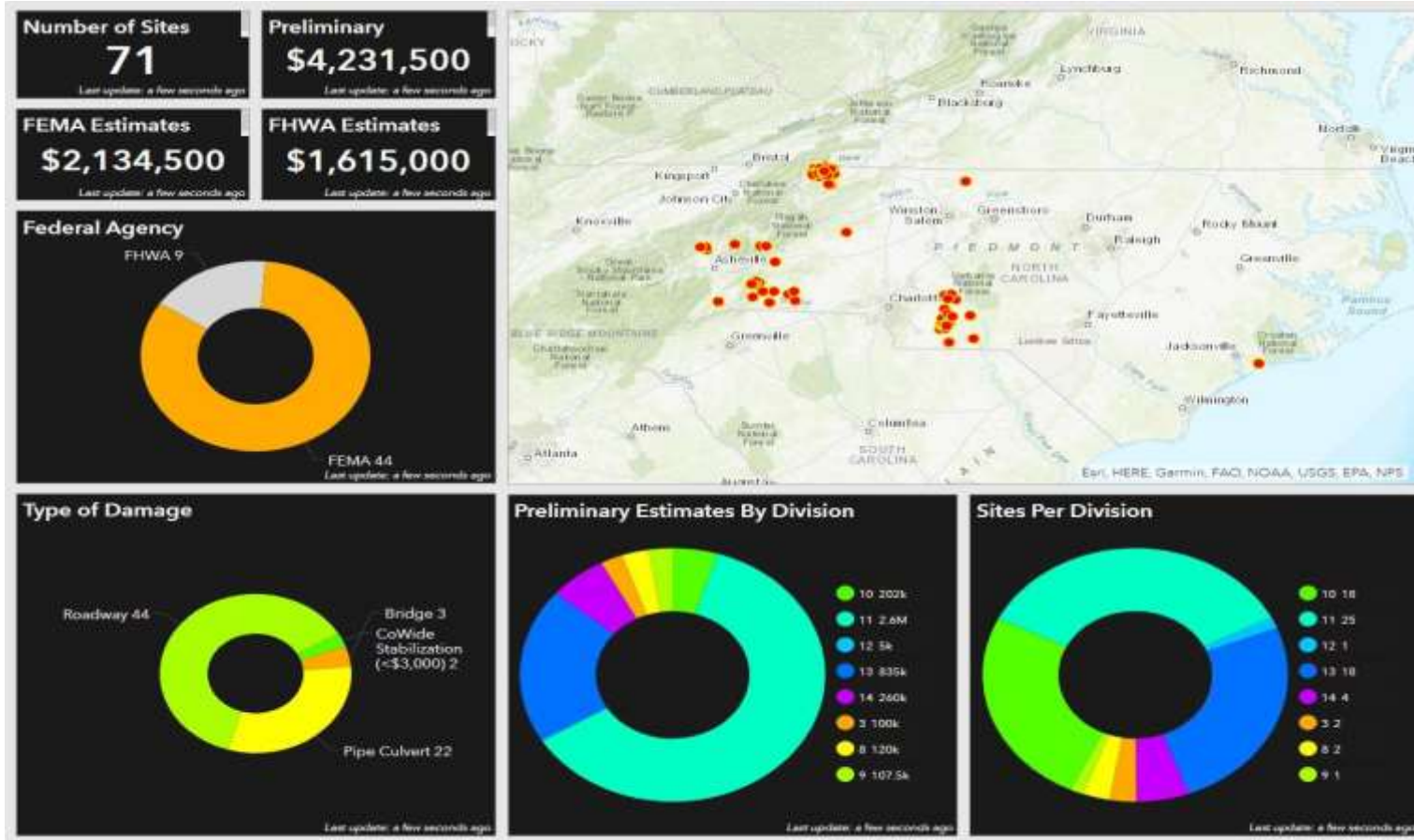
Usage (2020 February 6 Rains)



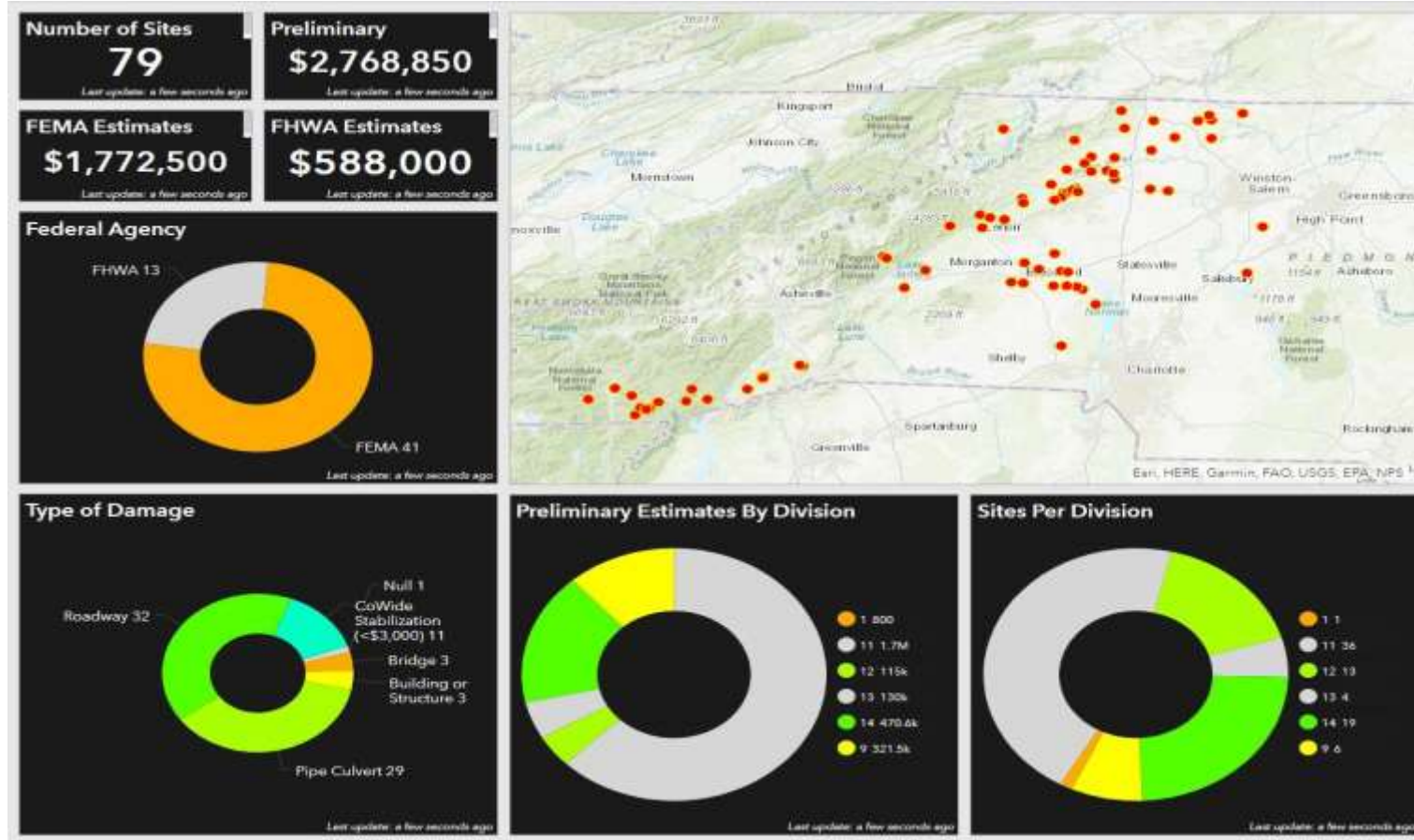
Usage (2020 April Severe Weather)



Usage (2020 May 19 Rains)

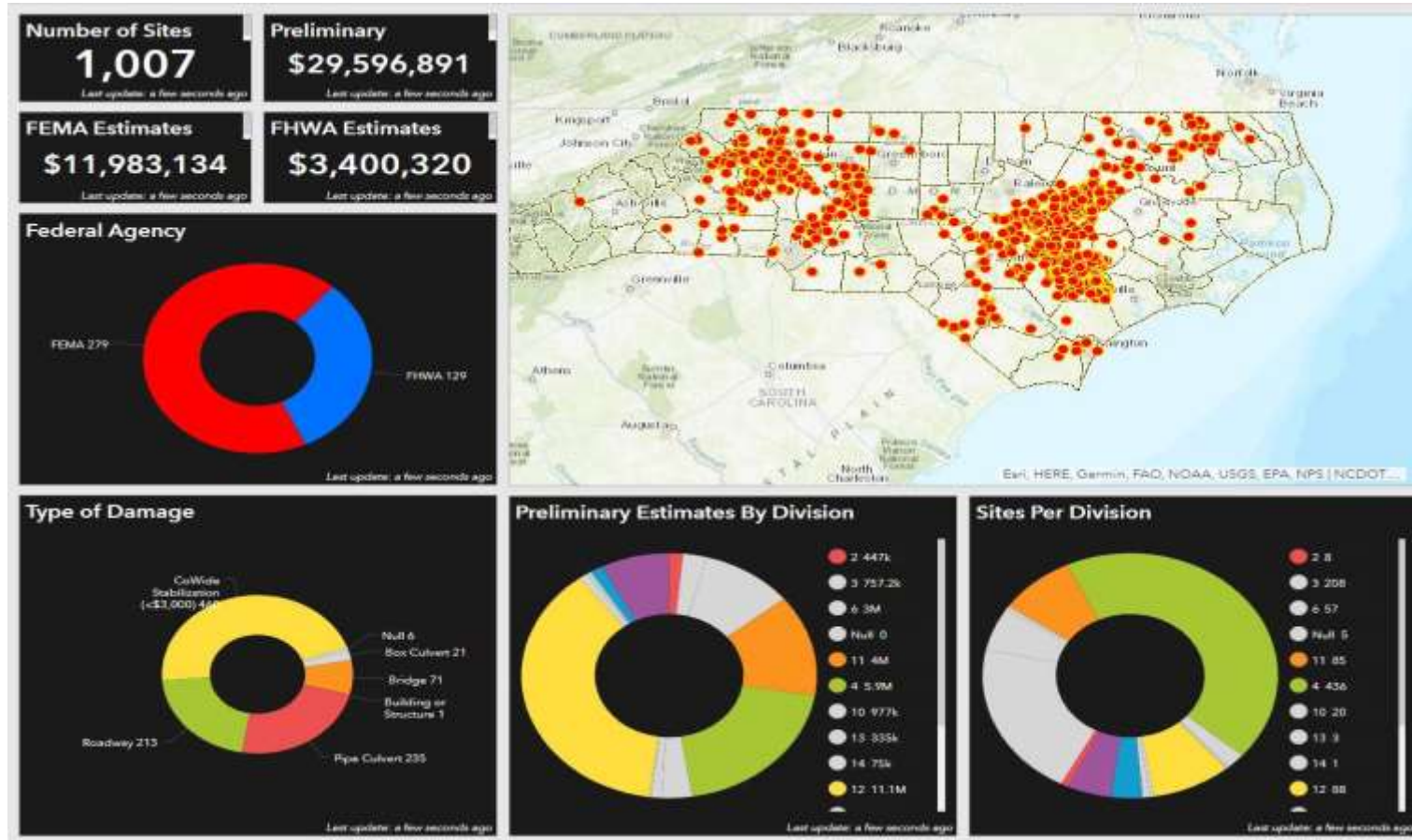


Usage (2020 TS Zeta)

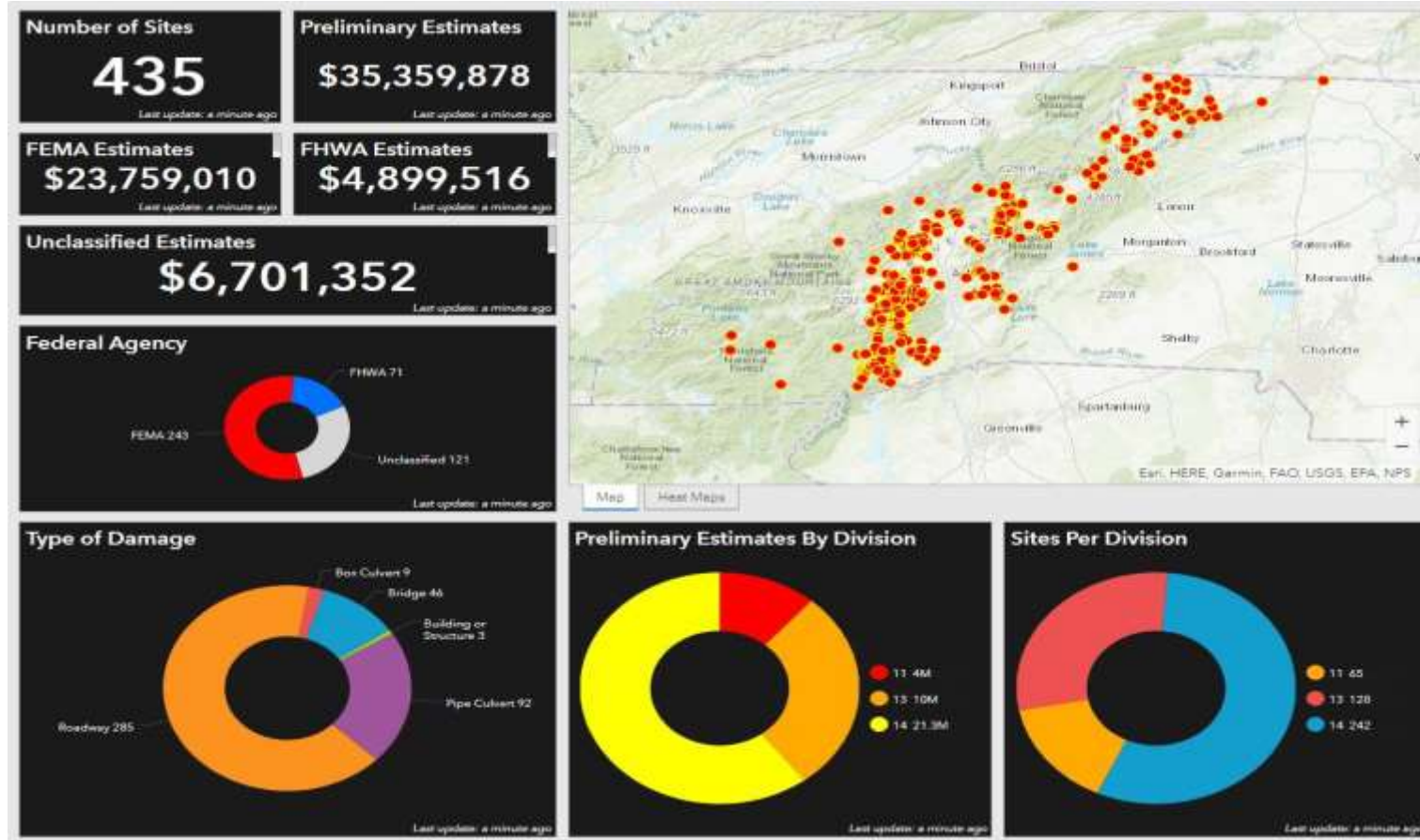




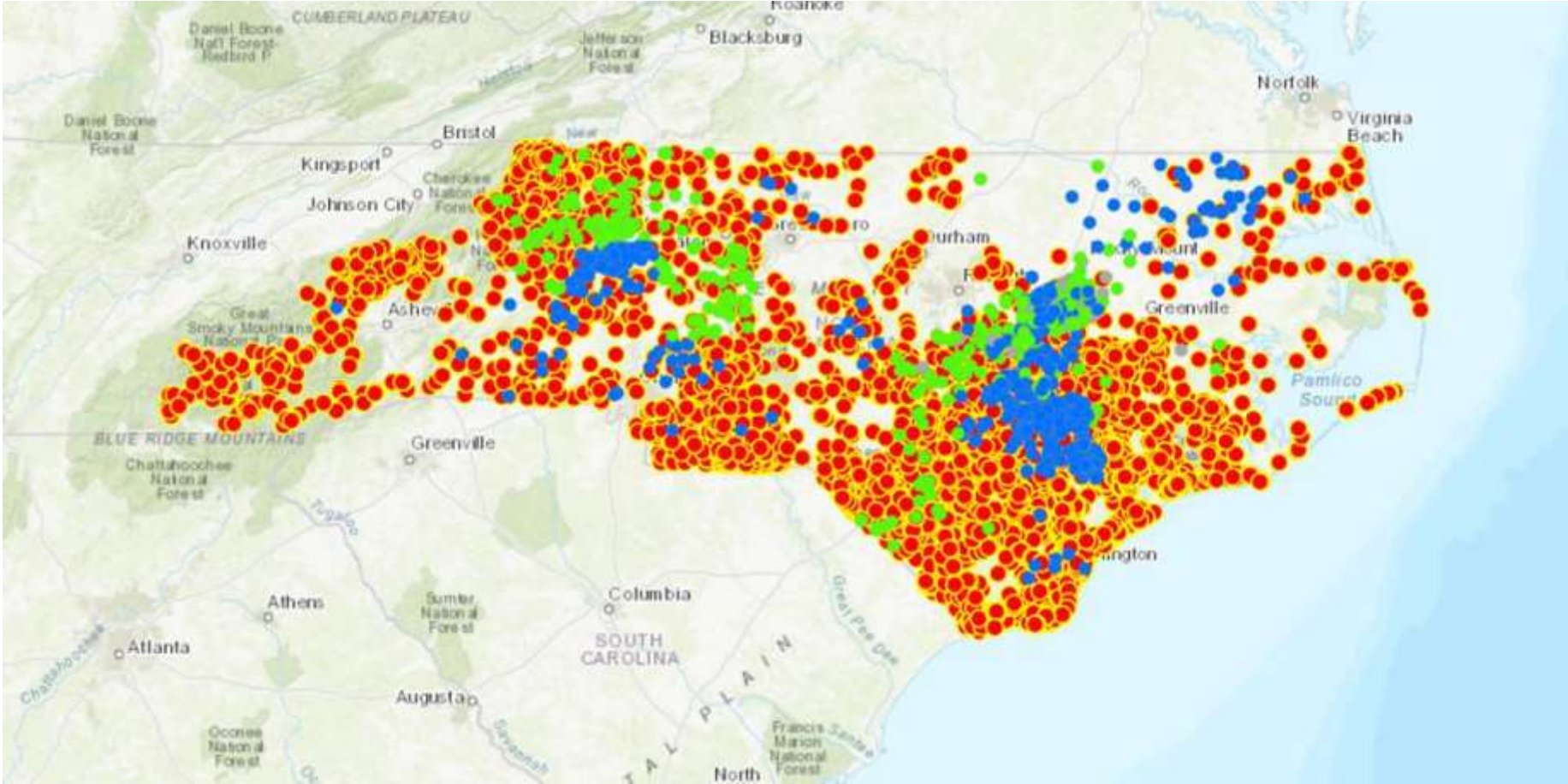
Usage (2020 November 11 Rains)



Usage (2021 Fred)



Usage



## Technology: User Interface

### Field Personnel

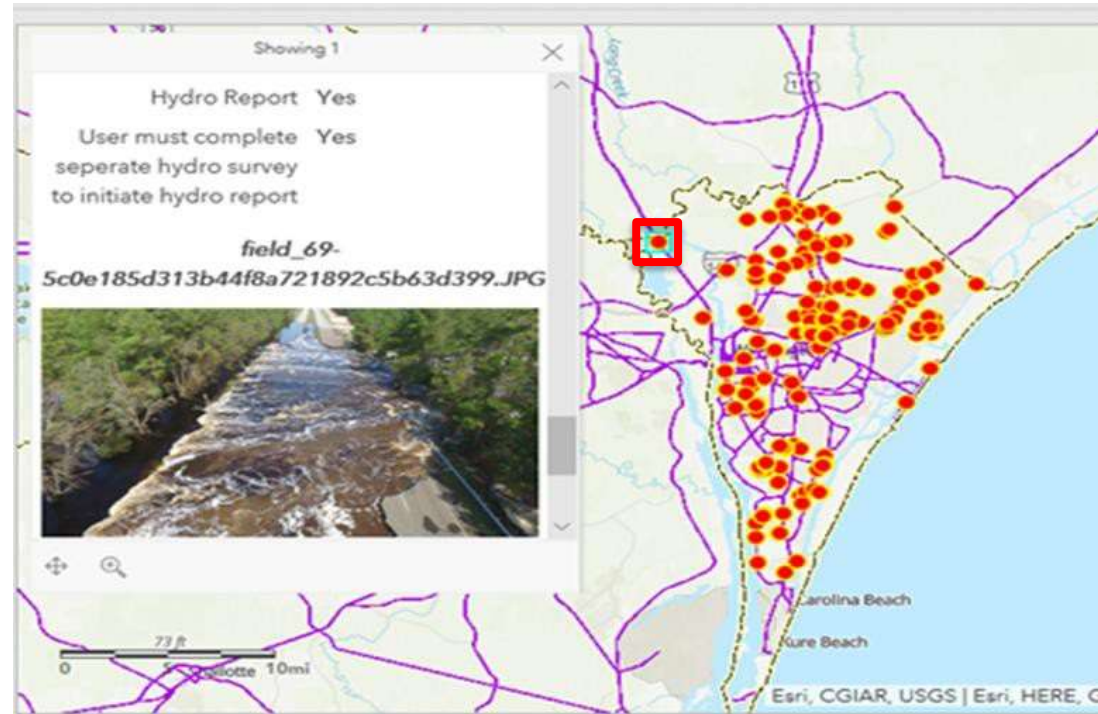
- Single trip to sites for data
- Map/Type of Damage led to work plans
- Standardization of data collection (CEI and State Forces)
- Automation of data management

### Management

- Real time analysis
- Reporting capability
- Eyes in the field

### FEMA/FHWA

- Declarations made based on data
- Automatically creates the “List of Identified Damages”
- Consolidates collected data and simplifies submissions
- Reduces RFI's



## *Additional Outcomes*

- Tied to Financial System – SAP
  - Automated WBS creation
  - Automated WBS data transfer
  - Automated site report creation
- Automate required documentation creation
  - Preliminary Estimates extrapolation
  - Engineer's Estimates
  - Fulfilled need for DD & SOW
  - Future edits captured (actual repair documentation)
  - Part 667 of the TAMP
  - Automated Hydraulic Report request
  - Repair status reporting
- Acceptance by field personnel beyond disasters



## Outcomes

### Hurricane Florence Site Specific

Submitted By: gmtaylor1  
 Submitted Time: Sep 25, 2018, 4:03:51 PM  
 Date of Inspection: Sep 20, 2018  
 Name of Damage Inspector: D Monro  
 Phone Number of Damage Inspector: [REDACTED]

Site Number: 15403.1065027  
 Division: 3  
 County: New Hanover  
 Type of Route: US  
 Route Number: 421  
 Road Name: Hwy 421  
 Site Configuration: FHWA  
 Site Location: Lat: 34.33086 Lon: -77.99958



Type of Site Damaged: pipe culvert  
 Diameter of Pipe: 78  
 Length of Pipe: 210  
 Number of barrels: 1  
 Headwalls: No  
 Type of Pipe Damaged: CMP\_corrugated metal pipe

Pavement Damage: Yes  
 Length of Pavement damaged: 600  
 Width of Pavement damaged: 56  
 Thickness of Pavement damaged: 12

Roadbed Damage: Yes  
 Length of Roadbed damaged: 700  
 Width of Roadbed damaged: 700  
 Depth of Roadbed damaged: 5

Shoulder/Embankment Damage: Yes  
 Length of Shoulder/Embankment damaged: 1,500  
 Width of Shoulder/Embankment damaged: 20  
 Depth of Shoulder/Embankment damaged: 20

Notes: Site 065-00-19 still has flow cannot fully assess at base, washed out. Pipe to be determined.

Signs and Guardrail: Yes  
 Length of Guardrail Damaged: 1,500  
 Number of Signs Damaged: 0

Utilites: Yes  
 Affected Utilities  
 • fiber  
 • gas

Damage Photo 1



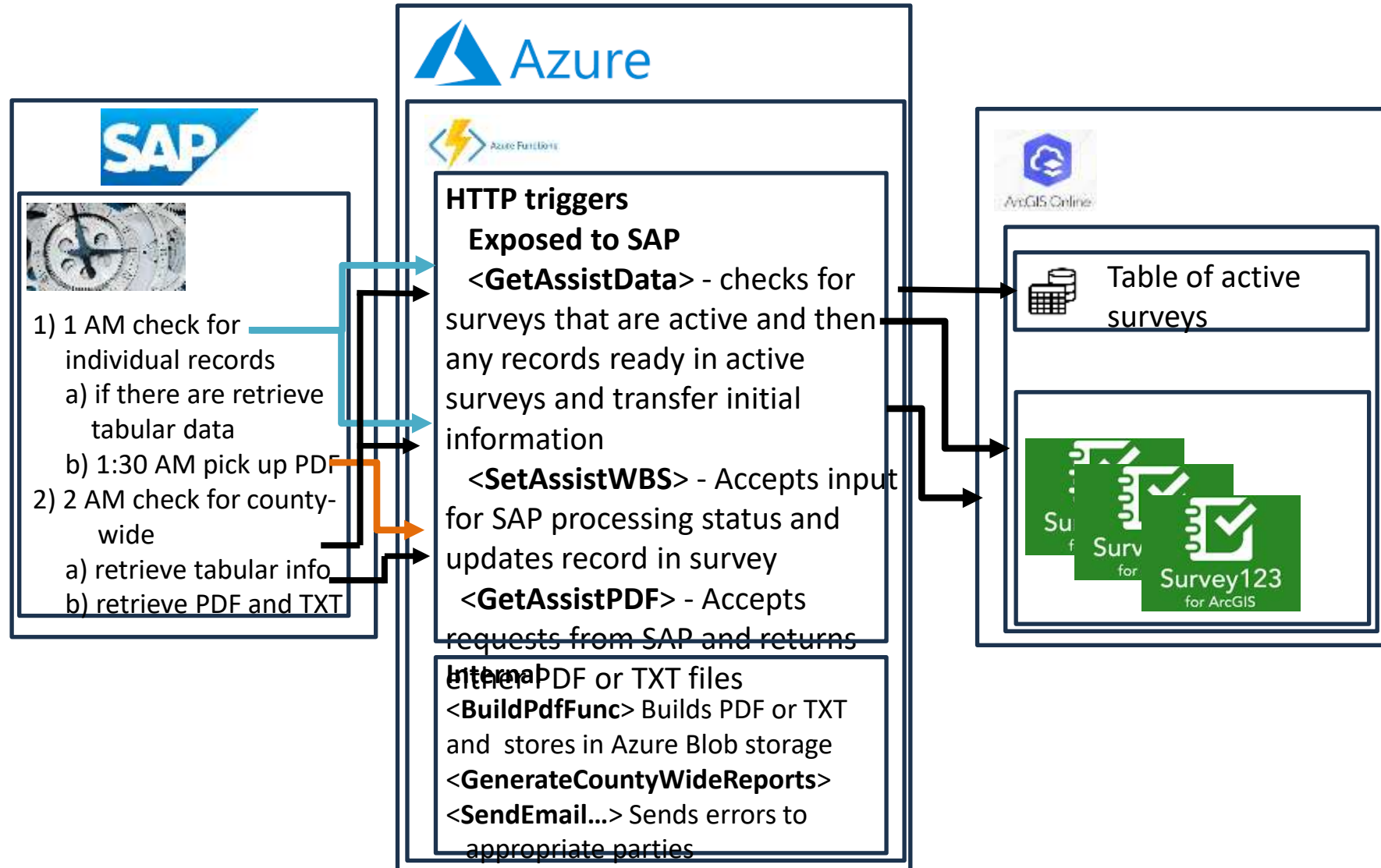
Damage Photo 2



Preliminary Estimate: 15,000,000

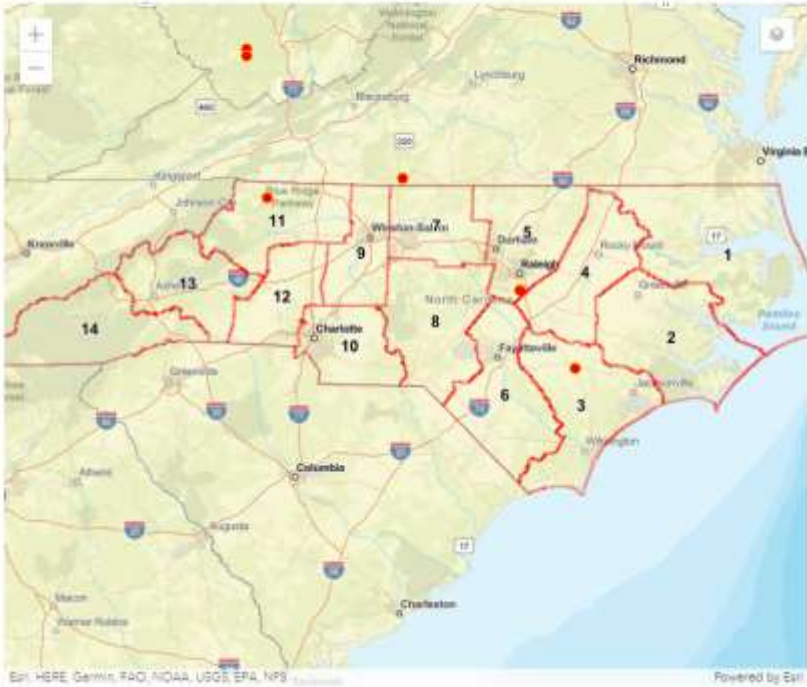
Hydro Report: Yes

## Overview of Transfer to SAP



COMING SOON

AssistEditor Time until logout: 0d 0h 28m 35s [Logout](#)



Map showing 14 numbered regions in North Carolina. Red dots are placed on regions 11, 12, 13, and 14.

County Division [Filter Table](#) [Edit Columns](#) [Back](#)

Division	Site Number	Wbs Number	County	Route Number	Road Name	
11	016	DF14011.2003016	3	25	Road Name	<a href="#">Edit</a>
3	872	14003.131004	31	25428	Road Name	<a href="#">Edit</a>
9	150	14009.1080150	80	25	name	<a href="#">Edit</a>
4		72626	5	25	name	<a href="#">Edit</a>
4	726		3	25	name	<a href="#">Edit</a>
8	45		13	25	name	<a href="#">Edit</a>
4	72		4	25	name	<a href="#">Edit</a>
12	6		13	65	name	<a href="#">Edit</a>
10	7		10	25	name	<a href="#">Edit</a>
10	75		3	25	name	<a href="#">Edit</a>
10	76		4	25	road name	<a href="#">Edit</a>



# Damage Assessment Viewer

2022 Ian TS - Damage Assessments (ASSIST) Image Viewer Map

The screenshot displays the '2022 Ian TS - Damage Assessments (ASSIST) Image Viewer Map' interface. On the left, a map of North Carolina is shown with several colored markers (red, orange, green, purple) indicating damage locations. A sidebar on the left contains a search bar and navigation controls. Below the map, a details panel is visible with the following information:

- Repair Status: Damaged
- Date of Inspection: 10/1/2022, 12:00 PM
- Division: [blank]

The main area of the interface is a large image viewer showing a photograph of a beach with significant erosion and debris. The photo is framed by black bars on the left and right. At the bottom of the image viewer, there is a navigation bar with the text 'Attachments: 1 / 4' and arrows for navigation.



# Damage Assessment Viewer

Tropical Storm Isaias Damage Assessments (ASSIST) Image Viewer

Isaias Damage Assessment (ASSI...

The interface displays a map of North Carolina with various colored markers (red, green, orange, purple) indicating assessment locations. The map includes labels for major cities and counties such as Winston-Salem, Greensboro, High Point, Durham, Raleigh, Rocky Mount, Goldsboro, Fayetteville, Jacksonville, and Florence. The left side of the interface shows a grid of image thumbnails, including road damage, debris, and signs. The top navigation bar includes a search bar and a title bar.

# UAV Media Ingestion



Azure Functions



## Drone Image Viewer - Tropical Storm/Hurricane Isaias

### Images in Map Area

To ensure good performance, only 10 images are displayed. Pan and zoom in the map to change the list. Select/unselect an image to highlight the map point.

Description:

Image Taken: post-storm

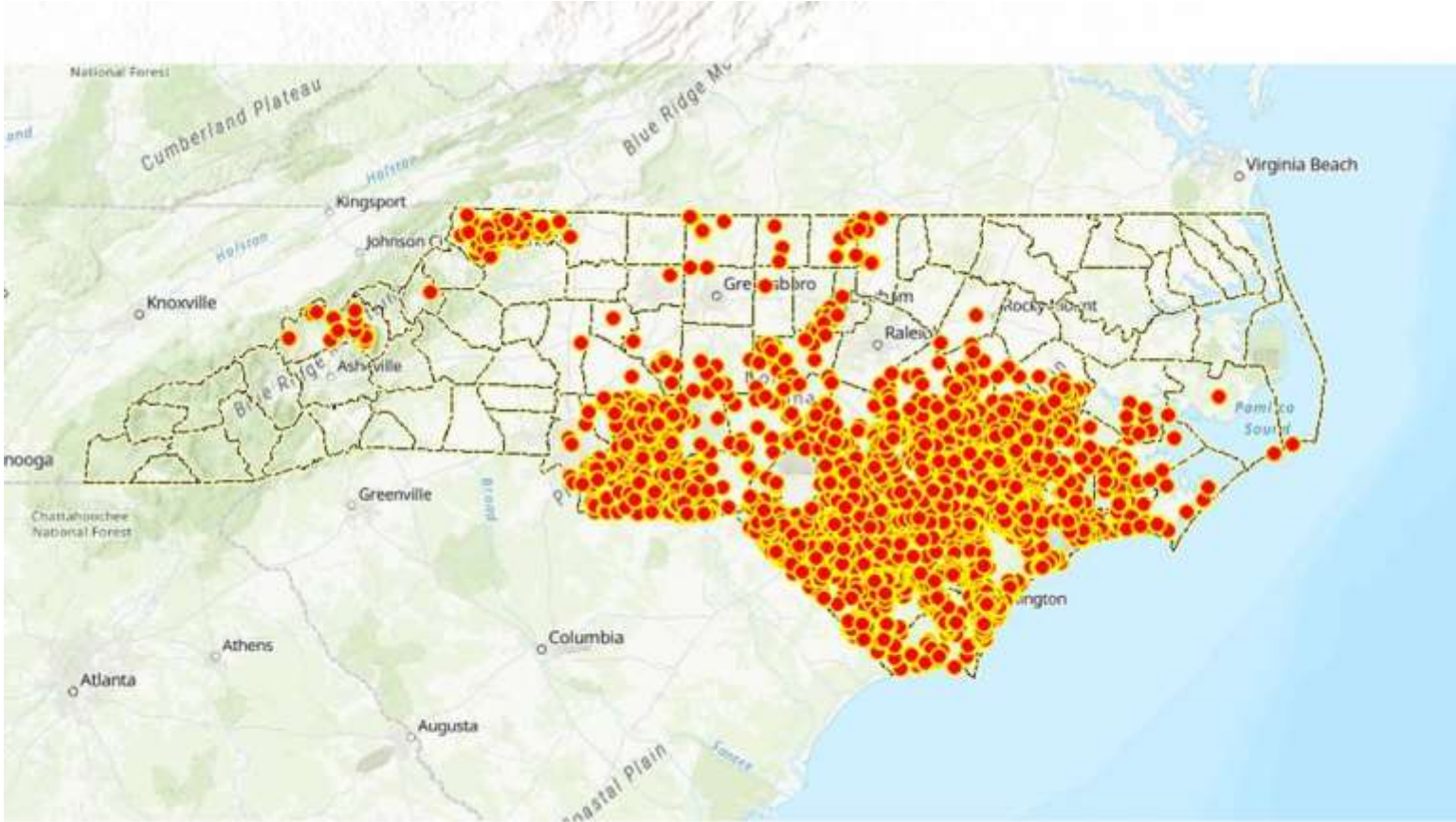
Image Date: 8/4/2020, 3:46 AM

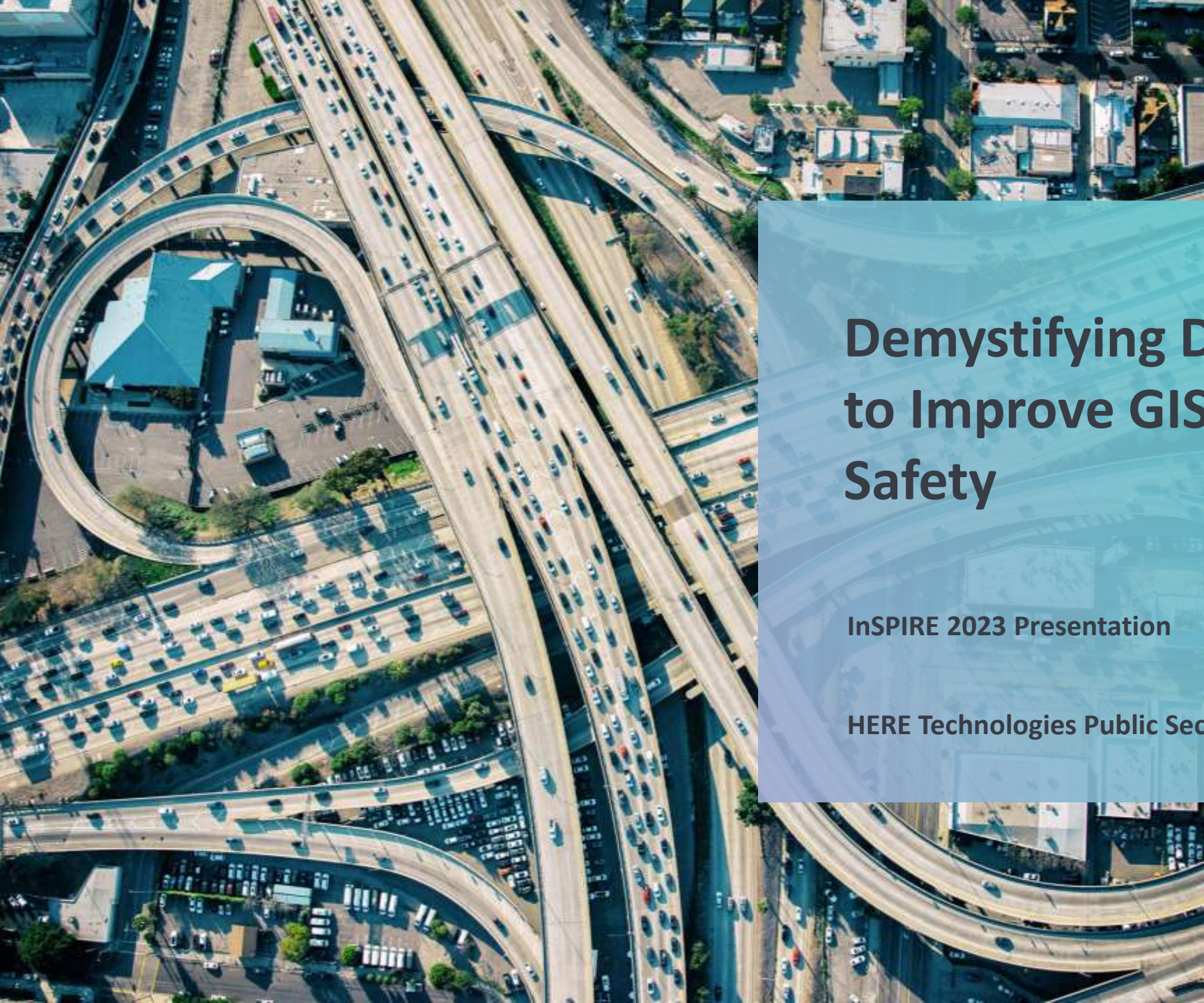
Flight Angle:

Lat,Long: 35.87, -77.03



Questions





# Demystifying Digital Twins to Improve GIS for Public Safety

InSPIRE 2023 Presentation

HERE Technologies Public Sector

# HERE Presentation Team



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## Agenda

1

Reframing the Digital Twin

2

Creating a Digital Twin w/Mobile Mapping

3

Applying the Digital Twin to Emergency Management

4

Takeaways & Call to Action

5

Questions & Discussion



# Reframing the Digital Twin

# Demystifying the Digital Twin

Steps to create an achievable digital twin

## What is a digital twin?

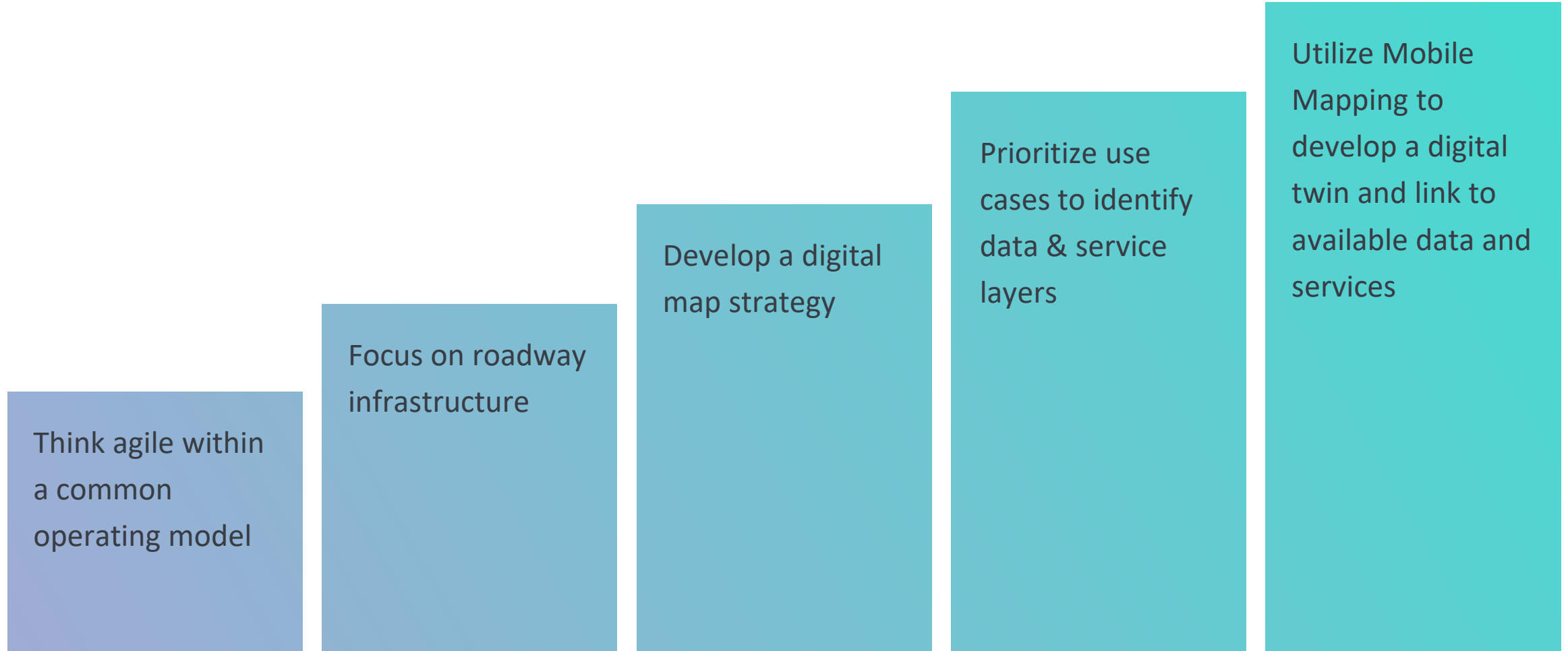
- An industry buzzword
- Immersive, photorealistic, interactive
- A virtual representation of a real-world physical asset or system, continuously updated



DON'T build the Death Star!

# Creating a Digital Twin

One step at a time

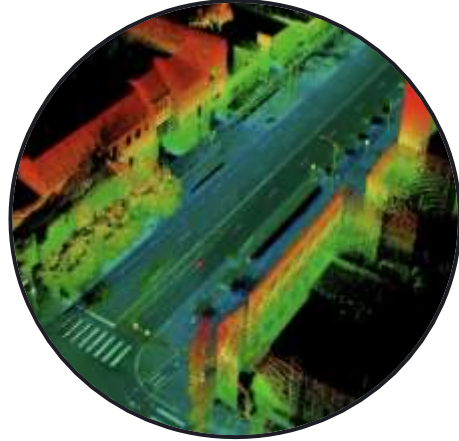


# Creating a Digital Twin using Mobile Mapping

# What is Mobile Mapping?



**Data  
Acquisition**



**Data  
Processing**

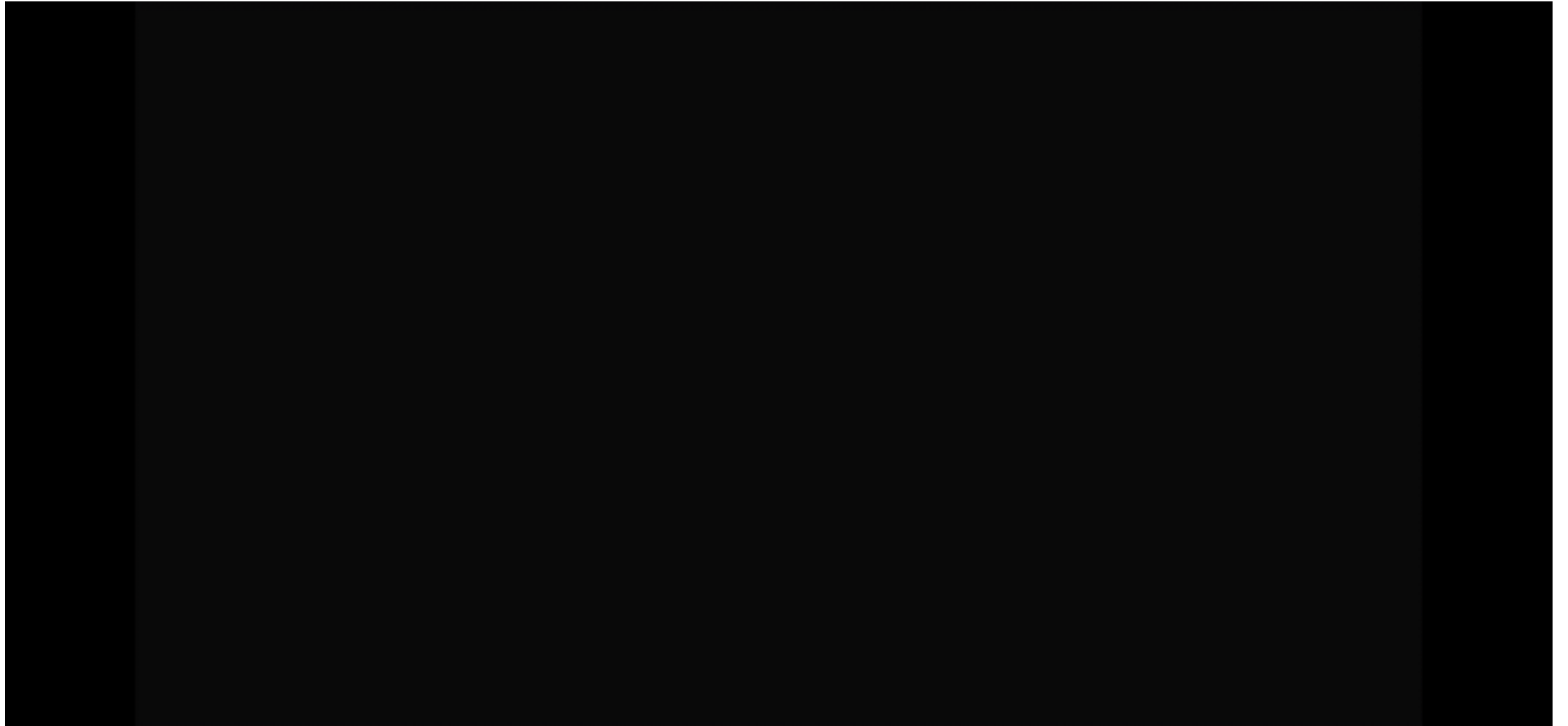


**Feature  
Extraction &  
Conflation**



**Deployment**

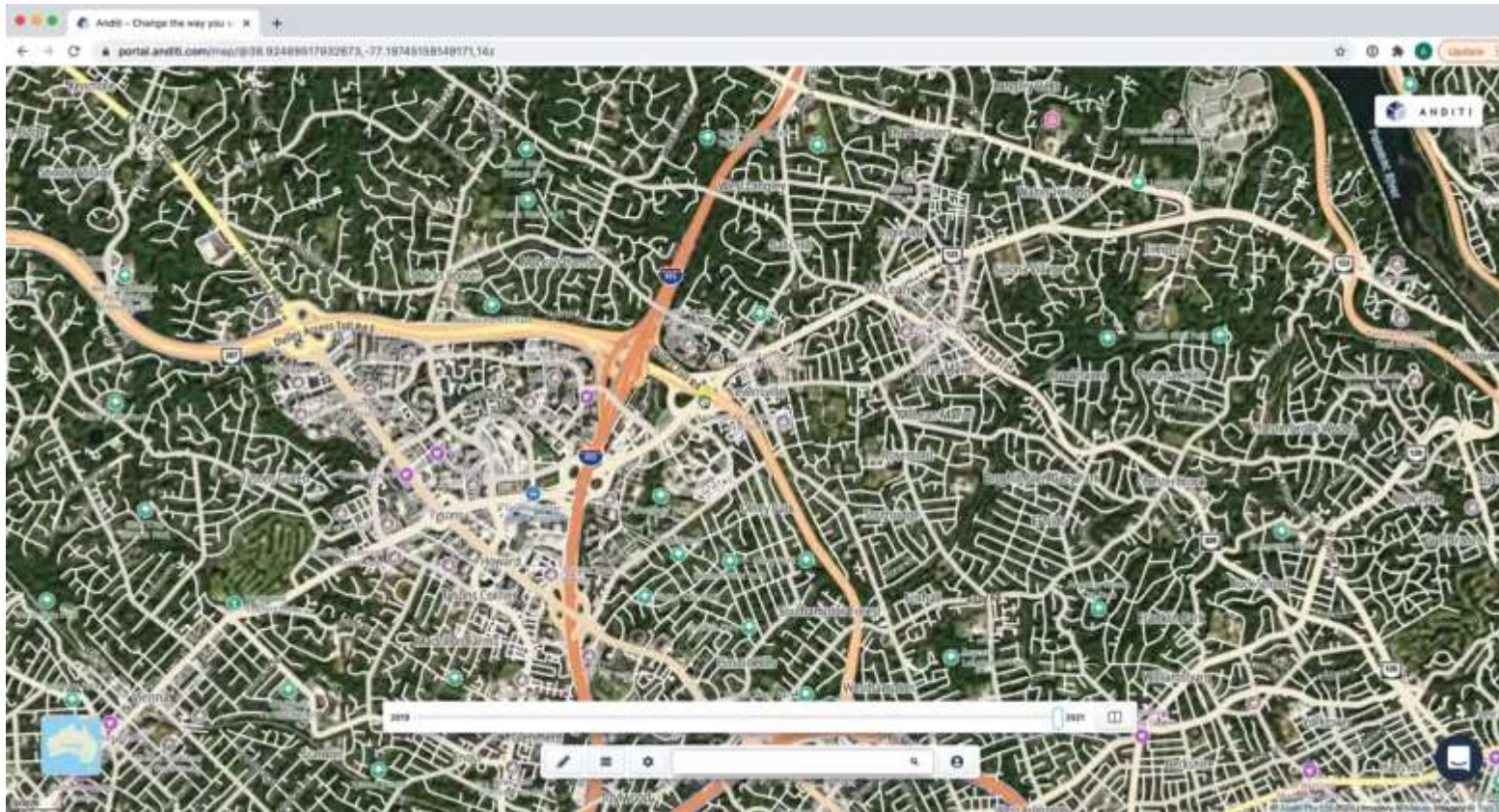
# Mobile Mapping Use Cases



# Digital Twins for Emergency Management

# Scenario 1 – Emergency Planning

Planners can identify potential risks, better understand the impact of disasters, and develop more effective mitigation strategies.



Establish roadway clearances to understand if they can accommodate emergency response equipment



# Scenario 2 - Mitigation

Identify at risk infrastructure and effective ways to prevent failure during a natural disaster.



Identify the condition of critical infrastructure and prioritize maintenance

# Scenario 3 – Tactical Response

Identify and prioritize areas of the transportation network that need to be restored quickly to minimize disruption and provide relief to affected areas.



Prioritize critical transportation infrastructure during emergency response

Incorporate real time data within a digital twin

# Takeaways & Call To Action

# Key Takeaways



Digital Twinning is Agile using software, data, and capture capabilities you can access



Achieve DTs by integrating immersive basemap, imagery, ground based lidar, and extracted features



Mobile Mapping is a DT for the road network that enhances public safety, including emergency management



Mobile Mapping is scalable and interoperable – DOTs and public safety agencies access the same information



Call To Action – 2024 private sector & public sector can together make a difference!

**CALL TO ACTION:** In Early 2024, HERE, with support of others, shall gather public sector and private sector together to workshop a digital twin solution strategy and develop POC deliverables

# Q&A / Discussions

# Thank you

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# THANKS!

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Do you have any questions?  
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