GIS IN TRANSPORTATION

Emergency Management Peer Exchange Summary Report

Columbia, South Carolina

September 11-12, 2019

Host Agency:

South Carolina Department of Transportation

Participating Peer Agencies:

Hillsborough Metropolitan Planning Organization (MPO) (FL)
Iowa Department of Transportation (Iowa DOT)
North Carolina Department of Transportation (NCDOT)
South Carolina Department of Transportation (SCDOT)
Vermont Agency of Transportation (VTrans)
Western CT Council of Governments (WestCOG)

U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Transportation
Volpe Center

Contents

Purpose

The Federal Highway Administration's (FHWA) GIS in Transportation program sponsored a peer exchange to bring together practitioners of Geographic Information System (GIS) applications to discuss and learn about how State Departments of Transportation (DOTs) and metropolitan planning organizations (MPOs) are leveraging GIS in their emergency management efforts. The South Carolina Department of Transportation (SCDOT) agreed to host the peer exchange in Columbia, SC, and present their efforts using GIS as it relates to emergency management activities. Participants included staff from SCDOT, the Iowa Department of Transportation (Iowa DOT), Vermont Agency of Transportation (VTrans), North Carolina Department of Transportation (NCDOT), Hillsborough Metropolitan Planning Organization (Hillsborough MPO), Western Connecticut Council of Governments (WestCOG), FHWA, and the Office of the Secretary of Transportation (OST).[1]

The peer exchange occurred over the course of two days and included a series of presentations from each participant and several roundtable discussions. The exchange concluded with a discussion of next steps FHWA can take to help State DOTs and MPOs reach their emergency management goals, and final remarks that summarized recurring themes in the event's discussions. To help manage and highlight the overall effort, FHWA asked the United States DOT (USDOT) John A. Volpe National Transportation Systems Center (Volpe Center) to develop a report that includes a summary of the peer exchange, a background and summaries of each presentation, themes, roundtable discussions, and next steps for the participants.

Background

FHWA initially recognized the need for a peer exchange on this subject through a roundtable event titled "Geospatial Tools/Processes for Emergency Management." Held at the American Association of State Highway and Transportation Officials (AASHTO) GIS in Transportation (GIS-T) Symposium in April 2019, the roundtable consisted of GIS practitioners from various State DOTs. Participants expressed the need for information sharing among peers on the current state of practices and projects undertaken to leverage GIS for use in emergency management situations. With that goal in mind, the Volpe Center and FHWA reached out to the appropriate stakeholders in the field and invited them to participate in this peer exchange.

Day 1: State DOT and MPO Presentations

Road Condition Application on ArcGIS Online - South Carolina DOT

SCDOT has incorporated GIS into its emergency management activities since 2015. At the time, the State DOT began with a need to know road closures for routing during emergencies. Then SCDOT developed their road conditions application to identify the conditions of each road in the network. At the same time, a demand across the agency existed for an ArcGIS Online (AGOL) map that would allow all staff to see and share the same information. It was not until 2016, when Hurricane Matthew made landfall, that SCDOT fully realized these efforts. The road conditions application and the AGOL map allowed SCDOT to identify which roads were not open for the evacuation procedures. Since then, SCDOT has improved the road conditions application and the map. Most recently, SCDOT implemented a color-coding system on

[1] A staff member from FHWA presented on behalf of OST.

the map to better identify current conditions for each road. Today, SCDOT works on featured services that require more development before they can be widely launched.

While SCDOT continues to improve their road conditions application and AGOL map, it continues to identify limitations and their solutions. For example, SCDOT uses the road conditions applications extensively in their call center for routing purposes. However, SCDOT identified that when individuals traveling through the State ask for routing, SCDOT has limited information on the status of roads in neighboring States. SCDOT continues to advance their emergency management GIS capabilities through a new Palmetto resource,[2] which compiles several datasets into one location that refreshes on a regular basis. SCDOT is reimbursed by the Federal Emergency Management Agency (FEMA) for costs to develop and maintain the Palmetto resource.

Uniform Datasets between States - OST and FHWA

The USDOT Office of the Secretary has the responsibility of gathering data on and reporting the status of roads during states of emergency to the Secretary of Transportation. One of the challenges USDOT faces during emergencies is a lack of uniform data from all States involved. For example, when reporting on bridges, many States represent a bridge as a point in GIS rather than a line, which would demonstrate how a vehicle could approach the bridge from a road. The challenge is not only the lack of desired data but identifying which States use linear representations. Iowa DOT and SCDOT both confirmed they have linear and point representations available.

The USDOT identified other datasets that are of interest in addition to roadway information. One of the more sensitive datasets relates to pipelines. The USDOT is currently working to draft a baseline map of this data. Once a specialist creates a baseline map, USDOT will determine the process to update that data set by determining what States have data and what the acquisition process will be. For USDOT, the challenge is not only knowing what data are available but how to acquire the data.

Vulnerability Assessment of Sea-Level Rise, Storm Surge, and Inland Flooding - Hillsborough MPO

Hillsborough MPO is a participant in an FHWA resiliency pilot to assess the transportation system in Hillsborough County, Florida. In the pilot, participants use Federal, State DOT, and local resiliency planning information to assess the transportation network's vulnerability to sea-level rise, storm surge, and inland flooding. The Hillsborough MPO used a regional economic model to conduct modeling of several extreme weather events. The modeling leveraged the National Oceanic and Atmospheric Administration's (NOAA's) low, medium, and high sea-level rise projections. Through the modeling, the MPO found that since Tampa Bay has many shore and inlet areas, flooding created more damage than the storm itself. Additionally, the MPO was able to validate the importance of bridges for the Tampa Bay region. From their modeling, Hillsborough MPO and partners developed adaptation and mitigation strategies for the county that fed into a toolbox of adaption strategies. The toolbox allows Hillsborough MPO to identify strategies based on status, criticality, and vulnerability. The pilot will be delivered to the FHWA by the end of the year. Hillsborough MPO identified some lessons learned, one of which was a need to use the same platforms and scenarios to ensure all stakeholders are able to easily communicate.

[2] https://www.palmettoeoc.com/webappviewer/
The Palmetto application is State-specific and a username and password is required to access it.

GIS Dashboard Providing a Compendium of Emergency Management Data Resources - North Carolina DOT

It was not until Hurricane Florence that NCDOT began to use GIS as a response tool. Initially, all response efforts for Hurricane Florence were ad hoc. In anticipation of another storm, NCDOT built on the efforts during Hurricane Florence and developed a GIS dashboard.[3] The dashboard includes:

- A map that visualizes issues directly related to a storm.
- A link to the Flood Inundation Mapping and Alert Network (FIMAN) tool, which publishes real-time water level readings.
- Road closures.
- A damage assessment tool that uses Survey123, which contractors deploy to collect field data during storms.
- A surge model that identifies what roads will experience surging given selected levels of surge.
- A bridge span vulnerability assessment tool, which allows users to identify the type of event, and can identify what bridge spans are vulnerable.
- A map that contains drone and other aerial photography.
- A Memorandum of Agreements (MOA) debris map.

Since Hurricane Florence, NCDOT has used this dashboard/landing page for response efforts. This has led to further improvements of the dashboard as challenges arise. During Hurricane Dorian, for example, NCDOT learned that since the dashboard/landing page is access-controlled, it is challenging to give new users permission to use the dashboard with a short turnaround. To address this, NCDOT worked to identify who in the agency needs access as well as create multi-login generic accounts. Additionally, NCDOT has shared their data with Google and Waze. The NCDOT also discovered that all road closure data are point data, which is not an effective type of data for response efforts. The State DOT is now in the process of converting these data to linear data. Finally, NCDOT also identified a lack of backup systems that would account for any data loss. NCDOT is now in the process of moving their data to a cloud server and creating a web service with closure data. As each experience allowed NCDOT to improve upon their response efforts and the integration of GIS, allowing them to better serve their population, they expect to continue to learn and implement those lessons as future emergencies occur.

Federated GIS Environment and Organizational Structure - Iowa DOT

Iowa DOT leverages its federated GIS environment and organizational structure to accomplish a lot of work with only two core staff members. The State DOT organized itself so that when an emergency happens, all relevant parties are in the same chain of command. In Iowa DOT, the maintenance, traffic, construction, and motor vehicle enforcement units are all in the same bureau.

Iowa DOT identified that there are three main types of emergencies in Iowa: winter weather events, flooding, and agriculture-related infection control. The State DOT publishes fixed cameras feeds, digital message boards, and traffic speeds on ArcGIS online for anyone to access. The agency uses ArcGIS to share weather data, data from sensors on trucks, images from snowplow dash cameras, and more. To supplement its own data, Iowa DOT incorporates surrounding States' data and displays them along with their own for travelers crossing State borders. In an attempt to alleviate the stress of an emergency,

[3] https://www.drivenc.gov

Iowa DOT humanizes the snowplows by giving them names. Iowa DOT then tracks the snowplows on a live map that the public can see from the dash camera. [4]

The MY School Track application is another data mapping and tracking tool produced by Iowa DOT. The tool allows school superintendents to access road condition data for all roads in their school districts. Similarly, Iowa DOT works with television stations to create custom KML files that show road closures and conditions for television broadcast. The State DOT is now in the process of using the images from the snowplows and incorporating machine learning image recognition to automatically identify road conditions for quicker database updates.

One unique case in Iowa included the identification of avian flu-infected sites across the State. With GIS, Iowa DOT was able to identify each site and map related buffer zones. Given the success of this work, the State DOT concluded it can expand the application to address other bio-hazard emergencies.

In addition to publishing data on ArcGIS online, Iowa DOT opened a data website that has maps showing truck locations, camera streams from the trucks, and other relevant maps. Currently, the published maps are reflective of State-maintained roads.[5] Overall, these are areas where Iowa DOT aims to continue improving over time.

Mobile Damage Assessment Tool and Dashboard - Vermont Agency of Transportation

VTrans started using GIS for emergency events during Tropical Storm Irene in 2011 when the State received seven inches of rain in a 24-hour period. After the storm, Vermont lost access to 22 bridges and over 200 segments of highway. What VTrans discovered during this time was that there were significant data gaps. Because VTrans recorded several different coordinate formats for different locations, it was a challenge to map all damaged infrastructure together.

Following Tropical Storm Irene, VTrans developed a mobile damage assessment tool. The tool leverages Survey123 with a user-friendly interface. First, users identify a damaged location. Then, users answer a series of prompted questions so VTrans can gather more information such as severity and type of damage. Finally, VTrans uses the data to estimate repair costs and to feed the Detailed Damage Inspection Report (DDIR) process that uses the information that was collected with the Survey123 app.

Similar to other peers, VTrans also developed a dashboard to visualize the extent and severity of damage resulting from emergencies. One unique aspect of the dashboard is that it also provides cost tracking. This provides a view of magnitude of damage by county and when thresholds for emergency declarations may be exceeded. VTrans also uses GIS to identify areas that required repair during emergency events and identifies hotspots for damage. This reporting helps VTrans meet certain requirements under the Moving Ahead for Progress in the 21st Century Act, or MAP-21, for Part 667 and reporting repeat damage to infrastructure.

The damage assessment tool and database allows VTrans to comply with Part 667 of MAP-21 which requires State DOTs to report to FHWA any infrastructure on the National Highway System (NHS) that has been damaged two times or more.

[4] https://marc.iowadot.gov
[5] https://data.iowa.gov

When concluding the presentation, VTrans noted that one lesson they learned is the need to define authoritative sources for its data. Although it is beneficial to acquire crowd-sourced data, there is still a need to validate the data.

Waze Connected Citizens' Program and Lane Reversal Evacuation Routes - South Carolina DOT

In 2019, SCDOT became a partner of the Connected Citizens' Program created by the navigation company Waze. This partnership allows SCDOT to enter a two-way data exchange with Waze. In the experience of SCDOT, becoming a partner in the Connected Citizens program was relatively easy. SCDOT is now able to develop a feed specifically for Waze identifying all road closures with the goal of becoming a higher-level editor so that they can provide definitive edits on road closures. An elemental issue with using Waze, however, is that the agency is dependent upon user feedback. If a road does not have a vehicle operating on it using Waze, there is lack of data for that road. On the other hand, a benefit of working with Waze is Waze's relationship with Google and the access to the data that Google owns. Given Waze and Google Map's popularity, SCDOT call centers are able to confirm that if callers use either Waze or Google Maps for navigation, both apps will have the most up-to-date data on South Carolina roads because the State DOT provided that data directly.

When South Carolina needs to evacuate a shoreline, SCDOT will reverse some lanes to create more capacity for evacuating vehicles. SCDOT developed and now uses diagrams demonstrating ramps to use during an evacuation. They also created a map for users that allows them to click on a ramp so the user can see the respective diagrams for that ramp. When discussing challenges, SCDOT noted miscommunications between stakeholders continues to occur. For example, in some cases, SCDOT does not always have the most up to date information on the status of all ramps. The Highway Patrol, which is in charge of opening and closing ramps, sometimes gets involved with traffic incidents and is unable to report the changes of a ramp. This ultimately causes conflicts in the call center, as the call center is not able to provide accurate information. This is not to say there are always conflicts, however. The SCDOT concluded that in most cases it is able to overcome these challenges and has continued to improve its ability to relay important and timely data across the State during emergencies.

Emergency Services Dispatch and Coordination in a Fragmented Environment - Western Connecticut COG

The WestCOG operates in a complex setting. It is located in the State of Connecticut, which does not have county governments and most of the functions associated with county governments now belong to local governments. There are also no coincidences between service areas and geographic boundaries of hospitals, State police, highway maintenance, and other groups. In Connecticut, there are over 100 public safety-answering points, which is more than any other State in the U.S. Additional complexity comes from a mix of private and public paramedics working at the sub-municipal, municipal, and regional levels. Currently, regional coordination is a solution for emergency management in Connecticut. Connecticut entities involved in emergency management coordinate through the Division of Emergency Management and Homeland Security (DEMHS) Emergency Support Functions provided by regional COGs.

The State faces several challenges related to emergency response including: limited funding for local first responders, more reliance on non-local responders, increasing complexity of living situations, and

higher public expectations. The WestCOG found that it could alleviate the issues by providing data to responders faster. Currently, WestCOG is working to improve emergency service dispatch by developing First Responder Cards. The cards detail important information about addresses such as environs, structures, inhabitants, and safety concerns. The cards apply existing data but the challenge is integrating all of the data into one location. These data come from the COG, assessor, 911, social services, school district, and town clerk. West Cog plans to use GIS to provide access to these data. The maps would be able to help identify close water sources including natural bodies of water and fire hydrants, give responders a layout of a property, provide the environs, structures, inhabitants, and responder safety concerns data.

Roundtable Discussion: GIS Emergency Management Resources

Natural disasters often highlight what is wrong with an organization. When you do not have the people, you do not have the time; however, by having a federated GIS, an agency is not as reliant on one person. WestCOG noted that resources are not always available. Coordinating a response to a natural disaster is difficult when it is unclear if the needed support is there. Iowa DOT noted that it operates with limited staff. It took the agency about 12 years to implement the Iowa Geospatial Infrastructure Initiative, which now allows them to be more productive with limited staff. The initiative allows Iowa DOT to share and make data available while at the same time providing more users access to GIS tools. The Iowa DOT also noted that its effectiveness is due to the culture within its organization.

SCDOT noted that an incident that occurred a few years ago created an ongoing challenge for it with respect to GIS resources. The incident involved a cybersecurity break of the State revenue department. Since that incident, SCDOT has had difficulty making data available without the Chief Information Officer approving.

Iowa DOT shares 95 percent of its State DOT data through ArcGIS online. The State DOT's organizational structure makes sharing data easier. The Iowa DOT GIS Manager has enough authority within the organization that when the agency has a data sharing-request there is an easier and quicker approval process. Florida DOT has official memorandums for data sharing, all of which is run out of the State University. Other peers noted that in their DOTs they hired a Geospatial Manager but did not put the position high enough in the organization structure, which led to delay in approval procedures. Iowa DOT noted that to get to where it is it took a dedicated person with a vision for the agency. Some agencies have hired Chief Transformation Officers to streamline change.

Culture change is also a difficult undertaking. The WestCOG noted that in Connecticut there was a statewide geospatial initiative. When the State Governor set up a Geospatial Information Officer position, however, there were many restrictions and a lack of collaboration with geospatial data. The result of these restrictions was a number of divisions circumventing policies designed to maintain data integrity and uniformity. This practice resulted in divisions overstepping other divisions by working outside of the established methods. This approach, the peers described, creates long-term damage and may be best to avoid. One approach to build the case for improving geospatial data is using a geospatial maturity model. This approach would assess the maturity of the State with respect to organizational maturity as it relates to geospatial data, and can highlight deficiencies in practices which can then be resolved.

SCDOT noted it has many people who recognize the importance of geospatial data. However, there are always budget challenges; primarily the budget is too small. According to all peers, this is a common challenge throughout the GIS community. While GIS helps Departments of Transportation answer important questions, people who request GIS data do not understand the amount of work and time that goes into collecting and analyzing that data. For hurricanes, for example, it may be beneficial to identify the total cost; typically, the damages done and response efforts made. This then helps identify the value or benefit of using GIS compared to not having it available. Additional resources are available such as a GIS lead in each region of the Incident Command System (ICS) and the Esri disaster response program is available during emergencies.[6]

Another challenge surrounding GIS is maintaining in-house expertise so that when an emergency does occur an agency has the capability to respond appropriately. The SCDOT contracts out much of its GIS work, which limits the abilities of the in-house group. VTrans noted that since most transportation agencies have a finite amount of resources, GIS groups could try to mimic the work performed by contractors. This would allow the agencies to move more general-purpose functions back to internal GIS groups and leverage contractors to do more complex projects. Another approach Iowa DOT proposed is to empower more staff so they can use GIS themselves. By having GIS available to everyone, the people who need specific GIS tools are able to create the tools. FHWA has been working on a GIS capability maturity model called Slimgim-T to support DOTs in understanding their capabilities.

Finally, Iowa DOT noted that one of the best practices that it adopted is emergency response efforts should have defined roles and be responsible for different activities. Attendees from VTrans and the USDOT reinforced this lesson learned as they also use the same approach.

Roundtable Discussion: GIS Emergency Management Tools

State DOTs have many needs for GIS tools during emergency scenarios. When an emergency occurs, GIS tools should be easily available to those who need them. Peers agreed that not everyone in an organization needs a desktop version of GIS. Most users likely can benefit from using ArcGIS online. Understanding the uses and levels of expertise needed for GIS will help transportation agencies make better, more informed decisions.

The Iowa DOT noted transportation agencies also need to understand their spatial ecosystems to know how to meet the needs of the overall organization. For Iowa DOT, the spatial ecosystem is the software that it uses and what tools it has available. Tools include ArcGIS online and even SharePoint. By knowing what the ecosystem looks like, it is possible for State DOTs to help other agencies during an emergency, faster. VTrans also noted that the spatial ecosystem has a human component as well. The human component is composed of the people who have the knowledge of how to use GIS and other spatial tools. Once a DOT knows its ecosystem, it can improve its ecosystem by focusing on resiliency.

Another lesson learned was the importance of the relationship between GIS groups and IT. It is important for IT to work with their GIS counterparts instead of outright instructing GIS groups how to use their software. Poor relationships hinder the progress of the DOT. Bad experiences with software available to other staff in the DOT can leave a poor impression potentially leading to users neglecting valuable tools in the future.

[6] https://www.esri.com/en-us/disaster-response/overview

The Federal Government provides several resources to DOTs. For example, USDOT shares data through the Bureau of Transportation Statistics (BTS) and data.gov. The United States Geological Survey (USGS) provides aerial imagery, which agencies can leverage for damage location identification. In addition to USGS, the latest imagery can also be obtained from Digital Globe, now Maxar. State DOTs also make resources available. However, a challenge at both the Federal and State level is marketing the resources, as they are often unknown by many in the industry.

Sharing data can be a contentious issue. In South Carolina, some counties will share data with SCDOT for a steep fee. Another issue with sharing data is that when it becomes public knowledge, it is much easier to request that data under the Freedom of Information Act (FOIA) which can lead to lawsuits if it is believed there has been negligence. Other fears include criticisms over the condition of infrastructure or how the State maintains that infrastructure, e.g., how the State plows roads. Iowa DOT noted, however, that although criticisms remain a concern for how Iowa DOT plows its roads, Iowa DOT no longer get calls inquiring if and how many plows the State DOT deployed. Iowa DOT noted that although there may be liabilities in sharing data, such as camera feeds on trucks, an agency has to be risk adverse. Other State DOTs such as SCDOT are much more risk adverse. Although SCDOT is now a Waze partner, there was originally pushback on this partnership as in the Waze agreement that the liability with the information provided would be on SCDOT.

Roundtable Discussion: GIS Emergency Management Policies

One important solution to some of the identified challenges is better-defined policies. Ultimately, policies can help ensure staff follow predetermined procedures during an emergency. The first example described by the peers was to develop a set of standard operating procedures (SOPs). SOPs are a common tool used in any situation that requires multiple steps for executing an action or responding to a problem. During an emergency, SOPs allow for quicker response times and overall increased efficiency.

Another policy identified during the roundtable discussions was formalizing the documentation of points of contact during an emergency scenario. Knowing who to contact and how to reach them is critical in situations that require immediate actions or approvals. Other important documentation is a list of standard responses to commonly asked questions. These responses can quickly address issues the agency already experienced. Likewise, developing formal templates for all types of maps produced for an emergency event can standardize outputs and allow for easier comparisons across products. Having documentation that includes best practices and lessons learned, can be instrumental for containing each of these product and their specifications.

Policies typically require regular updates, the timings of which are important. SCDOT does not change its policies mid-event during an emergency. After an event, however, there is a post-event conference to discuss needed changes or updates. VTrans has a similar process. Originally, decisions were not as formalized as they are today. It took VTrans many years to better document its processes so staff could follow them during an emergency. In Iowa DOT's case, it documents all its procedures in its traffic incident management plan.

While State DOTs often know how they will respond during an emergency there may be a lack of coordination with counties and municipalities. Transportation agencies need to ensure there exists coordination with utility companies as well. Among other potential issues, there could be underground gas leaks during an event that require the direct involvement of the affected utility company. In addition

to coordinating on the response to an emergency, it is important to keep track of the assets a DOT owns. In 2016, a road over a dam washed out during a flooding event in South Carolina. Having the road over a dam that the State DOT did not own presented a legal challenge. Where the SCDOT owned the road the Army Corps of Engineers (ACE) owned the dam. Due to a lack of communication with the State DOT it is not always known what bridges or dams ACE closes if ACE does not provide the information to them.

State DOTs also need to coordinate with transit agencies that they do not directly control. It has to be clear to the DOT how an emergency affected transit services and what services, if any, remain operational.

Although in-State procedures may operate well within State emergencies there may still be issues operating across State boundaries. In one example, SCDOT tried to display NCDOT data in their maps so users could identify road closures. However, due to liability concerns, SCDOT had to remove this information. The group of peers agreed Federal guidance could be beneficial in sharing data between States. The USDOT could also provide maps on a regional basis that shows road closures. However, this would be challenging because there is no minimum uniform data set and each State would need to conform to a new format, creating further burdens on the staff that might already be time and resource constrained. Ultimately, participants identified a need for authoritative sources of data.

Day 2: Roundtable Discussions

Roundtable Discussion: Data Sharing

During emergency events, peers agree data sharing is of the utmost importance. Data exchanges take place at many levels during emergencies including in between and among States, MPOs, USDOT, and the public.

During Hurricane Florence, USDOT led an effort to know what data State DOTs have available. This is part of an overall effort on behalf of USDOT to improve their emergency management activities. One piece of information of interest is who to contact during an emergency event. SCDOT now has the points of contact well documented. This has reaped immediate benefits for the State DOT as mentioned in a previous roundtable discussion.

Knowing what to share is part of the challenge when it comes to data sharing. The other part is how to share data. Several peers liked the dashboard that NCDOT produced for data sharing. The dashboard includes tabs for different information of interest. When an event takes place, NCDOT can start feeding data into a template page and publish it quickly afterwards. SCDOT has an application, Palmetto, which was developed with a FEMA grant to centralize information from utility companies and various State Agencies. Although the application provides a centralized location for information to be shared and displayed on a map there is a lack of marketing of the application throughout State agencies. In addition to having a central place to gather data from, a catalog of all applications available would also prove beneficial in GIS-related emergency response efforts.

Although there may be data sharing agreements in place, there are little to no ramifications for those who fail to share data. In SCDOT, counties are supposed to share data with the State DOT, Secretary of State, and other stakeholders. However, there are no repercussions for not sharing, which has led to lapses in data exchanges.

With the advent of social media, State DOTs and MPOs can leverage communication platforms. In Illinois, Iowa DOT leverages Twitter as a data source. The State DOT uses Twitter to help identify where there may be issues based on other Twitter users' messages. It also leverages Twitter to communicate with the public. During an emergency event, Iowa DOT has a staff member who monitors Twitter for information relevant to the event.

Sharing data between States has met with different responses. Some agencies are not willing to take on the liability associated with publishing another agency's data—in scenarios where SCDOT wants data from another State but does not want to maintain the data, for example, SCDOT requests other DOTs create a service for them so that they can link to the data. Having to warehouse data can be challenging and often discourages States from pursuing these data. Iowa DOT noted that it used to warehouse data but now leverages Oracle and ArcGIS online. Overall, this has improved data processing.

Some peers noted that they refuse to publish data that can give their agency a bad reputation. In one case, SCDOT described requests for signs. Due to the poor quality of the data, however, the State DOT does not publish the sign data. More States are leveraging data governance to ensure their data quality is at an appropriate level so they can share more data. While some States refuse to publish any dataset that isn't very accurate, publishing data that is not perfect can have the added benefit of people seeing that it could be useful if it was more accurate.

Where DOTs collect a significant amount of data, conduct analyses, and produce products, they do not tend to market these items. It was mentioned by one of the peers that ODOT noted it spends a lot on marketing. Not only does the State DOT market its products, it also markets the value of producing those products. States may benefit from having a staff member that can effectively manage this type of communication, proving the worth of the work accomplished.

With FHWA influence, the peer group determined that changes to operating procedures have a better chance at adoption. The peers agreed they see significant benefits from FHWA leadership in data sharing, which can take the form of guidance.

Roundtable Discussion: Public Outreach

Today, State DOTs and MPOs focus heavily on mobility. Part of this means informing the public about road closures and other related issues. According to peers, there are several ways to communicate with the public. One method Iowa DOT uses is media marketing. The State DOT set up specific services for television stations to broadcast maps of road closures. It believes that GIS should have a close connection with media marketing, as it is an effective way to reach the public.

One challenge with publishing for the public is accessibility. At the Federal level, all documents published need to be Section 508 compliant.[7] Similarly, SCDOT also needs to address accessibility before publishing maps. This requirement is not standard across all States, which can create significant challenges for individuals with disabilities.

Another way to communicate with the public is pushing notifications through Waze and other navigation programs. As discussed earlier, SCDOT successfully leverages Waze and Google. Knowing that Waze and Google will be up to date saves time when people call into their call center as the call center

[7] Section 508 is part of the Rehabilitation Act of 1973. The 508 standards and guidelines ensure that information and communications covered by Section 508 are accessible to individuals with disabilities.

representative can direct people to those navigation programs. When SCDOT wants to make a change in Waze, they are now able to reach out to the public affairs representative for the region. Waze has the capabilities to communicate data that don't appear in the 511 system. Participants generally came to the consensus that the public is unlikely to use 511 instead of Google. Therefore, State DOTs should make the effort to provide input to Waze and Google. The benefits of GIS and cooperation/inputs provided to Google and Waze need to be communicated to upper management effectively to get their buy-in. Although Google and Waze have many benefits they also have limitations such as not being able to deal with complicated situations like lane reversals.

Today, social media is a vital component in communicating with the public. The SCDOT has developed relationships with news outlets on Twitter to help further broadcast important, emergency-related information. By watching tweets in response to what SCDOT shares, the State DOT is able to further understand the feedback on the materials shared. Another area where social media has been instrumental is identifying if there is a misunderstanding for lane reversals during evacuations. The issue in this case occurs when the Governor announces lane reversals will be at a specific time. What SCDOT learned, however, is this information is best conveyed by explaining that lane reversals will start at a specific time as it takes a while to complete all the ramp configurations.

Another method used to convey information to the public is the 511 hotline. VTrans and SCDOT noted that they do push information through 511. In Iowa DOT, there is an in-house 511 person who works out of the maintenance group. This set up allows for easy updates. All peers agreed that while all States have 511 or its equivalent, none of the 511 services communicate with each other. If a person travels through multiple States, they need to use multiple 511 systems, creating additional burdens to the traveler.

Key Takeaways

At the conclusion of the peer exchange participants were asked what their key takeaway was from the peer exchange.

Practices That Work

Participants felt that the dashboards and landing pages that were presented by peers appeared to be very effective tools for conveying important information during an emergency. Another key takeaway identified by participants was the benefit of federated approach to GIS practices and applications. Participants agreed that this approach seemed effective in lowering barriers to accomplishing tasks more efficiently. As such, participants recognized the importance of open data policies. Participants noted that allowing cross-departmental data sharing made for some innovative applications. Conversely, when departments or agencies restrict their data from being used by other business units, fewer applications are able to contribute to disaster management efforts.

One lesson learned that participants found useful is the importance of identifying points of contact prior to an emergency event. Participants found it useful to establish point of contact both for public-facing offices as well as internally. Automating information-dissemination functions as much as possible is ideal, however, participants found that during an emergency event, human-to-human interactions became necessary in some cases and preferred in others.

Opportunities for Improvement

Participants identified a number of actions that would improve an agency's ability to react to needs in the immediate wake of an emergency event. Natural disasters do not always happen on one side of a State or municipality border. As such, those affected will necessarily require information about the transportation network at their origin, destination, and where their loved ones may be. To achieve efficiencies in acquiring data on a regional level, peers identified an opportunity to share location data across borders. This would similarly require the sharing of data across agencies to accomplish the same.

While agencies use GIS in numerous ways to help respond to emergency situations, peers identified opportunities to leverage geospatial systems even further. Ways in which GIS is underutilized during emergency situations include damage visualization and routing, among others. During emergencies, a robust routing infrastructure with up-to-date information on the status of blocked routes can prove to be invaluable. After an emergency, damage visualizations can assist agencies in responding to areas that are in the greatest need of assistance.

Suggested Next Steps

In support of using GIS to advance the capabilities of agencies to respond in an emergency situation, peers identified a number of ways that would be beneficial in improving these capabilities. One of the ways peers feel the field could be supportive is by creating a workshop at the annual GIS in Transportation Symposium on the topic of emergency management. Such a workshop would be inclusive of a larger audience of GIS practitioners across the country.

Peers also suggested that a special interest group be created to focus on the topic of using GIS for emergency management. This would provide similar benefits to the GIS in Transportation workshop but have the added benefit of being an ongoing support group available to GIS practitioners. This may be especially important in the days immediately preceding and following a major natural disaster.

Peers also indicated that they would benefit by a written case study on how other agencies across the country are using GIS for emergency management purposes.

Appendix A: Peer Exchange Agenda

Day 1 (Wednesday, September 11)

8:45 AM	Welcoming Remarks • Introductions, Agenda, and Meeting Logistics - Mark Sarmiento, FHWA • Welcome from our Host - Todd Anderson, SCDOT • Round Table Introductions
9:00 AM	South Carolina DOT – Elizabeth Thebo – Publishing Line and DOT Closures
9: 20 AM	DOT Office of the Secretary – Mark Sarmiento presenting on behalf of Amy Nelson (attending remotely) – State Data of Road Closures
9:40 AM	Hillsborough MPO – Allison Yeh - Resiliency Pilot
9:55 AM	Morning Break
10:15 AM	North Carolina DOT – John Farley – Response to Dorian: Data, Analysis, Requests
10:30 AM	Iowa DOT – Eric Abrams – Data Sharing, Data Integration within Iowa DOT
10:50 AM	Vermont Agency of Transportation – Johnathan Croft – Mobile Damage Assessment Tool
11:10 AM	South Carolina DOT - Emily Watts – Waze Connected Citizens and Pushing Closure Data Out to Travelers
11:30 AM	Western CT COG – Frances Pickering – Connecticut's Emergency Response System
11:50 AM	Morning Wrap-up – Open Discussion on Morning Presentations
12:00 PM	Lunch
1:30 PM	Round Table 1: GIS Emergency Management Resources
2:30 PM	Round Table 2: GIS Emergency Management Tools
3:30 PM	Afternoon Break
3:45 PM	Round Table 3: GIS Emergency Management Policies
4:45 PM	Day 1 Wrap-up
5:00 PM	Adjourn Day 1

Day 2 (Thursday, September 12)

8:45 AM	Day 1 Recap
9:00 AM	Round Table 4: Data Sharing
10:15 AM	Morning Break
10:30 AM	Round Table 5: Public Outreach
11:30 AM	Peer Exchange Wrap-up
12:00 PM	Adjourn Day 2

Appendix B: Peer Exchange Participants

Agency	Name	Title	Email
FHWA	Mark Sarmiento	GIS Planning Specialist	Mark.Sarmiento@dot.gov
Hillsborough MPO (FL)	Allison Yeh	MPO Executive Planner	YehA@plancom.org
Iowa DOT	Eric Abrams	Spatial and GIS team leader	Eric.Abrams@iowadot.us
South Carolina DOT	Elizabeth Thebo	GIS Manager, Planning Services	TheboVE@scdot.org
South Carolina DOT	Emily Watts	GIS Manager	WattsEK@scdot.org
South Carolina DOT	Jennifer Rhoades	Assistant State Traffic Management Engineer	RhoadesJO@scdot.org
Vermont Agency of Transportation	Johnathan Croft	Mapping Section Chief	Johnathan.Croft@vermont.gov
Volpe Center	Bryan Lee	Transportation Analyst	Bryan.Lee@dot.gov
Volpe Center	Drew Quinton	Community Planner	Drew.Quinton@dot.gov
Volpe Center	Gary Baker	GIS Specialist	Gary.Baker@dot.gov
Western CT COG	Frances Pickering	Executive Director	FPickering@westcog.org