The Local Road Research Board is seeking information from other state and local agencies that have experience with developing and maintaining a central repository for local and state road closure and traveler information. Of particular interest are systems that update the traveling public about road network closures via Google Maps, Apple Maps, Waze smartphone applications or the state’s travel information database.

This Transportation Research Synthesis presents the findings of a survey of state and local agencies that effectively support programs for gathering and distributing road closure data at the local and state levels. These findings are supplemented by the results of a literature search for relevant national and state practices and guidance.
The purpose of this TRS is to serve as a synthesis of pertinent completed research to be used for further study and evaluation by MnDOT and the Local Road Research Board. This TRS does not represent the conclusions of the authors, MnDOT or LRRB.
Systems for Notifying the Public of Local Road Closures Using Smartphone Map Applications

Introduction

The Local Road Research Board (LRRB) is interested in developing a central repository of local and state road closure and traveler information that could be used to notify the traveling public about road network closures in real time. Updates to this travel information database will feed Google Maps, potentially through Waze, and Apple Maps to provide information about current road closures and road conditions to smartphone users. (Waze is a geographic information system (GIS) based roadway mapping and navigation application that includes crowdsourced and partner-provided data. The application provides driving directions, a live traffic map and road alerts.) Updates may also appear on the state’s 511 traveler information database.

To inform the development of this database, selected state and local transportation agencies were surveyed about their use of systems for notifying the public of road closures and reopenings through traveler information services. Also surveyed was a representative from University of Maryland’s Center for Advanced Transportation Technology Laboratory (CATT Lab), which developed and maintains a web-based system of selected state and local road closure data. Follow-up interviews were conducted with selected survey respondents and with a representative from Florida Department of Transportation (DOT). This Transportation Research Synthesis presents the results from the surveys and interview. Findings from a limited literature search supplement these outreach efforts.

Background

Previous collaborations among Minnesota state and local agencies and private-sector partners can inform the current effort to develop a central repository for local and state road closure and traveler information. Representatives from Minnesota IT Services (MNIT), the Minnesota state information services agency that supports MnDOT and other state agencies, described an informational website developed in the aftermath of the 2007 collapse of the I-35W bridge in Minneapolis, and the practices used to report on road flooding and closures related to Red River flooding in 2010 and 2012.

Summary of Findings

Survey of Practice

Online surveys were distributed to two groups of respondents: state transportation agencies and selected local transportation agencies within those states. Respondents in both groups addressed techniques and workflows involved with aggregating local data into an integrated, statewide feed that can then be shared with popular smartphone mapping applications.

The initial online survey was distributed to members of the American Association of State Highway and Transportation Officials (AASHTO) GIS for Transportation Symposium. Eight state transportation agencies responded to the survey:
Arkansas.  
Georgia.  
Kansas.  
Kentucky.  
Maryland.  
Ohio.  
Vermont.  
Wyoming.

The representative from the University of Maryland CATT Lab also participated in this survey.

A second survey was then distributed to four local transportation agencies expected to have experience with reporting and maintaining local road closure data. Only one local agency—Harford County, Maryland—responded.

None of these agencies and organizations maintains a comprehensive, real-time database of state and local road closures. Systems used by agencies and organizations participating in this project follow:

| System includes state and some local roads | Georgia, Maryland, Vermont, University of Maryland CATT Lab |
| System includes only state roads | Arkansas, Florida, Kansas |
| Developing a system for state and local road closures | Wyoming |
| Use of Waze for real-time traffic updates | Kentucky |
| No system | Ohio |
| Interest in pooled fund to develop a system | Kansas, Ohio |

Below is an overview of survey results, information from supplemental contacts and additional research in the following topic areas:

- Systems including some local road closure data.
- Systems not reporting on local road closures.
- System in development.
- Other data-sharing applications.
  - Geographic Roadway Inventory Tool.
  - Waze for Cities (formerly Waze Connected Citizens Program).

**Systems Including Some Local Road Closure Data**

Four agencies—Maryland DOT, University of Maryland CATT Lab, Georgia DOT and Vermont Agency of Transportation—support systems that include some local road closure data and allow some local agency engagement. Features and functions of each system are summarized below.
Maryland DOT

Maryland’s Road Closure Reporter (MRCR) is a web-based system and application that local road jurisdictions use to capture road closure events. Maryland DOT State Highway Administration (SHA) hosts and administers the application. The system is not designed to be a public-facing viewer or analytical tool. Instead, data is available through various access points, including local GIS maps maintained by MRCR participants and a statewide GIS map supported by Maryland Emergency Management Agency. MRCR has a bidirectional data-sharing relationship with Waze and uses advanced closure attributes such as partial closure, specific times of day, reason for closure, lanes blocked and limited access. Representatives from local agencies enter data through a desktop or smartphone.

Local agencies can only enter closure information for roads in their jurisdictions using a batch roadway submission. Events auto-expire or are “retired,” and future events can be entered. MRCR also permits a mobile workflow and offers entry in “storm mode,” after action reporting and an email notification system. Statewide updates occur in MRCR whenever local agencies enter data; this data updates instantly on Waze. Harford County enters road closure data several times each week. Information about construction projects, weather or special events is entered and includes date of closure, anticipated reopening date, type of closure (construction, flooding or special event) and affected road segments. The MRCR team emails local agencies after creating, editing or ending a road closure, providing information about the closure and a link to view the closure in the MRCR public-facing demonstration application. Archived data is openly available.

Maryland DOT SHA continues to establish and provide login credentials to local agency users on request and is working with the Coordinated Highways Action Response Team (CHART) and other agencies on data consumption and utilization issues. The agency also plans to migrate to Geocortex Workflow 5.

University of Maryland Center for Advanced Transportation Technology Laboratory

The University of Maryland’s CATT Lab developed and maintains TrafficView, a web-based system that includes selected state and local road closure data posted on a traveler information map service. TrafficView partners with several state transportation agencies and is free to organizations that subscribe to the CATT Lab’s Regional Integrated Transportation Information System (RITIS), an operations and planning transportation data gathering and analytics system. Data sources include advanced traffic management system (ATMS) platforms, computer-aided dispatch feeds from state and local police departments, lane closure permitting systems, third-party private sector data providers, Waze, application programming interfaces (APIs) and file transfer protocols (FTPs). Most local data comes from cities and metropolitan areas rather than county road agencies.

Because TrafficView is a web service, it does not feature a smartphone application or voice reporting. While local agencies can submit data to TrafficView, the system also gathers data automatically from available local data sources.

Information is shared with other agencies through the RITIS platform and with the public through a centralized API and the TrafficView website. Online data sources typically send updates every minute or every five minutes; TrafficView updates once per minute; and the RITIS API updates in real time as data arrives. MRCR notifies city, county, state and Waze contacts when a road closure is entered into the system, and notifies Waze if a closure is entered with a detour. Some data sources provide closure data on a schedule (making the lane closure active through the agency’s ATMS platform), some only provide point location data, and others provide segment-based location data. The respondent noted that providing data to the public in a standardized way can be challenging when information is received from so many different sources. Information, including openings, is archived in RITIS indefinitely. Agencies have access to tools that allow them to review and analyze historical data.
Georgia Department of Transportation

Local agencies in Georgia enter road closure data into Georgia DOT’s ATMS for display in NaviGAtor 511, the statewide 511 traveler information services and road closure application. Developed and maintained by Iteris, the NaviGAtor 511 website offers email and text alerts to the subscribing public. Smartphone applications include Georgia 511 and Atlanta Traffic.

The agency has a bidirectional data-sharing relationship with Waze and is a TrafficView partner. Advanced closure attributes used are the number of lanes blocked and start time and end time, but subscribers with a user account can access an XML file with all event data. The agency has not measured the frequency of data updates. Data, including proposed and actual start and end times, is archived for four years.

Vermont Agency of Transportation

Vermont Agency of Transportation and partners in New Hampshire and Maine worked with Southwest Research Institute to develop New England Compass 511, a regional 511 traveler information service. This modular software system includes some local road closure information but does not offer statewide integration. Road closure data is provided to Waze through the system. In addition to using New England Compass 511, the agency also publishes road closure data through social media and VT-ALERT, an emergency messaging program that publishes text, email and call notifications.

The agency’s ATMS cannot easily create closure events on local roads. Select closure data is managed for high-volume local roads, depending on the potential effects on the driving public. Each road is individually configured in the database based on intersection location. This process is too costly to execute for all local roads, and without a reliable way to manage the local road closings and reopenings, the agency has not considered a broader approach to entering local road closure data. However, it has initiated changes to the program’s basemap, which is an important step in being able to post local road closures.

Data is updated approximately every five minutes for Waze and every 10 to 15 minutes for Google Maps. Changes to the Waze map are posted whenever agency staff edits the map. Traffic management center staff has editing rights in the Waze map editor, but Waze volunteer map editors also monitor the New England Compass 511 website for information. Advanced closure attributes are determined on a case-by-case basis. Data is archived on the vendor’s servers and can be accessed by agency staff for reporting.

Systems Not Reporting on Local Road Closures

Florida DOT and Kentucky Transportation Cabinet maintain systems that do not report on local road closures. Both agencies have developed a relationship with Waze to provide real-time traffic updates about state roads. Each system is summarized below.

Florida Department of Transportation

Traveler information for state-managed roadways only is available through the Florida 511 website and Florida 511 Mobile (FL511) application. Data is drawn from standard traffic operations and management sources. Florida DOT participates in the Waze for Cities program and has a bidirectional data-sharing relationship with Waze (the agency receives a data feed from Waze, and Waze draws data from the Florida DOT API). Some crowdsourced information from the Waze data feed is removed before combining with Florida DOT’s road closure data for posting on the API. The agency has considered a state and local integrated data repository and traveler service, but has no immediate plans to develop a system.
**Kentucky Transportation Cabinet**

Kentucky Transportation Cabinet developed GoKY, a web-based interface, after a significant decline in the public’s use of a phone-based 511 traveler information system. This traffic and roadway information portal offers details about traffic alerts, construction activity and road weather conditions. Users are directed to download Waze to view real-time traffic updates and road navigation.

**System in Development**

Wyoming DOT is developing a system under U.S. DOT’s Connected Vehicle Pilot Deployment Program that communicates road information and alerts to motorists in near real-time time. The agency is working with a multidisciplinary team to develop a system that pushes road condition and other traveler messages using vehicle-to-vehicle communications, delivering messages using a combination of the Sirius XM streaming radio service and roadside beacons. The system in development does not include local road closure data.

**Other Data-Sharing Applications**

Two data-sharing applications used by transportation agencies to gather, monitor or share travel-related and roadway data are summarized below.

**Geographic Roadway Inventory Tool**

Geographic Roadway Inventory Tool (GRIT) is a web map-based roadway inventory application used by counties in North Dakota and Minnesota for various mapping, planning and data-sharing activities. Participating counties enter pavement construction and planning data—including planned construction and maintenance projects that involve road closures—and GRIT generates pavement condition forecasts and maps. The application does not appear to be widely used to record, update and share local road closure data.

**Waze for Cities**

Introduced in 2014, Waze for Cities (formerly Waze Connected Citizens Program) is a free service that encourages bidirectional data sharing with agencies. Through this program, Waze provides partners with traffic incident and congestion data, and participating agencies provide Waze with data on anticipated closures, rerouting information and similar data. The program has grown to more than 1,000 global partners and hosts an online forum where partners collaborate and discuss strategic and operational issues.

**Related Research**

Supplementing the survey results are publications sourced through a limited literature search. A 2018 Federal Highway Administration (FHWA) report synthesizes information about travelers’ information needs and current practices for information dissemination, including a discussion of data collection technology, emerging technologies and trends, two case studies focused on the use of mobile applications and a comprehensive summary of 511 capabilities among state DOTs. A 2014 FHWA report examines best practices for Road Condition Reporting Systems (RCRS) and presents industry practices for using traveler information websites to notify the public about construction, roadwork, traffic incidents and road weather information. Resources from three states— Iowa, Michigan and Wisconsin—provide details about traveler information websites and the use of Waze data in traffic management. Additional resources address partnerships between state transportation agencies and crowdsourced smartphone application providers to map road closures for travelers.
Next Steps

Going forward, MnDOT may wish to consider:

- Reviewing lessons learned from previous initiatives to report on local road closures.
  - Develop best practices based on successful state and national reporting systems.
  - Consider how to make the system user-friendly and self-regulating to encourage smaller local agencies to participate in updating the system.
  - Recruit agency partners such as law enforcement to participate.
- Developing standards and a central GIS database that all highway agencies can update in real time.
- Providing data parameters for agencies with more robust technology capabilities to provide data updates via a web service.
- Collaborating with GIS software vendors on best practices for the structure of a central GIS database.
- Collaborating with commercial mapping and navigation providers (Google Maps, Apple Maps and Waze smartphone applications) on developing a data standard that can be used by these providers to ingest closure data automatically in real time.
Detailed Findings

Systems for Notifying the Public of Local Road Closures Using Smartphone Map Applications

Introduction

The Local Road Research Board (LRRB) is seeking information that will inform development of a central repository for local and state road closure and traveler information. Data from this repository will be used to notify the traveling public about road network closures in real time using Google Maps, Apple Maps, Waze smartphone applications and/or the Minnesota 511 travel information database. Updates to the database will feed Google Maps, potentially through Waze, and Apple Maps to provide information about current road closures and road conditions to smartphone users. (Waze is a geographic information system (GIS) based roadway mapping and navigation application that includes crowdsourced and partner-provided data and provides driving directions, a live traffic map and road alerts.) Database updates may also appear on the state’s 511 traveler information database.

To inform this investigation, selected state and local transportation agencies were surveyed about their use of systems for notifying the public of road closures and reopenings through traveler information services. Follow-up contacts to selected survey respondents were then conducted along with a phone interview of a Florida Department of Transportation (DOT) representative. Also surveyed for this project was a representative from University of Maryland’s Center for Advanced Transportation Technology Laboratory (CATT Lab), which developed and maintains a web-based system of selected state and local road closure data. Findings from a limited literature search supplement these outreach efforts.

Background

Previous collaborations among Minnesota state and local agencies and private-sector partners can inform the current effort to develop a central repository for local and state road closure and traveler information. Representatives from Minnesota IT Service (MNIT), the Minnesota state information services agency that supports MnDOT and other state agencies, described two efforts that illustrate the successes and challenges of interagency collaboration:

- I-35W bridge collapse.
- Red River flooding.

I-35W Bridge Collapse

MnDOT, the city of Minneapolis and Esri, an international supplier of GIS software, teamed up following the August 1, 2007, collapse of the I-35W bridge in Minneapolis to develop Applications for Road Closures and Routing and Common Operating Picture for the I-35W Bridge Collapse. These web applications gathered and reported information on road conditions.

City and county staff, the public and first responders used the site to enter and share information on road closures and a range of other data. The web applications won a national award recognizing digital government initiatives (see Related Resources below).
**Red River Flooding**

In 2010, MnDOT faced flooding in the Red River area of northwestern Minnesota. MNIT and MnDOT developed a GIS web platform with Microsoft’s Silverlight application for use as a repository of information on flooded locations. Local agencies were invited to participate by email with information or a geospatial data file, or by entering road closure data on the map using a Silverlight editor provided by MNIT. This approach was used again in 2012 when flooding occurred in the same area. Flooding was the only road closure data point considered in these data collection and mapping efforts.

According to MNIT representatives, the Red River flooding mapping projects worked well for some counties, with some assigning a specific staff member to enter information using the Silverlight editor. Other counties did not have time to enter data or decided not to duplicate efforts already underway to maintain existing county map services.

**Lessons Learned**

Based on experience with the I-35W bridge collapse online application and Red River flooding mapping, MNIT representatives recommended the following when developing a shared local and state repository of road closure data:

- Establishing an effective collaborative process with all partner agencies.
- Getting information from authoritative sources.
- Working toward common goals.
- Accepting and working with imperfect data that may not be comprehensive.
- Recognizing that the effort cannot be an unfunded mandate.

**Related Resources**


https://www.mngeo.state.mn.us/committee/emprep/download/other/I35W_COP_Flyer.18JAN08.dxr.pdf

This publication provides a brief description and screen shots of the informational website collaboratively developed after the August 2007 I-35W bridge collapse.


https://www.mngislis.org/mpage/434

From the article: Minnesota won a 2008 award from NASCIO for Applications for Road Closures and Routing and Common Operating Picture for the I-35W Bridge Collapse.

Founded in 1969, the National Association of State Chief Information Officers (NASCIO) represents state chief information officers and information technology executives and managers from the states, territories and the District of Columbia.

The Minnesota project won the national award in the Digital Government: Government to Government category which recognizes digital government initiatives aimed at enhancing intergovernmental collaboration, cross-jurisdictional services and intergovernmental transaction processing. In response to the I-35W bridge collapse in Minneapolis, August 1, 2007, the project had developed web applications to quickly publish incident site
information to city staff and responders, and to communicate to the public how the bridge collapse would impact their transportation needs.

**Survey of Practice**

An online survey was distributed to members of the American Association of State Highway and Transportation Officials (AASHTO) GIS for Transportation Symposium. Transportation agencies from eight states participated in the survey:

- Arkansas
- Georgia
- Kansas
- Kentucky
- Maryland
- Ohio
- Vermont
- Wyoming

The University of Maryland CATT Lab representative also participated in this survey.

A separate survey of local agencies expected to have experience with reporting and maintaining local road closure data followed the state agency survey. Of the four local agencies contacted, only one—Harford County, Maryland—responded.

Survey questions are provided in Appendix A. The full text of survey responses is provided in a supplement to this report. Appendix B provides the contact information for survey respondents and key contributors.

None of the agencies participating in the survey maintains a comprehensive, real-time database of state and local road closures, although Wyoming DOT is working to create a comprehensive database of road closure data that includes local roads. Three state transportation agencies (Georgia DOT, Maryland DOT and Vermont Agency of Transportation); one local agency (Harford County); and the University of Maryland CATT Lab support systems that include some local road closure information but not statewide integration. Arkansas and Kansas DOTs maintain road closure information only for roads directly managed by the agencies (state highways). Ohio DOT does not maintain a central database of road closure information. Table 1 summarizes the road closure notification systems supported by survey participants and supplemental contacts.

<table>
<thead>
<tr>
<th>Category</th>
<th>State Agency or Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Includes State and Some Local Roads</td>
<td>Georgia, Maryland, Vermont, University of Maryland CATT Lab</td>
<td>See Systems Including Some Local Road Closure Data for system descriptions.</td>
</tr>
<tr>
<td>System Includes Only State Roads</td>
<td>Arkansas, Florida, Kansas</td>
<td>Arkansas. Recently the DOT began working with State Police to allow system access for the latter agency to enter road closure data from the state highway system along with the DOT’s traffic management center employees. The DOT is not considering implementing local road closures at this time. Florida. The state DOT provides traveler information for state-managed roads only through its 511 travel information website and a 511 mobile app. (See page 21 for further details.) The agency has considered an integrated system reflecting state and local road closures, but has no immediate plans to develop it.</td>
</tr>
</tbody>
</table>

*Appendix A* 

*Appendix B* 

* Systems Including Some Local Road Closure Data
<table>
<thead>
<tr>
<th>Category</th>
<th>State Agency or Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing a System for State and Local Road Closures</td>
<td>Wyoming</td>
<td>The agency is developing a system under a U.S. DOT pilot project that shares road condition and other traveler information using connected vehicles, the Sirius XM streaming radio service and roadside beacons. The pilot project does not include local road closure data.</td>
</tr>
<tr>
<td>Agencies Relying on Waze for Real-Time Traffic Updates</td>
<td>Kentucky</td>
<td>Waze describes Kentucky’s GoKY web-based 511 system as using Waze as its “core reporting and data pool.” See page 21 for further details of Kentucky’s system.</td>
</tr>
<tr>
<td>No System</td>
<td>Ohio</td>
<td>Ohio DOT’s traffic operations team recently initiated a project to develop a detour database for state routes. Cataloging local road closures is not currently within that scope.</td>
</tr>
<tr>
<td>Interest in Pooled Fund to Develop a System</td>
<td>Kansas, Ohio</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Below is a discussion of survey results, information from supplemental contacts and additional research in the following topic areas:

- Systems including some local road closure data.
- Systems not reporting on local road closures.
- System in development.
- Other data-sharing applications.
  - Geographic Roadway Inventory Tool.
  - Waze for Cities (formerly Waze Connected Citizens Program).

**Systems Including Some Local Road Closure Data**

Four agencies—Maryland DOT, University of Maryland CATT Lab, Georgia DOT and Vermont Agency of Transportation—support systems that include some local road closure data and allow some local agency engagement. Below are summaries of the key attributes and functions of these four systems. Information provided in these summaries varies based on the level of detail provided by survey respondents and the public information available that supplements the survey responses. Following each summary is a Related Resources section that includes publications and other resources that were provided by the respondent or sourced through a limited literature search.

**Maryland Department of Transportation State Highway Administration**

Maryland’s Road Closure Reporter is described as a “tool for Maryland’s local jurisdictions to submit and manage authoritative road closures.” Details of this road closure system are provided in Table 2; this discussion was informed by survey responses from Maryland DOT State Highway Administration (SHA) and Harford County, Maryland, and follow-up interviews with a consultant assisting Maryland DOT with its reporting system and with the Harford County respondent.
### Table 2. System Description: Maryland’s Road Closure Reporter

<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Description</th>
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</table>
| **System Description** | Maryland’s Road Closure Reporter (MRCR) ([geo.sha.maryland.gov/mdrc](geo.sha.maryland.gov/mdrc)) is a web-based system and application that local road jurisdictions use to capture road closure events. Maryland DOT SHA hosts and administers the application and has established a relationship with Waze to share data. **Participants**

As of April 2019, eight counties (including Harford County, a survey respondent for this project) and three cities participated in MRCR; work is underway to bring Baltimore City and four other counties online. **Public Access**

The MRCR user’s guide indicates that the system is not designed to be a public-facing viewer or analytical tool for the data captured. Instead, this is done through the consumption of the data via various access points. (While not designed as a public-facing viewer, an MRCR data demonstration site does provide current data on road closure events entered by participating local agencies; see Related Resources for a link to this demonstration site.)

Access points for local road closure data include local GIS maps maintained by MRCR participants and a statewide GIS map supported by Maryland Emergency Management Agency (OSPREY (Operational and Situational Preparedness for Responding to an Emergency) Public; see Related Resources). **Map Details**

Each map presenting local road closure data includes an icon for each closure. Users may click on the icon for closure details, including the name of the road, its accessibility, and the start and end dates for the closure. **Data Sources**

Local agency representatives enter data with a desktop or smartphone. **Data Updates**

A local jurisdiction can only enter closure information for roads in its jurisdiction using a batch roadway submission. Events auto-expire or are “retired,” and future events can be entered. MRCR also permits a mobile workflow and offers entry in “storm mode,” after action reporting and an email notification system. See Related Resources for an April 2019 presentation that provides examples of these notifications. **Updating the System**

- **Local updates.** Harford County enters its closure data several times a week, including road closures due to construction, storm or other event. Data entered includes date of closure, anticipated reopening date, type of closure (construction, flooding or special event such as a parade), and affected road segments.

  Local agencies receive an email from the MRCR team after creating, editing or ending a road closure. These emails provide information about the closure and a link to view the closure in the MRCR public-facing demonstration application.

- **Statewide updates.** MRCR is updated as frequently as local agencies enter data. The state DOT SHA respondent noted that this data updates “instantly” on Waze; the
<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Description</th>
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<tbody>
<tr>
<td>Harford County respondent</td>
<td>Harford County respondent has never checked the timing of Waze updates. Maryland DOT SHA has identified no differences in update times for closures and reopenings.</td>
</tr>
<tr>
<td>Advanced Closure Attributes</td>
<td>Partial closure, specific times of day, reason for closure, lanes, limited access.</td>
</tr>
<tr>
<td>Engaging With Commercial Apps</td>
<td>MRCR has a relationship with Waze for bidirectional data sharing. Data is provided via map and data services and through automated email notifications of closures. Maryland GIS is part of the Waze for Cities program. See page 23 for information about this program.</td>
</tr>
<tr>
<td>Local Agency Submission of Data</td>
<td>Local agencies use the MRCR interface to enter data.</td>
</tr>
<tr>
<td>Engaging With Local Agencies</td>
<td>Maryland DOT SHA encourages local agency use by promoting the mutual benefits of data sharing and by providing local governments with direct access to the data they submit. This level of engagement encourages ownership of the data and the system.</td>
</tr>
<tr>
<td>Archiving Data</td>
<td>Archived data is openly available.</td>
</tr>
<tr>
<td>System Development</td>
<td>Harford County was one of six counties participating as local partners in MRCR’s development. The Harford County respondent noted that local partners worked hand in hand with Maryland DOT SHA in developing MRCR to address all county needs. Those involved in system development attempted to keep data entry simple so information could be entered in the field on mobile devices by people with a range of computer skills.</td>
</tr>
<tr>
<td>Interaction With 511</td>
<td>The Maryland DOT SHA GIS consultant noted that MRCR does not feed data to the state’s 511 system, but the state’s 511 system may have a relationship with Waze. He added that travelers appear to be making greater use of Waze, Google Maps and similar private-sector platforms than the agency’s 511 system.</td>
</tr>
<tr>
<td>Future Plans</td>
<td>According to information in an April 2019 presentation (see Related Resources), local jurisdiction outreach and training continues. Maryland DOT SHA administrators are continuing to establish and provide login credentials to local users as requested and are working with agencies such as Maryland DOT SHA’s Coordinated Highways Action Response Team (CHART) on data consumption and utilization issues. Also planned was a migration to Geocortex Workflow 5, described as a tool “that allows web map developers to quickly and efficiently create complex user interfaces and geoprocessing tasks.” See Related Resources for more information about this tool.</td>
</tr>
</tbody>
</table>
| Contacts                           | Craig Mackowiak  
Chief, Data Governance Division  
Office of Planning and Preliminary Engineering  
Maryland Department of Transportation State Highway Administration  
410-545-5524, CMackowiak@mdot.maryland.gov  
Marshall Stevenson  
Consultant, GIS Program Management Support  
Maryland Department of Transportation State Highway Administration  
410-545-5531, MStevenson@mdot.maryland.gov |
### Related Resources

**Maryland’s Road Closure Reporter**, Maryland Department of Transportation State Highway Administration, undated.

[https://geo.sha.maryland.gov/mdrc](https://geo.sha.maryland.gov/mdrc)

Local agencies log in to MRCR at this site to enter local road closure data.

**Harford County Road Closures**, Road Reports, Harford County, Maryland, undated.

[http://harfordgis.maps.arcgis.com/apps/webappviewer/index.html?id=cd481d571a054f0a90d7d36e4c516756](http://harfordgis.maps.arcgis.com/apps/webappviewer/index.html?id=cd481d571a054f0a90d7d36e4c516756)

Harford County’s current and planned road closures are noted on this map using data that was originally entered into MRCR.


[https://geodata.md.gov/ospreypublic/](https://geodata.md.gov/ospreypublic/)

This interactive map presents information about current road conditions. When users enter an address, the map will automatically zoom into that location for a more detailed view of the area. The Layers tool allows users to include reported local road closure locations and reported local road closure segments (data entered using MRCR).

**Map Services: SHA_RoadClosure**, ArcGIS REST Services Directory, Version 10.7, Maryland’s Road Closure Reporter, Maryland Department of Transportation State Highway Administration, undated.

[https://geodata.md.gov/appdata/rest/services/SHA_RoadClosure](https://geodata.md.gov/appdata/rest/services/SHA_RoadClosure)

This site provides details of three map services associated with MRCR:

- SHA_RoadClosure/RoadClosureActive (MapServer).
- SHA_RoadClosure/RoadClosurePlanned (MapServer).
- SHA_RoadClosure/RoadClosurePublic (MapServer).

According to the MRCR user’s guide cited below, these map services present the information captured in MRCR as an “approved ‘Public’ filtered road closures version of the database with both active and past closure events.”


See [Appendix C](#).

This presentation provides a high-level overview of the MRCR, a description of participating partners and next steps for the system.

**Maryland’s Road Closure Reporter User’s Guide**, Maryland Department of Transportation State Highway Administration, updated November 2018.


Information and illustrations in this guide help users to navigate the site; create, edit and end road closure events; and access data services. *From the guide:*
The Maryland Road Closure Reporter application has been established as a unified web-based application for local jurisdictions to capture, publish and consume road closures events across the State of Maryland. The application is in no way intended to be a viewer or analytical tool for the data captured, as this should be done through the consumption of the data via its various access points as stated later in this document. The road closure events captured in the database are date and time stamped and stored in the database for historical reference and analysis.

**Maryland Road Closure Reporter**, MD iMAP, Maryland Department of Information Technology, April 2019. [https://data.imap.maryland.gov/datasets/4c8c8439a4a046cddbb9e248ee8f9eccf](https://data.imap.maryland.gov/datasets/4c8c8439a4a046cddbb9e248ee8f9eccf)

*From the website:*

Maryland’s Road Closure Reporter is a tool for Maryland’s local jurisdictions to submit and manage authoritative road closures.

A 2016 conference announcement offered the following description of this tool:

Maryland’s Road Closure Reporter is a free web-based application built and provided by SHA in partnership with the Maryland Department of Information Technology for Maryland’s local jurisdictions. The purpose of the application is to provide a consistent statewide tool for local jurisdictions to easily and authoritatively submit, manage, disseminate, track and archive road closure events for their jurisdiction as they deem necessary.

A data demo site is available at [https://maryland.maps.arcgis.com/apps/webappviewer/index.html?id=dd8df89e5d604ea4a8f36cf20cd394ec](https://maryland.maps.arcgis.com/apps/webappviewer/index.html?id=dd8df89e5d604ea4a8f36cf20cd394ec).


Geocortex Workflow is used in MRCR to develop and maintain mapping applications. This technology allows users to easily and efficiently model, streamline and automate complex business processes with step-by-step workflows that can be saved and shared in ArcGIS, and are available to work crews without access to network connectivity. *From the website:*

- **Activity library**
  Avoid writing code to build custom widgets: choose from a library of over 200 pre-built activities that chain together to automate almost any task.

- **Designer**
  Building workflows is easy with the web-based Geocortex Workflow Designer. Simply sign in, drag and drop activities into the design area, then save and share in ArcGIS Online or Portal.

- **Offline**
  Your workflows are available in Geocortex Mobile, keeping your team productive even without network connectivity.

- **Forms**
  Lay out your own forms to capture the information you want.

**University of Maryland Center for Advanced Transportation Technology Laboratory**

The University of Maryland’s CATT Lab developed and maintains TrafficView, a web-based system that includes selected state and local road closure data. Details of this system are provided in Table 3 and were informed by
the CATT Lab survey response, feedback from follow-up contacts with the lab’s director and independent research.

### Table 3. System Description: TrafficView

<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Description</strong></td>
<td>TrafficView (<a href="http://trafficview.org">trafficview.org</a>) is a web-based system of state and local road closure information posted on a traveler information map service. The system is free to organizations that subscribe to the CATT Lab’s Regional Integrated Transportation Information System (RITIS), an operations and planning transportation data gathering and analytics system. See page 17 for further details about RITIS.</td>
</tr>
</tbody>
</table>
| **Data Sources**    | TrafficView draws data from a variety of information technology data sources, including:  
  - Advanced traffic management system (ATMS) platforms.  
  - Computer-aided dispatch feeds from state and local police departments.  
  - Lane closure permitting systems.  
  - Third-party private sector data providers.  
  - Waze.  
  - Application programming interface (API).  
  - File transfer protocols (FTPs).  

Data is ingested into the RITIS platform and shared with other agencies and the public through a centralized API and the TrafficView website (see Related Resources below).  

Most of the local data comes from cities and metropolitan areas rather than county road agencies (see Engaging With Local Agencies below). |
| **Data Updates**     | Typically, online data sources send updates every minute or every five minutes; TrafficView updates once per minute. The RITIS API updates in real time as data arrives.  

CATT Lab has not tested the latency of third-party traveler information service providers and does not know how quickly new closure data appears on those sites. |
| **Advanced Closure Attributes** | Some data sources provide closure data on a schedule and then make the lane closure active through the agency’s ATMS platform. Some only provide point location data, and others provide segment-based location data. While some data sources provide per-lane information, others only indicate “one lane closed” and do not specify which lane is closed.  

CATT Lab director Michael Pack noted that “[d]ealing with so many different data representations and providing them to the public in a standardized way is a challenge.” |
<p>| <strong>Smartphone App</strong>   | TrafficView is a web service and does not feature a smartphone application or voice reporting. |
| <strong>Engaging With Commercial Apps</strong> | TrafficView publishes or provides data to other traffic information providers—including Waze, the media, Google Maps and Sirius FM—via access to the RITIS API. Pack noted that Apple Maps may use TrafficView data, presumably through a third party. |</p>
<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Agency Submission of Data</td>
<td>Local agencies can submit data to TrafficView. Data is also gathered automatically by TrafficView from available local data sources. The system does not feature a front end for participants to use for entering data.</td>
</tr>
<tr>
<td>Engaging With Local Agencies</td>
<td>A TrafficView API (<a href="https://trafficview.org/developers">trafficview.org/developers</a>) is available for public sector agencies and organizations wishing to use the data. Interested users are directed to click on the Request API Key button at the top right side of the screen to get started. Pack indicated that most of the local data ingested into the RITIS platform comes from cities and metropolitan areas rather than county road agencies. Rural agencies, he noted, don’t often have an information management system or available staff to produce this data, which is one reason police dispatch feeds can be valuable. Pack also said that “[t]he more public an agency’s information becomes, the more visible it is. When data is old or inaccurate or missing, the public (and neighboring agencies and partners) notice. Visibility is a great motivator.”</td>
</tr>
<tr>
<td>Archiving Data</td>
<td>Every piece of data sent to RITIS is archived indefinitely (including openings). Separate tools are available only to agencies that allow for review and analysis of historical data.</td>
</tr>
<tr>
<td>Other Partners</td>
<td>TrafficView state agency partners include Connecticut, Delaware, Florida, Georgia, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Vermont and Virginia (see <a href="https://trafficview.org/partners/">trafficview.org/partners/</a>).</td>
</tr>
<tr>
<td>Recommendations</td>
<td>Pack recommended starting with a state road network, and then adding large cities and using crowdsourced data feeds like Waze data. He suggested adding local agencies as they recognize the value of the service and develop data production capabilities.</td>
</tr>
</tbody>
</table>
| Contact                 | Michael Pack  
Director, Center for Advanced Transportation Technology Laboratory  
University of Maryland  
260-676-4060, PackML@umd.edu |

**Related Resources**

**TrafficView**, Center for Advanced Transportation Technology Laboratory, 2020.  
[https://trafficview.org](https://trafficview.org)  
Users log in to TrafficView at this website. Map views include live incidents and events, future construction and special events, and weather radar and alerts.

[https://www.baltometro.org/sites/default/files/bmc_documents/committee/minutes/timbr/TIMBR180315min.pdf](https://www.baltometro.org/sites/default/files/bmc_documents/committee/minutes/timbr/TIMBR180315min.pdf)  
These meeting minutes highlight issues that may be relevant to the current LRRB project, including:

- **From page 3 of the minutes**: A pending state of Maryland agreement with the Waze Connected Citizens Program (now Waze for Cities) that may allow for the inclusion of Waze data related to state and local road closures in RITIS (see citation below for information about RITIS).
From page 4 of the minutes: A suggestion to try to use RITIS for local road closures using the RITIS input tool that was in the test phase at the time of the meeting.

RITIS, Center for Advanced Transportation Technology Laboratory, University of Maryland, 2019. https://www.cattlab.umd.edu/?portfolio=ritis

From the website: The Regional Integrated Transportation Information System (RITIS) is an automated data sharing, dissemination and archiving system that includes many performance measure, dashboard and visual analytics tools that help agencies to gain situational awareness, measure performance and communicate information between agencies and to the public. RITIS automatically fuses, translates and standardizes data obtained from multiple agencies in order to provide an enhanced overall view of the transportation network. Participating agencies are able to view transportation and related emergency management information through innovative visualizations and use it to improve their operations and emergency preparedness. RITIS also uses regional standardized data to provide information to third parties, the media and other traveler information resources including websites, paging systems and 511.

RITIS Features

There are three main RITIS components including

1. real-time data feeds,
2. real-time situational awareness tools, and
3. archived data analysis tools.


This recorded presentation offers a high-level overview of the real-time operations tools within the RITIS platform. Not included is a discussion of the historical analytics tools that are embedded within RITIS.

Georgia Department of Transportation

In Georgia, local agencies can enter data about local road closures into the state DOT’s ATMS for display in the statewide 511 traveler information services and road closure application, NaviGAtor 511.

Georgia DOT also exchanges data with Waze in connection with its 511 application. The agency announced its NaviGAtor 511 partnership with Waze in November 2012. In 2016, Georgia DOT emphasized the bidirectionality of its relationship with Waze in announcing partnership with the Waze Connected Citizens Program (now Waze for Cities), a service that Waze began in 2014 to establish closer working relationships with transportation agencies. Table 4 briefly describes NaviGAtor 511 using information drawn from survey responses and independent research.

Table 4. System Description: NaviGAtor 511

<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Description</td>
<td>Road closure information is provided to the public through the NaviGAtor 511 website (<a href="http://511ga.org">511ga.org</a>), which was developed and is maintained by a consultant (Iteris). The 511 website offers email and text alerts to the subscribing public.</td>
</tr>
<tr>
<td>Data Updates</td>
<td>The agency has not measured the frequency of data updates.</td>
</tr>
<tr>
<td>Topic Area</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Advanced Closure Attributes</td>
<td>Georgia DOT specifies the number of lanes blocked, start time and end time; subscribers with a user account can access an XML file with all event data.</td>
</tr>
<tr>
<td>Smartphone App</td>
<td>Applications include Georgia 511 and Atlanta Traffic, via iTunes or Google Play; see 511ga.org/mobile.</td>
</tr>
<tr>
<td>Engaging With Commercial Apps</td>
<td>Waze is identified on the NaviGAtor 511 map legend as a source for accident, congestion, hazard and shoulder events; a pop-up offers to connect users to Waze.</td>
</tr>
<tr>
<td>Local Agency Submission of Data</td>
<td>Georgia DOT provides local agencies free use of its statewide ATMS software. Entering data about local road events or closures is at the discretion of local agencies.</td>
</tr>
<tr>
<td>Archiving Data</td>
<td>All data in the Georgia DOT system is archived for four years, including proposed and actual start and end times.</td>
</tr>
<tr>
<td>Other Sources for Closure Data</td>
<td>Georgia DOT is a TrafficView partner that brands TrafficView as part of its own 511 service; see 511ga.org/trafficview/. The TrafficView link is not prompted or clearly listed on the NaviGAtor 511 home page, so its use is unclear.</td>
</tr>
</tbody>
</table>
| Contact                           | Mark Demidovich  
Assistant State Traffic Engineer  
Georgia Department of Transportation  
404-635-2838, MDemidovich@dot.ga.gov |

**Related Resources**


While the survey respondent did not report it, a search of relevant literature identified this publication that describes the planned replacement of NaviGAtor. *From the online post:*

Kapsch TrafficCom (Kapsch) has been selected by the Georgia Department of Transportation (GDOT) to design and implement a statewide Advanced Traffic Management System (ATMS). The new ATMS will serve as the foundation for the state’s intelligent transportation system (ITS) applications, and replace the existing NaviGAtor system that has been in place since 1996.


*From the press release:* Georgia Department of Transportation today announced a data-sharing partnership with Waze, the free, real-time crowdsourced navigation app powered by the world’s largest community of drivers. Designed as a free, two-way data share of publicly available traffic information, the Connected Citizens Program will promote greater efficiency, deeper insights and safer roads for citizens of Georgia, as it does for nearly 80 partners around the world. The partnership provides real-time, anonymous, Waze-generated incident and slowdown information to Georgia DOT directly from the source: drivers themselves. In exchange, Georgia DOT provides real-time construction, crash and road closure data to Waze. This will result in a succinct, thorough overview of current road conditions.

From the press release: Waze, a crowd-sourced social GPS and real-time traffic application for iOS and Android phones, will provide enhanced traffic data to the current 511 system, and create a special 511 user group, specifically for Georgia travelers, within the existing Waze mobile app.

Vermont Agency of Transportation

Vermont Agency of Transportation worked with partners in New Hampshire and Maine and the team’s consultant, Southwest Research Institute, to develop New England Compass 511, the region’s 511 traveler information service. New England Compass 511 is a modular software solution implemented in 2016 by these three states in connection with their intelligent transportation system programs. Table 5 describes the 511 system using information drawn from the survey responses.

### Table 5. System Description: New England Compass 511

<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Description</td>
<td>New England Compass 511 (<a href="http://newengland511.org/">newengland511.org/</a>), developed by Southwest Research Institute, includes some local road closure information but does not offer statewide integration. The system provides road closure data to Waze. The agency also publishes road closure data through social media accounts on Facebook (<a href="http://www.facebook.com/VTransontheroad/">www.facebook.com/VTransontheroad/</a>) and Twitter (<a href="http://twitter.com/511VT">twitter.com/511VT</a>), and through VT-ALERT (<a href="http://vem.vermont.gov/vtalert">vem.vermont.gov/vtalert</a>), an emergency messaging program that pushes text, email and call notifications.</td>
</tr>
<tr>
<td>Data Sources</td>
<td>The agency’s ATMS cannot easily create closure events on local roads. The agency manages select closure data for high-volume local roads, depending on the potential effects on the driving public. Each road has to be individually configured in the database based on intersection location. This process is considered to be too costly to execute for all local roads, and without a reliable way to manage the closing and reopening of local roads, the agency has not considered a broader approach to entering local road closure data.</td>
</tr>
<tr>
<td>Data Updates</td>
<td>Data is updated approximately every five minutes for Waze (if agency staff doesn’t update it) and every 10 to 15 minutes for Google Maps. Changes to the Waze map are posted whenever agency staff edits the map. The agency has identified no difference in response time for data about reopenings.</td>
</tr>
<tr>
<td>Advanced Closure Attributes</td>
<td>Attributes are determined on a case-by-case basis. For example, construction projects may be described as “[S]ingle lane closures expected Monday-Saturday daytime only.” If a crash closes a road, the agency will push notifications when a single lane opens before all lanes are open. (Note: In general, if an incident closes a single lane, the agency does not issue push notifications, but may do so depending on incident location.)</td>
</tr>
<tr>
<td>Engaging With Commercial Apps</td>
<td>Traffic management center (TMC) staff has editing rights in the Waze map editor. Waze volunteer map editors (area managers) monitor the New England Compass 511 website and often enter the closure in the application before TMC staff. Closures appearing in Waze also appear in Google Maps.</td>
</tr>
<tr>
<td>Topic Area</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Local Agency Submission of Data</td>
<td>The agency’s ATMS does not allow local agencies to create closure events on local roads.</td>
</tr>
<tr>
<td>Engaging With Local Agencies</td>
<td>During large-scale emergencies that close many roads, district staff responsible for collecting data will assist towns in gathering information for the Federal Emergency Management Agency.</td>
</tr>
<tr>
<td>Archiving Data</td>
<td>Data is archived on the vendor’s servers. Agency staff can access this information for reports.</td>
</tr>
<tr>
<td>Future Plans</td>
<td>The agency has initiated changes to its program’s basemap, which is an important step in being able to post local road closures.</td>
</tr>
</tbody>
</table>
| Contact                     | Ryan Knapp  
Transportation Management Center Supervisor  
Vermont Department of Transportation  
802-828-5663, Ryan.Knapp@vermont.gov |

**Related Resources**

This website is the public-facing 511 system for Maine, New Hampshire and Vermont.

**Vermont Alert (VT-ALERT)**, Vermont Emergency Management, Vermont Department of Public Safety, undated.  
[https://vem.vermont.gov/vtalert](https://vem.vermont.gov/vtalert)  
*From the website:* VT-ALERT is used by the state and local responders to notify the public of emergency situations. Those include, but are not limited to, evacuation information; chemical spills; shelter-in-place alerts; severe weather advisories; boil water advisories; and roadway interruptions. Residents can tailor the alerts to specific locations, types of alerts and on which devices they will be notified.

**NE Compass:** Tri-State Advanced Traffic Management System/Traffic Information System (ATMS/ATIS) Software Platform, MobilityTech, LLC, undated.  
*From the website:* The New Hampshire Department of Transportation, along with the Vermont Agency of Transportation and Maine Department of Transportation, deployed a new modular software solution in 2016 for their respective ITS [p]rograms. The New England Compass system consists of three major components:

- An Advanced Transportation Management System that includes an Event Management Module, monitoring and control of ITS field devices, provides automated incident response scenarios that will streamline notification, detection and verification of an incident, and provides a robust performance management system to report, manage and review incidents and events.
- A Regional Traveler Information System (TIS) that provides a traveler information website and email/text alerts subscription service, [http://www.newengland511.org](http://www.newengland511.org) and;
- Data Fusion Hub that primarily facilitates the exchange of information between the ATMS, the 1201 data feed to the private sector, the TIS and regional partners and stakeholders.
**Systems Not Reporting on Local Road Closures**

Florida DOT and Kentucky Transportation Cabinet maintain systems that do not report on local road closures. Both agencies have developed a relationship with Waze to provide real-time traffic updates about state roads. Brief descriptions of these systems are provided below using information drawn through an interview (Florida DOT) or survey responses (Kentucky Transportation Cabinet).

**Florida**

Florida DOT provides traveler information for state-managed roadways only using its 511 website and a 511 mobile application. Data is drawn from standard traffic operations and management sources; Florida participates in the Waze for Cities program. Florida DOT has a bidirectional data-sharing relationship with Waze; the agency receives a data feed from Waze, and Waze draws data from the Florida DOT API. When Florida DOT receives the data feed, the agency removes some crowdsourced information from the feed before including the Waze data with its own road closure data for posting on its API. Florida’s 511 system coordinator indicated that the topic of a state and local integrated data repository and traveler service has been considered but the agency has no immediate plans to develop such a system.

The Florida 511 Mobile (FL511) smartphone application offers a range of features, including mapping, navigation, voice interaction, real-time closure information, functional speeds and incident information.

**Related Resource**

*Note:* Additional information about Florida DOT’s partnership with Waze appears in [Partnerships Between State Agencies and Map Application Providers](#); see page 27.

**Florida 511 Mobile App,** Florida Department of Transportation, September 2019.  

This brochure details the features and services of the Florida 511 Mobile application for Android and Apple smartphone users.

**Kentucky**

In November 2016, Kentucky Transportation Cabinet shifted its 511 travel and weather information system from a phone-based system to a web-based interface—GoKY—after identifying a significant decline in the public’s use of the phone-based system. This traffic and roadway information portal offers details about traffic alerts, construction activity and road weather conditions. Users are directed to download Waze to view real-time traffic updates and road navigation. Waze describes Kentucky’s GoKY 511 system as using Waze as its “core reporting and data pool.”

**Related Resources**

*GoKY, Commonwealth of Kentucky, 2020.*  
[https://transportation.ky.gov/sites/GoKY/home](https://transportation.ky.gov/sites/GoKY/home)

The homepage for the GoKY site includes a prompt to download the Waze application for real-time traffic information and navigation.
https://www.waze.com/ccp/casestudies/improving_5_1_1_to_incorporate_real_time_crowdsourced_driver_insights

From the online post: In November 2016, KYTC [Kentucky Transportation Cabinet] revamped its current 5-1-1 infrastructure to use Waze as its core reporting and data tool, improving response times and saving the department time and costs.

Impact:

- $500,000+ tax dollars saved using free Waze app & tools.
- <30 minutes of staff time saved per report.


This online article describes the “improved, user-friendly platform” employed by GoKY that uses data from the Kentucky Transportation Cabinet and Waze to provide travelers with access to reliable, up-to-date information regarding traffic conditions, construction activity and road weather conditions.

System in Development

Wyoming DOT is developing a system under U.S. DOT’s Connected Vehicle Pilot Deployment Program that will share road condition and other traveler information with a subset of drivers.

Wyoming

Wyoming DOT is developing a system under U.S. DOT’s Connected Vehicle Pilot Deployment Program that communicates road information and alerts to motorists in near real-time time. The agency is working with a multidisciplinary team to develop a system that pushes road condition and other traveler messages using vehicle-to-vehicle communications, delivering messages using a combination of the Sirius XM streaming radio service and roadside beacons. The system in development does not currently include local road closure data, and there are no plans to include it under the pilot project.

The system in development uses the U.S. DOT-sponsored Situation Data Warehouse (SDW), an open source data exchange system in a cloud environment that allows users to deposit situational data and facilitates nationwide data sharing. Wyoming DOT’s pilot vehicle safety program collects and shares mobile and roadside data with drivers. Vehicle data such as vehicle location, heading and acceleration is collected from connected vehicles by Wyoming DOT’s Traffic Management Center and then shared with various entities, including the SDW. Roadside alerts and travel guidance provided through the system include collision advisories, work zone warnings and road condition reports.

Related Resources

https://wydotcvp.wyoroad.info/

This website provides a wealth of information about the agency’s pilot project to “test and deploy advanced dedicated short-range communication (DSRC) technology to improve safety and mobility.”
From the website:

WYDOT [Wyoming DOT] has adapted the code for the USDOT’s Operational Data Environment (ODE), originally written to collect data from a connected vehicle testbed in Detroit, to process and distribute messages received from connected vehicles in the Wyoming CV Pilot program. The Basic Safety Messages transmitted by equipped cars and trucks contain vehicle location, heading, acceleration, and other vehicle status data, and are transmitted using Abstract Syntax Notation (ASN.1) to minimize radio bandwidth for the messages. WYDOT’s ODE contains an open source decoder for ASN.1, expanding the messages into easily-readable JSON (JavaScript Object Notation) used by the Wyoming TMC and many other TMCs.

Road weather and road condition information collected by the Wyoming CV System is ingested into and processed by the Pikalert system for dissemination to the public.

Other Data-Sharing Applications

Briefly described below are two data-sharing applications used by transportation agencies to gather, monitor or share travel-related and roadway data:

- Geographic Roadway Inventory Tool.
- Waze for Cities.

Geographic Roadway Inventory Tool

Geographic Roadway Inventory Tool (GRIT) is a web map-based roadway inventory application used by counties in North Dakota and Minnesota for various mapping, planning and data-sharing activities. Participating counties enter pavement construction and planning data—including planned construction and maintenance projects that involve road closures—and GRIT generates pavement condition forecasts and maps. A pavement condition forecasting module recently developed for GRIT automatically updates the inventory of Minnesota county agencies with MnDOT-collected roadway condition and traffic data.

It does not appear that the application is widely used to update and share local road closure data. While North Dakota DOT, a GRIT user, allows local agencies to enter load restriction data in GRIT, the agency has no current plans to encourage local agencies to enter road closure data or create an API that draws information from GRIT into a North Dakota DOT traveler information data repository or information service.

Related Resource

Asset Inventory Toolkit, Upper Great Plains Transportation Institute, North Dakota State University, undated. https://www.ugpti.org/resources/asset-inventory/

This website provides access to videos and webinars describing key elements of GRIT.

Waze for Cities (Formerly Waze Connected Citizens Program)

Waze’s no-cost Connected Citizens Program, introduced in 2014, encouraged closer, bidirectional data sharing with agencies. Through this program, Waze provides partners with traffic incident and congestion data, and
participating agencies provide Waze with data on anticipated closures, rerouting information and similar data. This program, now known as Waze for Cities, has grown to more than 1,000 global partners.

The frequently asked questions portion of the Waze for Cities website describes the resources available to partners:

- Partners have access to an exclusive tool for inputting road closures and surfacing major traffic events or emergencies. Partners are also invited to join a partner-only online forum that serves as a hub of collaboration and a space to discuss both strategic and operational issues.

**Related Resources**


*From the website:* Cities use Waze’s data to inform mobility projects and policies, from congestion pricing to event-specific traffic control, as well as share their own information about street closures or construction directly with their citizens on a daily basis. Partners can choose to access this data via Google Cloud.


*From the online article:* Waze for Cities data, formerly known as the Connected Citizens Program, launched in October 2014 with 10 city partners and has now grown to more than 1,000 partners globally. The free, collaborative program makes use of mobile technology and crowdsourced traffic data to empower municipalities and first responders to improve their existing city infrastructure. By hosting the information on the web-accessed platform, Waze’s partners will now be able to review and analyze travel and traffic patterns, creating visualizations using the Google Cloud’s suite of tools for the first time.

**Related Research**

Below are the results of a limited literature search about the development and use of a central repository of local and state road closure data. Citations are organized into the following topic areas:

- National research and practice.
- State research and practice.
- Partnerships between state agencies and map application providers.

**National Research and Practice**


*From the abstract:*

The goal of this study was to review and synthesize information about travelers’ information needs and current practices for information dissemination related to nonrecurring events. Researchers identified, reviewed and synthesized academic literature, practitioner reports and best practices for information provision related to nonrecurring events. This report discusses user needs, best practices, data collection
and information dissemination technologies, and knowledge gaps. Case studies and information dissemination strategies are also provided.

Chapter 3 summarizes agency practices and dissemination methods, emerging technologies and trends; a discussion of data collection technology and mobile devices begins on page 16 of the report (page 24 of the PDF). Chapter 4 highlights common challenges and issues with implementing traveler information dissemination strategies for nonrecurring events, and includes features recommended by travelers (beginning on page 31 of the report, page 39 of the PDF).

Two case studies examine traveler information dissemination practices in several states (beginning on page 35 of the report, page 43 of the PDF). The first case study reviews mobile applications used by MnDOT, Georgia DOT and Washington State DOT to inform travelers about a variety of traffic disruptions, including road construction and weather-related road conditions. The second case study addresses a comprehensive rural intelligent transportation system (ITS) that provides traffic information to travelers in Wyoming.

Appendix B (page 51 of the report, page 59 of the PDF) lists a sampling of mobile applications from state DOTs and regional agencies. (Source information for these agencies and applications is available in the report’s references section.)


From the abstract:

Often, the center of an agency’s traveler information system is a Road Condition Reporting System (RCRS) ... populated by manual and automated data and information feeds, supplying information to various information dissemination mechanisms. While the potential benefits of an RCRS are obvious, there are also costs associated with the development, management and support of the software system as well as costs associated with the operator time to perform entry. The benefits and costs are impacted by many institutional and technical issues that operations managers must face. This report presents a synthesis of current industry practices regarding the design, development, operation, maintenance and use of RCRSs. This report compiles information received through a survey and interviews with transportation agencies throughout North America to understand the uses of RCRSs and to identify industry practices that have delivered benefits to the agencies operating RCRSs.

Industry practices for the use of traveler information websites to notify the public about construction, roadwork, traffic incidents and road weather information are discussed in Chapter 2 (beginning on page 13 of the report, page 19 of the PDF), with examples from state and local transportation agencies. Also included in the report are best practices implemented by transportation agencies, including the integration of lane closure databases into RCRS (beginning on page 60 of the report, page 66 of the PDF) and automatic entry of weather data into RCRS, including data from road weather information systems, the National Weather Service and other weather reports (beginning on page 59 of the report, page 65 of the PDF). Example success stories from state and local transportation agencies are included.
State Research and Practice

Iowa

Citation at https://trid.trb.org/view/1495833
From the abstract: This research studied crowdsourced data from a smartphone navigation application called Waze to identify the characteristics of this social sensor and provide a comparison with some of the common sources of data in traffic management. Moreover, this work quantifies the potential additional coverage that Waze can provide to existing sources of the advanced traffic management system (ATMS). One year of Waze data was compared with the recorded incidents in Iowa’s ATMS in the same time frame. Overall, the findings indicated that the crowdsourced datastream from Waze is an invaluable source of information for traffic monitoring with broad coverage (covering 43.2% of ATMS crash and congestion reports), timely reporting (on average 9.8 minutes earlier than a probe-based alternative) and reasonable geographic accuracy.

Michigan

From the news release: The Michigan Department of Transportation (MDOT) has launched its newly designed Mi Drive construction and traffic information website. With motorists in mind, the streamlined Mi Drive website makes it even easier to view traffic cameras and speeds, locate incidents, and search construction projects — helping motorists know before they go. Inside the new Mi Drive website, motorists will be able to turn on layers on the map that show speeds, construction, cameras, incidents, snowplow/maintenance vehicles, and truck parking locations and information on state highways. Motorists also can favorite their most-used cameras for easy viewing. New traffic lists make it simple for motorists to search and sort construction, camera and truck parking information, as well as having the option to go to that information directly on the map. Resource links allow motorists to sign up to receive MDOT traffic alerts via e-mail or text, report potholes on state trunklines, and locate carpools, rest areas and roadside parks.

Wisconsin

From the article:

More help, free of charge! That's what the Wisconsin Department of Transportation announced Tuesday in a new partnership with popular crowd-sourcing traffic navigation mobile app Waze. The DOT says it can enhance your daily commute through Waze's real-time information and latest updates before you hit the roads.

Now the Wisconsin DOT will verify and then post that information on its website and app.

...
The Wisconsin Department of Transportation plans to incorporate Waze’s data into the 511 Wisconsin Website redesign this spring. This change will give drivers faster updates, personalized camera feeds and better knowledge to know well before you hit the roads.

**Partnerships Between State Agencies and Map Application Providers**

The publications below focus on partnerships between state transportation agencies and crowdsourced smartphone application providers to map road closures for travelers.


*From the article:* It didn’t take long for Waze to get a foothold in the transportation space. The company launched in 2009 and today boasts millions of drivers who use the community-based GPS navigation app to help get them from point A to point B, notify them of speed traps and avoid traffic jams. It also didn’t take long for cities to take notice and ask for a peek at the traffic insights Waze was amassing. ... Under the partnership participating cities and states get filtered data based on aggregated traffic information Waze collects from their communities of drivers. The feed is updated every two minutes, which lets transportation officials see and analyze what’s happening on their roadways—backups, accidents, potholes and even roadkill—in near-real time. When cities share construction or road-closure data with Waze, the app pushes that information to drivers in real time, reroutes traffic and minimizes the impact of incidents or events that affect traffic. ... The data Waze provides to cities isn’t accessible through a public API [application programming interface]. The cities apply to be a part of the program and are given access to an XML or JSON feed that can be ingested into their operations.

On the other end, Waze provides cities with specifications on how to send it information [on] road closures or other information.


*Summit presentations available at* [http://i95coalition.org/events-calendar-event/crowdsourcing-summit/](http://i95coalition.org/events-calendar-event/crowdsourcing-summit/)

This brief provides information on practices used by Florida (which uses Waze in its traveler information services), Maine, Massachusetts and Virginia DOTs. *From the executive summary:*

To assess if crowdsourced data is a cost-effective option for delivering the right type of information to agencies ... [six] member [I-95 Corridor Coalition] agencies gave presentations on how their programs were using Waze in: Advanced Traffic Management System (ATMS) Data Integration, Traveler Information Outreach, Traffic Incident Management and Data Analysis. This document contains brief high level briefs of each presentation that covers what the agency is doing with respect to Waze, planned next steps and summit participant questions.


*Citation at* [https://trid.trb.org/view/1458014](https://trid.trb.org/view/1458014)

*From the abstract:* Crowdsourced data taken from sources such as cell phones is a cost effective way of gathering real time information about traffic, weather and incidents. Third party providers are making more and different kinds of data available to transportation agencies at less cost than previously was possible with sensor technologies such as loop detectors. ... Recommendations are outlined for addressing the volume and quality of data, acceptable use and public policy implications.
From the article:
An app developer very much in the fast lane for two-way traffic-related data sharing is Waze, whose user base of ‘Wazers’ stretches into the tens of millions, making it one of the world’s largest driver communities. Early adopters of the ‘Waze Connected Citizens Program,’ which was launched nearly a year ago in New York include: the city of Rio de Janeiro in Brazil, the New York Police Department and the State of Florida. ... In May 2014 Florida Department of Transportation (FDOT) gave the ‘green light’ to a data sharing partnership with Waze—the first American DOT to do so. ... Iowa DOT (IDOT) is also starting a relationship with Waze. Sinclair Stolle, IDOT’s traveller information program manager, is enthusiastic about the potential: “We are always looking at ways to broaden the reach of our information, traffic information, closures and construction to the public and the media. Having the two-way data exchange between IDOT and Waze is a mutually beneficial arrangement.” Stolle says finalising the contract took longer than putting the data on Iowa’s website, which was partly down to ensuring that as a public agency it tied in with any ‘open records’ legal requirements: “Once we got that in place and had access to the data feed it was about three months to tweak it to what we needed.”
Appendix A

Systems for Notifying the Public of Local Road Closures Using Smartphone Map Applications: Survey Questions

State Survey

The following survey was distributed to state departments of transportation (DOTs) and academic institutions with expertise on GIS systems and traveler information mapping.

Closure Notification System

1. (Required) Please choose the best answer that describes your agency’s practice of maintaining or planning use of a real-time geospatial database of road or lane closures that includes local road data (not just state highway closures).
   - We have a comprehensive real-time database of state and local road closures.
   - Our closure database includes some local road closure information but is not a full statewide integration.
   - We are working to create a comprehensive database of road closure data that includes local roads.
   - We have attempted to implement a system to collect local road closure data but were unsuccessful.
   - We maintain road closure information only for roadways directly managed by our agency (state highways).
   - We do not maintain a central database of any road closure information.

Database Description and Management

1. Please describe how your agency provides road closure information from your agency’s real-time database to the public by selecting all that apply.
   - Through a custom app developed and maintained by your agency.
   - Through a website developed and maintained by your agency.
   - By providing data to Waze (please respond to Questions 1A and 1B).
   - Other (please describe).

1A. Does your agency use bidirectional data sharing, such as supplying data to Waze and receiving data from Waze?
   - No
   - Yes

1B. Does your agency use advanced closure attributes, like partial closure, specific times of day or other complex closure data in your traveler information reporting?
   - No
   - Yes (please describe the advanced closure attributes your agency uses)

2. If your agency provides closure data to commercial navigation apps, please describe how data is provided to the app service.

3. If your agency provides closure data to commercial navigation apps, please indicate how long it typically takes for these apps to post the closure information for users.
4. Is there a different response time for data about reopenings?
   - No
   - Yes (please describe how the response time differs for reopenings)

5. Does your agency retain an archive of road closure and reopening information?
   - No
   - Yes (please describe the data archive; for example, identify whether the archive data is open or closed)

6. Please provide links to documents associated with your agency’s database of state and local road closures. Send any files not available online to Matt.Mullins@ctcandassociates.com.

**Engagement With Local Agencies**

1. Does your agency allow local agencies to submit and manage their road closures in the state DOT’s real-time database?
   - Yes
   - No (please describe the formats or platforms local agencies use to provide your agency with road closure data)

2. Do local agencies submit road closures using geographic information system (GIS) web services?
   - Yes
   - No (please describe how local agencies submit road closure data)

3. How does your agency encourage or ensure local agencies provide and update data in a timely fashion?

4. (Required) Please provide contact information for up to three local agencies, preferably counties with a mix of urban and rural areas, that provide data for your agency’s road closure database.
   - First local agency contact
   - Second local agency contact
   - Third local agency contact

5. Please use this space to provide any comments or additional information about your previous responses.

**Agencies Attempting to Collect Local Road Closure Data**

1. Please describe your agency’s attempt to implement a system to collect local road closure data and why you feel it was unsuccessful.

2. Does your agency have any plans to make another attempt to develop such a system?
   - No
   - Yes (please describe these plans)

3. Is your agency interested in possibly working with other states to determine best practices to create such a system (e.g., through pooled fund research)?
   - No
   - Yes
4. Please use this space to provide any comments or additional information about your previous responses.

**Agencies Not Collecting Local Road Closure Data**

1. Has your agency considered developing a database that includes real-time data about both state and local road closures?
   - No
   - Yes (please describe what your agency has considered)

2. Is your agency interested in possibly working with other states to determine best practices to create such a system (e.g., through pooled fund research)?
   - No
   - Yes

3. Please use this space to provide any comments or additional information about your previous responses.

**Local Agency Survey**

The following survey was distributed to local agencies expected to have experience with adding road closure data to a state closure database.

1. Please describe the workflow for the system updates your agency makes to add new local road closure/reopening data.

2. How often does your agency provide updates about road closures and reopenings? Select the best response from the options below.
   - In real time.
   - Every 15 minutes.
   - Every 30 minutes.
   - Every hour.
   - Several times a day.
   - Once a day.
   - Several times a week.
   - Once a week.
   - Other (please describe).

3. How quickly do you notice the commercial navigation app or similar platform updates its road closure information?

4. How quickly do you notice the commercial navigation app or similar platform updates its road reopening information?

5. Please rate the ease with which your agency provides updates on local road closures to your state’s traveler information service using the rating scale of 1 = not at all easy to 5 = extremely easy.

6. Do you have any suggested changes to the current system that your state manages that would benefit your local agency?

7. Please provide links to any documents you can share about your agency’s practices to update local road closure data or send any files not available online to Matt.Mullins@ctcandassociates.com.

8. Please use this space to provide any comments or additional information about your previous responses.
Appendix B

Systems for Notifying the Public of Local Road Closures Using Smartphone Map Applications: Contacts

Below is the contact information for the individuals responding to the survey and other inquiries for this report.

State and Local Agencies

Arkansas
Sharon Hawkins
Staff GIS and Mapping Administrator
Arkansas Department of Transportation
501-569-2205, Sharon.Hawkins@ardot.gov

Florida
Clinton Smith
Program Development Engineer
Transportation Systems Management and Operations
Florida Department of Transportation
850-410-5626, Clinton.Smith@dot.state.fl.us

Georgia
Mark Demidovich
Assistant State Traffic Engineer
Georgia Department of Transportation
404-635-2838, MDemidovich@dot.ga.gov

Kansas
Kyle Gonterwitz
Civil Engineer
Kansas Department of Transportation
913-481-2977, Kyle.Gonterwitz@ks.gov

Kentucky
Tracy Nowaczyk
Director, Operations and Pavement Management
Kentucky Transportation Cabinet
502-782-5595, Tracy.Nowaczyk@ky.gov

Maryland
Renee Baumgardner
GIS Coordinator, Division of Highways
Harford County Department of Public Works
410-638-3509, ext. 1275,
ReBaumgardner@harfordcountymd.gov

Craig Mackowiak
Chief, Data Governance Division
Office of Planning and Preliminary Engineering
Maryland Department of Transportation State Highway Administration
410-545-5524, CMackowiak@mdot.maryland.gov

Marshall Stevenson
Consultant, GIS Program Management Support
Maryland Department of Transportation
410-545-5531, MStevenson@mdot.maryland.gov

Minnesota
Joella Givens
Application Portfolio Manager, System Analysis Unit Supervisor
Minnesota IT Services
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Daniel Ross
Chief Geographic Information Officer
Minnesota IT Services
651-757-2550, Dan.Ross@state.mn.us
North Dakota
Travis Lutman
ITS Manager
North Dakota Department of Transportation
701-328-4274, TLutman@nd.gov

Ohio
Ian Kidner
GIS Program Manager
Ohio Department of Transportation
614-752-5743, Ian.Kidner@dot.ohio.gov

Vermont
Ryan Knapp
Transportation Management Center Supervisor
Vermont Department of Transportation
802-828-5663, Ryan.Knapp@vermont.gov

Wyoming
Vince Garcia
GIS/ITS Program Manager
Wyoming Department of Transportation
307-777-4231, Vince.Garcia@wyo.gov

Academic Institutions

North Dakota State University
Bradley Wentz
Director, Advanced Traffic Analysis Center
Upper Great Plains Transportation Institute
North Dakota State University
701-231-7230, Bradley.Wentz@ndsu.edu

University of Maryland
Michael Pack
Director, Center for Advanced Transportation Technology Laboratory
University of Maryland
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Appendix C

Maryland’s Road Closure Reporter

Overview

Marshall Stevenson – MDOT SHA

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
Overview

• The app is for the capture of road closure events by local jurisdictions, e.g. Emergency Management/Public Safety, DPW etc.

• COTS based Desktop/Mobile Platform Geocortex by Latitude Geographics

• Local Development Partners
  - Baltimore City
  - Anne Arundel County
  - Harford County
  - Frederick County
  - Washington County
  - Queen Anne’s County

• MDOT SHA hosts and administers the application

• Maryland DoIT hosts the database on MD iMAP infrastructure including local sourced roadway geometry

• Relationship with Waze

“The Road Closure Reporter (both the map and email alerts) is a valuable tool aiding Waze Editors to add and monitor the road closures due to the recent rains.” David Tomb - Waze State Manager, Maryland
Key Functionality

- Jurisdiction can only enter closure for roadways in their jurisdiction
- Batch roadway submission
- Events Auto Expire/Retire
- Future Events
- Storm Mode Workflow
- Mobile Workflow
- After Action Reporting
- Jurisdiction e-mail notification system
Notifications

An active road closure has just been reported in FRIENDSVILLE.

Details:
Start Time: 4/22/17
End Time: 5/31/17
Closure Type: Closet
Road: MAPLE ST
Lanes: All
Direction: All Direction
Reason: Construction
Comments: On April 22, the N Maple Street (MD 217) road is closed for the $500 M expansion.
View the closure.

An active road closure has just been reported in FREDERICK CITY.

Details:
Start Time: 4/19/2017
End Time: 5/2/2017
Closure Type: Limited
Road: STONEGATE DR
Lanes: 1
Direction: All Direction
Reason: Construction
Comments: Decision Communicated!
View the closure.

Road closure has ended in Frederick.

Details:
Start Time: 5/6/2017
End Time: 5/11/2017
Closure Type: Limited
Road: MOORES MILL RD
Lanes: All
Direction: All Direction
Reason: Construction
Comments: Road closure has ended.
View the closure.

An active road closure has just been reported in BEL AIR.

Details:
Start Time: 5/6/2017
End Time: 5/11/2017
Closure Type: Limited
Road: STONEGATE DR
Lanes: 1
Direction: All Direction
Reason: Construction
Comments: Road closure has ended.
View the closure.

An active road closure has just been reported in Washington.

Details:
Start Time: 7/24/2017
End Time: 7/28/2017
Closure Type: Closed
Road: MOUNT EPHRAIM RD
Lanes: All
Direction: All Direction
Reason: Construction
Comments: Road closure has ended.
View the closure.
Partners

Current Users
- Allegany County
- Anne Arundel County
- City of Annapolis
- Cecil County
- Frederick County
- City of Frederick
- Garrett County
- Harford County
- Prince George’s County
- Washington County
- City of Hagerstown

Working to bring online...
- Baltimore City
- Carroll County
- Howard County
- Montgomery County
- St. Mary’s County
Partner Integrations
Event Data Capture
Future (Geocortex Workflow 5)
Next Steps

- Continued Local Jurisdiction Outreach/Training
- Establish/Provide login credentials to local users as requested
- Working with agencies such as MDOT SHA (CHART) for data consumption and utilization
- Continued application and database enhancements based on local user feedback
- Migration to Geocortex Workflow 5
Demonstration

MDRC Reporter Application: https://geo.sha.maryland.gov/mdrc

Map Services: https://geodata.md.gov/appdata/rest/services/SHA_RoadClosure

Public Viewer: https://arcg.is/2fdlIING

MEMA Osprey Public: https://geodata.md.gov/ospreypublic/
Thank You

Marshall Stevenson

mstevenson@mdot.state.md.us