Automating Waze Road Closures

Final Report

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Description of Project

The North Carolina Department of Transportation (NCDOT) has been providing travel information to the public via the internet since 2000. The DriveNC.gov website provides day-to-day and emergency travel conditions through an interactive map. NCDOT staff and partners in all 100 counties enter information about crashes, work zones, road closures, and other incidents that impact travel into the Traveler Information Management System (TIMS) in real time. This information populates the DriveNC.gov website and alerts media, emergency responders, school bus managers, and commercial navigation systems like Google, Waze, and Apple Maps of travel disruptions.



DriveNC: NCDOT's Traveler Information Website

With a significant shift of travelers toward commercial navigation platforms, NCDOT aimed to elevate the quality and utility of information it offered. Particularly with Waze, a leader in crowdsourced traffic and navigation, there was an observed gap. While Waze efficiently displayed TIMS incident data, it only recognized NCDOT's data as "hazards", alerting users but not rerouting them. Addressing this, NCDOT realized the need to provide Waze with a specialized "closure feed" that would facilitate automatic rerouting.

NCDOT explored existing commercial off-theshelf solutions to communicate with Waze through different vendors, but eventually landed on creating an in-house solution. At national peer exchange meetings such as EDC-6 Crowdsourcing for Traveler Information, facilitated by FHWA, we learned that other state DOTs also found this task to be challenging, but was reported to have been successfully achieved by a consultant for other State DOT's, such as Louisiana, Wisconsin, and Alaska and by a technology service company for transportation agencies in the UK.

Approximate Active Waze Users in TETC States (2020-2021)

	Daily Active Users	
Season	Peak	Off Peak
Alabama	60,000	50,000
Connecticut	150,00 - 170,000	120,000 - 140,000
DC	35,000 - 40,000	35,000 - 40,000
Delaware	30,000 - 35,000	20,000 - 25,000
Georgia	375,000	325,000
Maine	20,000 - 25,000	10,000 - 15,000
Maryland	250,000	225,000
Massachusetts	300,000 - 325,000	250,000 - 275,000
New Hampshire	45,000 - 50,000	35,000 - 40,000
New Jersey	375000	325000
New York	700,000	600,000
North Carolina	200,000 - 225,000	150,000 - 175,000
Pennsylvania	300,000	275,000
Rhode Island	35,000 - 40,000	25,000 - 30,000
South Carolina	100,000	90,000
Tennessee	130000	110000
Vermont	6,000 - 10,000	4,000 - 6,000
Virginia	300,000	250,000

Overall Budget

Table 1 Project Budget Performance

Task	Internal Labor Costs	NCDOT Funding	STIC Funding
Task 1 – GIS Team Development			
Task 2 – TIMS Web Team Development	\$75,233	\$15,233	\$60,000
Task 3 – Testing and Refinement			

How the Work Specifically Meets the Program Criteria

The project was developed to improve the quality of information available to travelers on the Waze navigation app, while leveraging in-house skills and resources.

The Technology and Innovation Deployment Program (TIDP) goals addressed include:

TIDP Goal	How Addressed by this Project
Significantly accelerate the adoption of	Communicate the location of road closures
innovative technologies by the surface	instantly and automatically from NCDOT to Waze
transportation community; develop and deploy	to improve the quality of traveler information.
new tools, techniques, and practices	
Reduce the congestion from construction	Many road closures are due to road work, and
	they are addressed by this project, in addition to
	closures due to crashes.
Improved quality and user satisfaction	Through the Waze app, travelers will be rerouted
	during their trips as the road conditions change.
Improve highway efficiency, safety, mobility,	By rerouting traffic around road closures, traffic
reliability, service life, environmental protection,	flows more efficiently with fewer slowdowns.
and sustainability	Additionally, the occurrence of secondary crashes
	of vehicles hitting the back of queue may be
	prevented or reduced.

Project Development

Following receipt of the STIC memorandum in May 2021, this project was initiated. The project team conducted regular meetings between the TIMS development team and the GIS Unit at NCDOT. The joint team considered existing technologies and suggested initial solutions. Throughout the project, the Waze For Cities (WfC) program outreach coordinators provided technical details about the data feeds and how they would be used within the Waze platform. Peer groups, EDC-6 and The Eastern Transportation Coalition (TETC), also provided useful suggestions and discussion.

The work required to make this project successful was broken down into two categories: (1) modifying the TIMS system to automatically output the data in a compatible format for Waze, and (2) setting up a secure external feed hosting system to allow Waze to access the data. For Waze to be able to read and accept the closure data, it must be saved into a JSON or XML file, with polyline data that resembles the geometry of the roadway in Waze, matching road names, and the directionality of the closure. NCDOT changed the procedures for entering incident data into TIMS as a line versus a point to meet the data requirements. The Waze Reverse Geocoding API was used to determine the road name. Road and direction fields in our system are used to determine the closure directionality. The procedural changes required several training and re-training sessions to cover all TIMS users in the DOT, nearly 900 people. An example of road closure data automatically sent to Waze, is shown in the figure to the right.



Results

The automated closure feed from TIMS to Waze was completed in December 2022. After it was launched, we observed a large increase in the count of closure incidents in Waze (see figure below) and received feedback from Waze volunteers and users. In January 2023, a patch was released in TIMS that improved the feed beyond the original deployment. Due to the efforts of NCDOT's Web Team, GIS and Traffic Systems Operations, in January of 2023 NCDOT was second among the eastern states in number of full closures shared with Waze, second only to Florida. Main development work on the project was considered completed in January 2023.

Closure feeds are up and running!	
Nearly 1,000 closures	100 October (last 2) November December January (frst 2) October (last 2) November December January (frst 2) October (last 2) November December January (frst 2) October (last 2) Florida DOT January (frst 2) Florida DOT January (frs
waze	Proprietary and confidential

Monthly Automated Closure Incidents by State DOTs, January 2023

From December 2022 to March 2024 over 36,000 road closure incidents were sent from TIMS to Waze.

Challenges

Uncertain Waze Map Topology

TIMS stores the location of closure incident using manually entered polyline segments. They are not snapped to a road network or GIS within TIMS. At the onset of this effort, the exact function of the Waze system and the requirements were uncertain. What's more, the Waze network map is proprietary, so its exact roads and locations are unknown. Based on our observation of other states successfully implementation of the automated closure feed, we thought that our system would require adding map snapping functionality to TIMS. However, based on guidance we received from Waze for Cities Program outreach, we settled on a more lightweight approach, using manually entered closure segment polylines.

No Test Environment in Waze

Waze lacks a dedicated testing environment, meaning any closure input directly affects all its users, potentially triggering reroutes. Our testing, therefore, required selecting roads minor enough to reduce traveler disruptions yet significant enough to be recognized by Waze. By meticulously reviewing, confirming, and swiftly removing test closures from the TIMS feed, we minimized the occurrence of erroneous closures.

Enhanced Review for TIMS Data Entry

With TIMS now automatically relaying full-closure incidents to Waze, we are making the data in TIMS usable in the real world, more than before. This is largely a positive outcome as travelers are receiving usable info from TIMS to avoid getting stuck in traffic jams. However, since there are over 900 NCDOT and other users who enter TIMS incidents there is potential for incorrect TIMS entries leading to unwarranted road closures and detours by Waze users. Before the automated TIMS to Waze closures, a Waze volunteer would manually plot the closure on the Waze map. Now this process is automated. We have had challenges with closures not being drawn carefully enough and mistakenly closing an adjacent road. Or "fat fingers" saying that an overnight closure ended at 6 pm instead of 6 am, thereby erroneously closing an Interstate and rerouting Waze users for several extra hours. To address this, we've implemented stricter quality control measures for data verification by our Traffic Management Centers (TMCs). A regular periodic process for review of the road closure incidents is performed at every daytime TMC operator shift.

Lessons Learned

Since the automated closure feed was introduced, NCDOT has continued to oversee the feed's performance, routinely examining closure incidents on Waze and fine-tuning procedures as necessary. Collaboration with Waze volunteers, known as "Wazers," has been invaluable. These Wazers, who manually input or amend data in Waze, communicate any inconsistencies directly to NCDOT. Engaging with them has fostered prompter cooperation. Notably, the Wazers have welcomed the automation of closure entries, noting a considerable reduction in their workload. NCDOT has also allowed the Wazers to see the contact info for the TIMS incident authors to cut out the middleman of having to go through the Engineers or the TMC so a faster fix can be made to any erroneous entries.

A key takeaway from this initiative has been that an agency may already have the technical capability to build new functionality in its systems, by reaching across sub-units and leveraging diverse skills from members at the agency itself. Another is that when the Waze closures are automated a greater level of Quality Control may be required.