

Cloud Based Dynamic Warning System

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About UGPTI

- The Upper Great Plains Transportation Institute is a research and education center at North Dakota State University.
- Mission: Providing innovative transportation research, education, and outreach that promote the safe and efficient movement of people and goods.
- The institute has centers working on various transportation areas including traffic; transit; safety and security; and freight and logistics.



research

Enhancing rural & small urban mobility for people & goods



education

Building tomorrow's transportation professionals



outreach

Putting research to work through relationships

Project Sponsor



“The mission of the LRRB is to serve local road practitioners through the development of new initiatives, the acquisition and application of new knowledge, and the exploration and implementation of new technologies.”

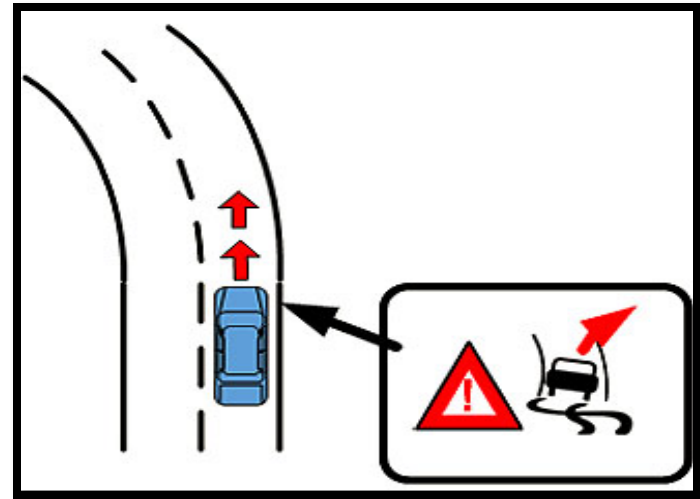
Partners: *MnDOT*, Otter Tail and Pope counties, MN

Synopsis

- Emulate a connected vehicle environment by utilizing a smartphone application to deliver dynamic, speed-based, directional warnings at locations in an online database

The Problem

- Vehicles entering horizontal curves at speeds that may be too high for safe travel
- >25% of fatal crashes
- Crash rate 3X of other highway segments
- Vehicles with features such as adaptive cruise control and access to curve warnings



Existing Solutions

- Static Warning Signs
- Dynamic warning signs



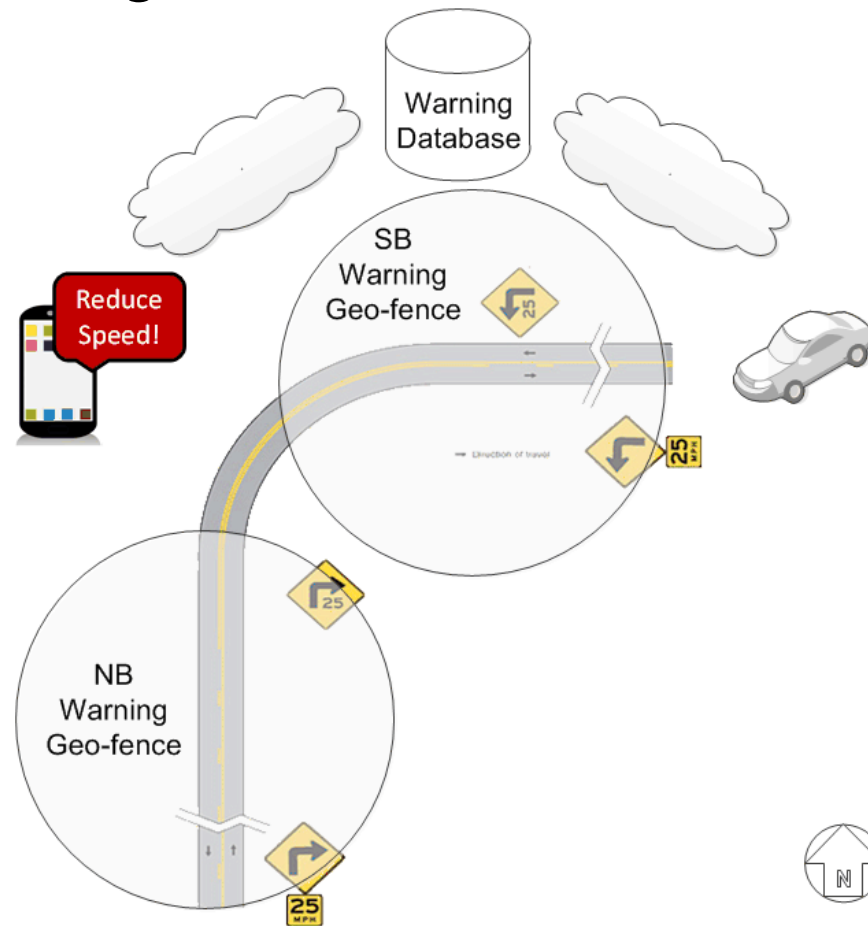
Dynamic Systems

- Consist of a detection component, and a warning component, in addition to power and communications
- Cost: roughly \$14,000
- Limited to high-crash locations
 - ≥ 10 crashes in a 24 month period and ≥ 7 crashes in a 12 month period
 - Research: dynamic systems are more effective at reducing vehicle speeds

Goals

- Expand safety improvement potential of dynamic CSW system-wide to all reduced speed curves
- No infrastructure investment
- Provide cloud database maintained by agency in charge of roadway
- Warning database flexibility for additional warning situations

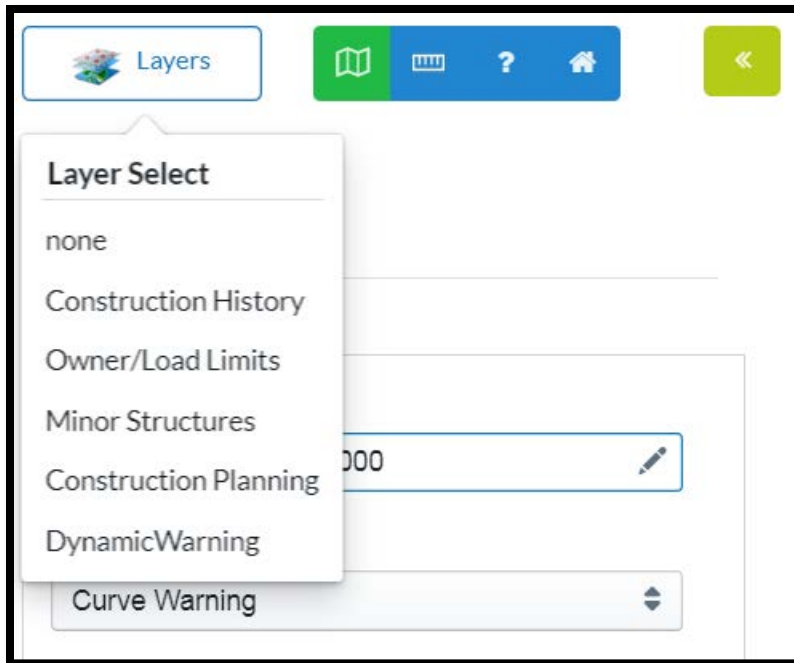
System Overview



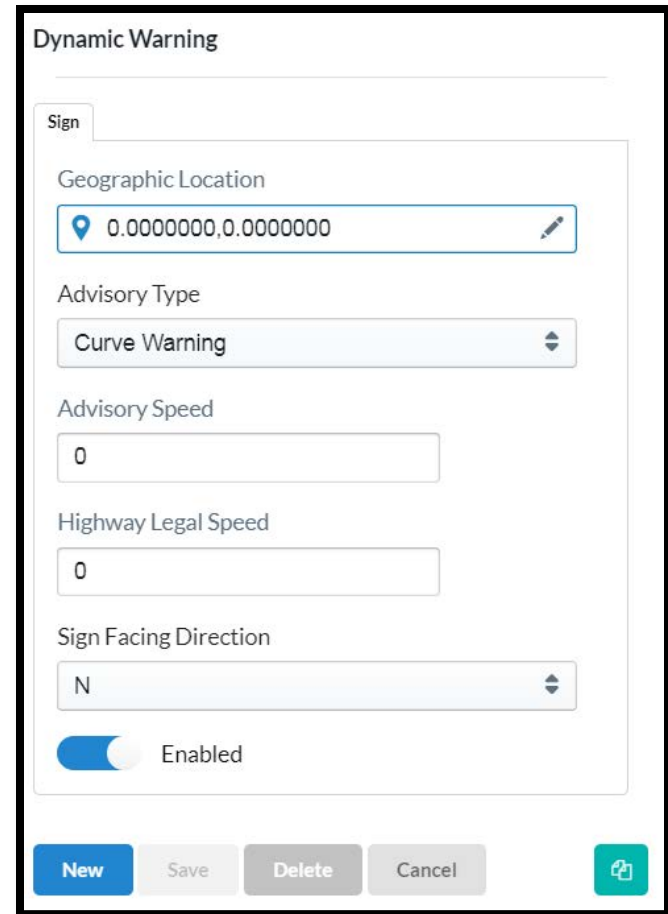
Warning Database

- Managed through an online tool created at UGPTI: Geographic Roadway Inventory Tool (GRIT)
- GRIT is a web application that allows agencies to manage an inventory of their transportation assets
- A layer within the application was created for managing speed warning locations

GRIT

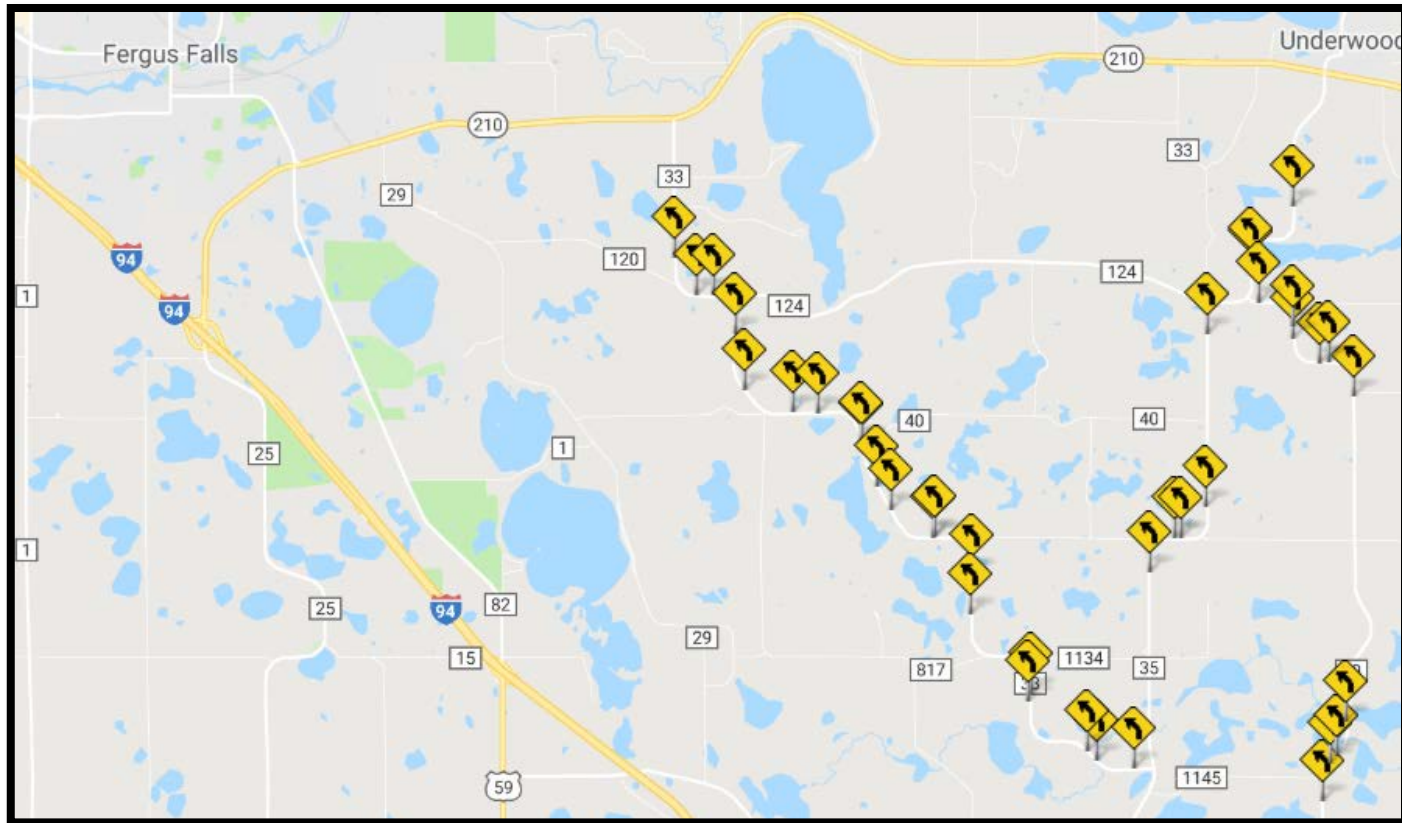


A screenshot of the GRIT application's 'Layers' menu. The menu is open, showing a list of layer options. The top option is 'Layer Select'. Below it are 'none', 'Construction History', 'Owner/Load Limits', 'Minor Structures', 'Construction Planning', 'DynamicWarning', and 'Curve Warning'. The 'Curve Warning' option is currently selected, indicated by a blue highlight. The background shows a portion of the application interface with a top navigation bar containing icons for layers, a list, help, home, and a back arrow.



A screenshot of the 'Dynamic Warning' configuration panel. The panel is titled 'Dynamic Warning' and has a 'Sign' tab. It contains several input fields and a toggle switch. The 'Geographic Location' field is set to '0.000000,0.000000'. The 'Advisory Type' dropdown is set to 'Curve Warning'. The 'Advisory Speed' field is set to '0'. The 'Highway Legal Speed' field is set to '0'. The 'Sign Facing Direction' dropdown is set to 'N'. A toggle switch is turned on, labeled 'Enabled'. At the bottom of the panel, there are four buttons: 'New', 'Save', 'Delete', and 'Cancel', along with a share icon.

Warning Locations – Otter Tail CO



Layers



Dynamic Warning

Sign

Geographic Location

46.2583800,-95.9889500

Advisory Type

Curve Warning

Advisory Speed

45

Highway Legal Speed

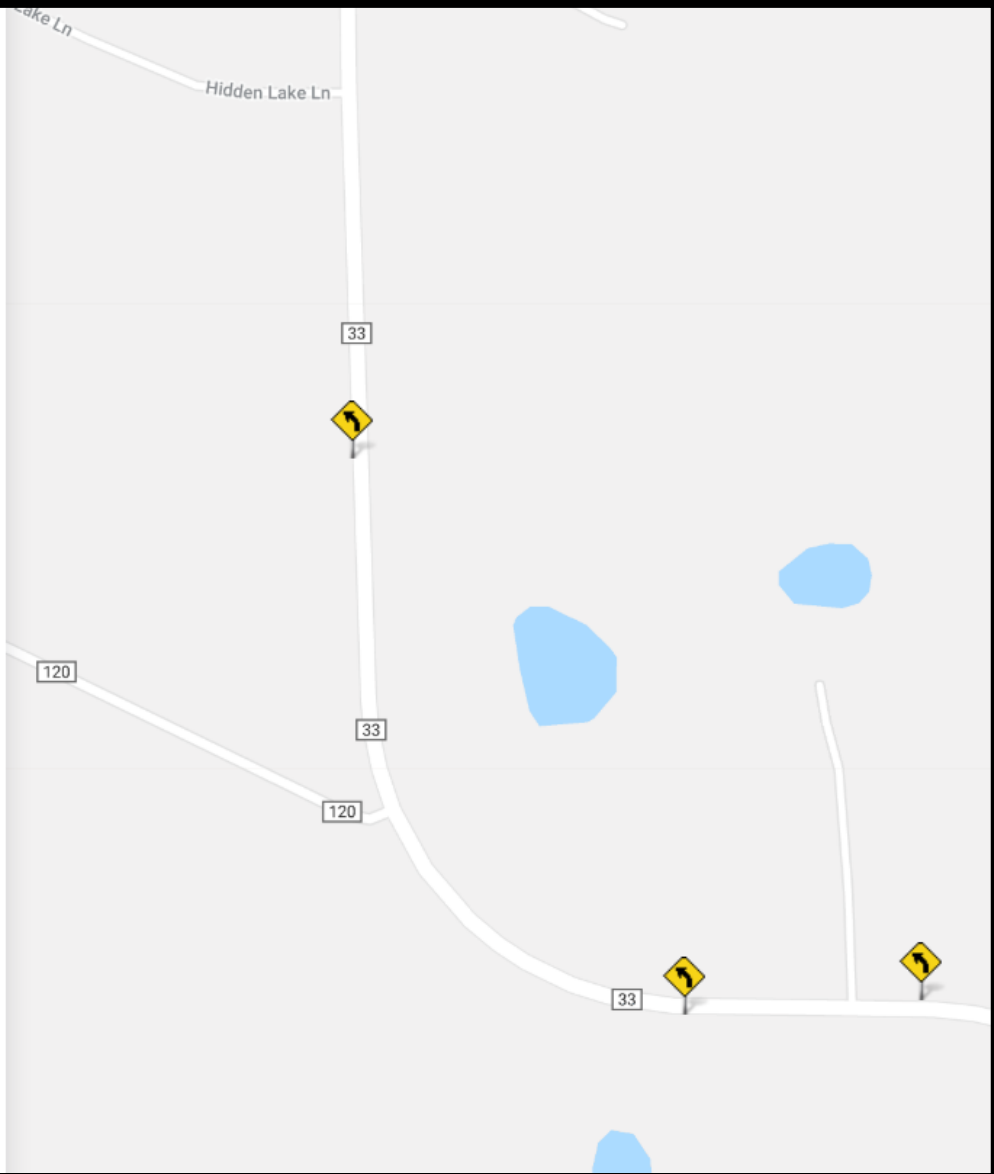
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Sign Facing Direction

N

Enabled

New Edit Cancel



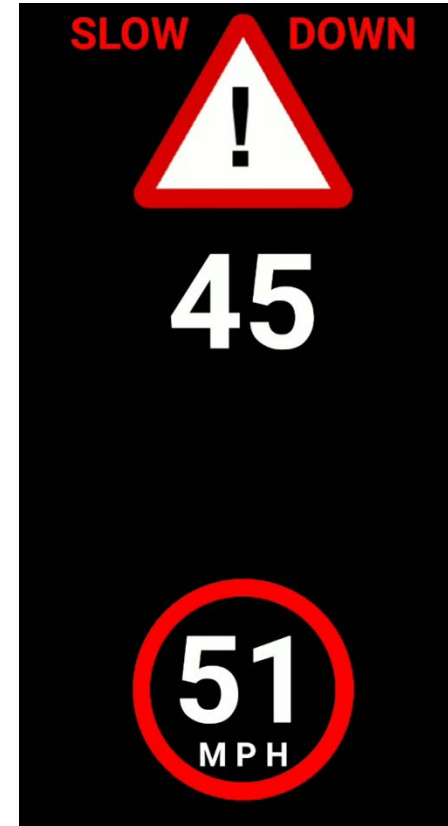
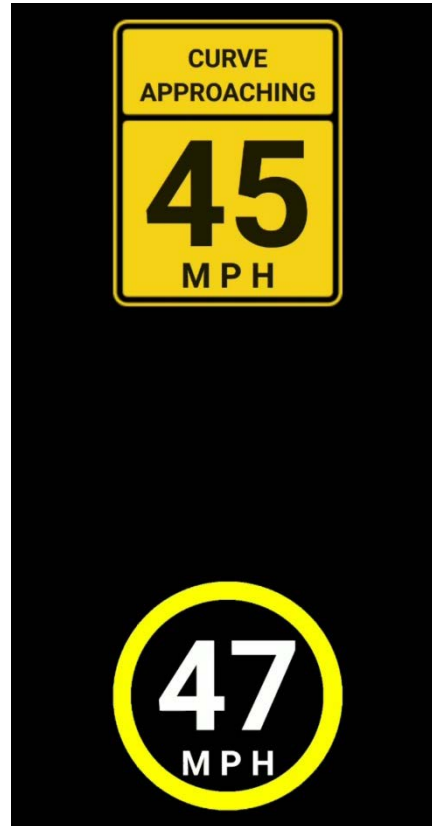
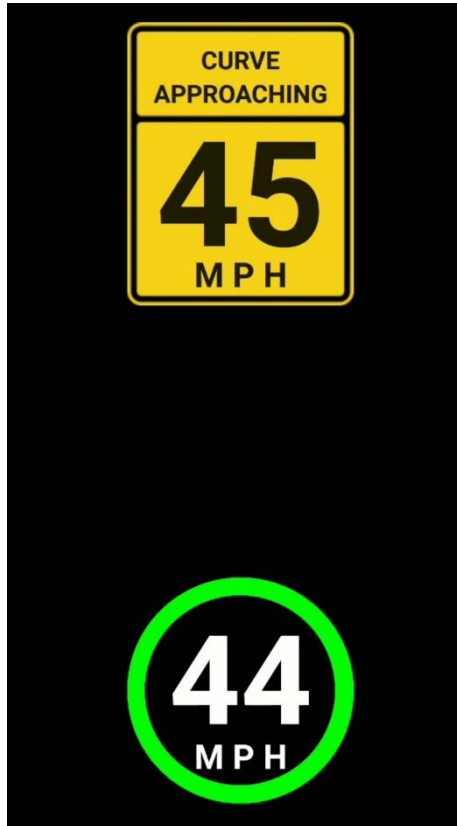
Warning Application

- Android smartphone app utilizing Google Maps API
- The app captures location, heading, and speed data from the phone (GPS) which are checked against the warning database
- The app pulls warning locations within a 20 mile radius with a 15 minute refresh to handle large volumes of data

Warning Application

- The app applies geo-fencing technologies to determine when a vehicle enters a warning location
- The warnings are directional based on sign facing
- Warning levels:
 - The initial warning is a caution for approaching a curve
 - If speed is not reduced, an audible warning is applied

Warning Application





Testing

- Ottertail County Road 33 – 15 CSW signs
- Drove 4 times each direction at varying speeds
- Results:
 - 100% accuracy picking up CSW sign
 - 100% accuracy in providing the audible warning only when warranted

Expanded Benefits

- Ob-board dynamic warning systems can be used for other situations requiring reduced travel speed:
 - Bumps and cracks (seasonal changes)
 - Maintenance and construction activities
 - Special events

Questions?

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