Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

5-6912-01: Statewide Implementation of Innovative Safety Analysis Tools in Identifying Highway Safety Improvement Projects

Background

The Highway Safety Improvement Program (HSIP) aims to reduce the number and severity of fatalities and serious injury crashes on all public roads by implementing highway safety improvement projects. Over the last few years, particular emphasis has been placed on employing advanced safety predictive methods and tools. In 2016, the Texas Department of Transportation (TxDOT) funded Research Project 0-6912, which tailored the *Highway Safety Manual*'s (HSM's) roadway safety management process to TxDOT's needs, objectives, and HSIP requirements and used it as a general framework to develop:

- A network screening process for roadway segments.
- Preliminary crash analysis and visualization (CAVS) products to support the HSIP project selection process.
- A project prioritization tool.

Based on the benefits realized from the use of the Project 0-6912 network screening and CAVS products, TxDOT funded Implementation Project 5-6912 to:

- Develop a network screening tool that incorporates the Project 0-6912 network screening process for roadway segments.
- Improve the CAVS process and products and implement them to support the diagnosis and countermeasure selection processes during the 2018 HSIP call.

What the Researchers Did

Researchers developed a network screening tool using geographic information systems tools. The tool automatically scans all on-system main lane roadway segments using a dynamic sliding window method.

According to the HSM, this is the most appropriate method for segment network screening. In this method, a window of a certain length (e.g., 0.3 miles) is conceptually moved along a roadway segment from one end to the other at specified increments (e.g., 0.1 miles). Seven safety performance measures are calculated for each position of the window:

1. Crash frequency.
2. Crash rate.
3. Critical rate.
4. Excess predicted average crash frequency using a method of moments.
5. Probability of specific crash types exceeding the threshold proportion.
6. Excess proportion of specific crash types.
7. Excess predicted average crash frequency using safety performance functions (SPFs).

After scanning the entire network, the tool can rank the sites based on one or multiple performance measures. The goal is to further review the sites with the highest crash risk, understand the causes of crashes and risk factors, identify safety problems, and select appropriate countermeasures that can mitigate the safety issues at each site.

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In addition, researchers improved the Project 0-6912 CAVS process and developed new CAVS products that were implemented statewide during the 2018 TxDOT HSIP call. The CAVS products can help TxDOT staff perform safety diagnostic activities and select candidate HSIP projects. The CAVS products mainly include Google Earth® layers and Microsoft® Excel files. The Google Earth layers display crashes by applicable work codes (WCs), crash severity, and road part (e.g., main lane, frontage roads, or ramps). The Excel files include all crash data along with all single WCs and combinations of WCs that can theoretically prevent each observed crash.

What They Found

The new processes and tools developed in this project enhance and streamline current project selection practices at TxDOT. Incorporating performance measures and data-driven systemic safety analyses into the program can minimize, to the extent possible, dependence on human discretion, regression-to-the-mean effects, and retrospective examination of historical crash data. Crash predictive methods will enable TxDOT to apply safety funds in places with the greatest potential to reduce fatal and serious injury crashes. The main benefits realized by TxDOT districts from using the CAVS products include the following:

- District officials reported that the amount of time and resources needed to complete project identification activities decreased on average by 20–50 percent compared to previous years.
- The total number of projects (1,394) submitted by all districts to the 2016 HSIP increased by 31 percent compared to the number of projects (1,067) identified in the 2013 HSIP, when districts used simple spreadsheets or their own visualization products to select safety improvement projects.
- The total number of projects (1,680) submitted by all districts to the 2017 HSIP increased by 57 percent compared to those submitted in the 2013 HSIP.
- The total number of projects (1,434) submitted by all districts to the 2018 HSIP increased by 34 percent compared to those submitted in the 2013 HSIP.

What This Means

TxDOT should continue to improve its HSIP by adopting advanced data-driven safety assessment methods and modern crash visualization tools. Recommendations to improve TxDOT's HSIP include the following:

- Incorporate the network screening process into the HSIP.
- Implement network screening for segments.
- Incorporate the CAVS process and products into the HSIP and other safety-related business processes and practices.
- Incorporate the HSM roadway safety management process into the HSIP.
- Develop an intersection inventory.
- Provide training on the use of the Project 5-6912 deliverables.
- Assess the need for calibrating existing SPFs and develop new SPFs.
- Assess the need for collecting more roadway inventory and other types of data.
- Update the process of geolocating frontage road crashes in the Crash Records Information System.
- Save the version of TxDOT's road-highway inventory network that is used to determine the distance from origin of each crash in the Crash Records Information System.

For More Information

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