

0-6961: Evaluation of Highway Safety Improvement Projects and Countermeasures

Background

The Highway Safety Improvement Program (HSIP) is a core federal-aid, state-administered program in which each state is required to develop and establish planning, implementation, and evaluation processes. The goal of evaluation activities is to determine if highway safety improvements are achieving the desired results and the investments are worthwhile. The expectation is to continuously feed and improve the planning and implementation components of the HSIP with findings and data from the evaluation process. The general guideline is to identify actionable and measurable goals (e.g., reduce the number of fatalities and serious injuries) and perform evaluations using robust data-driven methods that account for traffic volume fluctuations, regression to-the-mean (RTM) effects, and roadway design and other characteristics.

As the national safety assessment procedures have evolved, legislation has mandated that the use of safety performance methods be elevated. These evolving methods tend to provide more reliable results than simple before/after comparisons, which have several limitations and do not account for RTM bias.

The goal of this study is to advance the Texas Department of Transportation's (TxDOT's) HSIP evaluation processes and practices and evaluate the safety and cost-effectiveness of HSIP projects and countermeasures or work codes (WCs) that have been implemented in Texas over the last few years.

What the Researchers Did

Researchers completed the following activities:

- **Reviewed safety and cost-effectiveness evaluation methods, state practices, and tools.** This task involved reviewing safety and cost-effectiveness evaluation methods available in the

literature, determining general trends and state practices, and reviewing evaluation tools developed by federal and state agencies.

- **Gathered, compiled, and assessed TxDOT data.** Researchers gathered and processed roadway, traffic, crash, and construction data for completed HSIP projects and countermeasures in Texas. After compiling the data, researchers assessed their appropriateness for supporting HSIP evaluations and identified opportunities for improvement.
- **Developed safety and cost-effectiveness evaluation tools for segments and intersections.** Researchers developed two evaluation tools: one for roadway segments and one for intersections. The tools incorporate data-driven evaluation methods customized to TxDOT's needs, data availability, and HSIP requirements. TxDOT can use these tools in the future to evaluate the safety and cost-effectiveness of individual HSIP projects and groups of projects (i.e., countermeasures or WCs).

Research Performed by:

Texas A&M Transportation Institute

Research Supervisor:

Ioannis Tsapakis, TTI

Researchers:

Sushant Sharma, TTI

Bahar Dadashova, TTI

Srinivas Geedipally, TTI

Alfredo Sanchez, TTI

Minh Le, TTI

Lorenzo Cornejo, TTI

Subasish Das, TTI

Karen Dixon, TTI

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Both tools incorporate four safety-effectiveness evaluation methods (naïve, naïve with traffic volume correction, comparison group, and empirical Bayes that uses safety performance functions) and conduct economic analysis that calculates benefit/cost (B/C) ratios for each evaluated project and countermeasure.

- **Evaluated safety and cost-effectiveness of implemented HSIP projects and countermeasures.** Researchers evaluated the safety and cost-effectiveness of 457 completed HSIP projects (387 segments and 70 intersections) and the corresponding countermeasures of these projects.

What They Found

The evaluation results show that the HSIP projects implemented in Texas have been effective from both a safety and cost perspective in reducing target fatal, suspected serious injury, and non-incapacitating injury (KAB) crashes. The safety-effectiveness index of all 387 segment projects (treated as one group) is 0.84, and the corresponding index of all 70 intersection projects (treated as one group) is 0.74, indicating an overall reduction in target KAB crashes after the projects were constructed. Both indexes are statistically significant at the 95 percent confidence level. The B/C ratio of all segment projects (treated as one group) is 71.9, and that of all intersection projects (treated as one group) is 145.6.

Among 46 segment-related WCs that were evaluated in this study, four WCs included 30 or more projects with complete (non-missing) data. Of the 21 intersection-related WCs, WCs 108 (Improve

Traffic Signals) and 107 (Install Traffic Signal) contained 26 and 13 projects, respectively, with complete data. Overall, the results show that all six WCs have been effective in reducing target KAB crashes. Additional HSIP project data are needed to develop quality crash modification factors (CMFs) for more WCs.

What This Means

TxDOT should continue to evaluate the effectiveness of completed HSIP projects and WCs and make changes to the HSIP based on the evaluation results. Recommendations to improve TxDOT's HSIP evaluation practices include the following:

- Find missing data for completed HSIP projects.
- Develop new CMFs.
- Establish a safety and cost-effectiveness evaluation process, incorporate it into the HSIP, and update the TxDOT *HSIP Manual*.
- Implement Project 0-6961 evaluation tools statewide.
- Apply advanced data-driven evaluation methods.
- Assess the need for calibrating existing safety performance functions and develop new safety performance functions.
- Assess the need for collecting more roadway inventory and other types of data.
- Develop an intersection inventory.
- Update the process of geolocating frontage road crashes in the Crash Records Information System (CRIS).
- Save the version of Road-Highway Inventory Network (RHiNo) that is used to determine the distance from the origin of each crash in CRIS.

For More Information

Project Manager:

Joanne Steele, TxDOT, (512) 416-4657

Research Supervisor:

Ioannis Tsapakis, TTI, (210) 321-1217

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Research and Technology Implementation Office
Texas Department of Transportation
125 E. 11th Street
Austin, TX 78701-2483
www.txdot.gov
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