

0-6991: Evaluation of Roadside Treatments to Mitigate Roadway Departure Crashes

Background

The main purpose of this research project was to develop a systemic framework to identify high-risk locations for roadway departure crashes and applicable countermeasures for implementation (e.g., improving guardrails and barriers, or safety-treating roadside fixed objects). This research provided the Texas Department of Transportation (TxDOT) and its districts with data-driven tools to select locations at risk of roadway departure proactively instead of reactively (based on crash history only). Additionally, this project updated work code values that will help to better prioritize projects, making better use of limited resources and maximizing benefits.

What the Researchers Did

This research project was divided in two main efforts:

- Developing a systemic framework.
- Evaluating and updating a set of roadway departure work codes, selected based on their data availability.

For the systemic framework, the research team selected a probability sample of rural two-lane undivided highways representative of Texas. The sample design was determined as a stratified sample balanced at key safety variables (average annual daily traffic [AADT], truck AADT, lane width, shoulder width, and section length). The stratification criteria were the four TxDOT regions (north, west, south, and east). To draw the equal-probabilities sample, cube sampling methods were applied. Given considerations of

the anticipated size of the uncertainty from using a sample for the systemic approach, a sample size of between 400 and 600 roadway segments was deemed appropriate for this research. Additional data on roadside conditions were collected from the probability sample, drawing from multiple data sources and using data collection tools previously developed by the Texas A&M Transportation Institute. Data were collected for a final sample of 420 roadway segments (302 miles).

For the effort to update work codes, an initial set of 16 candidate work codes was identified. The research team mined data from Highway Safety Improvement Program (HSIP) projects implemented in the past six years to determine the availability of data. A subset of these candidate work codes (five) were selected for evaluation, including projects that had a combination of two of these work codes. The projects were located at 59 different rural corridors, including two-lane divided, four-lane divided, and four-lane undivided highways, and

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represented 626 miles. The exact locations of the projects were determined, and the 59 corridors were further divided into 340 segments. For each of the 340 segments, the research team merged the crash data for the before and after periods for analysis.

What They Found

From the effort to develop a systemic approach method, the research team identified risk factors associated with three crash types:

- Roadway departure.
- Guardrail hit.
- Fixed object hit.

For each crash type, weights were computed for site prioritization, based on the crashes being over- or underrepresented on the highways analyzed (based on the vehicle-miles traveled on those highways). Percentile groups were developed to be used as a relative measure of crash risk, given the total number of points a particular location may obtain in the prioritization framework.

From the effort to update the select work codes, 24 crash modification factors (CMFs) were estimated using the empirical Bayes method. Only nine of these CMFs were statistically significant. Three of these nine estimates were considered over-optimistic because of either the

limited number of sites or the limited number of crashes. Considering the unanticipated result for those three CMFs, only six CMFs were recommended to be considered in updating their corresponding work codes:

- 209 (safety-treat fixed objects).
- 532 (texturize shoulders).
- The combination of work codes 206 (improve guardrail to design standards) and 209.

This combination is not readily available as a single work code in the current HSIP manual from TxDOT but is recommended, given these results.

What This Means

The project products are available to be used in site project prioritization and project selection to mitigate roadway departure crashes. Because this research developed a new methodology for site prioritization, the research team recommends further implementation work to disseminate the findings and their usage. Workshops with interested districts would help clarify any doubts about the new systemic approach methodology proposed in this research. Additionally, adoption of the updated work codes is recommended in a future version of the HSIP manual.

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