



Project Summary

Texas Department of Transportation

0-4813: Advisory Speed Signing and Pavement Markings on Freeway-to-Freeway Connectors

Background

Crashes on freeway-to-freeway connector ramps, especially truck rollovers, are typically high-impact and high-visibility incidents that can bring traffic on freeway facilities to a halt. These incidents tend to require several hours for cleanup and removal and often result in injuries or fatalities. This project examined the potential effectiveness in reducing truck and passenger car speeds at freeway connector curves using a dual-advisory speed signing concept (with a differing advisory speed for trucks than for cars) and a novel pavement marking treatment using sets of converging chevrons.

What the Researchers Did

For this project, researchers:

- surveyed Texas Department of Transportation (TxDOT) districts and state departments of transportation to assess existing freeway-to-freeway connector ramp signing and pavement marking practices,
- conducted focus groups of car and professional truck drivers to refine prototype signing and pavement marking treatments, and
- tested deployments of the dual-advisory signing and converging chevron pavement marking treatments at locations throughout the state.

Researchers evaluated the dual-advisory signing concept at five freeway-to-freeway connector ramps. The dual-advisory speed signing concept was based on the results of TxDOT research project 0-4318 “Safe Speeds on Curves for Vehicles with High Centers of Gravity”, where it was recommended that car advisory speeds be based on a 13- or 14-degree ball-bank reading, and truck advisory speeds remain based on a 10-degree ball-bank reading.

The converging chevron pavement marking treatment was installed at a freeway-to-freeway connector in the El Paso District. This treatment is intended to warn drivers of all vehicles of a critical roadway feature ahead and to stimulate a response from drivers to slow down by:

- visually narrowing the lane using transverse striping and
- inducing a sense of overspeed by using progressively closer sets of chevron-shaped pavement markings.

What They Found

Dual-Advisory Speed Signing. The dual-advisory speed signs had a positive impact on operations and safety at the study sites. A majority of the five sites had reductions in average car and truck speeds along the connector ramp, increased compliance with the posted advisory speed, and/or reductions in speed-related crashes.

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Project Completed:

8-31-07

For the year before and year after the signs were installed, the cumulative crash frequency at all five ramps fell from seven to two crashes. It appeared that there was no negative impact on safety when using a 13- or 14-degree ball-bank reading to set passenger car advisory speeds.

Looking specifically at three sites in which the posted advisory speed limit for trucks on the experimental sign was the same as on the previous advisory sign, the rate of compliance increased modestly (by about 10 percent) at some ramps.

Converging Chevron Pavement Markings. A comparison of mean speeds between before and after the markings were installed indicated that there was a reduction in speed on the approach to the chevron markings and at the start of the freeway-to-freeway connector curve. This effect was observed in both cars and trucks, with trucks showing more speed reduction. Researchers noted that speeds in the middle of the connector curve actually showed a small increase after the markings were in place on the approach. It appears that since drivers were slowing more on the approach to the curve, they were then able to accelerate slightly once in the curve.

What This Means

Both the dual-advisory speed signs and converging chevron pavement marking treatment showed promise to assist engineers in mitigating overspeed and crash issues at freeway-to-freeway connector ramps.

Based upon a review of operational data and crash experience at study sites, it appears that the use of the dual-advisory speed sign is a viable concept and provides enhanced warning, especially to trucks on freeway-to-freeway connectors. While focused on trucks, the signs appear not to sacrifice the ability to inform drivers of passenger cars of an appropriate advisory speed on the ramps as well. The use of a ball-bank indicator of 10 degrees to set advisory speeds for trucks and of 14 degrees for passenger vehicles appears to be appropriate. However, in the absence of dual-advisory signs, it is recommended to use either engineering judgment as allowed in the Manual on Uniform Traffic Control Devices or to continue to use a 10-degree ball-bank reading to set curve advisory speeds for 35 mph and higher. The dual-advisory signs should be considered on freeway-to-freeway connector ramps where there has been a demonstrated truck crash experience over time and where the engineer feels that truck-specific warning is warranted.

The converging chevron pavement marking treatment also shows promise in reducing speeds on the approach to freeway-to-freeway connector curves. Researchers recommend that TxDOT consider the use of converging chevron pavement markings on only the most critical freeway-to-freeway connector ramps in the state with most, if not all, of the following characteristics:

- high-speed approaches followed by lower-speed curves, typically with sight distance restrictions;
- curves with higher numbers and percentages of truck traffic,
- curves on vertical grade (either up or downgrade), and
- curves with a demonstrated crash experience.

Converging chevron pavement markings should be selectively used and preferably after traditional mitigation measures have been implemented.

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