Project Summary

Texas Department of Transportation

0-6135: Super 2 Design for Higher Traffic Volumes

Background

As rural traffic volumes rise, often approaching the limits of capacity for two-lane highways, the pressure on those highways rises accordingly, with corresponding effects on congestion, air quality, and safety. High proportions of heavy vehicles compound the problem, contributing to a decrease in safety as impatient drivers attempt to pass slower vehicles in no-passing zones or pass trucks despite having diminished sight distance beyond such vehicles.

Traditionally, roadway agencies expand a two-lane highway to four lanes when certain criteria are met, such as average daily traffic (ADT), peak volumes, prevailing speeds, and/or crash history. As more rural highways approach conditions that meet these criteria, agencies are looking for alternatives to full four-lane expansion to provide a measure of operational benefits at lower cost. Previous research in Texas demonstrated that periodic passing lanes can improve operations on two-lane highway corridors with low to moderate volumes (e.g., average daily traffic at or below 5000 vehicles per day); called "Super 2" highways in Texas, these improved corridors can provide many of the benefits of a four-lane alignment at lower cost.

As traffic volumes increase on the state's two-lane roads, along with the volumes of heavy vehicles, the effects of limited passing sight distance are magnified. This results in more locations where Super 2 highways may be effective. As a result, providing longer passing lanes and/or providing passing lanes with greater frequency may be justified. Project 0-6135 expanded on previous research to develop design guidelines for passing lanes on two-lane highways with higher volumes.

What the Researchers Did

Super 2 corridors have been installed at locations with higher volumes on highways across the country, and the agencies responsible for those roadways have varying guidelines for their use. In addition, a review of operations and safety on such corridors in Texas had not been done. In order to properly evaluate that information, researchers at the Texas Transportation Institute:

- Reviewed the design manuals from each state's department of transportation to determine the state of the practice nationwide.
- Reviewed results from recent domestic and international research on operational and safety characteristics at higher volumes.
- Distributed a questionnaire to TxDOT personnel to assess the current state of the practice in Texas and identify existing Super 2 corridors.

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- Reviewed and analyzed 12 years of crash data on five existing corridors.
- Conducted a field study of Super 2 corridors on two highways with higher volumes.
- Performed a simulation analysis to evaluate Super 2 operations with varying volume, passing lane, and traffic characteristics.

What They Found

The location and configuration of a passing lane may be influenced by the need to alleviate an operational problem, adjacent development, terrain, or other factors. This allows flexibility for the designer to avoid a bridge, intersection, or major driveway and to place passing lanes where they will be most useful. Passing lanes are beneficial at volumes approaching 15,000 vehicles per day, particularly on rolling terrain; the presence of passing lanes improves delay and percent time spent following. Most passing occurs within the first mile of a passing lane, so additional length may be less useful than additional lanes in a Super 2 corridor, particularly at lower volumes. Empirical Bayes analysis of crash data showed that there is a statistically significant crash reduction of 35 percent for segment-only KABC crashes on the study corridors, as compared to the expected number of crashes without passing lanes.

What This Means

The use of ADT as an upper limit on the installation of passing lanes is not necessary. As budget, terrain, and other factors allow, passing lanes may be added or lengthened to provide additional passing opportunities regardless of volume. There is, of course, the proviso that as passing lanes are added and lengthened, the highway more closely resembles a four-lane undivided alignment and the incremental cost and operational benefits of each added lane diminish.

While ADT need not be a limiting factor in installation, it can be used to prioritize candidate sites for passing lanes, particularly when considering truck volumes. In lieu of guidelines related to specific ADT values, other general principles should be used to assist designers in the decision to install Super 2 corridors, such as consideration of terrain and right of way in determining alignment and placement of passing lanes, avoiding major traffic generators within passing lanes, and providing sufficient sight distance where passing lanes are terminated to avoid conflicts with oncoming traffic. As part of their proposed revisions to the *Roadway Design Manual*, researchers recommended including these and other principles, such as avoiding intersections with state highways and high-volume county roads within passing lanes, avoiding the termination of passing lanes on uphill grades, and discouraging passing lane lengths longer than 4 miles.

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