Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6811: Reducing Lane and Shoulder Width to Permit an Additional Lane on a Freeway

Background

This research identified the operational and safety implications of using reduced lane and shoulder widths for a variety of freeway configurations. As demand on Texas freeways continues to increase, it is important to better understand the impacts of narrowing lanes and shoulders in an effort to add lanes for additional capacity.

What the Researchers Did

The research team used speed, crash, and geometric data for freeways in Dallas, Houston, and San Antonio to evaluate how varying lane and shoulder widths on urban freeways can influence corridor operations and safety.

What They Found

The research team found that narrowing lanes and shoulders will generally result in lower speeds. However, the location of the individual lane and whether it is adjacent to another lane or a shoulder directly influence the level of speed reduction. The operational analysis identified an increase of about 2.2 mph in speed for a 12-ft lane as compared to an 11-ft lane. The shoulder width is significant when the adjacent lane is 11 ft wide but not when it is 12 ft wide, which suggests that left-shoulder width is more important with a reduced lane width. Operating speeds on Texas freeways are 2 mph lower during nighttime (with roadside lighting present) than during the day. Speeds were higher (by 1.5 mph) on the weekends (Saturday) than on the weekday studied (Wednesday).

The number of crashes can also be expected to increase at locations with narrower lanes. The safety analysis determined a crash difference when comparing freeways with 12-ft to 11-ft lanes. The research team observed a reduction in injury crashes that ranged from 5 percent for two-lane freeways to 12 percent for five-lane freeways, other roadway characteristics being equal. Similarly, there were crash reductions associated with each additional lane, increased left-shoulder widths, and increased right-shoulder widths. While constructing an additional lane is beneficial in terms of safety, a larger safety impact caused by narrow lanes or shoulders offsets this benefit. However, if it is possible to increase the total paved width when adding a travel lane, the safety model allows the analyst to identify lane and shoulder widths so that the expected number of crashes along the corridor will remain unchanged.

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What This Means

The narrowing of lanes and shoulders for the purposes of adding capacity to a Texas freeway can also be expected to affect the overall traffic operations and safety. This study demonstrated an adverse effect on the number of crashes as a result of reducing shoulder widths so that the freeway travel lanes could be widened or another travel lane could be added within the existing paved surface width. At locations where it is feasible to widen the overall pavement width (lanes plus shoulders), it is possible to identify optimal widths that will facilitate the operational performance without increasing the number of crashes. However, where feasible, the lane and should widths should conform to recommended Texas Department of Transportation design values.

The findings from this research provide numerical, data-based ways for a decision maker to predict the actual impact and select specific configurations that better balance the operational and safety effects. The operational and safety equations developed as part of this effort can be used to facilitate these decisions.

The resulting operating speed equation for a Texas freeway is:

$$S = 67.80 - 0.00018(V^2) + 4.60(MedType_{Grass}) + 2.21(LaneW) + 3.62(ToLeft_{B+P}) + 2.03(ToLeft_{Shld}) - 3.89(ToRight_{SCL}) - 4.39(ToRight_{Shld}) - 2.00(NLight) - 1.47(DayofWeek)$$

The resulting crash prediction equations for total (N_{Total}) and injury (N_{KAB}) crashes are:

$$N_{Total} = 1.0027 \times L \times AADT^{0.539} \times e^{[-1.0243(RampUp_{Dist}) - 1.0877(RampDn_{Dist}) - 0.0241(NLane \times Lane\_W_{Avg}) - 0.0735(RShld) - 0.0646(LShld)]}$$

$$N_{KAB} = 0.0514 \times L \times AADT^{0.662} \times e^{[-1.5787(RampUp_{Dist}) - 0.8659(RampDn_{Dist}) - 0.0253(NoLn \times LaneW_{Avg}) - 0.0956(RShld) - 0.0547(LShld)]}$$

The associated variable definitions and boundaries are included in Tables 48 and 49 of the full report.

For More Information

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