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Project Summary Report 0-4434-S

Project 0-4434: Safety Evaluation of HOV Lane Design Elements

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PROJECT SUMMARY REPORT

Crash Data Identify Safety Issues for High-Occupancy Vehicle Lanes in Selected Texas Corridors

In Texas, high-occupancy vehicle (HOV) lanes have emerged as an integral part of the state's current and future transportation system to aid urban mobility. As a result, the issue of HOV lane design and the influence of design on safety has become the focus of much attention in the transportation community.

The objective of this research was to develop a better understanding of the safety issues associated with HOV lanes, particularly buffer-separated concurrent flow HOV lanes. The research team increased understanding primarily through analyzing freeway corridors in Dallas, where HOV lanes have been implemented. These corridors offer a valuable opportunity to evaluate "before" and "after" crash data and determine whether there has been a change in injury crash occurrence. Based on the key findings of the crash data analysis, the research team developed guidance for future HOV lane projects.

What We Did...

The research team began by conducting a comprehensive literature review on the topic of HOV lane safety. Then, transportation professionals from across the United States were surveyed to gain a better understanding of the various issues regarding HOV lane safety prior to any quantitative data analysis. Next, the research team analyzed injury crash data from three corridors in the Dallas area with HOV lanes.

Based on the analysis of injury crash data and a sample of manually reviewed crash reports, the research team developed guidance for future design of HOV lanes in the Dallas area. This guidance focuses on recommended cross-sections for barrier-separated contraflow HOV lanes and painted buffer-separated concurrent flow HOV lanes.

What We Found...

Literature Review

Previous studies regarding the safety of HOV lane projects have been relatively inconclusive. Some studies have concluded that buffer-separated concurrent flow lanes are as safe as other types of HOV lane projects, while others have indicated a safety concern with these types of projects. The literature indicates a safety concern with buffer-separated concurrent flow HOV lanes due to the potential speed differential between the HOV lane and the general-purpose lanes.

Studies regarding the safety of barrier-separated HOV lanes focus mainly on the fact that crashes occurring in the general-purpose lanes do not typically disrupt operation of an HOV lane because the barrier prevents mixing of

traffic. For the same reason, crashes occurring in the barrier-separated HOV lane do not typically disrupt operation of adjacent general-purpose lanes. The literature indicates a safety concern with incidents occurring within a barrier-separated HOV lane where the barrier limits the ability of the HOV lane traffic to maneuver around the incident.

HOV Lane Safety Survey

The research team developed survey questions on the topic of buffer-separated and barrier-separated HOV lane safety. Most issues that the survey respondents indicated as being associated with buffer-separated HOV lanes can be classified into one of the following categories: ingress/egress difficulty, vehicles illegally crossing the buffer, speed differential, and reduced inside shoulder width.

Survey respondents indicated that incidents occurring on barrier-separated HOV lanes are restricted mainly to the HOV lane and do not routinely impact the general-purpose lanes. Most issues that the survey respondents indicated as being associated with barrier-separated HOV lanes can be classified into one of the following categories: excessive vehicle speeds, disabled vehicles within the lane, safe access point design, and emergency access to the barrier-separated HOV lane.

Crash Data Evaluation

The research team analyzed crash data to evaluate buffer-separated concurrent flow and moveable barrier-separated HOV lanes. A "before" and "after" comparison of corridor crash rates on IH-35E North in Dallas indicated a 56 percent increase in injury crash rates since installation of the buffer-separated HOV lanes. IH-635 experienced a 41 percent increase in injury crash rates since installation of the buffer-separated HOV lanes.

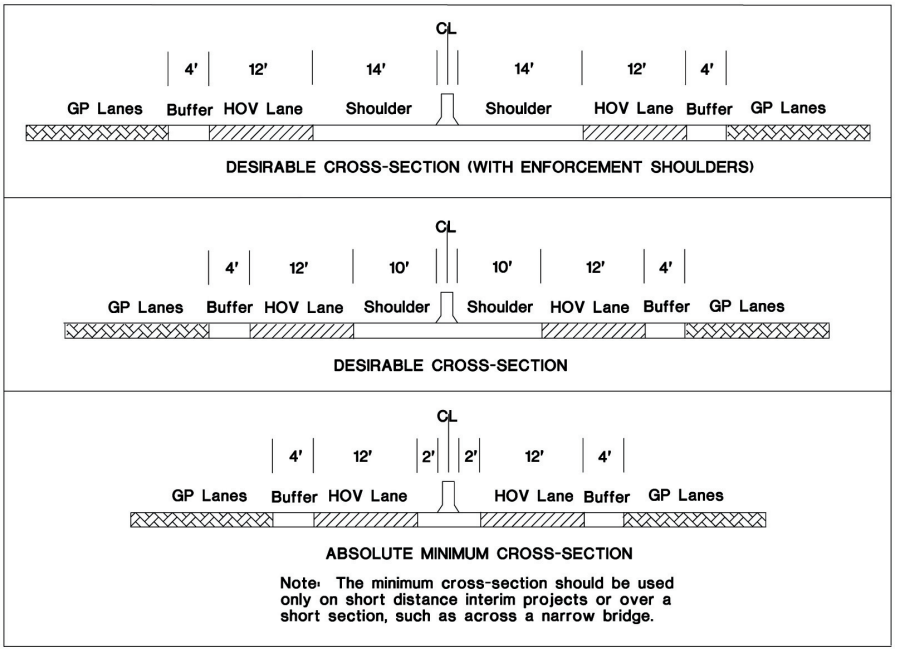

Figure 1. Desirable/Minimum Cross-Section for Buffer-Separated HOV Lanes.

The research team identified three key findings from the crash data analysis of Dallas corridors with buffer-separated concurrent flow HOV lanes:

- The injury crash rate increased.
- Increase in injury crashes was primarily focused in the HOV lane and the adjacent general-purpose lane (Lane 1).
- Increase in injury crashes was likely due to the speed differential between the HOV lane and the general-purpose lanes. The general-purpose lanes experienced congestion during peak periods, while the HOV lanes usually operated at the speed limit.

Based on the freeway's traffic characteristics and a review of crash data within each corridor, it appears that the excessive congestion in the general-purpose lanes (i.e., bumper-to-bumper traffic) makes it difficult for vehicles in the HOV lane to find gaps in Lane 1 to easily change lanes. Also, vehicles in the slow-moving general-purpose lanes wishing to enter the HOV lane must first change lanes into the HOV lane and then accelerate up to speed. In either situation, the speed differential between the HOV lane and Lane 1 appears to be a factor in crash occurrence.

The analysis of crash data from the IH-30 corridor indicates that the moveable barrier-separated HOV lanes did not

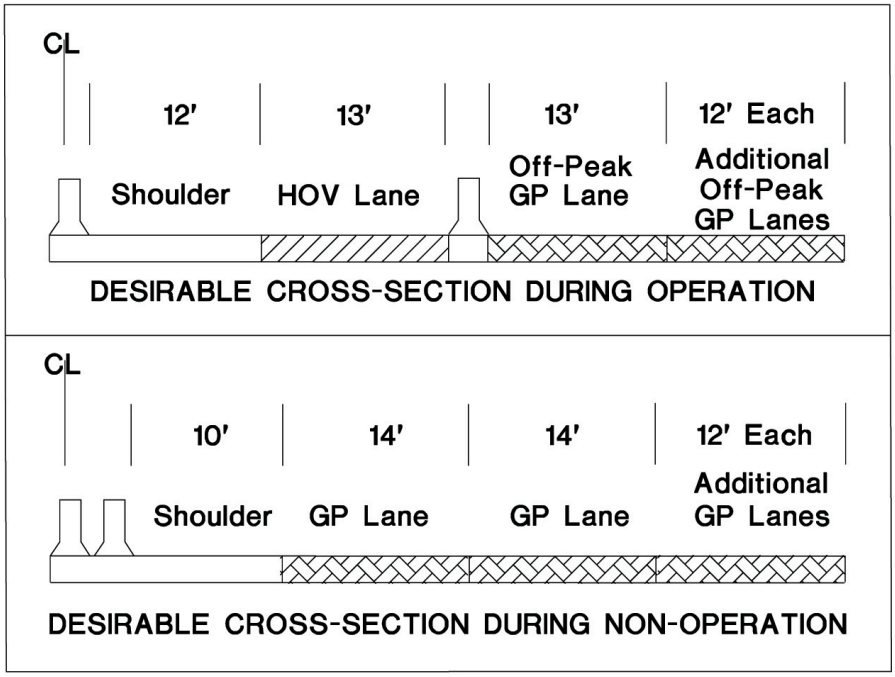

Figure 2. Desirable Cross-Section for Contraflow Moveable Barrier HOV Lanes.

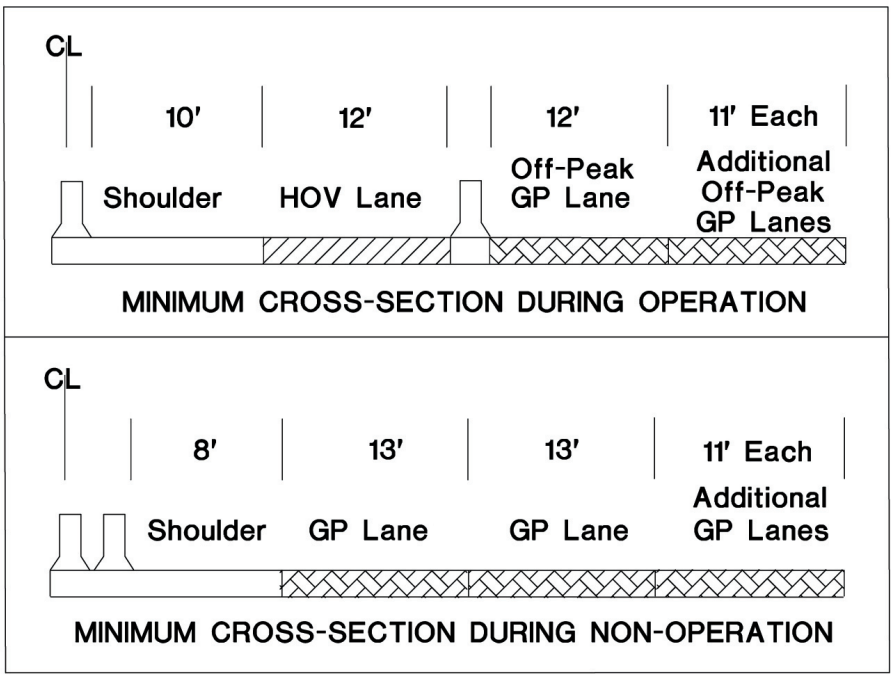

Figure 3. Minimum Cross-Section for Contraflow Moveable Barrier HOV Lanes.

have an effect on injury crash rates. However, the research team has identified the following items for further research based on the analysis:

- A relatively small number of crashes are occurring within the HOV lane, with most occurring at or near access points.
- Although there are few crashes related to excessive speed, it would be of benefit to examine possible ways to reduce speed at critical locations.
- It would be helpful to examine whether crashes within the HOV lane may be averted if enough room is available between the median and the moveable barrier that passing a stalled vehicle is possible.

The Researchers Recommend…

Cross-Section for Buffer-Separated Concurrent Flow HOV Lanes

Based on the available crash data regarding Dallas' buffer-separated concurrent flow HOV lane corridors, the research team recommends cross-sections for future HOV lane projects as shown in Figure 1. The minimum cross-section provides enough room for two 8-foot-wide vehicles to be in the HOV lane area (inside shoulder, HOV lane, and painted buffer) of the freeway without encroaching on the general-purpose lanes. This design may prevent many of the types of crashes studied.

Cross-Section for Moveable Barrier-Separated HOV Lanes

Based on the available crash data regarding Dallas' moveable barrier-separated HOV lane corridor, the research team recommends cross-sections for future HOV lane projects as shown in Figures 2 and 3. The minimum cross-section is currently being used in the IH-30 corridor in Dallas.

For More Details...

This research is documented in: Report 0-4434-1, *Crash Analysis of Selected High-Occupancy Vehicle Facilities in Texas: Methodology, Findings, and Recommendations*.

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TxDOT Implementation Status—January 2005

The objective of this research project was to develop an understanding of the safety issues associated with the three different types of HOV lanes in the Dallas District. The project led to the development of suggested HOV lane geometries, including the type of HOV lanes recommended for use in the Dallas District. One product was required for this project: suggested geometric design elements for HOV lanes. The information contained in this product will be implemented by the Dallas District and Dallas Area Rapid Transit.

For more information, contact Mr. Wade Odell, P.E., RTI Research Engineer, at 512-465-7403 or email wodell@dot.state.tx.us.

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