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Project Summary Report 7-4961-S

Project 7-4961: An Evaluation of Dallas Area HOV Lanes

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PROJECT SUMMARY REPORT

Evaluating HOV Lanes in the Dallas Area

While carpooling declined nationally by an average of 30 percent in the past two decades, recent research on Texas freeway corridors with mature interim high-occupancy vehicle (HOV) lanes has shown an increase in carpooling of 100 percent or greater during the same period. An extensive system of permanent HOV lanes is planned for the Dallas-Fort Worth urbanized area. Until these permanent treatments can be implemented, the Texas Department of Transportation (TxDOT) and Dallas Area Rapid Transit (DART) are pursuing interim HOV lane projects that enhance public transportation and overall mobility.

Currently, there are 54.2 miles of operational interim HOV lanes in the Dallas area, including a barrier-separated contraflow lane on IH-30 (Figure 1), buffer-separated concurrent flow lanes on IH-35E North and IH-635 (Figure 2), and a barrier-separated reversible flow lane on IH-35E South connected to a buffer-separated concurrent flow lane on US-67.

What We Did...

The goal of this project was to investigate the operational effectiveness of Dallas' interim HOV lanes as well as to analyze the effectiveness of concurrent flow versus contraflow HOV lanes in the area. By looking at the performance of both concurrent flow and contraflow HOV lanes, recommendations could be made on suggested HOV lane policies, including the type of permanent HOV lanes recommended for the Dallas area.

To evaluate and monitor HOV lane performance, it was necessary to look at both quantitative data and qualitative issues.

What We Found...

Person Volumes and Occupancy

The total person volume has increased in each corridor since the opening of the HOV lanes. All five freeways with an HOV lane have shown an 8 to 12 percent increase in average automobile occupancy, suggesting that motorists have formed carpools to gain the benefits of traveling in an HOV lane.

Travel Times and Speeds

HOV lane speeds on all five facilities are significantly higher than the speeds on the adjacent general-purpose lanes. Peak-hour

Figure 1. Barrier-Separated Contraflow Lane on IH-30 in Dallas.

travel-time savings on incident-free days for each of the five HOV lanes ranged from 3 to 13 minutes, which actually underestimates the average weekday savings due to potential delay from incidents on the freeway general-purpose lanes. Additionally, general-purpose lane speeds have remained constant or have increased on all corridors since the opening of the HOV lanes.

Transit Operations

Bus operating speeds have more than doubled since the opening of the HOV lanes on IH-30, IH-35E North, and IH-35E South during the AM and PM peak hours. DART's bus operating costs have been reduced by approximately $587,000 per year since the implementation of HOV lanes.

Cost-Effectiveness

All HOV lane projects are cost-effective and have attained or are projected to attain a benefit-cost ratio greater than 1.0 within the first six years of operation.

Enforcement

The HOV lanes are routinely enforced by DART transit police through a combination of roving and stationary enforcement in squad cars and motorcycles during the peak periods and sporadically during the off-peak periods.

The violation rate on the barrier-separated IH-30 HOV lane (1-2 percent) is lower than the rate on the concurrent flow HOV lanes (3-6 percent). The concurrent flow lane rates are at the lower end of typical nationally reported concurrent flow HOV lane violation rates, which range between 5 and 40 percent.

HOV Lane Safety

An analysis of crash data evaluated the safety impacts of barrier-separated versus buffer-separated facilities. A "before" and "after" comparison of corridor crash rates on IH-30, a barrier-separated facility, did not indicate anything significant. Increases in daily crash rates appeared to occur during periods of construction with crash rates being slightly lower during peak periods since HOV lane implementation. A review of individual crashes after introduction of the barrier-separated HOV lane indicated increased crashes near the entrance in the AM peak period.

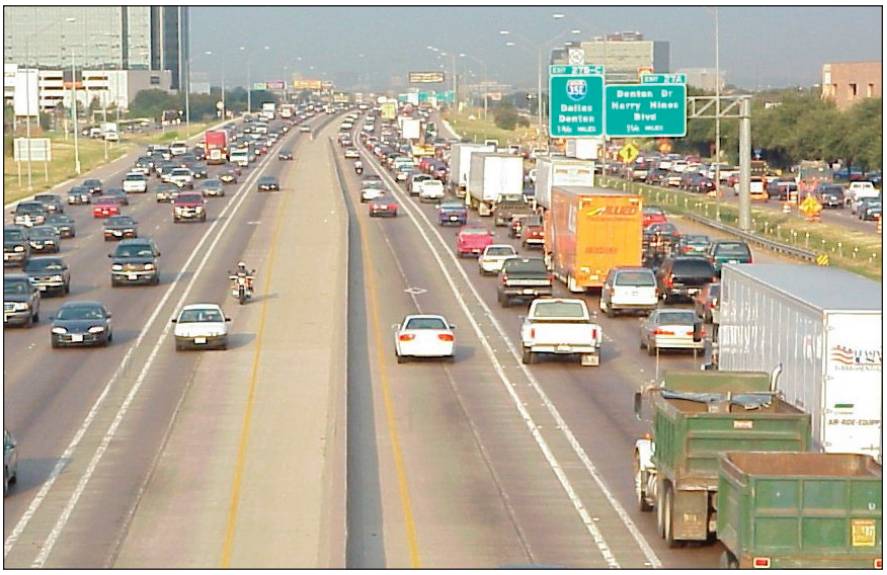

Figure 2. Buffer-Separated Concurrent Flow Lanes on IH-635 in Dallas.

A "before" and "after" comparison of corridor crash rates on IH-35E and IH-635 indicated an increase in corridor crash rates since the installation of the buffer-separated HOV lane, particularly in the peak travel periods. A review of individual crashes on IH-35E in the "after" condition indicated increased crashes related to the northbound intermediate access location during the evening peak period. On IH-635, a similar review indicated increased crashes related to the HOV lane enforcement area, which affected westbound traffic in both the AM and PM peak periods.

Researchers were unable to pinpoint a single cause for increased crash rates on the buffer-separated HOV lane corridors. Rather, they developed a list of possible factors that should be considered when implementing buffer-separated HOV lanes. These factors include: the loss of an inside shoulder; the reduction of the widths of general-purpose lanes; the speed differential between the HOV lane and the general-purpose lanes; vehicles weaving from lane to lane for access to and from the HOV lane; and law enforcement activities related to the HOV lane which could require sudden lane changes. These findings are based on crash data available at the time of this research report. More extensive crash data will be available and reported in TxDOT Project 0-4434, Safety Evaluation of HOV Lane Design Elements. The findings will be specific regarding the safety issues outlined in this report.

Design Requirements

HOV lanes are generally implemented in corridors with severe congestion and a high transit demand. Barrier-separated lanes usually require more right-of-way (ROW) than other types of HOV facilities because of acceleration and deceleration lanes at ingress/egress areas and wider areas to allow for direct connect ramps. This requirement, many times, makes it difficult to retrofit these types of facilities into existing cross sections.

Buffer-separated or concurrent flow HOV lanes generally require less ROW than barrier-separated lanes. These facilities are typically located on the inside lane of the freeway; however, they can be the outside lane of the freeway, although non-HOV traffic would need to access the HOV lane to enter and exit the freeway, which is undesirable.

Implementation Time

Barrier-separated lanes generally take a longer time to implement. The additional time is required for designing and building structures, obtaining needed ROW, and obtaining funding for the project, similar to any long-term construction project. The implementation time for concurrent flow HOV lanes is relatively short, particularly when an inside freeway shoulder already exists.

Capacity

The capacity of any facility depends on many factors, including design speed, lane width, and the presence of vehicles other than passenger cars in the traffic stream. Differences in capacity can be attributed to the number of and the design of ingress/egress areas and the offset to either a barrier or general-purpose lane traffic.

Concurrent flow lanes with continuous ingress and egress will have continuous merging of high- and low-speed traffic, which will reduce the capacity of the facility. Limited access via a painted buffer focuses this merging activity to specific areas and should improve operations. However, the absence of acceleration and deceleration lanes, which typically are provided at barrier-separated access/egress areas, negatively impacts operations and capacity.

Access

Access to barrier-separated lanes is controlled and more limited than on concurrent flow facilities. On concurrent flow facilities, access may be provided continuously along the facility or restricted to certain locations, as delineated by pavement markings. Frequent access increases the potential number of carpoolers but also decreases operational effectiveness.

Incident Management

Incident management is an issue that designers must address in all freeway corridors; however, it is especially critical on concurrent flow HOV lanes. HOV lane users who do not regularly gain a travel-time savings and trip-time reliability may choose not to continue to use the HOV lane. Incidents that occur on the freeway general-purpose lanes can, and have, blocked the concurrent flow HOV lane because of the lack of a physical barrier separating the HOV lane and adjacent general-purpose lanes. DART has personnel that patrol the HOV lanes and respond to all incidents that occur on the facilities.

Flexibility

A barrier-separated facility allows for flexibility in the criteria for eligible users because of the limited access, while concurrent flow HOV lanes offer flexibility in design. Such projects can be considered interim and retrofitted into an existing cross section, or they can be designed as long-term permanent facilities.

Hours of Operation (24-Hour versus Peak-Period Operation)

Typically, barrier-separated HOV lanes are reversible, so they can serve the peak-direction commuting traffic; therefore, they usually cannot operate 24 hours a day. Buffer-separated HOV lanes offer the option to operate 24 hours a day or in peak periods only. They can be used as general-purpose lanes or shoulders during certain (non-peak) hours of the day. "Part-time" buffer-separated lanes, however, may confuse commuters, are more difficult to enforce, and have increased signing needs.

Toll Applications

Congestion pricing can be more easily implemented on barrier-separated HOV lanes, due to their physical separation from the adjacent freeway lanes, to allow single-occupant vehicles and/or trucks to pay a toll to use the facility during certain time periods. Congestion pricing cannot be easily implemented on concurrent flow HOV lanes due to the lack of physical separation.

The Researchers Recommend...

The interim HOV lanes in Dallas have generated a substantial number of carpools, have increased the person movement in the corridor, have increased the occupancy rate in the corridor, and have not negatively impacted the operation of the adjacent freeway general-purpose lanes.

The person movement increase on the contraflow lane justifies the continued operation of the moveable barrier-separated system since the HOV lane is moving approximately twice as many people as two general-purpose lanes during the peak hour. This increase is attributed to a substantially higher occupancy rate in the HOV lane due to the large number of buses utilizing this lane.

The person movement increase on the buffer-separated concurrent flow lanes justifies the concurrent flow HOV lanes, as they are moving more persons than a single adjacent general-purpose lane during the peak hour. However, the number of buses servicing the buffer-separated concurrent flow corridors is less than the number of buses servicing the moveable barrier corridor. Additionally, the fixed barrier-separated reversible flow HOV lane is moving slightly more persons than a single adjacent general-purpose lane during the peak hour, but the lane has been operational only for a short period of time, approximately six months.

Experience from Houston, however, indicates that two to four years of operation of a facility are required before a complete and thorough assessment can be made. Therefore, researchers recommend continued operation of the buffer-separated concurrent flow and fixed barrier-separated reversible flow lanes with ongoing monitoring, in addition to continued operation of the highly successful moveable barrier-separated contraflow HOV lane.

For More Details. . .

Research for this project is documented in:

Research Report 4961-2, *An Evaluation of Dallas Area HOV Lanes, Year 2000*

Research Report 4961-4, *An Evaluation of Dallas Area HOV Lanes, Year 2001*

Research Report 4961-6, *An Evaluation of Dallas Area HOV Lanes, Year 2002*

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TxDOT Implementation Status
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The objective of this research project was to evaluate the operational effectiveness of HOV lanes in the Dallas District. This project also led to the development of suggested HOV lane policies, including the type of HOV lanes recommended for use in the Dallas District. One product was required for this project: *Dallas Area Guidance for HOV Lane Implementation* (7-4961-P1). The information contained in this product has been implemented by the Dallas District and Dallas Area Rapid Transit. Findings from this project led to a follow-up research project, 0-4434, which evaluated the safety aspects of HOV lane design elements in the Dallas area.

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

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