



# Project Summary

Texas Department of Transportation

## 0-5547: Best Practices for Access Between Toll Lanes and Free Lanes

### Background

Access to interior managed lanes has been achieved using elevated ramps and at-grade ramps. At-grade access includes intermediate access and slip ramp terminal access. Intermediate access is defined as access to a buffer-separated managed lane at a point located between the starting point and ending point of the managed lane. Slip ramp terminal access is defined as access to a buffer-separated managed lane through the use of a slip ramp located at the start or the end of the managed lane. The objective of this Texas Department of Transportation (TxDOT) research project was to develop guidance regarding intermediate access to and from buffer-separated toll lanes located within general-purpose lanes.



Division of Access Opening and Lane Assignments at Example Site

### What the Researchers Did

To develop the guidance material, researchers gathered other state guidelines, reviewed the literature, and recorded operations at five intermediate access sites. These sites were located in Dallas, Houston, and Minneapolis. Each site was either a high occupancy vehicle (HOV) lane or a high occupancy toll lane. The length of each opening was between 920 and 1500 ft. Speed limits were either 55 or 60 mph, and there were three or four general-purpose lanes present.

#### Research Performed by:

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From videotapes of the sites, characteristics were recorded for each vehicle that moved into or out of the managed lane. Information was collected for approximately 8400 maneuvers. Examples of the characteristics measured included the point at which the vehicle entered or left the managed lane (early, during one of three zones created within the opening, or late) and the lane of origin for the vehicle. An example of the zones used at an access opening is shown in the picture above. Speeds were recorded at one of the sites for several days. These speeds were associated with the maneuvers so that a comparison could be made when high speeds were present versus when low speeds were present. Volume counts for 5-minute periods were also associated with each maneuver.

## What They Found

The number of attempts to enter or leave the HOV lane was counted for the five sites. Approximately 9 percent of the vehicles crossed the solid white markings (i.e., were not in compliance with the pavement markings). When the two sites with the larger quantity were compared, compliance was better for the longer access opening length (1500 ft) as compared to the 1160-ft access opening length.

A surprisingly large number of maneuvers at the intermediate access openings (more than 7 percent) involved vehicles passing slower-moving vehicles. Between 40 and 80 percent of the passing vehicles involved a vehicle leaving the managed lane to pass a slower-moving managed-lane vehicle. The proportion of passing maneuvers was statistically related to the 5-minute managed-lane volume count. As the managed-lane volume increased, the proportion of passing maneuvers decreased.

Findings from one field site demonstrated that when presented with the opportunity to enter a managed lane that is located very close to an entrance ramp, drivers will attempt to cross multiple lanes to do so. These cross-facility maneuvers occurred less frequently when speeds were less than 40 mph (i.e., fewer acceptable gaps are available for the weaving). More than 25 percent of the cross-weaving vehicles were not in compliance with the markings in that they entered the HOV lane after the solid white lines had begun.

## What This Means

Guidance material was developed for the design of intermediate access. Recommendations included using a 1300-ft minimum, 1500-ft desirable access opening length. The layout and dimensions for pavement markings are shown in the guidelines included in the full research report. Use of these key dimensions will improve consistency in how this type of location is marked and designed across the state.

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