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Effects of Part-Time Operation:

HOV Lanes on Route 14

ELIZABETH G. HILL • LEGISLATIVE ANALYST

Chapter 337, Statutes of 2000 (AB 1871, Runner), temporarily changed the hours of operation of the high-occupancy vehicle (HOV) lanes on State Route 14 in Los Angeles County from full-time to part-time operation. Due to this law, single-occupancy vehicles can now use the Route 14 HOV lanes during off-peak hours. This report examines the effect this change has had on Route 14 traffic patterns and concludes that the conversion to part-time operation had essentially no effect on traffic congestion, either positive or negative.

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INTRODUCTION

Chapter 337, Statutes of 2000 (AB 1871, Runner), prohibited any high-occupancy vehicle (HOV) lane from being established on State Route 14 between the Cities of Santa Clarita and Palmdale in Los Angeles County unless the lane operates as an HOV lane only during hours of peak commute traffic, beginning January 1, 2001. This restriction will expire on June 1, 2002, unless another statute extends this date. In addition, Chapter 337 requires the Legislative Analyst's Office to report on the impact to traffic of limiting the hours of HOV lane operations on Route 14.

To comply with this law, the Department of Transportation (Caltrans) changed the existing HOV lanes on Route 14 from 24-hour to part-time operation so that use of the lanes was restricted to HOVs only during peak commute hours and open to all vehicles the rest of the day.

In this report, we discuss the goals of HOV lanes, describe the operation of these lanes on Route 14, and assess the impact of part-time operation of HOV lanes on Route 14 traffic.

HIGH-OCCUPANCY VEHICLE LANES ON ROUTE 14

California has a long history of using HOV lanes. The first HOV lane in Southern California was the El Monte Busway. This HOV lane consisted of one lane of Interstate 10 in Los Angeles County that was restricted to use by buses only in 1973, and later opened to all vehicles with three or more occupants. Since then, the number of HOV lanes in the Los Angeles area has steadily increased, with most existing lanes being built in the 1990s. By the end of 2000, there was a network of 688 lane-miles of HOV lanes in the Los Angeles area. (There are another 276 lane-miles of HOV lanes in the remainder of the state.)

The network of HOV lanes in the Los Angeles area includes one 16-mile stretch on Route 14, as shown in Figure 1 (see next page). The facility includes one HOV lane in each direction (southbound towards Los Angeles and northbound towards Palmdale), separated from three mixed-flow lanes by a four-foot wide buffer zone, striped with multiple yellow and white lines. Entrance into and exit from the HOV lanes is restricted to designated areas.

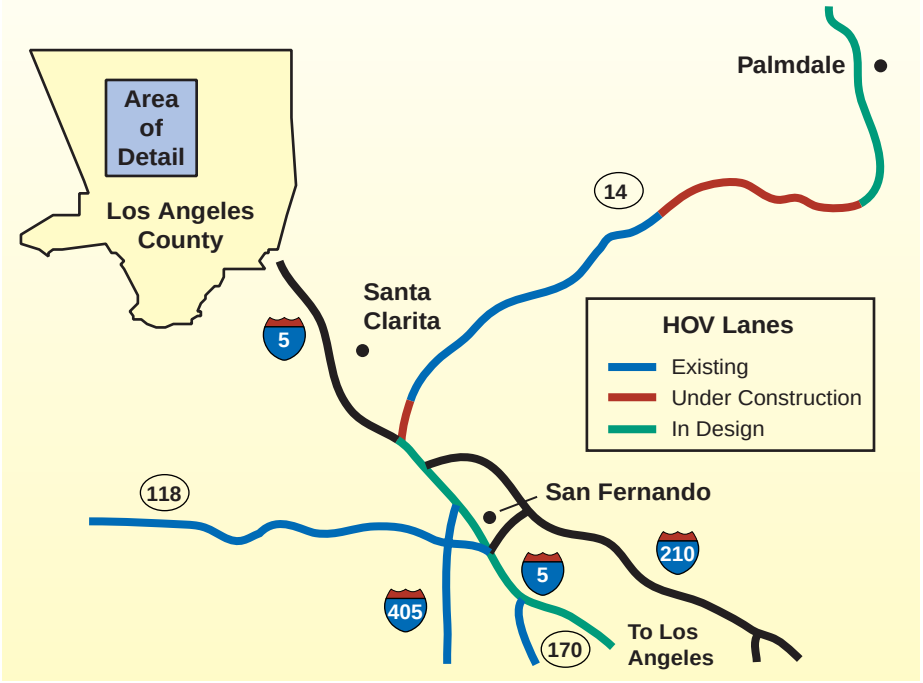
The Route 14 HOV lanes were originally restricted to HOVs (with two or more occupants) on a 24-hour basis, the same as all other HOV lanes in Southern California. After enactment of Chapter 337 and effective January 2001, Caltrans converted these HOV lanes from full-time to part-time HOV usage during the peak commute hours only. These peak hours are 5:00 A.M. to 9:00 A.M. in the southbound direction and 3:00 P.M. to 7:00 P.M. in the northbound direction, excluding weekends. During nonpeak hours, these lanes are open to all traffic (referred to as "mixed-flow" lanes).

In addition to the existing HOV lanes, Caltrans is currently constructing HOV lanes on14 more miles of Route 14, and more are in the design stage, as shown in Figure 1. Specifically, Caltrans' plans call for the Route 14 HOV lanes to eventually extend all the way from Palmdale to Interstate 5, where they would

connect directly to future HOV lanes on Interstate 5, integrating them with the rest of the HOV system in Los Angeles County.

Figure 1

Existing and Future HOV Lanes



GOALS OF HOV LANES

According to state law, the goal of HOV lanes is twofold: to reduce traffic congestion and improve air quality. State law declares that HOV lanes are "to stimulate and encourage the development of ways and means of relieving traffic congestion on California highways and, at the same time, to encourage individual citizens to pool their vehicular resources and thereby conserve fuel and lessen emission of air pollutants." Federal law and the policies of the Federal Highway Administration (FHWA) also encourage the construction of HOV lanes for the purposes of congestion reduction and air quality improvement.

In order to achieve these goals, an HOV lane must result in more single-occupancy vehicle (SOV) drivers choosing to carpool than would do so if there were no HOV lane on a given route. If an HOV lane fails to increase the number of carpools, but rather only serves to shift existing carpoolers to the new lane, the HOV lane could actually be less effective at reducing congestion and pollution than a new mixed-flow lane. This is because it would bar all SOVs from using the new HOV lane capacity, thereby relieving less congestion than a mixed-flow lane would. Thus, HOV lane effectiveness, in general, hinges on the extent to which it causes a change in behavior, or a "mode shift" from SOVs to HOVs.

(For a further discussion of the overall effectiveness of HOV lanes, please see our January 2000 report *HOV Lanes in California: Are They Achieving Their Goals?*)

TRAFFIC IMPACT OF PART-TIME OPERATION OF ROUTE 14 HOV LANES

Chapter 337 required the Legislative Analyst's Office to assess what effect, if any, the changes imposed by the legislation had on traffic on Route 14. To accomplish this, we compared traffic volume and speed data on the route before and after the HOV lanes were converted to part-time use. The primary information used was from detectors embedded in the pavement in each of the lanes on Route 14. These "loop detectors" count the number of vehicles that pass over them in a given amount of time, and are also used to estimate the speed of the vehicles. Caltrans provided a large amount of data, which were augmented with data from the Freeway Performance Measurement System (PeMS) at the University of California, Berkeley.

Data Used Have Limitations

Although a large amount of data were available, the information used had limitations:

- ***Limited Times and Locations.*** The primary data provided by Caltrans were collected at one location on Route 14, about five miles from the southern end of the existing HOV lanes. These data were collected in one week of October 2000 *before* the conversion to part-time operation, and in ten weeks from ten different months in 2001, *after* conversion to part-time operation. The PeMS data came from loop detectors at several locations closer to the southern end of the HOV lanes. The PeMS data analyzed were from one week of December 2000 and one week of December 2001.

- ***Limited Vehicle Occupancy Data.*** Data on the number of occupants in each vehicle were estimated by individuals who observed the traffic at various sites on Route 14 on different days before and after the conversion. These data, however, were always collected during peak commute hours. Therefore, they cannot be used to determine whether vehicle occupancy rates were different after January 2001 during the off-peak hours when the HOV lanes were opened to mixed-flow traffic.

Although the data used were limited as described above, they were sufficient to draw a few definite conclusions. These conclusions are detailed in the following section.

Route 14 Is Generally Not Congested

As noted earlier, one of the goals of HOV lanes is to reduce traffic congestion. Our review found that while Route 14 experienced definite peak periods of traffic volume (both before and after conversion to part-time HOV lanes), this route, with the exception of the segment closest to Los Angeles, is not congested as measured by state and federal standards.

Route 14 Traffic Has Sharp "Peak." Our analysis of the data from October 2000 (prior to conversion to part-time HOV lanes) shows that weekday traffic on Route 14 had a very definite "peak" in each direction, corresponding exactly to the current hours of HOV operation. Southbound traffic peaked in the morning as commuters headed toward jobs in Los Angeles, and

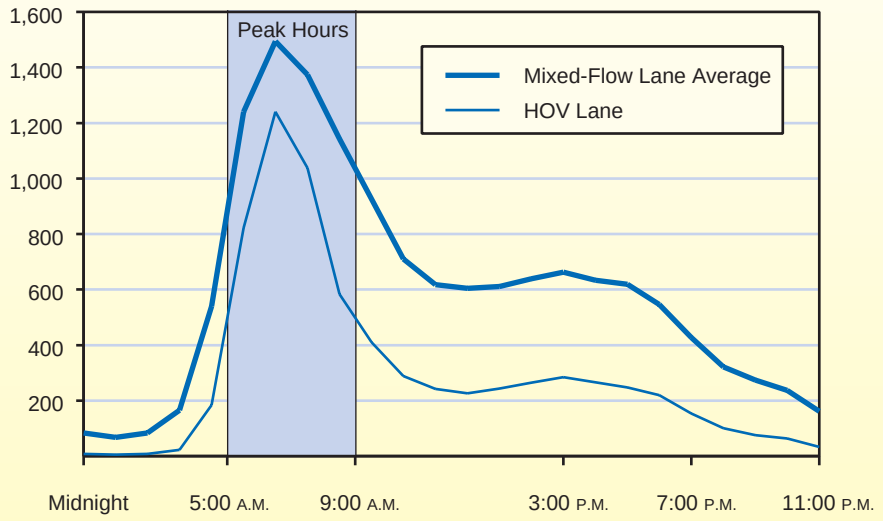
northbound traffic peaked in the afternoon as commuters headed back to their homes in Northern Los Angeles County. Figures 2 and 3 show southbound and northbound traffic volumes respectively, for one week in October 2000. These data were collected five miles from the southern end of the HOV lanes. Analysis of traffic data collected at different times and locations indicates that the patterns shown in these figures are typical of weekdays before the HOV lanes were converted to part-time use, though traffic volumes were generally higher closer to Los Angeles. Based on our review of data collected after conversion to part-time HOV lanes, we found a similar pattern of sharp peaks in traffic volumes.

Only Southern End of Route 14 Experiences Congestion. According to federal highway design standards, the maximum capacity of the average mixed-flow lane is approximately

Figure 2

Route 14 Southbound Traffic Volume October 2000[a]

(Vehicles per Hour)

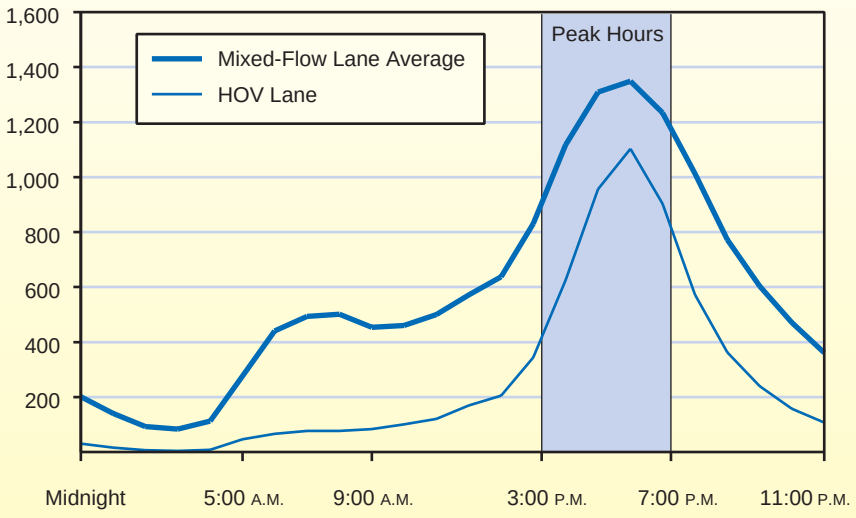


[a] Data averaged from five weekdays.

Figure 3

Route 14 Northbound Traffic October 2000[a]

(Vehicles per Hour)



[a] Data averaged from five weekdays.

2,200 vehicles per hour under ideal conditions, including good weather, good pavement conditions, and standard freeway configuration. However, according to Caltrans, traffic tends to flow safely and smoothly at 55 miles per hour up to about 1,800 vehicles per hour, after which it begins to slow down. As traffic volume increases to near capacity, traffic flow becomes congested when vehicles travel at below 35 miles per hour for at least 15 minutes. Figures 2 and 3 show that average weekday traffic volume at the observed location in October 2000 was less than 1,600 vehicles per hour per mixed-flow lane even during peak commute hours. During off-peak hours, traffic volumes only approached 600 vehicles per hour on the mixed-flow lanes. Thus, this location on Route 14 was not congested before conversion to part-time HOV lanes.

Detectors closer to Los Angeles, however, revealed higher traffic volume during peak hours. Specifically, traffic volumes further south often reached a maximum of around 2,200 vehicles per hour in each lane during peak hours. This high traffic volume resulted in peak-hour congestion closer to Los Angeles. Our review of data collected after conversion to part-time HOV lanes revealed that congestion on Route 14 remained limited to the southern end during peak hours.

Traffic Flowed Freely During Off-Peak Hours. While there is no direct measure of traffic speed on Route 14, the loop detectors that measure traffic volume provide a reasonable estimate of how fast traffic moves. They do this by measuring how long each vehicle is directly on top of them and, assuming an average vehicle length, estimate an average traffic speed at regular intervals.

With few exceptions, the estimated speed data from the loop detectors indicate that traffic flowed freely during off-peak hours during the entire period under analysis, with congestion appearing during these hours only in isolated incidents such as accidents and construction. Even detectors within a mile of the southern end of the HOV lanes, closest to Los Angeles where traffic volume is typically higher, usually reported speeds in excess of 60 miles per hour throughout the off-peak hours. Analysis of data from different locations along Route 14 at different times reveals that this pattern of no congestion in off-peak hours is typical.

Part-Time HOV Lane Operation Has Minimal Effect on Traffic

Our review shows that immediately after Chapter 337 took effect in January 2001, there was no noticeable change in the number of vehicles using the HOV lanes during off-peak hours, when they were open to all vehicles. However, Figures 4 and 5 (see next page) show that, almost one year after the HOV lanes were converted from full-time to part-time operation, traffic volume in each direction had increased significantly in the HOV lanes operating as mixed-flow lanes in the hours just before and after the peak traffic period. Specifically, Figure 4 shows that traffic in the southbound HOV lane in the hour before the morning peak increased from about 220 vehicles per hour to about 460 vehicles per hour, an increase of 110 percent. In the hour after the peak period, traffic volume in this lane increased from about 380 to about 590 vehicles per hour, an increase of 54 percent. Figure 5 shows that northbound traffic volume in the HOV lane operating as a

mixed-flow lane increased similarly in the hours before and after the afternoon peak.

Figures 4 and 5 also show that traffic volume on each of the mixed-flow lanes appears to have decreased slightly in the off-peak hours in three of the four hours examined. Thus, the data suggest that there is an overall evening out of traffic volumes between the HOV lane operating as a mixed-flow lane and the mixed-flow lanes in the off-peak hours. This reflects an obvious change in behavior after the conversion to part-time HOV lane operation, presumably as SOVs began to take advantage of the newly available capacity. However, as indicated in the previous section, traffic flowed freely during off-peak hours even before the HOV lanes were converted to part-time operation. Thus, Chapter 337 does not appear to have had any positive or negative effect on congestion.

Figure 4

Southbound Morning Traffic Volume Per Lane October 2000 Versus October 2001

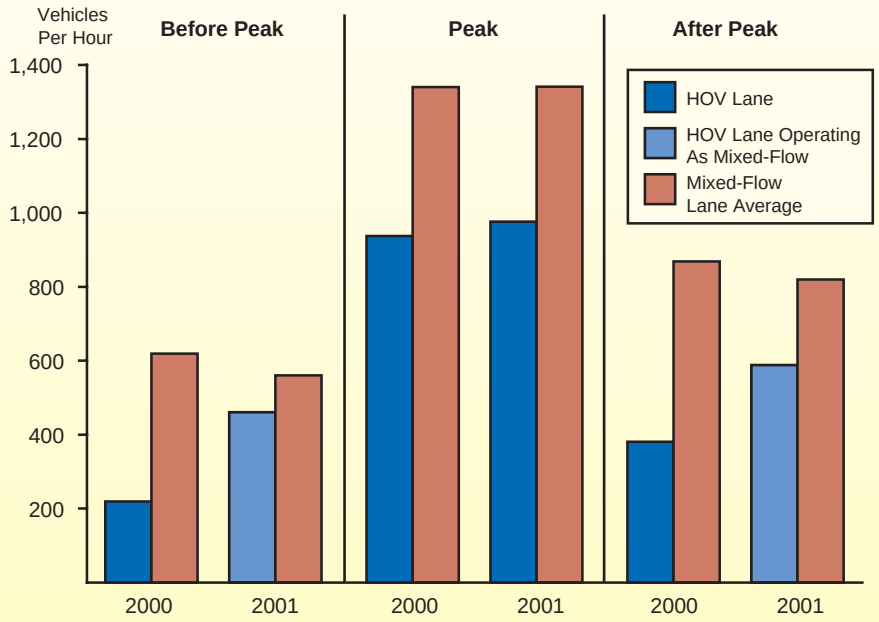
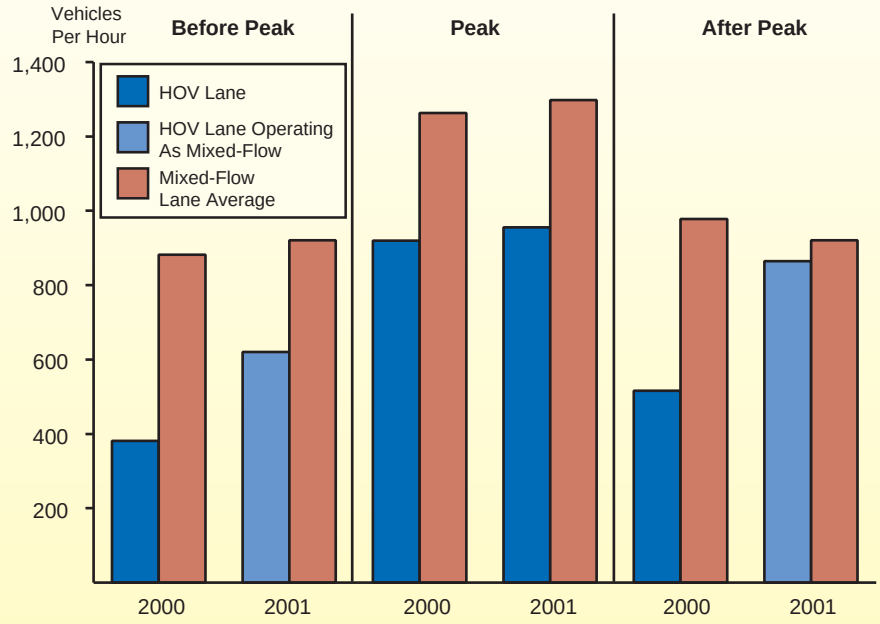


Figure 5

Northbound Afternoon Traffic Volume Per Lane October 2000 Versus October 2001



Furthermore, given that congestion is rare during off-peak hours on Route 14, there would be little incentive for commuters on that route to carpool in these hours. The primary incentive that HOV lanes provide to carpool is the time savings motorists would experience compared to travel in congested mixed-flow lanes. If the mixed-flow lanes are not congested, the HOV lanes will not provide any time savings, and therefore they will not cause more people to choose to carpool. Therefore, Chapter 337 likely had little or no effect on the number of people that chose to carpool on Route 14 during off-peak hours.

As regards peak commute hours, traffic volumes in both the HOV and mixed-flow lanes changed very little. This is not surprising, as Chapter 337 only changed the HOV lanes on Route 14 to mixed-flow lanes in the off-peak hours, leaving their operation unchanged during the peak hours. Thus, the slight increases in traffic volume in both the HOV and the mixed-flow lanes from 2000 to 2001, as shown in Figures 4 and 5, only reflect natural traffic volume growth over time.

CONTINUING PART-TIME OPERATION MAY HAVE OTHER IMPLICATIONS

Route 14 HOV Lane Will Be Integrated With Other HOV Lanes in the Future. As indicated above, the Route 14 traffic data on their own indicate that converting the HOV lanes to mixed-flow lanes during the off-peak hours has had no positive or negative effect on traffic flow. Our analysis shows that Route 14 has worked efficiently with both 24-hour and peak-hour-only HOV lanes, and there does not currently appear to be an inherent reason to prefer one mode of operation to the other. However, two complicating factors should be considered when determining the hours of HOV lane operation on Route 14 on an ongoing basis.

First, there may be system-wide implications if the Route 14 HOV lanes are operated on a part-time basis indefinitely. As part of its goal of creating a fully integrated HOV system in the Los Angeles area, Caltrans plans to connect the Route 14 HOV lanes directly to future HOV lanes on Interstate 5 by 2008. The HOV lanes on Interstate 5, like the rest of those in Los Angeles County, will operate on a 24-hour basis. Both Caltrans and the California Highway Patrol believe that allowing any HOV lanes in the system to operate on different hours than the rest of the system can cause driver confusion, increase HOV lane violations, and impair traffic flow and safety. However, the full extent of these negative effects will be uncertain until the connection is actually built.

Second, Northern Los Angeles County population and employment will likely grow substantially in the coming decades resulting in traffic congestion on Route 14. The Los Angeles County Metropolitan Transportation Authority projects that north county population will grow by 165 percent from 1998 to 2025, and employment will grow by 137 percent over the same period. These growth rates are the fastest in Los Angeles County and represent an acceleration of the north county's already rapid growth. For

example, from 1990 to 2000, north county population grew by 29 percent, compared to a 7 percent growth rate for Los Angeles County as a whole. As population and employment grow, traffic on Route 14 will grow as well, and congestion on the route is likely to become more severe and spread to more hours of the day in both directions.

Both of these factors suggest that the Route 14 HOV lanes will likely have to revert to 24-hour operation by 2008, when Caltrans expects to directly connect them to HOV lanes on Interstate 5. One option to accomplish this would be to allow the HOV lanes to revert to 24-hour operation when Chapter 337 expires on June 1, 2002. This would ensure that the lanes' operation is compatible with the rest of the HOV system in the future. However, as the HOV lane connection to Interstate 5 is not projected to occur until 2008, and traffic congestion on Route 14 is unlikely to extend beyond peak hours in the near future, the Legislature may choose to extend part-time operation of the Route 14 HOV lanes until they are directly connected to the rest of the HOV system in Los Angeles County. If the Legislature wishes to continue part-time HOV operation on Route 14 beyond this point, further analysis could be performed at that time to determine whether continuation is feasible.

Converting HOV Lane to 24-Hour Mixed-Flow Lane Is Not Warranted at This Time. While the data indicate that Route 14 experiences peak hour congestion at its southern end, they show that congestion decreases further north, so that even during peak hours the traffic flows at 60 miles per hour or faster. However, it would be premature to conclude based on this information that HOV lanes are only necessary at the extreme southern end of Route 14. Caltrans bases its decisions to build HOV lanes on projected traffic volumes five years after any proposed HOV lane would open. These projections indicate that traffic volume will increase on Route 14 within a few years, slowing down mixed-flow traffic enough to give commuters an incentive to carpool. This would ensure adequate use of both the existing HOV lanes and those currently under construction.

If the projected increase in traffic volume does not materialize in this time and the HOV lanes are underutilized, the lanes can be converted to mixed-flow traffic in the future. This occurred with HOV lanes on Interstate 580 in Northern California, which typically carried fewer than 300 vehicles per hour. However, the state does not have the authority to unilaterally convert HOV lanes to mixed-flow. This is because the HOV lanes currently in existence on Route 14 and those under construction have received a substantial amount of federal funding. In such cases, the state cannot convert HOV lanes to mixed-flow lanes without approval of the FHWA.