Evolution of High-Occupancy Vehicle Facilities

Maximizing Efficiency and Effectiveness

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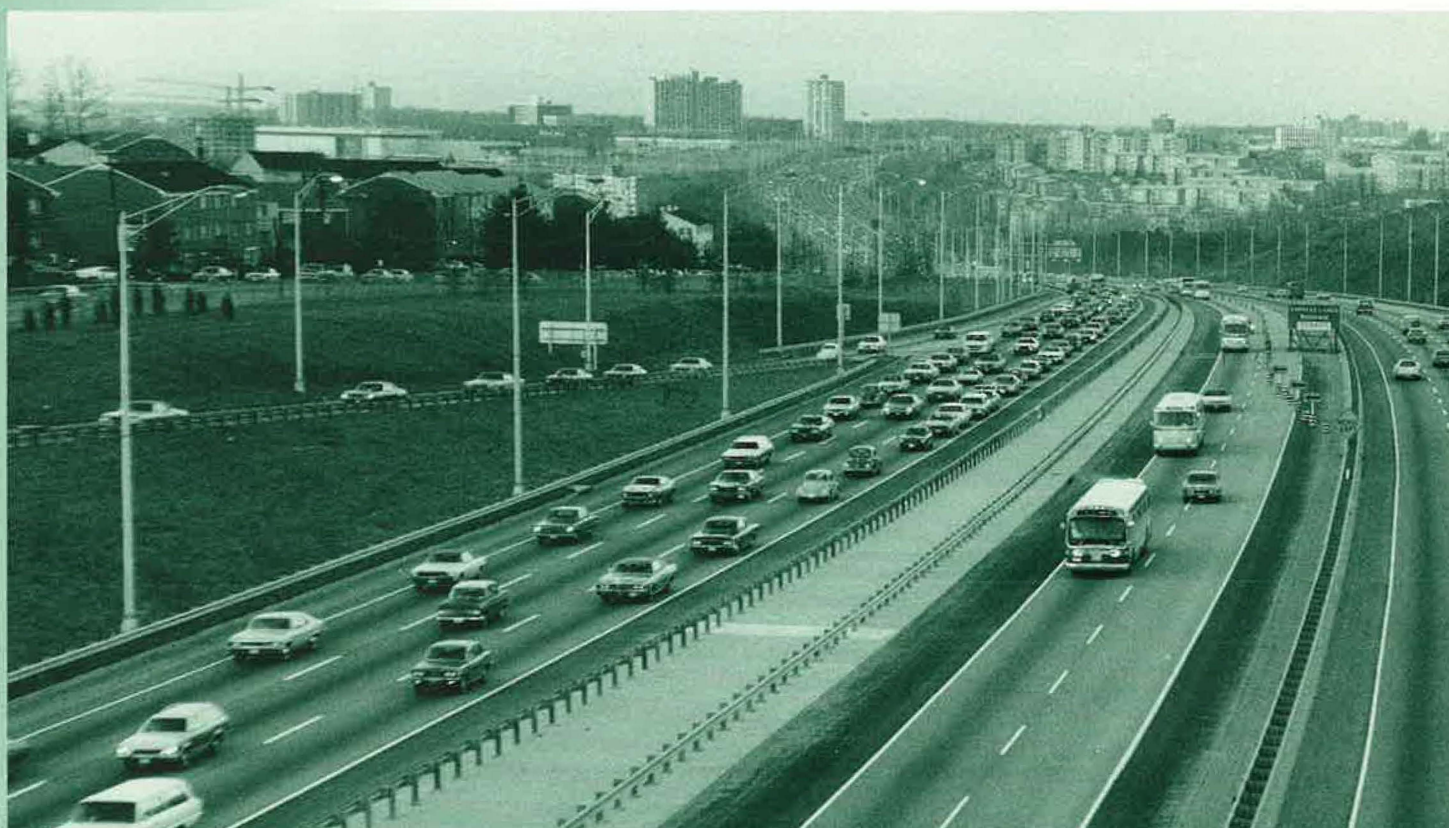
High-occupancy vehicle (HOV) facilities have been part of the urban transportation landscape for the past 30 years. During this time, HOV lanes have had their share of proponents and critics. Recently some groups have argued that HOV lanes are outdated and no longer benefit the transportation system. Others continue to promote HOV facilities as one way to deal with increasing levels of traffic congestion in major metropolitan areas.

What have we learned about HOV facilities in the past three decades? Recent studies sponsored by the National Cooperative Highway Research Program (NCHRP), the Transit Cooperative Research Program (TCRP), and the Federal Highway Administration (FHWA)—as well as ongoing state and local monitoring and evaluation efforts—provide insight into what works and what does not work with HOV facilities, and what future trends might develop.

Trip Down HOV Memory Lane

Most HOV projects are intended to improve the people-moving capacity rather than the vehicle-moving capacity of congested freeway corridors. As a result, common objectives for HOV facilities are to

- Increase the average number of persons per vehicle,
- Preserve the people-moving capacity of a freeway,
- Improve bus operations, and
- Enhance mobility options for travelers.



The travel time savings and improved trip reliability of HOV facilities provide incentives for individuals to change from driving alone to carpooling, vanpooling, or riding the bus.

HOV facilities come in all shapes and sizes, and no "one size fits all." Many of the early HOV lanes developed in response to specific issues and opportunities in congested freeway corridors. The opening of the bus-only lane on Shirley Highway (I-395) in Northern Virginia outside Washington, D.C., in 1969 and the contraflow bus lane on the approach to New York–New Jersey's Lincoln Tunnel in 1970 represent the first freeway HOV applications in the country. Both of these projects still serve significant volumes of commuters.

The development of HOV lanes in North America progressed slowly during the 1970s and early 1980s. Major growth occurred from the mid-1980s to the late 1990s. Currently, there are 96 HOV projects on freeways and in separate rights-of-way in 30 metropolitan areas in North America. These facilities account for approximately 2,000 centerline miles of HOV lanes. Major HOV systems operate in Houston and Dallas, Texas; Seattle, Washington; the Los Angeles and Orange County area and the San Francisco Bay region in California; the Newark, New Jersey, and New York City area; and the Northern Virginia, Washington, D.C., and Maryland region. Other facilities are in various stages of planning, design, and construction.

Northern Virginia's pioneering I-395 in 1973, showing the separate bus-and-carpool lanes.

HOVing Today

The attractiveness of HOV facilities—their ability to change travel behavior—depends on the travel time savings and the trip reliability, the nature and level of the bus service, the location within a metropolitan area, the use requirements, the congestion levels in the corridor, the years of operation, and the supporting policies, programs, and facilities.

Most freeway HOV facilities carry more people per lane than the adjacent general-purpose freeway lanes during the peak hour. For example, 725 buses carrying 34,000 passengers use the 30-year-old Lincoln Tunnel Express Bus Lane in the morning peak hour (*1*), and 1,700 buses with a total of approximately 60,000 passengers use the lane daily (2). Other examples of morning peak-hour use levels are

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- 1,500 vehicles including 22 buses, carrying 4,000 people on the exclusive Northwest HOV lane in Houston;
- 1,200 vehicles including 64 buses, carrying 5,600 people on the I-5 concurrent-flow HOV lanes in Seattle; and
- 1,300 carpools and vanpools with 3,100 people on the Route 91 concurrent-flow HOV lanes in Los Angeles (*1*).

The travel time savings and trip time reliability offered by HOV facilities are key to attracting travelers to change from driving alone to carpooling, vanpooling, or taking the bus. Compared with travel time on adjacent general-purpose lanes, morning peak-hour travel time savings range from a few minutes on relatively short HOV lanes to almost 40 minutes on the 27-mile I-95/I-395 HOV facility in Northern Virginia (*3*).

Surveys of bus riders, carpoolers, and vanpoolers using HOV facilities around the country indicate that approximately 25 to 50 percent formerly drove alone. Carpoolers and vanpoolers tend to be at the upper end of this range, with bus riders more likely in the lower to middle range.

Overall growth trends in HOV use vary widely among projects. However, if new express bus service is introduced with the HOV facility, bus ridership grows steadily during the first few years of operation. Overall increases in HOV volumes slow on some

Park-and-ride facility in Portland, Oregon.

projects after three to four years, but others sustain steady growth for six to eight years (*1*).

Not every HOV lane has remained in operation. Some projects have been discontinued, such as the Santa Monica diamond lanes in Los Angeles, the HOV lanes on the Dulles Access Road in Northern Virginia, and the HOV lanes on I-287 and I-80 in New Jersey. Specific reasons for the terminations vary, but all had met negative responses from the public and from policy makers.

For example, although 1,000 to 1,400 vehicles used the I-80 HOV lanes during the morning peak hour, volumes on the I-287 HOV lanes averaged between 330 and 650 vehicles. The lower-than-anticipated use levels on I-287 raised strong opposition from the public and policy makers, leading to the termination of the HOV restrictions on both freeways (*4*).

Changes in HOV Facilities

An old saying claims that "No one likes change but a wet baby." However, change is continual, and much change has occurred in the operation of HOV facilities in the past 30 years. Some of these changes stem from monitoring programs and from attempts to maximize the use and benefits of the projects or to address issues as they arise. Other changes come from policy directives or legislation.

Operational Changes

Houston provides a good example of ongoing operational changes to maximize levels of use, to maintain bus operating efficiencies, and to address specific issues and opportunities. Agency personnel—not policy makers—have driven these changes, and the information from extensive and ongoing monitoring programs has been key in considering and evaluating options.

For example, Houston lowered the vehicle occupancy level from an initial four or more persons per vehicle to two or more, but later increased the requirement on selected facilities during the peak hours from two or more to three or more to address

Reversible lanes, Boston, Massachusetts.

Park-and-ride facility in King County, Washington.

HOV congestion. The hours of operation have varied over the years in an attempt to balance demand with operating costs. The agency also has tested weekend operations and now has a value pricing demonstration project under way, allowing use of two HOV lanes by two-person carpools for a $2.00 fee per trip during the periods restricted to vehicles of three-or-more occupants.

Policy Measures

Policy directives or legislative actions have influenced changes in HOV operations in other areas. For example, Congressional action modified the vehicle occupancy requirements and hours of operation on HOV lanes in Northern Virginia.

In 2000 California legislation lowered the vehicle occupancy requirements on the San Bernardino Transitway from three or more to two or more. However, this change significantly degraded bus travel times, with delays of 20 minutes or longer caused by the increasing volumes of smaller carpools. An analysis by the California Department of Transportation highlighted the negative impacts, and the legislature has reversed its action, reverting to the three-or-more requirement during the morning and afternoon peak periods (5).

To HOV or Not To HOV?

Experience suggests a few characteristics that are key to the success of HOV projects. These indicators include

- Metropolitan areas with more than one million people,
- Work trips to major urban centers with 100,000 or more jobs,
- Corridors with physical barriers,
- The potential for at least 25 buses during the peak hour, and
- High levels of traffic congestion.

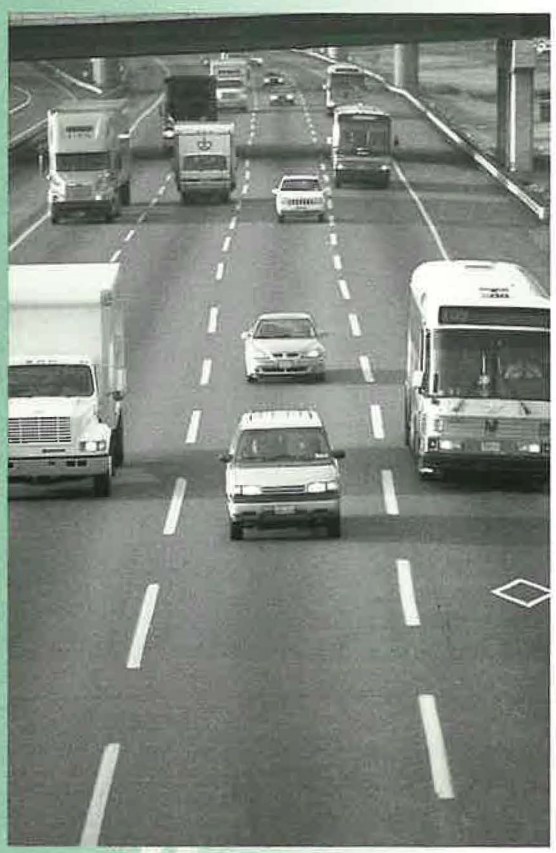
In addition, other important components of successful HOV facilities include the following:

- Support programs and policies,
- Ongoing marketing and public information activities,
- Visible enforcement, and
- Strong working relationships among the responsible transportation agencies.

For example, recent NCHRP and TCRP projects indicate that most freeway HOV facilities are in

urban areas with populations of a least one million, and that HOV use tends to increase with larger populations.

Since demand on the transportation system is at its busiest and congestion is at its worst during the morning and afternoon peak periods, many HOV lanes primarily serve work trips. Facilities that are oriented toward downtown areas or other major employment centers with 100,000 or more jobs tend to have higher use. These corridors also are able to support higher levels of bus service, with 25 or more buses operating on 21 freeway HOV lanes during the morning peak hour. In addition to bus services, other supporting programs—such as park-and-ride lots, rideshare programs, public information and marketing activities, and enforcement efforts—play key roles in encouraging the use of HOV facilities.



New Jersey has been using bus lanes—shown here on the New Jersey Turnpike—since 1970.

Do all of these elements have to be present to ensure well-utilized HOV projects that enjoy public support? No, but experience indicates that if more of these components are present, the likelihood of a successful project is greater (see sidebar, page 11). As with all parts of the transportation system, HOV facilities require ongoing monitoring, management, and appropriate operational changes.

Future of HOVs

What does the future hold for HOV facilities? HOV facilities are one of many approaches for managing traffic congestion in heavily traveled corridors. HOV lanes may not be appropriate in all situations or areas, but they have become critical components of the transportation system in many metropolitan areas. The facilities will continue to provide benefits; extensions to projects and new HOV lanes are likely in some areas.

A coordinated, systemwide approach to HOV facilities is another trend that will continue. This approach considers HOV projects as one element in an integrated intermodal system including general-purpose freeway lanes, intelligent transportation systems, incident management strategies and courtesy patrols, all types of transit services, travel demand management programs, and other elements.

The transportation system in North America has evolved in response to increasing demands, innovative approaches, and new technologies. HOV facilities are one technique for managing traffic in congested corridors. Value pricing, congestion pricing, managed lanes, and truck lanes represent possible alternatives for managing freeway and roadway space. Many areas throughout the country will consider these approaches and will test new concepts and ideas in demonstration projects. In this way, ongoing changes will maximize the efficiency and effectiveness of HOV facilities and other components of the transportation system.

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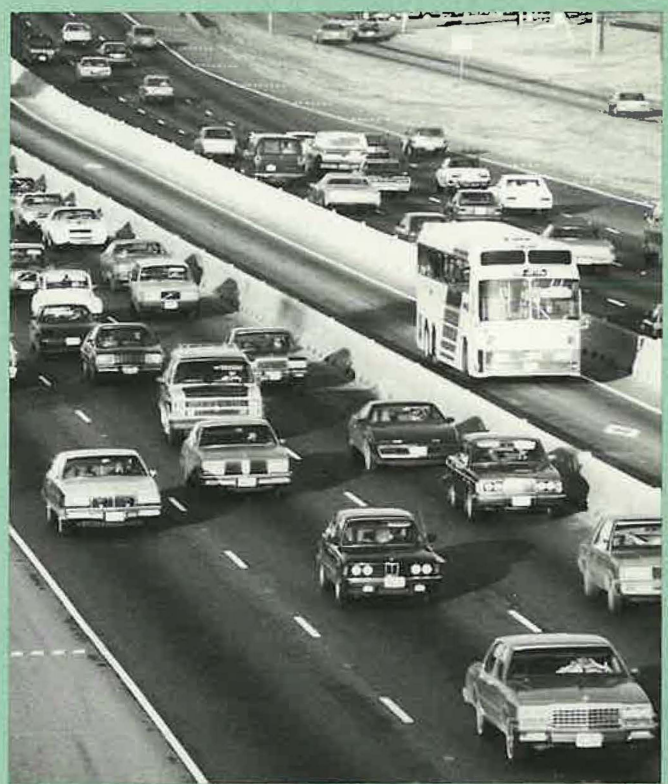
Successful HOV Projects

Houston, Texas. The HOV system in Houston has evolved from an initial 9-mile contraflow lane demonstration project in 1979 to a 90-mile network of HOV lanes, direct access ramps, park-and-ride lots, and transit centers. Currently, barrier-separated, reversible HOV lanes operate on six freeways. Frequent express bus service is provided to downtown Houston and other major activity centers from 24 park-and-ride lots in the six corridors. Rideshare programs also promote carpooling and vanpooling.

In 2000 approximately 106,400 people used the HOV lanes daily, including 42,400 bus riders, 1,620 vanpoolers, 62,260 carpoolers, and 120 motorcyclists. On an individual facility basis, the I-45 North HOV lane carries approximately 5,050 people in 1,265 vehicles during the morning peak hour, including 2,600 passengers in 52 buses. Depending on the facility, the HOV lanes provide travel time savings of 4 to 22 minutes compared with the general-purpose lanes.

Ongoing surveys of carpoolers and bus riders indicate that between 38 and 46 percent of bus riders and 40 to 57 percent of carpoolers and vanpoolers formerly drove alone. Between 54 and 76 percent of bus riders responded that the opening of the HOV lanes were very important in their decision to ride the bus. Ongoing surveys of motorists in the general-purpose lanes indicated that 40 to 81 percent believed the HOV lanes had improved transportation.



Reversible HOV lane on I-10, Houston, Texas.

Southern California. Concurrent-flow HOV lanes operate on many freeways in Southern California, from the Los Angeles area to Orange County to San Diego. On average, each lane carries 1,200 vehicles and 3,100 people during the morning peak hour, mostly in carpools of two or more.

The San Bernardino (I-10) Freeway HOV lane is the oldest and the most highly used facility in the region. Opened in 1973 for buses only, carpools of three or more were allowed to use the lane starting in 1976. In 1999 approximately 1,288 vehicles were using the lane during the morning peak hour in the peak direction of travel, including 71 buses carrying 2,750 passengers.

State legislation lowered the vehicle occupancy level to two or more on the facility in 2000. This change resulted in a significant degradation in travel time savings and trip reliability because the volumes of two-person carpools using the lane increased, and buses lost riders. In response to an analysis by the California Department of Transportation documenting these changes, the state legislature reversed its decision and increased the vehicle occupancy requirement during the morning and afternoon peak periods to three or more.

Seattle, Washington. Approximately 200 miles of HOV lanes operate on freeways in the Seattle area. The I-5 North concurrent-flow HOV lanes serve the University of Washington and downtown Seattle. Opened in 1983, the HOV lanes operated with a three-or-more-person carpool requirement until 1991, when a two-or-more-person requirement was instituted.

Morning peak-hour levels grew from 280 vehicles during the opening week in 1983 to 530 in 1989. Use increased to 1,233 vehicles after the change to two or more occupants in 1991 and to 1,679 in 2000. On average, 64 peak-hour buses use the lane, serving the university and downtown Seattle. Surveys in 1998 and 1999 indicated that 95 percent of HOV users and 72 percent of freeway motorists believed the HOV lanes in the region were a good idea.

Northern Virginia and Washington, D.C. The Shirley Highway HOV lanes have been operating for more than 30 years. Opened in 1969 as a bus-only demonstration, the vehicle-occupancy levels have changed to the current three-or-more-person requirement, and the facility now extends 27 miles on both I-95 and I-395.

In 1969, 39 buses carrying 1,920 passengers used the lane during the morning peak hour. By 1997, 2,772 vehicles carrying 11,297 people—including 118 buses with 3,085 passengers—were using the two-lane section of the HOV lanes on the Shirley Highway. Other transportation improvements have been made in the corridor, including Metrorail and the Virginia Rail Express Commuter Rail. Commuters riding the full 27 miles save from 34 to 39 minutes compared with travel times in the general-purpose lanes.