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# EXECUTIVE SUMMARY

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This technical memorandum reviews the history of how managed lanes, primarily in the form of high-occupancy vehicle (HOV) and high-occupancy toll (HOT) lanes, have been implemented primarily on freeways within the United States. Arterial experience is primarily related to bus lanes in major urban centers. Experiences have been collected from project practitioners and a wide variety of references and resources published by American Association of State Highway and Transportation Officials (AASHTO), National Cooperative Highway Research Program (NCHRP), Transportation Cooperative Research Program (TCRP) and Institute of Transportation Engineers (ITE), as well as various state departments of transportation. A compilation of these experiences is condensed into a series of lessons learned. While much experience is available for HOV lanes, more limited and recent experience exists for HOT lanes. Truck and commercial goods movement has been studied in a wide number of areas, but truck lanes only exist currently as bypasses at a few major interchanges primarily in California and as climbing lanes on numerous interstate highways. All types of dedicated lanes that are restricted by either eligibility, access or pricing strategies in order to maintain free-flow operation are termed managed lanes.

The following highlights experiences from each of these types of managed lane treatments. More detailed findings are provided in the following chapters.

## HOV Lanes

- HOV lanes were first implemented as bus-only lanes on several congested expressways in the late 1960s in northern New Jersey, Washington D.C. and Los Angeles. They served as the first examples of bus rapid transit (BRT) and were very popular in providing an incentive to ride transit. The Route 495 bus lane in northern New Jersey carried over 34,000 bus passengers per hour, saving each person an average of 20 minutes per trip.
- The El Monte Busway along I-10 in Los Angeles was the first to test carpool use when a bus strike occurred in 1976. The temporary use of allowing carpools showed potential to move more people in fewer vehicles. Subsequent federal policies encouraged the development of first 3+, then 2+ HOV lanes on freeways and major routes where the potential existed to promote better use through the encouragement of transit and ridesharing. Accordingly, the number of cities and routes employing HOV lanes grew from 125 route-miles in 1985 to over 1500-route miles (3000 lane-miles) by 2005.
- HOV lane benefits are primarily travel time savings and improved commute trip reliability.
- HOV lanes seem to be most successful where there is adequate use, where transit services can take advantage of the dedicated lanes, and where enforcement is performed to a level that promotes respect for the rules and regulations related to lane operations.
- Most HOV lanes have been implemented by state DOTs, but a majority of HOV and bus lane treatments on arterials have been implemented by local city, county and transit agencies.
- HOV lanes have typically shown that about 40 percent of their use comes from spatial shifts (carpools coming from adjacent lanes on the freeway or other routes), about 40

percent are newly formed carpools coming from former drive-alone commuters, and the balance as new trips or coming from other modes and taking bus transit or carpooling. Trends in average vehicle occupancies tracked for the past 20 years show that corridors with HOV lanes have higher bus and carpool use than those which do not.

- Growth in the implementation of HOV lanes doubled about every five to eight years through the 1990s, but has slowed since 2000. Still, about 50 lane-miles of HOV lanes are added annually, mostly to complete current systems in major cities in excess of a population of one million persons.
- The initial demand threshold for successful HOV lane use is about 400 to 600 vehicles (800-1200 persons per hour), with long-range person carrying parity being required when compared to adding a general purpose lane (typically 2000-2200 persons/hour).
- The desirable travel time savings for successful operations is around 0.5 minutes per mile when compared to adjacent traffic speeds, or a total trip savings of about 5 to 8 minutes to induce mode shifts to transit and ridesharing.

### HOT Lanes

- HOT lanes offer the potential to better manage an HOV lane by more finely regulating demand, giving some HOVs free use and tolling others.
- HOT lanes were first introduced in the mid-1990s based on emerging electronic toll collection technology that allowed pricing to be added to HOV lanes without the need for a conventional toll booth. The first projects included I-15 in San Diego and a public-private initiated project to fill in a missing HOV gap between Orange and Riverside County in California. Federal policies since the mid-1990s encouraged the demonstration of congestion pricing in a variety of forms, and HOT lanes were one of these applications.
- The first pricing demonstrations were on projects that served as commute “pipelines” with a single entrance and exit and separated from adjacent traffic by a barrier. These designs made pricing easier and more economical to implement. Since 1995 five other pricing demonstrations have been implemented on HOV lanes in Houston (I-10 and US-290), Denver (I-25), Minneapolis (I-394) and Salt Lake City (I-15). While most HOV lanes allowed solo drivers to use the lanes for a toll, the two Houston examples responded to excessive HOV demand by raising minimum free use to 3+ HOVs and tolled the 2-occupant HOVs.
- Three of the seven HOT lanes use flat-based tolls either on a single trip or by registering for a monthly toll permit for unlimited use. The other four examples apply variable tolls that price according to the level of use in the HOT lane. Some variable tolls are fixed according to a schedule (so motorists will always know the prevailing toll) while others vary the price in accordance with prevailing demand conditions and post the toll in advance of the entrance.
- A number of HOT lanes are currently in development so the number of projects will grow in the coming decade.
- Pricing for most single HOV lanes generates only enough revenue to cover the cost of pricing implementation, operation/administration and enforcement. Multiple lane projects like those in San Diego and Orange County have produced excess revenue which has largely been reinvested into the corridor in either paying down the construction cost of the HOT lanes or funding additional bus services.

### Other Types of Managed Lanes

While express lanes that assure a higher level of service through restrictions on access have been operated on various urban interstates in Chicago, St Louis, Seattle and other cities for many years, a broader application of dynamically managing express lanes through tolling is planned for a number of areas. These plans do not necessarily involve offering any free or discounted use to HOVs, but rather, serve all traffic. Some treatments are targeted at offering special lanes to serve commercial goods movement, as exemplified in Atlanta on I-75 and I-285. Southern California is also examining truck-only toll roadways. While no experiences are available yet from these plans, the nature of how managed lanes will be implemented and who they are tailored to are changing from past experience. Listed below are a few trends to watch:

- Local, state and private toll road agencies may be implementing more managed lanes than traditional DOT-sponsored projects.
- Toll road-sponsored managed lane projects are likely to be targeting a pricing structure that pays more of the capital cost, requiring wider lane configurations involving four or more lanes to make the projects economically viable.
- More managed lane systems will be implemented involving connections between one facility and another.
- Trucks, which value time greater than commuters, may be a more sought-after market for managed lanes.
- The need to create flexibility to serve different types of managed lane users is already apparent, where such lanes may serve a BRT or HOV function in the peak period and a commercial goods movement function in the off-peak, necessitating more flexible design.
- Planning and design guidance to address wider applications of managed lanes is just now being identified as a national need, and research into best practices is ongoing. It is likely that current plans will be influenced by this guidance before many of these projects are implemented.