High Occupancy Vehicle (HOV) Lanes

What is it?
High occupancy vehicle (HOV) lanes are travel lanes designated solely for non-single occupancy vehicle (SOV) automobiles (such as 2 or more people/vehicle) and transit vehicles. Free-flow highway lanes can be designated HOV lanes during certain hours of the day (peak periods) or designated HOV lanes for all hours of the day. HOV lanes encourage shift from SOV to carpooling by providing more reliable and shorter travel times during congested conditions. HOV lanes are included on freeways as well as arterial streets and may include exceptions for motorcycles and single-occupant hybrid or electric vehicles. Several indicators of success for HOV facilities include a regional population over 1.5 million, HOV access to major employment centers with over 100,000 jobs, a central business district, and geographic barriers that constrict travel patterns while concentrating development.¹

What are the benefits?
- **Mobility:** Encourages carpool travel by providing shorter and more reliable travel times for high occupancy vehicles during peak congestion periods. Reduces SOV use and vehicle miles traveled (VMT) by making ridesharing more accessible and convenient.
- **Environmental Stewardship:** Reduces the emission of criteria air pollutants and GHGs that are harmful to the environment and human health by encouraging reductions in SOV use.

Where is it being used?
HOV lanes have been used throughout North America as well as internationally. Relevant examples on the west coast include:²

- **I-5 HOV Lane**, Portland, OR
- **Washington State HOV Network**, Puget Sound Region, WA
- **HOV Lanes**, California

² [https://www.wsdot.wa.gov/Tolling/TNBTolling/default.htm](https://www.wsdot.wa.gov/Tolling/TNBTolling/default.htm)
³ [https://www.wsdot.wa.gov/HOV/](https://www.wsdot.wa.gov/HOV/)
⁵ In this summary, the best available data on program effectiveness is used. Whenever possible information is provided for the referenced examples; however, that information is not always available.
How effective is it?

This section describes what is known related to the effectiveness of HOV lanes. However, the reader should note that impacts in specific locations will require more detailed analysis using travel demand models.

Time savings from using an HOV lane vary from day to day and may be much higher during peak congestion periods than during the hours immediately before and after the peak (shoulders of the peak). An average of the travel time savings gathered from about 30 HOV examples nationwide ranges from 2 to 39 minutes for commuters traveling the full length of the HOV facility compared to the general purpose lanes. Based on the full length of the HOV facility being studied, the largest time savings (6 to 20 minutes per mile) are generally seen from short HOV lanes that function as queue bypasses at toll stations and other bottlenecks, such as bridges or tunnels. Longer HOV facilities along freeways save up to about 1.6 minutes per mile, while HOV lanes on arterial streets typically save about 0.5 minutes per mile.⁶

According to travel demand model research and travel surveys, new HOV facilities induce increased mode split for transit and carpooling. This results in lower SOV use, as roughly 25% to 50% of bus riders, carpoolers, and vanpoolers (higher for carpoolers and vanpoolers) on HOV facilities in various U.S. cities indicated that they previously drove alone. Shifts in carpool, vanpool, and bus route choice accounted for 15% to 35% of HOV lane carpool users.⁷

Although traffic volumes and vehicle miles of travel (VMT) may drop slightly when an HOV lane is opened and stay lower than they might otherwise, HOV facilities do not appear to counter long-term growth trends in travel demand. A more realistic expectation is that HOV lanes help reduce growth in VMT and increase potential person-carrying capacity by inducing higher vehicle occupancies.⁸ The long-term increase in average vehicle occupancy (AVO) for a freeway where an HOV lane is opened is 6% to 20% (with an average of 8% to 9%). The existence of parallel highways can dampen the effect of HOV facilities on AVO increases by 33% to 50%. In a summary of 22 historical HOV projects, it was found that there was an average 9% gain in AVO in the AM peak hour. The change, over periods of time that varied from 1 to 20 years, ranged from a 2% decline in AVO to a 36% gain. The I-5 reversible express lanes in Seattle had an AVO increase of 36% over a 10-year span after opening in 1982.⁹

In several examples, HOV lane productivity is higher than the general purpose lane productivity overall. The regional averages for HOV facilities in Los Angeles, Houston, and Minneapolis are about 25% to 40% of all freeway person movement in the AM peak hour and direction, which is greater than the corresponding average proportions of freeway lanes allocated to HOV facilities.¹⁰ However, of studied facilities, there are wide differences in use; some had steady growth for 6 to 8 years, others had a slowing of growth after 3 or 4 years, and one had almost no growth in use immediately after opening. In areas where parallel transit or highway improvements have been introduced, HOV lanes typically have little or no growth in use after a short time as other travel options are available within a corridor.

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In terms of environmental benefits, according to the OSTI Greenhouse Gas Toolkit, HOV Lanes could result in up to a 1.7% reduction in total transportation sector baseline greenhouse gas (GHG) emissions in 2030. Additional findings suggest that the conversion of all existing and new HOV lanes to 24-hour operation could result in up to a 0.02% reduction in total transportation sector baseline GHG emissions in 2030 and converting off-peak direction general purpose lanes to reversible HOV lanes on congested freeways could result in a range of 0.07% to 0.18% reduction in total transportation sector baseline GHG emissions in 2030.\(^\text{11}\)

**How much does it cost to implement?**

The costs of constructing and operating an HOV lane will vary depending on the type and length of facility, the extent of signage required, and the extent of study needed to anticipate traffic impacts, appropriate access/egress locations, etc. However, HOV lanes are generally found to be cost-effective investments. Two example studies are described below:

- An evaluation of the economic feasibility for 14 HOV facilities in Los Angeles County concluded that, in general, the carpool lanes were a good investment for the California Department of Transportation. The benefit-cost (B-C) analysis found that the B-C ratios ranged from 0.9 to 36.2 (1.0 is the break-even point), while the average was 10.0 and median was 7.4. The economic rates of return ranged from 5% to 172% with an average of 42% and median of 27%. This analysis did not include benefits to bus operations and emission reduction or mode shifts to HOV, which are also likely to have occurred.\(^\text{12}\)

- A benefit-cost analysis of five Dallas and two Houston HOV facilities was conducted using an economic analysis tool developed under NCHRP Project 7-12. The analysis found benefit-cost ratios ranging from 6 to 48 with an average benefit-cost ratio of over 17. Constructing an HOV lane instead of an additional general purpose lane in each direction on each of the freeways was found to be 12% to 180% more effective when benefit-cost ratios were compared. The added benefit averaged across the seven facilities was 73%, which included accident rates.\(^\text{13}\)

**Implementation resources**

The following resources may be helpful for jurisdictions implementing HOV lanes:

- [Federal-Aid Highway Program Guidance on HOV Lanes](https://www.fhwa.dot.gov/highway/programguidance/), Federal Highway Administration
- [Transportation Control Measures: HOV Lanes](https://www.epa.gov/clean-fuel-vehicles/transportation-control-measures-hov-lanes), Environmental Protection Agency
- [HOV Priority: Strategies to Improve Transit and Ridesharing Speed and Convenience](https://www.vtpi.org/hov.htm), Victoria Transport Policy Institute

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