**Executive Summary**
**High Occupancy Vehicle Facilities for the Chicago Metropolitan Area:**
**A Review of National Experience, Success Factors and Decision Issues**

prepared for
The Metropolitan Planning Council
and
The Regional Transportation Authority
by
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## Study Objectives and Approach

This study reviews the characteristics and effectiveness of existing North America priority treatments for High Occupancy Vehicles (HOVs) and explores their potential for application in the Chicago region. Data from previous studies and communication with practitioners provide the basis for analyzing outcomes of HOV implementations and identifying factors contributing to success and failure. Three case studies are examined in more detail to gain insights into success factors and further explore key decision issues. General screening criteria are derived for selecting candidate corridors for more detailed evaluation studies.

## Objectives of HOV Facilities

HOV facilities are built to improve levels of service (LOS) for HOVs (reducing travel times and increasing reliability), which should encourage HOV use, and thereby increase the passenger-carrying capability of congested freeway corridors by increasing the average number of persons per vehicle. These actions are usually taken to reduce congestion, increase effective capacity, and ultimately to improve air quality and reduce energy consumption. The focus of this study is HOV facilities in freeway corridors. Such facilities almost always carry transit vehicles, sometimes exclusively, and in many cases buses carry a major share of the people moved on HOV lanes.

## Current HOV Projects and Outcomes

There is much experience with HOV lanes in North America: nearly 150 facilities with more than 1200 route miles are in service today, and many more are planned. The majority of these facilities move more people in the peak hours than parallel general purpose (GP) lanes, and most operate at a higher level of service than unrestricted lanes. There have been a few HOV facility failures, cases in which set-aside lanes were opened for general use after an unsuccessful trial period, but most have been successful, *i.e.*, they have been continued in operation, and most of these have attracted substantial utilization.

Examination of the characteristics of failed and successful HOV lanes provides consistent explanations of these outcomes. The primary factor differentiating successful and failed HOV facilities is utilization—the *empty lane syndrome*—with the boundary value at peak hour volumes of 800-1000 vehicles per lane hour(vplh) (see Figure 1). Some facilities continue to operate below this range, but usually there is some other aspect which makes these lanes acceptable. Similarly, a few lanes operating above 1000 vplh have failed (*i.e.*, have been opened to all traffic) when they have been undermined by insensitive implementation strategies, severe congestion created in general purpose lanes in the case of lane conversions, or the spillover opposition generated by an adjacent, under-utilized HOV lane.

Opposition to HOV lanes has developed largely in response to the empty lane syndrome, but also in settings where GP lane congestion is extremely high. At the same time, many regions have demonstrated substantial success with networks of HOV facilities, most notably Los Angeles and Orange Counties in southern California (260 miles of HOV facilities); Seattle (147 miles); and Houston (74 miles).

**Case Studies**

Three case were examined in more detail to look for useful lessons for the Chicago area.

<u>New Jersey I-80 and I-287</u> are intersecting suburban facilities with an HOV 2+ restriction which were recently closed (*i.e.*, opened to use by all vehicles).

- I-287 was very lightly used — under 400 vplh — while I-80 was quite successful — over 1000 vplh. It is apparent that the avalanche of political opposition to I-287 spilled over to force closure of I-80.

- Neither facility carried much transit service, and it appears that neither the decision makers nor the public were prepared for the start-up process necessary to build the HOV market.

- Finally, the severity of existing congestion was such that a much larger shift to HOVs would have been necessary to provide any relief in the I-287 corridor.

<u>I-66 in northern Virginia</u> is a radial expressway extending west from the downtown Washington, D.C. Inside the Capital Beltway I-66 is an expressway with two lanes in each direction, exclusively reserved for HOV 2+ in the peak period; beyond the beltway the road carries a single HOV lane. Metro, the regional rail rapid transit system, runs parallel to I-66 inside the beltway, and in the median of the road for some distance, and there is a parallel commuter rail service in the corridor.

- I-66 illustrates the effect of the relaxation of HOV restrictions from HOV 3+ to HOV 2+. This produced a 60% increase in lane utilization (to 1700 vplh), and a substantial reduction in lane use violation. This provides insight into the willingness of travelers to share rides.

- I-66 is a setting where an HOV lane coexists with several rail transit services without noticeable negative impacts; indeed, I-66 carries as many as 40 express buses per hour, extending transit into lower density parts of this region.

- This facility illustrates the effectiveness of flexibility in design (exclusive HOV lanes, concurrent flow lanes, median rail transit) and in access restrictions.

Houston I-10W Katy Transitway is an 11 mile radial facility built originally as a transit expressway and over time opened to use by HOV 2+ vehicles. Currently, the restriction is HOV 3+ during the peak and HOV 2+ at all other times.

- The Katy is operated by Houston Metro, the transit agency, showing the compatibility of the goals of transit and HOV priorities; about 45% of the people moved on the Katy are in buses.

- The history of changes in access restrictions on the Katy, from transit and HOV 8+ to HOV 2+, illustrates the limited willingness of travelers to share rides. Peak hour restrictions have been tightened to HOV 3+ to maintain LOS, which shows the operational flexibility of HOV lanes.

- Most recently Houston has experimented with tolls to permit HOV 2+ vehicle to use the Katy in the peak period for a fee, another aspect of flexibility which offers a way to guard against the empty lane syndrome on lightly-used HOV facilities.

- The success of the Katy has helped pave the way for a 74 mile and growing network of HOV facilities in Houston, which has a well-earned reputation as an auto-oriented city.

**Issues in HOV Planning and Decision Making**

Several key HOV decision issues are examined in detail. Among these are:

- **The relationship between HOV facilities and transit**. The most successful HOV facilities carry significant bus transit volumes and passengers, enhance transit LOS, and extend the reach of transit into low density areas. With thoughtful planning, transit and HOV facilities can generate important synergies.

- **Forming new car pools**. The evidence on the formation of new car pools, one of the objectives set for HOV lanes, is mixed. Ride sharing is not a preferred mode for many travelers, and a variety of support services and incentives will be needed to grow this market segment. Some regions, particularly those which have built extensive HOV networks, have seen considerable growth in ridesharing. Integrating transit services into HOV lanes is one way to assure efficient utilization.

- **Converting GP lanes to HOV lanes**. Converting GP to HOV lanes usually saves money and provides the strongest incentive (in the form of reduced LOS) to low occupancy vehicle (LOV) users to shift to HOVs. However, travelers resist forced behavior changes, and the preponderance of single occupancy vehicle (SOV) travelers will make this strategy for providing HOV facilities difficult or impossible. Political feasibility demands that there be little or no negative service level impacts on the GP lanes, which effectively precludes converting a GP lane to HOV-only unless congestion levels are already low.

· **Networks and support services**. HOV priority programs must respond to broad market needs to be successful. While HOV lanes will be implemented one segment at a time, a planning effort should approach them from the perspective of a future, integrated, network-scale system with the potential to serve many different market segments. Furthermore, if the HOV market share is to grow beyond initial levels, an appropriate set of support services must be provided, *e.g.*, ride matching, park and ride facilities, HOV priority access ramps, guaranteed rides home, *etc*.

**Screening Criteria**

The key screening criteria for selecting corridors for detailed network equilibrium studies to assess the feasibility of HOV lanes are:

1. <u>Congestion in the GP lanes</u>: The GP lanes must be congested to warrant an improvement; without sufficient congestion, there will be no advantage offered to HOV travelers.

2. <u>HOV level of service advantage</u>: It must be possible to generate a meaningful level of service advantage for HOVs. Savings over the GP lanes of 0.8 to 1.0 minutes per mile or more are needed to attract a reasonable number of HOVs.

3. <u>Length sufficient to generate substantial travel time savings</u>: Lengths on the order of 8-10 miles or more are desirable.

4. <u>HOV lane volumes</u>: At least 800 vplh and desirably 1000 or more are needed for a sustainable HOV operation. This is the primary criterion for an implementation decision; it requires a serious forecasting effort to prepare a reliable value, but this reports suggests ways to make judgmental estimates.

5. <u>Feasibility of adding (or converting) a lane</u>: The lane must be physically feasible (space for the lane and the connections to the road network); operationally feasible (safety and integration of transit); and financially feasible.

6. <u>Do no harm</u>: HOV facilities should provide a meaningful level of service advantage over GP lanes without substantially reducing the LOS for GP travelers.

7. <u>Market logic</u>: The HOV facility should serve an identifiable market, rather than simply be imposed on a congested corridor. The HOV facility should not serve the same market as a good and well-utilized transit service; it may be in the same corridor, but it should extend the HOV priority beyond the limits of existing fixed guideway transit service.

8. <u>Network potential</u>: Any corridor considered for an HOV facility should (someday) fit logically into a network of HOV facilities.

9. <u>Maximize transit potential</u>: Transit should always be included in the HOV equation. The competitive position of transit is likely to be enhanced through express operations on HOV lanes, and thus it is essential to engage the transit carriers in HOV planning.

10. <u>Provide supporting facilities and services</u>: To assure the success of the HOV operations, there must be a commitment to developing and maintaining a system of supporting facilities and services, including express transit; ride matching programs; guaranteed rides home; van pool subsidies; park and ride lots; marketing; and effective enforcement of HOV restrictions.

11. <u>Institutional support</u>: For HOV facilities to succeed, strong support from transportation agencies and public officials is essential.

**Conclusions and Recommendations**

To attract a sufficiently high volume of HOV users, several conditions must be met, which begin to define criteria for selecting promising settings for HOV treatments:

- **Congestion in the travel corridor must be sufficiently high** (1) to warrant some special treatment (investment); and (2) to give LOV drivers a level of service incentive for ride sharing.

- It must be physically and operationally **feasible to establish an HOV priority facility which provides the level of service advantage**.

- **The existing level of ridesharing in the corridor must be high enough** to assure reasonable HOV lane utilization through lane switching and route diversion when the set-aside lanes are opened. This may lead to setting the initial access requirements at the lowest level, *i.e.*, HOV 2+.

From the success experienced with HOV facilities across the US, it is apparent that there are many settings conducive to HOV use, and that it is often feasible to provide facilities and services which support that use.

Properly planned, HOV facilities can offer a flexible response to congestion problems, permitting adjustment of utilization levels through such actions as changing HOV access requirements (HOV 2+, 3+, *etc*.), opening or closing access points, providing or removing priorities at ramps or on arterial streets, and charging tolls to meter LOVs on underutilized HOV lanes.

HOV facilities and transit services can be designed to be compatible and synergistic. Express transit on HOV lanes can offer travel time advantages over LOVs, it can provide single-vehicle collection and distribution services, and it can attract a large market share. HOV lanes can extend transit into low density areas where traditional services are not economically viable. HOV lanes and public transit fulfill similar objectives, moving substantial numbers of people with fewer vehicles, and there are numerous examples of compatible, side-by-side operations.

If HOV priorities are to succeed, transit, highway, and local and regional planning agencies must work together to plan, implement and operate an integrated, network-scale HOV system. Interagency coordination is essential for balancing the transit system, the highway network, development patterns, and the HOV network.  HOV lanes are not likely to succeed as a single-perspective solution competing against other, narrow programs designed to reduce SOV use.

**Figure 1**

## GP vs HOV Vehicles/Lane Hour (Peak)