
10.0 High-Occupancy Toll (HOT) Lanes

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■ 10.1 Background

The HOT lane concept varies in detail from one application to another, but in general refers to HOV lanes where SOVs are permitted access for a fee. HOT lanes can be considered part of the broader concept of value pricing. Under TEA-21, the Value Pricing Pilot Program authorizes value pricing projects under TEA-21; the FHWA is permitted to enter into cooperative agreements with up to 15 state or local governments or other public authorities to establish, maintain, and monitor value pricing projects. States are allowed to permit SOVs in an HOV lane if the vehicles are part of a value pricing project as authorized by TEA-21.

Based on 1994 legislation, Mn/DOT and the Metropolitan Council conducted a joint study of road pricing and mileage-based fees for road usage. This study was conducted by Wilbur Smith Associates and SRF Consulting Group and was completed in 1997. In 1995, state legislation required Mn/DOT to consider alternative financing options for all projects valued over \$10 million. The *Toll-Lane System Preliminary Feasibility Study* was a follow-up study to the Road Pricing Study, and also was conducted by Wilbur Smith Associates and SRF Consulting. The study examined the following two options:

1. Creation of a HOT-lane system that would permit SOVs to use existing and planned HOV lanes for a fee; and
2. Permitting SOVs to use HOV ramp meter bypass lanes for a fee.

Under all of the options examined by the report, the existing HOV lanes on I-394 and I-35W were to be converted to HOT lanes. Key findings from the technical portion of the study were identified as follows:

- HOT lanes have the potential to guarantee toll revenue at levels above the cost of implementation and operation of the required electronic toll system;
- HOT lanes reduce congestion in the unrestricted, general-purpose lanes;
- HOT lanes preserve HOV-lane concepts;

- Ramp meter bypass buy-in traffic impacts are inconclusive and require further study; and
- A demonstration/pilot program study of the concept is required to evaluate various design and operational issues.

The legislature authorized a HOT lane demonstration project on the I-394 HOV lanes in 1997, but was cancelled due to public opposition. Currently, Mn/DOT is conducting a value pricing study under the FHWA's Value Pricing Pilot Program, and a Value Pricing Advisory Task Force has been formed to provide guidance, review various proposals, and help to build constituent support. The University of Minnesota Hubert H. Humphrey Institute of Public Affairs recently completed a study of value pricing titled, "Curbing Congestion - Improving Traffic Flow, Transit, and Transportation Funding Through Value Pricing."

■ 10.2 HOT-Lane Experience

California's two HOT Lane projects have been in operation for several years and have been the subject of major evaluation efforts. The Texas HOT lanes went into operation more recently, and as a result, more limited data are available.

10.2.1 SR-91 HOT Lanes (ExpressLanes)

The SR-91 HOT lanes were added as new capacity to a congested freeway. The SR-91 project was one of four private toll road ventures authorized by the California Legislature in 1989. A franchise agreement was signed between Caltrans and the California Private Transportation Corporation (CPTC) in 1990 for construction, operation, and maintenance of two 10-mile toll lanes. The franchise period is 35 years, after which ownership reverts to the State of California. The SR-91 toll lanes are separated from the non-toll lanes by a painted buffer and pylons. This system provides separation, but still permits access/egress by emergency vehicles. The corridor experiences high degrees of congestion and had few effective alternate routes until recently.

HOT lane fares are variable and are collected electronically, using the FasTrak system in use on other California freeways. Three or more carpools, now charged half-price, must travel through the toll readers in a separate lane, where California Highway Patrol (CHP) enforcement personnel can confirm the number of passengers from an observation booth. Motorcycles also are permitted to use this lane and receive a 50-percent discount. Large commercial vehicles are not allowed in the ExpressLanes.

The most recent evaluation of the SR-91 HOT lanes prepared by Edward Sullivan of California Polytechnic State University at San Luis Obispo was issued in December 2000.

It covers the period through mid-1999. Some of the major findings of that report are listed below:

- The ExpressLanes reached a peak ADT of 33,000 in 1998 (three years after the December 1995 opening), representing 14 percent of total corridor ADT. This volume represented 85 percent of the growth in corridor traffic during that period. It is estimated that about 20 percent of the traffic that shifted to the ExpressLanes in the first year after opening were returning to the freeway from parallel city streets.
- No parallel freeway corridor existed at the time the ExpressLanes opened. However, a parallel toll road, the Eastern Transportation Corridor, opened in 1998. In the six to eight months following the opening, traffic on the SR-91 ExpressLanes dropped from 33,000 ADT to 24,000 ADT, and then stabilized.
- There is a strong correlation between ExpressLane usage and timesavings. Over the period of evaluation, the percentage of travelers using the ExpressLane ranged from seven percent of total freeway volume in the mid-day peak, when timesavings were minimal to around 35 percent in the heaviest p.m. peak hour.
- In the six months following the opening, delays in the free lanes were reduced to five to 10 minutes from 30 to 45 minutes. Over a three-year period, they gradually climbed back to about 30 minutes.
- Fine-tuning of the toll structure had a significant impact on peak-period behavior. After tolls were adjusted on an hourly basis, peak demand began to spread out.
- Initially, no toll was charged for three or more person carpools. Immediately after opening, there was a dramatic increase in three or more carpools of over 40 percent. After the 50-percent toll for HOVs was implemented in 1998, about one-third of HOV traffic moved back to the free lanes. Most of this shift occurred during off-peak hours and at the edges of the peak periods.
- It appears that the ExpressLanes had no impact on either the number of HOV-2 commuters, or on patronage of the Inland Empire-Orange County (IEOC) commuter rail line serving the corridor.
- The percentage of SR-91 corridor commuters, who use the ExpressLanes at least some of the time, increased from 28 percent to 42 percent during the first three years of operation.
- In the first year after opening, more SOV commuters shifted to HOVs than vice versa. HOV commuters are more likely to choose the ExpressLanes, due in part to the opportunity to split tolls and in part to the travel timesavings achieved.
- Discounts are provided to those who use the lane more than 20 times per month. Only about 12 percent of transponder owners take advantage of this option.

- As expected, the primary reason for using the ExpressLanes is travel timesavings. About one-third of users gave other reasons, primarily driving comfort and safety. These two reasons are those cited primarily by drivers who pay to use the lane during off-peak periods. About 58 percent of ExpressLane users felt ExpressLanes were safer than the free lanes, while 14 percent felt they were less safe.
- The 1999 study data showed that propensity to use the ExpressLanes increased significantly with income.
- Female SOV drivers have a much higher propensity to use toll lanes, nearly 50 percent compared to fewer than 30 percent for SOV male drivers. Middle-aged drivers are more likely to use the ExpressLanes than younger or older drivers.
- Approval of toll financing in general remained in the 50 percent to 75 percent range during the first three years of operation, while approval for variable tolls by time of day dropped. Approval of the idea of private, for-profit toll roads declined significantly in the corridor over the first three years of operation. This is due in part to public relations problems and press coverage related to efforts to sell the business to a private non-profit corporation.
- Revenue increased over the first several years, and then dropped slightly after the opening of the Eastern Transportation Corridor. However, toll increases mitigated most of the impact of the 25-percent decline in traffic volume.
- The toll lanes did not have a significant impact on accidents on SR-91 itself, either in the toll or the free lanes.

10.2.2 I-15 HOT Lanes

The I-15 HOT lanes in San Diego were converted from HOV lanes and are operated by a toll authority. The I-15 HOT lanes represent a very different approach than SR-91. The system consists of two reversible lanes constructed in 1988 along an eight-mile stretch of I-15, about 10 miles north of San Diego. The HOV lanes were underutilized, leading to a proposal by the San Diego Association of Governments (SANDAG) to create a HOT lane under the U.S. DOT's Congestion Pricing Pilot Program. The program provided approximately \$8 million over a three-year period, which was matched by \$2 million of state funds. The original three-year period of the demonstration ended in 1999, and was subsequently extended by the Legislature.

The first phase of the project, called *ExpressPass*, was implemented in December 1996. During this phase, SOV drivers were permitted to use the lane with purchase of a permit. In March 1998, the second phase of the project, known as "FasTrak," was initiated. The flat rate monthly fee was replaced with a per-trip toll. Published toll rates currently range from \$0.50 at periods of lowest demand to \$4.00 during the highest peak hour. However, tolls can be varied based on the level service in the FasTrak lanes, and can be raised to as much as \$8.00 during periods of severe congestion. Electronic signs in front of HOT-lane

entrances provide advance notice of the toll as motorists approach the lane. A California Highway Patrol officer is generally stationed in the toll zone for enforcement purposes.

The project's stated primary goals were: 1) to maximize use of the existing I-15 Express Lanes; 2) to fund new transit and HOV improvements in the I-15 corridor; 3) to test whether allowing solo drivers to use the ExpressLanes' excess capacity can help relieve congestion on the I-15 main lanes; and 4) to use a market-based approach to set tolls.

An ongoing evaluation effort by San Diego State University indicated that these goals have been achieved. Some of the major conclusions of this evaluation were:

- Revenue from the project, \$1.6 million per year, has been adequate to fund operating expenses and has also provided funds for a new express bus service called the Inland Breeze. Analysis of ridership on this service indicates that it primarily serves a transit-dependent market and has not yet attracted choice riders.
- Contrary to some expectations, HOV usage increased in the corridor, although it declined slightly after the implementation of the FasTrak system.
- FasTrak was considered successful in distributing volume away from the peak period toward the edges of the peak and free-flow traffic has been maintained.

Under worst traffic conditions, FasTrak users save about 20 minutes of delay (increased travel time over free-flow conditions) over the 10-mile length of the corridor. However, there has been a slight reduction in congestion on the main lines of I-15 due to a shift of volumes from the middle of the peak to the edges of the peak.

- Although enforcement did not pay for itself through citations, it was necessary to maintain the integrity of the program. The report concluded that additional expenditures on CHP enforcement would have diminishing returns, and that a system relying on both CHP and camera enforcement should be considered.
- Surveys show that the majority of FasTrak users support the per-trip pricing concept and their acceptance increased over time. They were willing to pay higher tolls in order to keep the lane uncongested. Surveys also indicated that users of FasTrak tend to be from higher-income groups, were more highly educated, were more likely to be middle-aged females, and come from two or more vehicle households.

The success of this program has led SANDAG, Caltrans, and the Metropolitan Transit Development Board (MTDB) to cooperate on a more ambitious "Managed Lane" (ML) project in the corridor. The ML project will incorporate the existing HOT-lane segment and extend another 12 miles to the north. The first phase of this project is scheduled for completion by 2004, with 2012 as the goal for completing the entire project. Most of the \$200 million required for the first phase has been committed, but obtaining the funding to finish the project remains a challenge. The major elements of this project include:

- Construction of four median, moveable barrier-separated lanes for the length of the corridor. Three lanes would be provided in the peak direction and one in the off-peak

direction. The HOT lane pricing scheme will incorporate both peak direction and off-peak direction traffic.

- Unlike the existing HOT lanes, there will be intermediate access/egress points with separate ramps for HOVs and transit vehicles. SOV drivers buying into the lane may be allowed to use these ramps in the future. An improved communications backbone will be provided and real-time traffic information will be offered, so that SOV drivers can determine the benefits of using the lanes.
- A Bus Rapid Transit (BRT) system will be incorporated into the corridor with stations and park-and-ride lots at access points.

10.2.3 I-10 Katy Freeway

As a result of congestion, HOV lane carpool requirements on the Katy Freeway (I-10) were increased from 2+ to 3+. Carpools with two persons were permitted to use the lanes for a fee, while three or more person carpools continue to use the lane for free. The HOV lane is a 13-mile single reversible lane that originally opened in 1984. In order to increase the number of people served, METRO used a Pilot Program known as QuickRide, to permit two or more carpools to buy their way into the lane for a \$2.00 per trip fee. Three or more carpools are free. While the overall impact has been modest, HOV usage overall has increased and most of the QuickRide users are commuters who formerly used the SOV lanes. The project is a very limited experiment to control volume during the period of highest usage.

10.2.4 Other HOT-Lane Projects Proposed and Under Study

Several other cities are considering implementation of HOT lanes projects, either through new construction or through conversion of HOV lanes. Studies of value pricing options are underway in Atlanta, San Francisco, Portland, New York/New Jersey, and Seattle.

■ 10.3 Potential Benefits of HOT lanes

Limited experience has shown that HOT lanes can provide benefits to both the traveling public and operating agencies. These benefits include:

- **Increased usage of HOV lane** – The “empty lane” syndrome associated with HOV lanes continues to be a public relations problem for many transportation agencies, including Mn/DOT. Resentment among motorists who are unable or unwilling to carpool tends to increase, along with the speed differential between the general lanes and the HOV lanes. The hostility of this constituency can make it very difficult to obtain political support for new construction that only provides HOV lanes. HOT

lanes have been successful in helping agencies to address these issues. HOT lanes have increased both usage of the HOV lanes and overall throughput on the roadway. So far, they have done so without reducing the incentive to rideshare. It should be noted that all three applications discussed above are on freeways that are among the busiest and most congested in the United States, all carrying in the range of a quarter million vehicles daily.

- **Reduced congestion in non-HOV lanes** – On SR-91 capacity was added to accommodate the HOV lane, with a significant positive impact on non-HOV lane congestion. Over time, congestion returned, but has still not reached previous levels. On I-15, a small impact on general usage lanes has been noted. It is clear that this impact will differ depending on local conditions, particularly the level of latent demand and the availability of alternate routes. Each proposal must be carefully analyzed if this is an objective.
- **Overall optimization of facility usage** – Both the SR-91 and I-15 HOT lanes have resulted in overall improvements in speed and throughput. Impacts on air quality and safety cannot be clearly identified.
- **Peak demand spread over longer period** – Variable pricing based on time of day (SR-91) or time of day and volume (I-15) has proven effective in shifting demand and maintaining free flow on HOT lane facilities. Operating agencies have been able to experiment with different toll structures successfully to meet this objective. It is important that operating agencies have the maximum flexibility possible to make these adjustments and be able to explain their policies effectively to customers.
- **Additional revenue to pay for transportation improvements** – The Inland Breeze bus service along I-15 exemplifies how HOT lanes can generate revenue to improve alternate modes of transportation. HOT lanes are potential sources of revenue to help fund freeway reconstruction projects. Experience shows HOT lanes are capable of providing adequate revenue to fund operations, and possibly pay for a portion of capital expenses, but it is not realistic to anticipate that revenue will support major construction projects that cost hundreds of millions of dollars.
- **Customers make their own decisions regarding the tradeoff between money and time** – The benefits of providing more choices must be balanced against equity concerns, which may vary. The importance of this benefit needs to be debated locally in each area that considers HOT lane implementation.

■ 10.4 Potential Obstacles to HOT Lane Conversion

As previously discussed, the three corridors with active HOT lane projects are not typical U.S. urban freeway corridors. Each experiences very severe congestion and exceptionally high volumes, and they all have barrier-separated lanes and had existing toll infrastruc-

ture in place in the region. The following may be obstacles to HOT lane implementation in Minnesota:

- **Enforcement** – Barrier-separated HOT lanes enable enforcement activities to be conducted safely. The 1998 Minnesota HOT lane study proposed electronic readers every half mile in order to discourage weaving out of the lane to avoid toll readers. In addition, a minimum charge would be proposed upon entry. Given the lack of inside shoulder space along much of the proposed HOT lane right-of-way on I-35W in particular (presenting current enforcement challenges), camera enforcement would be the only safe and cost-effective method of addressing toll violations under current conditions. Allowing carpools to use HOT lanes for free poses further challenges. This would require transponders for carpools and a manned booth at or near the toll facility to provide a “credit” for being a carpool.
- **Need to implement toll structure** – Toll infrastructure requires significant up-front investment in electronic equipment, communications, accounting software and personnel, public information, and management. If the toll collection system in Minnesota is limited in scope, the investment in infrastructure for HOT lanes may not be very cost-effective.
- **Potential opposition to tolls or variable pricing** – Since Minnesota has traditionally not had toll roads, significant public relations efforts will be required to implement HOT lanes.
- **Safety concerns** – Implementation of HOT lanes without barrier separation would increase safety concerns by placing more traffic in the inside lane.
- **Non-barrier separated HOT lanes** – These lanes have not been implemented and would be nearly impossible to enforce. In addition, if carpools were allowed to use the facility for free or at a discount, manual “credit” would need to be provided via a manned booth at some location in the corridor as camera technology does not exist for accurately determining the number of persons in a vehicle.
- **Equity** – Both California applications indicate that HOT-lane users tend to have higher incomes, although the difference is less pronounced than originally anticipated on SR-91. It is clear that equity concerns will differ significantly from one metropolitan area to another.
- **Availability of alternate routes** – This could be an issue particularly on I-394; the I-35W corridor is constrained by a limited number of river crossings.