

**SO YOU WANT TO MAKE A HOT LANE?  
THE PROJECT MANAGER'S GUIDE FOR AN HOV-TO-HOT LANE CONVERSION**

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**ABSTRACT**

Although HOT lanes have been studied or have existed for over ten years, the continuing developmental nature of these concepts means there is little guidance for project managers on how to manage an HOV to HOT lane conversion process. Many guidelines have been published regarding the technical elements of HOT lane development and operations. As a project manager of an HOV to HOT lane conversion process, the issues one would face are different than the typical highway construction project, and managing these issues can be difficult and arduous. It is the intent of this paper is to address issues from the perspective of the implementing agency's project manager. Eight specific issues to be addressed within the conceptual development of the HOT lane conversion process are identified here:

- Presence of significant and predictable excess capacity in the HOV lanes
- Presence of significant and recurring congestion in the adjacent general purpose lanes
- Nature of traffic separation on the HOV lanes
- Primary means of funding for the HOV lanes
- Identification of the HOT lane program's primary objective
- Determination of the appropriate implementing agency
- Avoidance of overwhelming public opposition
- Ability to build political support for the process

This paper has summarized the first of what the authors see as four steps to the successful conversion of an HOV lane to a HOT lane – conceptual development. Planned subsequent papers will address the remaining three steps: program design, implementation, and ongoing operations.

## INTRODUCTION

High Occupancy / Toll (HOT) lanes have increasingly gained exposure in research and practice as a potential mobility measure throughout North America. The Federal Highway Administration (FHWA) defines HOT lanes as “limited-access, normally barrier-separated highway lanes that provide free or reduced cost access to qualifying HOVs, and also provide access to other paying vehicles not meeting passenger occupancy requirements.” (1) Three states – California, Texas, and Minnesota – have implemented HOT lanes primarily on existing, under-utilized High Occupancy Vehicle (HOV) lanes since 1995. By early 2006, Colorado will be the fourth state to do so. In the same 10-year timeframe, High Occupancy Vehicle (HOV) lane miles have more than doubled, from approximately 1,300 lane miles in 1995 to over 2,500 in 2000, and forecasted to be 3,100 in 2005. (2) As evident by public policy support for new facilities, HOV lanes have proven capable of providing a premium level of service and reliability. HOT lanes provide an opportunity to augment and enhance mobility options for these facilities, especially those which experience significant excess capacity even in peak periods.

Although HOT lanes have been studied or in existence for over ten years, the continuing developmental nature of these concepts means there is little guidance for project managers on how to manage an HOV to HOT conversion process. Although there are other useful, effective guidelines that address many of the technical elements of HOT lane development and operations, such as the aforementioned FHWA HOT Lane Guide (1), the intent of this paper is to address issues from the perspective of the implementing agency. The authors have served as DOT Project Manager and Consultant Project Manager in the development of Colorado’s HOT lane conversion project. At the time of submission of this paper, the Colorado project was in the final stages of construction and expected to open in June 2006. Therefore, this paper is written primarily for the prospective project manager at an agency that may be considering a HOV to HOT conversion process (rather than the management and ongoing operations of a HOT lane facility).

This paper attempts to document the lessons learned from the authors’ first-hand experiences with the Colorado project, for future study and use, as well as apply ten years of active sharing of project lessons learned with peers in other implementing agencies.

## HOV TO HOT CONVERSION PROCESS

The process of converting an HOV lane facility into a HOT lane facility can be summarized in four parts:

- **Conceptual Development** includes defining and developing the HOT operational concept for the HOV facilities under consideration. Much of the body of research on HOT lanes falls under this category, as it provides policy guidance and conceptual alternatives for HOT lane operations. For the project manager, three distinct components are identified for this category, building upon the base of research already conducted, and the principal topic of this paper: understanding the HOV facilities, the policy implications of HOT lanes, and building political support.

- **Program Design** involves detailed-level assessment of conceptual alternatives, including the design of implementation components. Generally, this category would include identifying specific needs of HOT lanes in terms of HOV termini, type of tolling, technology, enforcement, and intergovernmental agreements.
- **Implementation** activities relate to collecting sufficient data and building a program of operations for the medium to long term. This includes opening-day issues such as maintaining travel times on a facility, use and distribution of revenue, and marketing and education.
- **Ongoing Operations** pertains to the mature program, continuing the activities of Implementation, and ensuring ongoing performance monitoring.

As mentioned, the topic of this paper is the first part only – Conceptual Development. It is the intent of both authors to continue the documentation of each additional step as they mature within the context of the aforementioned, to-be-implemented Colorado HOT facility.

## UNDERSTANDING THE HOV FACILITIES

Although the most commonly applied basis for a HOT lane project is an underutilized HOV lane, the development of HOV lanes or systems requires an entirely different process than an HOV-to-HOT conversion process. The *HOV Systems Manual*, a product of the National Cooperative Highway Research Program, “provides direction to transit and highway professionals in planning, designing, implementing, operating, marketing, and enforcing HOV systems.” (3) The focus here is on the circumstances whereby conversion of existing HOV lanes to HOT lanes is appropriate.

Under existing applications, in order to use HOV facilities, users must adhere to the facility’s particular occupancy and use policies. Most freeway-based HOV lanes apply a two-person-or-more (HOV 2+) occupancy policy, generating a level of demand that justifies the HOV lane without it becoming overloaded or congested. (4) These policies may cause an inconvenience to the user, such as traveling additional mileage in order to pick-up a carpool partner. As a result, the user must weight the value of time gained from the HOV lane versus the cost of time as a result of inconvenience.

In many ways, HOV lanes in any given corridor are selling the possibility of recurring congestion or a minor incident in adjacent general purpose lanes in return for an uncongested trip in the HOV facility. The expectation, in return for accepting inconvenience associated with the trip, is that the use of the HOV lane will provide some travel time savings. As a result, carpooling rates have increased significantly within HOV corridors (over 100%) even as carpool rates nationwide have declined (30%) during the past two decades. (5) However, severe congestion in the general purpose lanes have tended to cause animosity on the part of the general public towards HOV lanes if they are underutilized. (4) As a means of mitigating the “empty lane syndrome”, HOT lanes have been promoted as an effective way of utilizing the excess capacity without yielding the HOV lanes’ travel time advantages. (6)

**Project Manager Issue 1: Do you have significant and predictable excess capacity in your HOV lanes or facilities during the peak periods?**

For the project manager, the important consideration for a prospective HOT lane is the existence of significant and predictable excess capacity in the HOV facility. Although theoretically, toll-based access could be constrained to periods on either side of the peak hour, it would be difficult to sustain sufficient toll traffic to justify the conversion and operation expense without peak hour service. Whereas the carpooler is trading inconvenience of sharing a ride in exchange for travel time advantage, the toll payer is agreeing to pay the fee for the advantage. By nature, travel outside the peak period is less congested and more likely free-flowing. As a result, the traveler is far less likely to agree to pay the fee. Hence, the availability of excess capacity in the peak periods is essential.

The term *capacity* here refers to uncongested, free-flow capacities. The full capacity of a lane is typically achieved in a heavily congested condition where the highest number of vehicles can pass by a given point, without total breakdown of travel speeds (e.g., stop-and-go conditions). Stop-and-go conditions are incompatible with either HOV or HOT operations in that the time savings derived from either carpooling or paying a toll is at least partially lost. The HOT lane project manager should look to ensure *free-flow capacity* within the HOT lanes at all times. (6) Free-flow capacity can be measured by correlating ingress volumes to either travel speeds or aggregate travel time between key points. In all of the implemented HOT projects in California (I-15), Texas (I-10 and US-290), and Minnesota (I-394), it was possible to add a significant number of vehicles to the existing HOV traffic – including the peak hours – without significantly impeding traffic flow. Depending on the funding sources used on the facility, the existing HOV lane may have specific Level of Service (LOS) targets that must be maintained at the risk of refunding. Additional states may have adopted policies mandating LOS. For example, the California Department of Transportation has adopted a policy target of LOS-C for HOV lanes, with an absolute limit of unstable flow (LOS-E). (7) For the I-15 HOT lane in San Diego, state law requires a maximum of LOS-D operations, with annual audits to ensure LOS-D is maintained. (8)

For the project manager in the conceptual development portion of the HOV-to-HOT conversion process, understanding the *potential* excess capacity is sufficient for evaluating the general feasibility of HOT lanes.

**Project Manager Issue 2: Is there significant and recurring congestion in the adjacent general purpose lanes?**

The first component to realized travel time savings is free-flow speeds in the HOV lanes. The second component is realized congestion in the general purpose lanes. The potential success of HOT lane implementation requires that there is significant, recurring congestion in the adjacent general purpose lanes. Clearly, if the driver has little or no expectation of saving time by using the HOT lane, his or her willingness to pay will be extremely low. It should be noted that research on SR-91 in Orange County, California, has indicated drivers are also willing to pay for use of HOT lanes when travel time savings are not expected to be significant. In these instances, drivers indicated comfort and safety were additional factors in their choice. (9) Nevertheless, the

expectation of predictable congestion is a primary factor in a customer's decision to use a HOT lane.

HOV design literature refers to minimum lengths of HOV lanes to be viable. (3, 7) Some states provide additional guidance on expected travel time savings from HOV lanes. In the case of California, HOV lanes are not implemented unless the facility is expected to generate both a one-minute-per-mile and ten-minute cumulative travel-time savings for the facility. (7) For HOT lane operations, willingness to pay is closely correlated to travel-time savings. (1) On SR-91, research has shown that the correlation is stronger for *perceived* travel-time savings than actual travel-time savings, with a predisposition on the part of travelers to overestimate the actual absolute travel-time savings. (9)

### **Project Manager Issue 3: Is my HOV lane barrier, buffer, or line separated?**

Prior to May, 2005, all implemented HOT lanes had been physically separated from general purpose lanes by either concrete barriers or plastic channelizers. The Minnesota Department of Transportation opened the I-394 HOT lanes with only a painted-stripe buffer separating the general purpose and HOV lanes. At this early stage of HOT lane implementation nationally, it has been generally considered preferable to utilize barrier-separated HOV lanes, in order to ensure greater enforcement and safety. (1, 10) However, as implementation experience and guidance is gained from the I-394 project, as well as advanced design guidelines as advanced by the Texas Department of Transportation, many initial issues may be resolved. (16)

From the project manager's perspective, implementing a HOT lane conversion on a non-barrier separated facility may be more difficult – issues related to weaving, safety, enforcement, toll zones, and toll rates are all more complicated with buffer- or line-separated HOV lanes. Specific issues in a buffer or line separated HOT lane project will be dependent upon the configuration of the existing HOV lane. Tolling will complicate issues as it pertains to specific traffic movement and behavior related to the driver's positioning for advantage in a facility without barriers (such as weaving to avoid a toll lane, or entering and exiting the lane frequently to reduce toll charges). If the proposed HOT lane project is in a region that is new to the HOT concept, it could be advisable to pilot the concept on another existing HOV facility that is barrier separated, while awaiting the lessons learned from Minnesota's I-394 buffer-separated HOT lane facility. The obvious dilemma presented to the project manager is whether the buffer-separated or line-separated HOV to HOT conversion project is such a strong candidate that it can withstand additional avenues for criticism and concern from project detractors.

## **THE POLICY IMPLICATIONS OF HOT LANES**

The project manager must reign in the often overly-high expectations of revenue generation and congestion relief from HOT lanes. A modicum of reality specific to the region and the proposed facilities must be infused into these expectations. HOT lane conversion projects are rarely significant net revenue generators, the implementation of pricing from an economics perspective is flawed by nature (due to non-priced advantages to HOV's), and traffic relief on general purpose lanes will likely be minimal-to-imperceptible. Countering high expectations with

realistic predictions can be very difficult and it may place the project manager in a tenuous position if the policymaker or executive has strongly held views on the concept. Project managers must outline all the pros and cons – and all projects have some of each – for them and then allow them to ascertain whether their pet project is viable. The outcome of attempting to implement the project for the wrong reasons can be far worse than the pain of opposing such a bad project from the start. The issues that follow will assist in identifying and evaluating some of the critical considerations that can easily be overlooked. It is also common to defer these important factors until later in the project development process, which, in itself, can be a fatal flaw for an otherwise worthy and viable project.

#### **Project Manager Issue 4: How was my HOV lane facility funded?**

Many HOV lanes were funded, at least partially, by either FHWA or Federal Transit Administration (FTA) grants. The grant agreements typically include a provision prohibiting the use of HOV lanes by single occupant vehicles, including agreements for facilities in Colorado, Texas, and New Jersey. Since 1994, the Environmental Protection Agency has promulgated rules for federally-funded HOV lanes that allow use by single occupant vehicles if they meet Inherently Low Emitting Vehicle (ILEV) standards. (11) In 2001, FHWA provided guidance to states on the implementation of HOT lanes on federally-funded HOV facilities. This process requires approval of HOT lanes as an *incidental use*, constituting a *significant change of operations*. (12) Hence, specific written permission for HOT lane operations must be extended from the appropriate funding agency.

In order to complete this process, the department must submit a brief proposal to FHWA and/or FTA that describes the intended facility's change of operations; affected roadways and geographic extent; category of Federal funding used for HOV implementation; discussions with affected agencies and localities; affects upon air quality conformity or achievement of the regional transportation plan; and any incidence upon the approved State Implementation Plan or other environmental impacts. (12) The project manager must clearly demonstrate the ability and intent to manage traffic in such a way as to maintain travel times throughout the day and especially peak periods.

#### **Project Manager Issue 5: What is my HOT lane project's objective?**

The typical toll road facility will have a primary goal of *revenue maximization*. This approach ensures tolls are set correctly to collect the greatest annual net revenue, primarily to ensure bonds are paid in a timely manner. (1) Revenue maximization can be a viable primary objective of a HOT lane facility in a certain set of circumstances. Certainly, repaying any bonds for construction or conversion in a timely can be a primary objective.

However, HOT lanes, by their nature, involve objectives of congestion relief and mobility enhancement in addition to revenue generation. As a result, the specific goal of revenue maximization may not serve the project's principal objective. If the primary reason for pursuing a HOT lane is to maximize throughput in a corridor (*congestion relief*), then tolls should not be set to maximize revenue, but rather, to maximize the vehicular volume in the HOT lane. If enhancing

mobility is the primary reason, then setting tolls to encourage greater use by carpools, vanpools, and buses may be appropriate.

The project manager should lead the process for identifying the project's principal objective, and ensure that this paradigm extends throughout the lifetime of the HOT lane program. This means that the project manager, if appropriate, must ensure congestion relief or mobility enhancement factors are the primary factors in future traffic-and-revenue studies, not revenue maximization. It is critical to firmly establish the project's objective in the conceptual development phase, in that many process and technical decisions to come are predicated upon the objective. The policy basis for the primary objective should be established by multiple agencies that represent all the users of the HOV and prospective HOT facility (transit, vanpool, carpool, and toll users). Understanding the guidance identified by FHWA in Issue 4, above, and its implications on project approval, this is especially critical when the facility was constructed with federal funding that is dedicated to one or more of these interests.

### **Project Manager Issue 6: Who will be an implementing agency?**

Policy advocates will commonly try to achieve a higher purpose with an HOV to HOT lane implementation; typically, the conversion is not an end of itself. If the desire of the conversion project is to extend the concept to either other HOV corridors or new toll corridors, an additional complexity may be introduced in the form of toll authorities. Consideration must be given to how will the HOT lane conversion project be integrated into an existing toll system. In Colorado, proposed concepts on I-25 for its HOT lane conversion project raised issues related to business rules in account management, technology integration, and customer expectations that affected the existing toll operators. In order to maintain compatibility with one another, these issues required the HOT lane project to revise its proposed implementation.

Many states, such as Minnesota, Georgia, Colorado, Texas, Virginia, and Washington, view HOT lanes as the first projects of a much broader future network of express toll lanes. Indeed, the Houston I-10 HOT lane demonstration project conducted by the transit operator, METRO, has been extended into a massive corridor expansion project involving the construction of new HOT lanes – the I-10 Katy Reconstruction Program. In these circumstances, the policies generated for the project manager's corridor may seem inappropriate for the particular corridor, as they may be designed to accommodate the broader goals and objectives of a statewide or regionwide system.

The latter scenario presents an additional challenge to the project manager. The business rules set in place today for the HOT lane conversion project might be precedent setting for the future express toll lane system. If the current project is to allow free access to HOV and transit vehicles, consideration must be given now for addressing a future extension of the tolled facility. The issue of free HOV and transit use will likely be determined in a subsequent NEPA process for that corridor. Not only will these differing operations affect signage, branding and customer expectations, but care must be taken to avoid bias in any subsequent NEPA-level studies.

## **BUILDING POLITICAL SUPPORT FOR HOT LANES**

By virtue of being a fairly new concept with few implemented projects nationally, HOT lane projects can be a lightning rod for controversy. National experience has demonstrated that these projects can engender a level of opposition far in excess of a comparable highway construction project of equal magnitude. Indeed, the extent of public involvement and outreach in Minnesota (13) and Colorado (14) has been more typical of a major NEPA-compliant corridor study, yet their HOT lane conversion projects are a small fraction of the cost of major corridor studies in each state. HOT lane projects draw regional and even national attention from interest groups across the political spectrum, including environmental groups, auto associations, trucking industry representative, and anti-tax libertarians. As these groups recognize that initial HOT lane projects will set national precedent for future HOT lane networks and potentially toll road development, their activities can be intensely supportive or obstructive.

**Project Manager Issue 7: How do you intend to avoid overwhelming public opposition before your HOT conversion project has a chance for consideration?**

The concept of tolling is new in many states, and HOT lanes have inevitably been controversial to one extent or another everywhere they have been considered. Public and political support has taken a considerable amount of time to nurture in Minnesota (13), Colorado (14), and Texas (15). In all states, public opinion was generally lukewarm, at best, to start. For example, Minnesota utilized an array of partners throughout the public realm to reintroduce the HOT lane concept to citizens prior to the opening of the MnPass program. (13) Through a gradual education process occurring with the cooperation of regional policy advocacy groups, university research, and a Special Task Force, Minnesota was able to introduce the concept of HOT lanes in a positive environment. Colorado, similarly, has utilized policy advocacy groups to identify the broader context for HOT lanes outside a DOT-specific framework. Regardless of the specific mechanism, only through the concerted efforts of project managers and partners were HOT lanes able to progress positively in public opinion. Project managers must make use of mechanisms appropriate to their regions.

A variety of reasons contribute to HOT lanes remaining controversial, including concerns regarding equity for low-income individuals; geographic distribution of toll benefits and burdens; privacy of electronic toll collection; and double-taxation implications of the public highway system. Furthermore, HOV lanes have dedicated user groups including transit riders, carpoolers, and environmentally-friendly automobile drivers that expect their interests to be protected at all costs. Experience nationally has shown that HOT lane conversion projects are an easy target for criticism. It is easy to make headlines that are critical to the concept, but rare to find lead stories favoring HOT lanes. Similarly, politicians can make a name for themselves by criticizing and even legislating against HOV or HOT lanes. (13) Traffic engineers can go to great detail to demonstrate that a particular proposed HOT lane conversion project will not degrade traffic operations for existing lane users. However, technical analysis involving concepts such as LOS and lane density lose credibility and relevance quickly when dealing with the public's perception and the media. Any traffic situation that they perceive to be in conflict with the analysis can lead to loss of credibility of the entire concept along with popular and media scrutiny.

Altogether, the consideration of HOT lane concepts will be a difficult road to traverse for project managers. For these reasons, it is advisable to take *baby steps* toward implementation of a proposed HOV to HOT conversion. The simplest project can stir significant emotions and controversy. Project managers should proceed with caution in adding complexity to that simple project and resist the urge to advance any innovation that can risk the success of the core concept of the conversion project.

**Project Manager Issue 8: How do you intend to build political support from within and external to your project?**

One common element of successful HOT lane projects has been the top-level, political champion. In the early 1990s, San Diego had the visible public support of key City Councilmembers who wished to use HOT lanes to finance new transit services. Not coincidentally, San Diego also had the first successful HOV to HOT conversion implementation on I-15. (9) Colorado's HOT lane project, despite strong support from the Transportation Commission, did not receive much attention until the President of the Colorado Senate endorsed the concept and project in state statutes. (11) Minnesota DOT's I-394 HOT lane project, which initially experienced substantial public opposition in the mid 1990s, advanced quietly in technical analysis and design apart from public scrutiny. In 2003, after the state legislature passed new legislation endorsing HOT lane considerations, the new governor promoted the concept from the *bully pulpit*. (13) It was from this position of political strength that Mn/DOT was able to move forward quickly with implementation, as years of study and behind the scenes work finally paid off.

The project manager is often put in the atypical role of finding and nurturing political champions for their HOT lane projects. Given the rising interest in HOT lanes and tolling nationwide, and the successful implementation of projects in California, Texas, and Minnesota, the project manager no longer needs to educate policymakers from a position of zero-knowledge. Rather, policymakers are likely looking for guidance and advice from the project manager on how to make these strategies happen in ways that conform to their policy dispositions. As a result, the project manager must be ready to provide *relevant information* to policymakers that act to build eventual champions. Tools not only include results from focus groups and prospective surveys within the project manager's community, but also public opinion results from other projects around the country. This can be particularly effective in engendering positive comparisons to the project manager's project.

Anticipating the intense scrutiny the project is likely to receive from the media and interest groups, the project manager must make it a priority to have full knowledge and support from the highest levels of the implementing agency and its project partners. Opposition issues likely to arise will be of a policy and political nature, such as equity, double-taxation, and environmental protection. Issues of this magnitude will quickly bypass the project manager and become an executive-level concern. For example, the executive director of a large organization such as the Sierra Club, AAA, or Cato Institute, will not settle for speaking with the staff level project manager on such a controversial, precedent-setting policy. Instead, the DOT or transit agency executive director, policy director, planning director, public information officer, and/or district engineer is most likely to field questions from influential agencies. Although these executives are typically

very adept at responding to such inquiries on controversial highway projects, HOT lanes carry their own unique array of issues that are unlikely to have been seen before on highway projects. As a result, the agency must establish a clearly defined position on the project which is consistent from the project manager up to the executive director.

## **CONCLUSIONS AND NEXT STEPS**

As a project manager of an HOV to HOT lane conversion project, the issues one would face are different than the typical highway construction project. Indeed, technical analysis and feasibility may not matter nearly as much as political will for the project to succeed. Initially, HOT lanes have been seen as a way to generate new revenue in cash-strapped states. However, as HOT lanes are not expected to generate much net revenue over the life of the project, many HOT lane considerations nationwide are more a leap-of-faith that the concept has merit for mobility or future toll projects than a referendum on the conversion itself. As a result, the project manager will need to manage the political expectations as much as the technical soundness of the project.

This paper has summarized the first of what the authors see as four steps to the successful conversion of an HOV lane to a HOT lane. The next steps for the project, reiterated here, will hopefully be the topic of a subsequent paper, following the opening of the nation's sixth HOT lane facility. The authors leave it to the reader to guess which facility that will be.

The next three steps in the process are:

- Program Design, involving the detailed-level assessment of conceptual alternatives, including the design of implementation components. HOT lane design issues include termini, type of tolling, technology, enforcement, and intergovernmental agreements.
- Implementation, including identifying the correct data to collect and analyze, and building a system of procedures to ensure ongoing promotion and active management of the facility.
- Ongoing Operations, pertaining to the ongoing customer service, maintenance, and management of a new consumer-oriented type of highway system.

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