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## The HOV/HOT Alternative: Working Paper #3

The feasibility of an HOV/HOT lane on the Maine Turnpike



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Original: April 2018  
Revised: June 2018

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## 1. Overview

The Maine Turnpike Authority has been exploring various options for addressing growing traffic demands on the Maine Turnpike in Greater Portland. Alternative 12 involves the addition of a travel lane in each direction between Exits 44 and 53. The purpose of this white paper is to provide a high-level assessment of the feasibility of designating the added lanes as High Occupancy-Toll (HOT) lanes. Usage of these lanes would be restricted to vehicles that are either carrying multiple occupants or are willing to pay a higher toll rate. The general intent of the lane is to provide congestion-free travel for vehicles that are willing to either carpool or are otherwise willing to pay a premium fare.

## 2. Definition of High Occupancy-Toll Lanes

The HOT concept is unique among conventional toll roads. In the United States, there are no conventional toll facilities with lanes designated for high-occupancy vehicles (HOVs) or for single-occupancy vehicles (SOVs) that are willing to pay an additional toll. Therefore, it is necessary to impose some definition of the concept prior to providing an assessment.

The following points outline a high-level concept of operations (ConOps) for an HOT facility on the Maine Turnpike in Greater Portland. It represents one of many possible approaches, and it helps identify the choices that must be addressed in the process of implementing such a facility.

- The HOT lanes represent a third lane being added to each direction of travel. The far-left lane in each direction would be designated as the HOT lane.
- Usage of the HOT lanes would be restricted to two groups of users:
  - **High-occupancy vehicles, or HOVs.** The definition of an HOV is typically either 2+ (e.g. 2 or more people in the vehicle, including the driver) or 3+. This ConOps assumes a requirement of 3 or more occupants.
  - **Single-occupancy vehicles (SOVs)** that are willing to pay a toll. In order to manage the demand, the toll would be related to the level of usage of the road—the higher the usage, the greater the toll. This toll would be added to the “base toll” assessed to all users of the Maine Turnpike.
- Access to the HOT lane would be open. Vehicles would be free to move in and out of the HOT lane at any point. This feature is important because if access to the lane were too restrictive—that is, if the lane were limited to vehicles traveling thru the region that either met the occupancy criteria or were willing to pay a toll—then the pool of potential users could be extremely small.
- Vehicles wishing to use the HOT lanes must have a transponder. Transponders would be equipped with a switch that would enable the driver to identify the vehicle as either an HOV or an SOV. Vehicles without a switchable transponder could use the facility, but they would be charged as SOVs, regardless of the number of occupants in the vehicle. An example of such a transponder (currently in use on selected HOT facilities in Virginia) is depicted in Figure 1.



**Figure 1 – Example of Switchable Transponder**

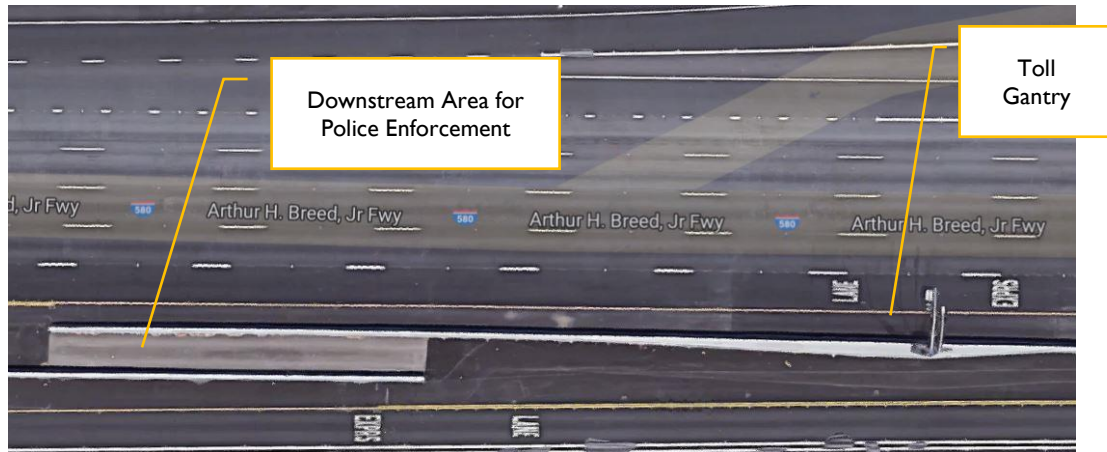
- Small gantries would be positioned at frequent intervals (e.g. every three-quarters of a mile) to detect users of the HOT facility. The gantries (see example in Figure 2) would be equipped with E-ZPass antennas as well as with enforcement cameras.
  - Vehicles with a transponder in “SOV” mode would be identified and charged appropriately; vehicles with a transponder in “HOV” mode would be identified but not charged.
  - Vehicles without a transponder would have an image taken of their license plate and would be processed as a violator.



**Figure 2 – Example of small gantry over HOT lane**

- Vehicle detections of either transponder readings or license plate images would be constructed into trips. Trips in the HOT lanes will be charged as either a flat fee (e.g. \$1.00 per trip) or as a rate per mile (e.g. 10¢ per mile traveled in the HOT lanes).

- All vehicles using the Maine Turnpike would be charged a base fare determined by the originating and destination interchanges, as per current practice. The HOT lane fare would be added on top of this “base” fare for travel on the Turnpike.
- HOV enforcement would be performed by state troopers making visual observations. Troopers located immediately downstream would be equipped to identify whether a vehicle is self-declared as HOV or SOV. Vehicles declared as HOV would be visually inspected to determine whether it meets the required number of passengers. Figure 3 illustrates how areas could be integrated into the median for use by enforcement vehicles.



**Figure 3 – Example of Enforcement Area**

- Advanced signing would make drivers aware of the current price in the HOT lane. Thus, drivers could decide whether to use the lanes based on real-time information regarding pricing. An example of advanced signing is depicted in Figure 4.



**Figure 4 – Example of advanced signing regarding HOT lane pricing**

In summary, the Concept of Operations outlined above illustrates one approach to implementing an HOT lane on the Maine Turnpike. The fundamental high-level decisions that would need to be made to operate an HOT facility would include eligibility requirements, access control, methods of enforcement, toll collection method and fare structure. Various toll agencies have taken different approaches to each of these decisions; final decisions would be made further into the planning process.

### 3. Comparable Facilities

As noted, no HOT lanes currently exist within conventional toll facilities in the United States. However, many of the components identified above can be observed at various facilities throughout the country. Some comparable facilities are identified below.

#### 3.1 Variable Tolling

The concept of variable tolling is commonly applied at various managed lane facilities. Variable tolling generally occurs in one of two forms:

- **Time of day.** The “time of day” approach to variable tolling elevates tolls during periods of the day when congestion is known to occur. This approach is employed on managed lanes on State Route 91 in Orange County, I-25 in Denver, and the Katy Freeway in Houston.
- **Dynamic.** The “dynamic” approach to variable tolling is one in which a tolling algorithm is employed to translate real-time traffic conditions into continually-changing toll rates. As congestion grows, the algorithm responds in such a way that the price escalates in response. Examples of managed lanes on which this approach is employed include I-66 near Washington, D.C., I-495 on the Capital Beltway, I-95 in Miami, I-15 in Utah, I-15 in San Diego, I-580 in Alameda County, CA, and I-10/I-110 in Los Angeles.

Generally, the dynamic approach is considered to be more responsive to real-time changes in traffic conditions, while the time of day approach is considered to be more customer-friendly due to its predictability.

#### 3.2 Open Access

The concept of “open access” to a priced managed lane has grown in popularity on the West Coast.

- The Alameda County Transportation Commission (Alameda CTC) employs open access on I-580. The facility operates on an 11-mile stretch of interstate between the towns of Pleasanton and Livermore, CA. Alameda CTC plans to expand the “open access” concept to a 14-mile stretch of I-680 between Pleasanton and Milpitas, CA.
- In October 2017, the Metropolitan Transportation Commission (MTC) opened express lanes on I-680 in Contra Costa County. It is a 13-mile facility operating between Walnut Creek and San Ramon, CA.

Figure 5 provides an illustration of the open access facility on I-680 in Contra Costa County. As the graphic illustrates, dashed lines indicate that vehicles are free to safely maneuver into and out of the HOT lanes at any point. Roadside signs as well as painted verbiage identify the lane as a high-occupancy toll lane, or “Express lane”.



**Figure 5 – Open access facility on I-680 in Contra Costa County**

Theoretically, vehicles in an open access HOT lane would be able to weave in and out of the lane, carefully avoiding the toll zones. However, three factors tended to mitigate this activity:

- First, because the gantries were fairly small, they were not very expensive to install. Consequently, they could be installed at relatively frequent intervals to make it more difficult to avoid them. Alameda CTC endeavored to install gantries at intervals of  $\pm 0.75$  miles.
- Second, the HOT lanes tended to be used during heavily-traveled time periods. High traffic volumes made frequent lane-changing maneuvers (i.e. to avoid a tolling point) more difficult to accomplish.
- Third, agencies can adopt business rules to minimize the impact of drivers attempting to dodge the tolling points. For example, when Alameda CTC reconstructed trips in the managed lanes, it identified the first and last tolling point traversed, and assumed that all intermediate tolling points were also traversed. In other words, the intermediate readings were not necessary to construct the trip.

### 3.3 Tolerated Lanes Embedded Within Conventional Facility

Only one facility in the United States—the Veterans Expressway in Tampa—involves the addition of priced managed lanes to a conventional toll road. The Veterans Expressway is a 16-mile facility oriented north-to-south that connects Lutz, Florida to downtown Tampa. The roadway is generally two to three lanes in each direction. The “express lanes” portion of the facility is planned to be opened in three phases:

- The first phase involves the addition of 1 lane in each direction to the southern 8.5 miles of the roadway. The additional lane will be tolled at the same rate as the rest of the facility. However, the express lanes will only have one entry point and one exiting point in each direction. In other words, only vehicles traveling the entire 8.5-mile distance can use the express lanes.

- The second phase involves the addition of 1 lane in each direction to the northern 7.5 miles of the roadway. Once again, the additional lane will only have one entry and one exit, and it will be tolled at the same rate as the rest of the facility.
- The third phase involves the implementation of “dynamic pricing” on the express lanes. As the lanes become more heavily traveled, the price will automatically rise to prevent congestion. The dynamic price will be added to the base toll rate that is assessed to the users in the parallel General Purpose (GP) lanes.

All drivers wishing to use the express lanes will need to have a transponder. There is no provision for HOVs to travel for free; all drivers must pay.

The first phase opened in December 2017, and the second phase is tentatively scheduled to be completed in the spring of 2018. Dynamic pricing will be implemented once construction is complete, though the timetable for implementation is unclear.

#### 4. Feasibility Considerations

The high-level ConOps outlined in Section 2 describes *how* an HOT lane could be implemented. However, a more fundamental question is: Does an HOT lane make sense for the Maine Turnpike in Greater Portland? The following factors should be considered in addressing this question:

- **Overall usage.** Usage of a priced managed lane on a 4-lane interstate highway would be minimal unless the average traffic volumes exceed about **65,000 vehicles per day** (vpd). At present, average daily volumes on the busiest portion of I-95 in Greater Portland are slightly under **49,000 vpd**. It would likely be 15-20 years until average daily volumes reached the level at which a priced managed lane would receive a reasonable level of usage.
- **HOV usage.** The Maine Turnpike Authority conducted a detailed survey of vehicle occupancy in 2010. The results are summarized in Table 1.

**Table 1 – HOV Usage on the Maine Turnpike**

HOV Level	Weekday Usage	Friday Usage	Weekend Usage
<b>2 or more occupants</b>	37.2%	55.8%	69.9%
<b>3 or more occupants</b>	13.1%	16.7%	27.3%

The data in Table 1 illustrates some of the challenges associated with implementing an HOT lane on I-95.

- If HOV2+ were selected as the requirement for the HOT lane, it would offer virtually no incentive for carpooling. Based on the data above, if all HOV2+ vehicles shifted to the new HOT lane, then the new HOT lane would have more traffic than each of the other two lanes. The new lane—accounting for one-third of the highway’s capacity—would be serving *more* than one-third of the traffic.
- If HOV3+ were selected as the requirement for the HOT lane, and if all vehicles with three or more occupants shifted to the HOT lane, then the volume in the GP lanes would drop by at least 10-15%, and even more on weekends. This would likely free up enough capacity in the GP lanes such that, for many years, there would be little incentive for SOVs to pay a toll to use the HOT lanes.



Thus, millions of dollars could be spent to dynamically toll a lane that would be virtually unused by SOVs for a long time.

- **Flex transponders.** The Maine Turnpike Authority does not operate any HOT lanes. Consequently, the Authority does not issue switchable transponders that allow users to self-identify as HOVs. Implementing an HOT lane would require the Authority to add these devices to their inventory—a potentially expensive undertaking.
- **Orientation.** HOV and HOT lanes are generally designed to connect residential areas to urban centers. The proposed lanes for I-95 in Greater Portland represent a very different orientation, since these lanes lie on the outskirts of the urban core of Portland. In other words, the lanes are not fed by a high-populated residential center, and they do not feed a high-density urban center. At the very least, adding HOT lanes on I-95 between Exits 44 and 53 would represent an unconventional approach to boosting capacity.
- **Equity.** The addition of a HOT lane to an already-tolled facility raises questions of equity. Is it fair that a new lane, whose construction is likely to be funded by current toll-payers, should be restricted in its use? In other words, if a frequent commuter today is paying a daily toll of \$1.00, and if that toll is being used to finance the construction of the new lane, should that frequent commuter be eligible to use that new lane?
- **Best approach.** If congestion is a concern in the corridor, is the best approach to simply impose dynamic tolling on one lane? If the precedent has already been established that the facility is a toll road, why not dynamically price the entire roadway? Would this be a more effective way to encourage discretionary trips to shift away from peak-period travel?

In short, it is important to consider the question of why an HOT lane is being considered for incorporation into an existing tolled facility.

- If the goal is to add revenue, it would be more equitable to increase tolls for everyone and make the lane available to everyone.
- If the goal is to manage capacity, it would be more effective to adjust tolls for everyone rather than to simply adjust tolls on a single lane.
- If the goal is to encourage carpooling, then an HOV3+ requirement would be appropriate. But this raises an equity concern of requiring toll-paying SOVs to fund a project while excluding them from eligibility.

## 5. HOV Only Alternative

At the request of the PAC, an HOV only alternative was evaluated that would allow buses to utilize the additional lane. From Section 4 of this report, HOV 2+ and 3+ utilization was identified as follows:

Table 2 – HOV Usage on the Maine Turnpike

HOV Level	Weekday Usage	Friday Usage	Weekend Usage
2 or more occupants	37.2%	55.8%	69.9%
3 or more occupants	13.1%	16.7%	27.3%

As seen from the table above, an HOV 2+ scenario would essentially operate as a defacto third lane as the percentage for weekday, Friday, and weekend are all above 33%. An HOV 3+ scenario could be more viable to operate as a true HOV lane and provide a travel time advantage compared to the general-purpose lanes.

This alternative would also provide an opportunity for buses traveling through the region to gain a travel time advantage. Using MTA data, the number of charter buses traveling through the Study Area was estimate. Charter buses are defined as class 3 vehicles that travel greater than 60 miles along the Maine Turnpike. Based on data from the Maine Turnpike Authority and 2010 origin-destination survey less than 10 charter buses will travel along the Maine Turnpike, within our study corridor, during the peak hour.

Based on the above analysis, number of buses traveling in the study corridor is limited. Bus utilization would be limited to charter buses i.e. busses making longer trips passing thru the study corridor. Local busses and even regional busses tend to make shorter trips along the turnpike and may not utilize the HOV lane. Because the alternative won't necessarily reduce congestion, and lane utilization would be lower than the HOT/HOV alternative, the HOV only alternative is not recommended as a standalone option.

## 6. Summary

Implementing an HOT lane on the Maine Turnpike between Exits 44 and 53 would be an immense effort. Although numerous HOT lanes are operating in the United States today, *none* are operating parallel to an existing conventional toll facility. The concept of charging all customers a base toll, while designating an additional lane solely for HOVs and for SOVs willing to pay a higher toll, is untested in this country.

The obstacles to such a facility are not technical. As outlined in Section 2, it is certainly possible to establish how such a lane *could* operate. The key components—namely, dynamic pricing, open access, and self-identification as HOVs—are in place at various facilities throughout the country. Rather, the obstacles are more behavioral and customer driven. They include the following:

- On a per-lane basis, the levels of traffic on the Maine Turnpike in the study area were much lower than the levels observed on existing managed lane facilities in the United States. This indicated that the amount of revenue to be generated by this proposed HOT lane would likely be very low. The cost to build and operate such an HOT lane would almost certainly be much greater than the revenue that it would generate.
- Given that an HOT lane would **not** be self-sustaining, the only way to build and operate the lane would be to finance it with existing toll revenue. The notion of charging SOVs to build a lane that they are not permitted to use (unless they pay a premium) raises equity questions.
- The tasks of raising revenue and managing traffic are more effectively done by managing tolls on *all* lanes, rather than focusing solely on a single express lane.

In short, implementing an HOT lane on the Maine Turnpike between Exits 44 and 53 is technically feasible, but not practicable today, and would likely be an expensive venture that would not be the most effective means of providing quality service in an equitable fashion. HOV for 2+ occupants would result in reasonable utilization of an HOV lane (approximately 37% to 70%), but HOV 3+ would have limited utilization. However, looking forward, this alternative could again be analyzed for practicality in the future and could be implemented on a policy basis if a third lane is built.

