

Regional Mobility Pricing Project

RMPP Managed Lanes Evaluation

September 7, 2023

1 Introduction

This report provides supplemental information and discussion related to managed lanes for the RMPP Options Comparison Report. Managed lanes, defined broadly, are any travel lanes where vehicle access to the lane requires meeting certain conditions of occupancy, price, vehicle type, or a combination of these. For purposes of this document, managed lanes are defined as pricing one or more lanes on I-5 and/or I-205, leaving other general-purpose lanes available as unpriced. This material includes a discussion of:

- Managed lane requirements, including the challenges of converting existing lanes.
- Managed lanes implementation costs, including the cost associated with converting existing lanes or adding new managed lanes.
- A managed lanes evaluation table using criteria to compare: constructing new managed lanes, converting existing general-purpose lanes, and all-lane tolling.

2 Managed Lanes Requirements

Number of Lanes Needed

On corridors with consistent, recurring congestion, managed lanes are a mechanism to provide an option to drivers for a less congested and more reliable trip. Drivers must meet the requirements for using the lane, which are usually a vehicle occupancy requirement, or a requirement to pay a toll. Managed lanes can only be implemented on facilities with at least 3 total lanes (one managed, two general purpose). A configuration with only one managed lane and one general-purpose lane would not function as an interstate (in terms of vehicle throughput and consistent speed of travel). Vehicles in the single general-purpose lane would be unable to maneuver around slower vehicles leading to slow and congested travel speeds as well as incursions from the general-purpose lane into the managed lane decreasing both the safety and the efficacy of the managed lane and the general-purpose lane. For these reasons, it is also highly unlikely that this type of configuration would be approved by FHWA, and there are no single managed lane/single general purpose lane facilities in the United States. In Portland, managed lane(s) would require newly constructed lanes on any facility or section of a facility with only two existing lanes of travel.

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Figure 1 illustrates the segments of I-5 and I-205 with only two general purpose lanes (or two general purpose lanes with an auxiliary lane). Any segments in the figure shaded red or yellow would require the construction of new capacity to accommodate a managed lane(s).

Challenges of Converting Single Lanes

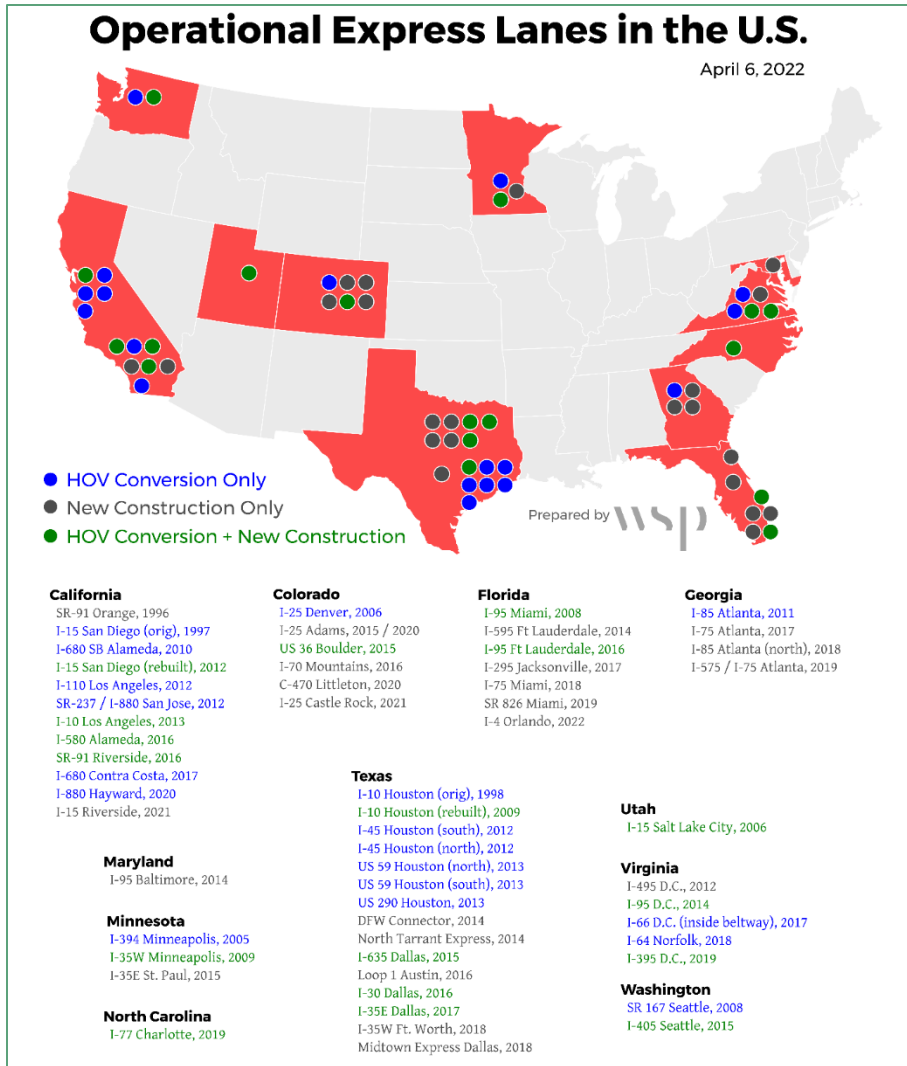
Even in areas where there is sufficient existing capacity, converting a general-purpose lane to managed lanes operation is challenging. Tolling an existing single general-purpose lane in an area with recurring congestion would increase vehicle demand in the remaining general purpose lanes, thus increasing congestion, reducing travel speeds, and increasing greenhouse gas emissions.

With two unique exceptions discussed below, every managed lane facility in the United States is the result of a conversion of an existing HOV lane (not general-purpose) or construction of new lanes, and not conversion of a general-purpose lane. Figure 2 summarizes current implementations of the managed lanes concept.

Managed lanes typically operate on the innermost lane of travel to minimize interactions with vehicles merging onto and exiting from the general-purpose facility. Without new direct access ramps, drivers accessing the managed lanes must weave across the general purpose lanes. This degrades performance in the general-purpose lanes and increases risk of crashes. If the general-purpose lanes are congested, some of the advantage of using the managed lane is also lost as the managed lane drivers weave through congested conditions. At interchanges, construction or reconstruction is often required to maintain the managed lane’s continuity and ingress and egress needs. As such, lane conversions generally require significant capital investments to reconfigure ramps and interchanges, particularly at major interchanges. In the RMPP area, this would include the I-5/I-205, I-5/I-84, I-5/OR 217 and I-5/I/405 interchanges. While auxiliary lanes might seem like a good candidate for conversion to a managed lane, auxiliary lanes serve a necessary specialized function that would need to be maintained. Since auxiliary lanes by their nature are not continuous lanes, they do not have the ability to deliver the benefits of a managed lane.



Figure 1: I-5 and I-205 Segments with 2 Travel Lanes



There are no examples in the United States of successful conversions of general-purpose lanes to managed lanes of the type needed in Portland.¹ Short sections of general-purpose lanes have been converted to a price-managed lane in the US: I-694/I-35E in St. Paul, Minnesota and I-64 in Hampton Roads, Virginia. However, these are not applicable in the current context given that both are short “connector” links between other managed lane facilities.

In summary, conversion of any general-purpose lanes to a managed lane is not advised in the Oregon context. A managed lanes solution would require the construction of new travel lanes.

Figure 2: Managed Lanes in the US

3 Managed Lanes Implementation Costs

The initial capital costs for managed lanes implementation vary significantly depending on the implementation approach. Converting a lane may seem to be relatively inexpensive, considering costs associated with placement of tolling infrastructure, restriping, barrier placement, etc. However, as noted earlier, on I-5 and I-205 there are likely to be significant costs associated with reconfiguring on-ramps, off-ramps, interchanges, and accommodating ingress and egress movements between the general-purpose

¹ <https://next10.org/sites/default/files/10%20High-Occupancy%20Vehicle%20Lanes.pdf>

and managed lanes. As such, converting a general-purpose lane to managed operations would require constructing infrastructure and covering the associated costs.

The major disadvantage of constructing a new priced managed lane is cost. For example, ODOT estimates that adding a third lane in each direction on I-205 between Stafford Road and OR213 (the second phase of the I-205 Toll Project) would cost about \$550 to \$600 million. The length of that project is 6.3 miles, which is approximately fifteen percent of the total centerline length of the entire RMPP study corridor. Adding a travel lane over all of I-5 and I-205 in the study area would be a multi-billion dollar undertaking, with no funding sources identified.

4 Managed Lanes Revenue Generation

In addition to managing congestion on I-5 and I-205, a desired outcome of the RMPP is to generate revenue for other transportation investments. While managed lanes have been shown to effectively generate revenue, few generate revenue for investment outside of maintenance and operations. Those that do, typically have at least two-managed lanes operating in each direction. Figure 3 summarizes gross revenue for managed lanes facilities of different lane configurations that were compiled by the RMPP technical team. As the figure shows, managed lanes with 2 managed lanes in each direction (2+2), or facilities with 3 managed lanes in each direction (3+3) generate significantly more revenue than facilities with only one managed lane in each direction (1+1).

Table 1 summarizes average revenues for 24 toll facilities in the US. Revenue is shown for facilities with a single priced lane in each direction (1+1), two priced lanes in each direction (2+2), segments with either two or three priced lanes in each direction (2+2/3+3) and two-lane reversible facilities (2R). As shown, a single managed lane is relatively weak at producing revenue compared to facilities with two lanes in each direction. Given existing capacity and right-of-way constraints along I-5 and I-205, only a single managed lane, not two managed lanes, could be accommodated in each direction of travel. If the intention of managed lanes is to generate revenue for transportation investment outside of paying for maintenance and operation of the managed lanes, then a single lane in each direction will not be suitable.

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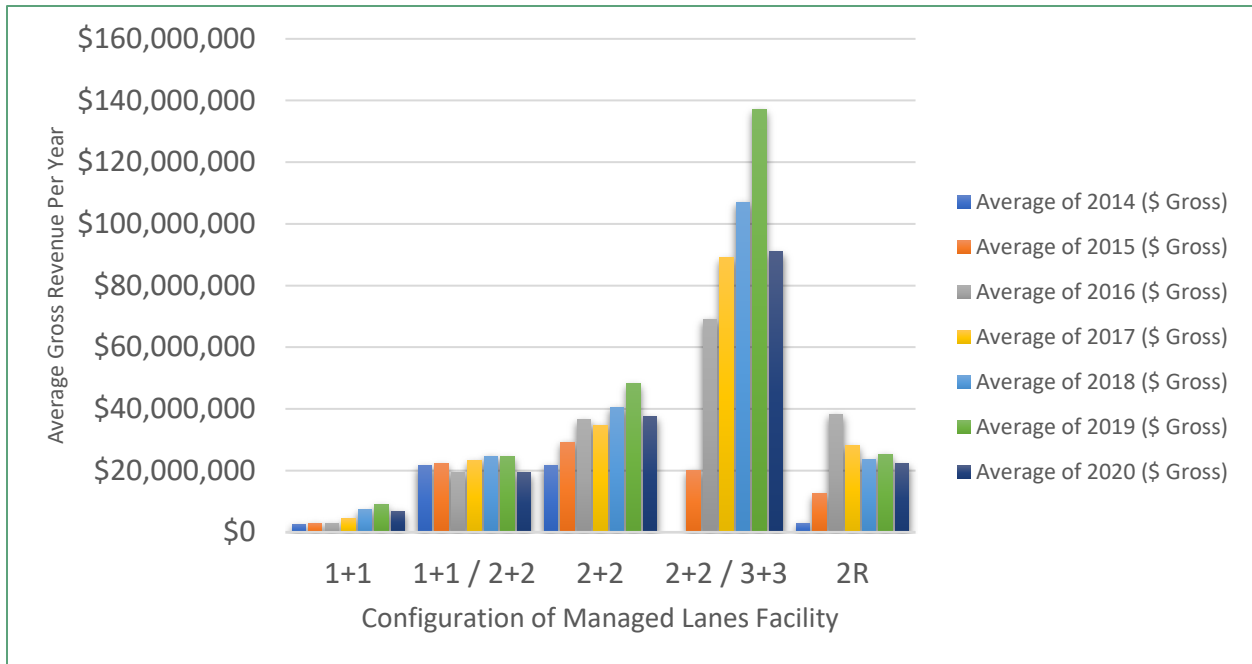


Figure 3: Average of Managed Lanes GROSS Revenue (2014 - 2020)

Facility Type	2019 Data Available for	2019 Average Revenue per Lane Mile	2020 Data Available for	2020 Average Revenue per Lane Mile
1+1	11 facilities	\$348,000	11 facilities	\$ 286,000
2+2	12 facilities	\$1,153,000	13 facilities	\$ 897,000

Table 1 - Average per lane mile annual revenue for priced lanes²

Finally, revenues from managed lanes are particularly volatile relative to traditional toll facilities that price all lanes, as usage is highly dependent on travel conditions in the general-purpose lanes. Managed lanes attract drivers when conditions on the general-purpose lanes are congested. In a sense, managed lane revenues are dependent on poor conditions in the adjacent general-purpose lanes. If improvements are made to travel conditions in the general-purpose lanes, there will be less demand for the uncongested, tolled alternative, thus lowering revenues. Nowhere is this more apparent than in the significant declines in managed lane revenues during the COVID-19 pandemic. Across the US, millions of commuters traveled less, thus reducing congestion. As a result, there was little need for drivers to choose a priced managed lane alternative, and revenue dropped significantly. Revenues from the I-405 Express Lanes in Seattle, for example, have still not recovered to their pre-COVID levels and are currently estimated at 45 percent relative to 2019. In short, the response of drivers to managed lanes during the reduced travel demand brought about by COVID-19 shows that when demand is reduced, managed lane volumes are the first to drop and the last to recover. As a result of overall managed lanes revenue volatility, they are

² Source: WSP research

difficult to leverage into other funding sources such as bonds. Fully tolled facilities are more reliable in terms of revenue generation and frequently support large bonding packages.

Given their volatility and relatively low levels of revenue generation, managed lanes are not considered to be a reliable or sustainable source of revenue for transportation investment within the Portland region and therefore do not meet the project purpose and need.

4.1 Managed Lanes Evaluation

Table 2 summarizes evaluations of a newly constructed managed lane, a converted managed lane, and all lanes tolling within the considerations used to evaluate the RMPP options. For almost all considerations, tolling all lanes performed better than either converting an existing general-purpose lane or adding a new managed lane.

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Table 2: Evaluation of Managed Lane Options (with two general-purpose lanes) relative to all-lane tolling

Consideration	Construct a New Managed Lanes	Convert a General-purpose Lane	Tolling All Lanes
Congestion & Demand Management on I-5 and I-205			
Vehicle Speed on I-5 and I-205	Improved travel speeds on I-5 and I-205	Reduced travel speeds on I-5 and I-205	Significantly improved travel speeds on I-5 and I-205
Through Trip Time Savings on I-5 and I-205	Improved through trip time savings on I-5 and I-205	Reduced through trip time savings on I-5 and I-205	Significantly improved through trip time savings on I-5 and I-205
Regional System Performance			
Regional VMT	Likely higher regional VMT	Potentially lower regional VMT	Likely lower regional VMT
Regional VMT per Capita	Likely higher regional VMT per capita	Potentially lower regional VMT per capita	Likely lower regional VMT per capita
Regional Vehicle Time Savings (VHT)	Likely lower regional VHT	Likely higher regional VHT	Likely lower regional VHT
Diversions			
Diversions to Non-Tolled Facilities	Limited diversion due to added capacity.	Potentially significant diversion due to new tolls, reduction in general-purpose capacity and worsening congestion on the remaining lanes.	Potentially some net diversion to non-tolled facilities
Freight Diversions to Non-Tolled Facilities	Limited freight diversion due to added capacity.	Potentially significant freight diversion due to new tolls, reduction in general-purpose capacity and worsening congestion on the remaining lanes.	Potentially some net freight diversion to non-tolled facilities
I-5 and I-205 Trip Characteristics			
Comparison of costs for several representative trips on I-5 and I-205	Lower cost to managed lanes users relative to using a converted general-purpose lane. Higher travel costs in managed lane than with all lane tolling.	Likely the highest cost to users of the managed lanes	Lower cost to I-5 and I-205 users relative to using a converted general-purpose lane.
Travel times for several representative trips on I-5 and I-205	Improved travel times	Degraded travel times	Improved travel times
Share of I-5/I-205 trips paying RMPP tolls	Lowest volume of tolled trips of options	Higher volume of tolled trips relative to constructing a new managed lane	Highest volume of tolled trips of the options

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Consideration	Construct a New Managed Lanes	Convert a General-purpose Lane	Tolling All Lanes
Multimodal Travel			
Mode Share Shift (HOV, SOV, Transit, Bike/Walk)	Lowest potential for mode shift due to presence of higher performing general purpose lanes.	Some potential for mode shift.	Some potential for mode shift.
Equity			
Location and number of non-tolled trips on I-5 and I-205	Highest number of non-tolled trips.	Fewer non-tolled trips relative to constructing a new managed lane	Lowest number of non-tolled trips
Revenue Potential			
Indexed comparison of gross revenue	Lowest gross revenue potential due to improved conditions	Higher gross toll revenue potential relative to constructing a new lane	Highest gross revenue potential
Indexed comparison of net revenue	Lowest net revenue potential due to improved conditions and high cost of building new lanes	Higher net toll revenue potential relative to constructing a new lane	Highest net revenue potential
Customer Experience			
Communication of toll rates	May use more complex dynamic pricing to maintain free flow travel conditions instead of scheduled fees	Will likely use more complex dynamic pricing, instead of scheduled fees, to maintain free flow speeds in managed lanes.	Will use scheduled fees that are easier for the public to understand and use to plan trips.
Understandability of trip costs	More difficult for users to plan trips. Toll rates can change while the driver is travelling.	More difficult for users to plan trips. Toll rates can change while the driver is travelling.	Drivers can know rates in advance, based on scheduled fees for each toll zone or congested area.
Ability to integrate with I-205 and IBR	Dynamic pricing is a different rate setting approach to I-5 and I-205. Would require educating the public on the differences and the reasons for those differences.	Dynamic pricing is a different rate setting approach to I-5 and I-205. Would require educating the public on the differences and the reasons for those differences.	Rate setting would be consistent with the approaches used for the IBR and I-205 Toll Project.
Construction Feasibility and Capital Costs			
Availability and experience of tolling service providers and vendors	Numerous experienced vendors available for managed lanes applications.	Numerous experienced vendors available for managed lanes applications.	Depending on the approach, there may be limited vendors with experience in full facility congestion pricing.
System Integration	Vendors available for system integration.	Vendors available for system integration.	Vendors available for system integration.

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Consideration	Construct a New Managed Lanes	Convert a General-purpose Lane	Tolling All Lanes
Constructability and capital cost of toll system	Highest Cost Option: Significant construction costs associated with managed lane development. Additional costs associated with general purpose lanes due to need to reconfigure interchanges, ramps, etc. to accommodate managed operations.	Capital costs incurred for restriping, barrier placement, signage, and merging/access points between the managed and general-purpose lanes. Potentially high costs for reconfiguring ramps and interchanges.	Lowest cost option in terms of construction.