COLORADO
Department of Transportation
Division of Transportation Development

DATE: October 14, 2015
TO: Transportation Commission
FROM: Debra Perkins-Smith, Director, Division of Transportation Development (DTD)
SUBJECT: High Occupancy Vehicle (HOV) Policy Guidance

Purpose

To provide guidance on proposed policy for High Occupancy Vehicle (HOV) lanes.

Action

Transportation Commission (TC) approval of revised HOV Policy resolution.

Background

Managed lanes are being considered with increasing frequency as a potential solution on many corridors (see Attachment A). HOV lanes, bus only, bus on shoulder, Bus Rapid Transit (BRT), Tolled Express Lanes (TEL), and congestion pricing are all examples of managed lanes. Guidance is currently being developed on how to apply the Managed Lanes Policy Directive 1603.0 (Resolution #TC-3039, December 2012), which states:

> "Managed Lanes provide the ability for the Department to respond to changing traffic conditions and provide operational flexibility and efficient operation of the multi-modal transportation system infrastructure by maximizing the number of vehicle or the number of people traveling in a given corridor. As congestion increases in a corridor, managed lanes can provide greater reliability of travel and also promote alternative travel choices. The challenge for transportation planners and highway engineers is to maximize the operation of transportation infrastructure by considering flexible, cost-effective strategies for sustaining or enhancing the movement of people and goods."

There are a number of managed lanes currently in the planning stages, including potential HOV and TEL projects and combinations thereof; therefore guidance is being developed on how to consider these strategies within a corridor. With a number of planned or future projects considering HOV lanes as part of a managed lanes strategy, the timing is appropriate for the TC to consider providing additional guidance on how HOV lanes should be considered on CDOT projects.

Details

As a state DOT, we recognize the benefits of HOV:

- To increase the person throughput of the transportation system (by providing incentives to use buses, vanpools, and carpools)
- To provide mode choice
- To reduce congestion
- To reduce the number of vehicles, and therefore reduce vehicle emissions

HOV lanes in Colorado have most often been implemented as part of a TEL. The goal of a TEL strategy is to optimize throughput of the transportation system, provide travel time reliability, reduce congestion, provide choice, and generate revenue to offset operations, maintenance, or project costs of a transportation investment. When developing a TEL strategy, the consideration of HOV lanes must also be balanced with the goals of the TEL.

PD 1603.0 requires that the use of managed lanes be strongly considered during the planning and development of capacity improvements on state highway facilities in Colorado, but does not provide guidance specific to HOV lanes. Resolution #TC-3052 (February 2013) required that as of January 1, 2017 all tolled HOV lanes on the state highway system be limited to vehicles with three or more total occupants (HOV-3+). It did not, however, provide guidance as to how it should be determined whether a facility should include HOV-3+ lanes. Staff is currently developing guidance on the implementation of

PD 1603.0 and requests TC input on how to address the consideration of HOV-3+ lanes. Staff has developed the following general concepts to guide the consideration of managed lane strategies, including HOV:

Establish Performance Measures - For managed corridors/lanes, set performance measures for corridor goals. For example, if the goal of the managed corridor/lane is to provide travel time reliability, a performance measure related to level of service (LOS) or speed should be established. (These performance measures are sometimes expressed as triggers at which an action is taken.)

Consider HOV-3+ Free - For managed corridors/lanes, in recognition of the benefits of HOV, begin with the assumption that HOV-3+ is free; however, there are conditions under which this strategy may not be feasible. For example, if HOV-3+ results in any of the following issues:

- Safety concerns
- Corridor performance measures will not be met
- Renders the transportation improvements financially infeasible

Each managed corridor/lane can be assessed based on its specific characteristics and may be reassessed as conditions change over time. See attached example of an HOV assessment. Attachment B provides example assessments for US 36, I-70 PPSL, and C-470.

At the TC Workshop, staff will review the proposed policy approach, as well as the specifics of its application on the I-70 PPSL and C-470 projects (see Attachments B and C). Given the need for a decision in the near future for C-470, staff requests TC input and consideration of an approval action on an updated resolution to replace Resolution #TC-3052 (see Attachment D). Staff will incorporate the direction provided by the TC in the PD 1603.0 guidance currently being developed.

Next Steps

- Transportation Commission adoption of revised HOV Policy resolution

Attachments

- Attachment A - Colorado Toll/HOV/BRT Facilities
- Attachment B – Example HOV Assessment
- Attachment C – C-470 Express Toll Lanes Exemption Analysis
- Attachment D – Updated Resolution #TC-3052 (HOV 3+ Policy)

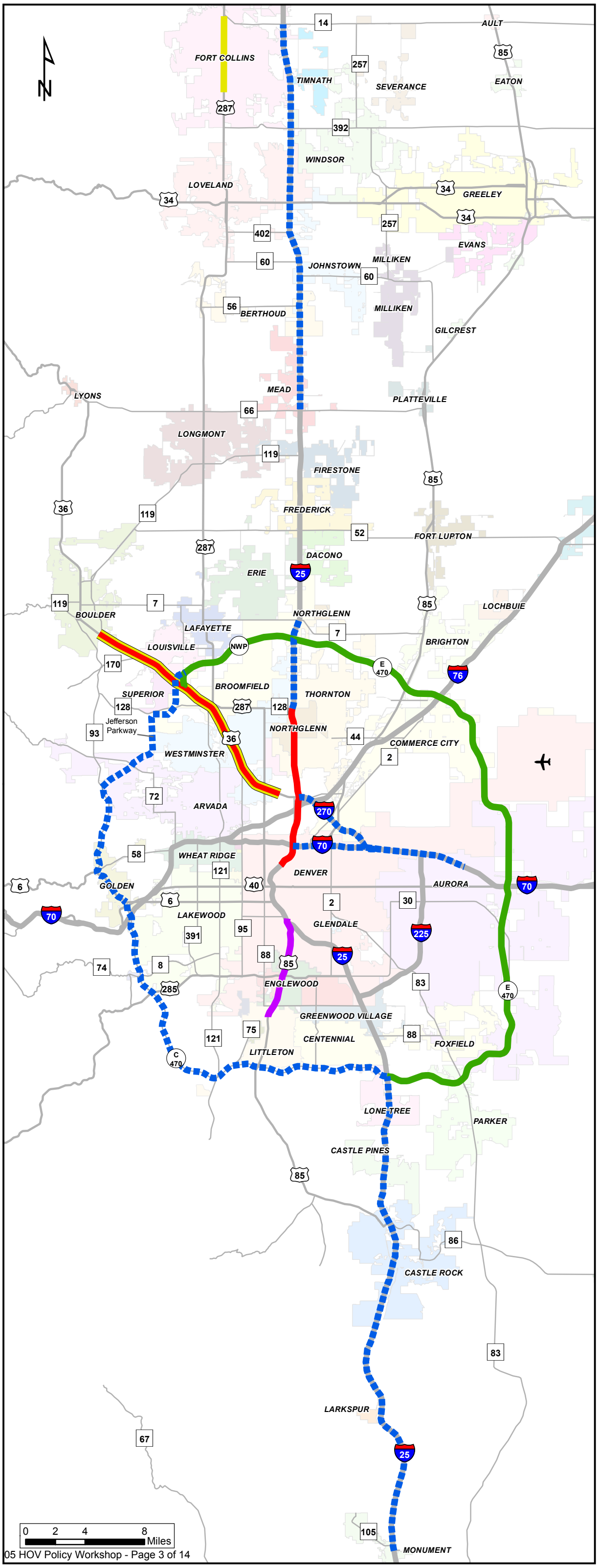
Colorado Managed Lane Facilities October 2015

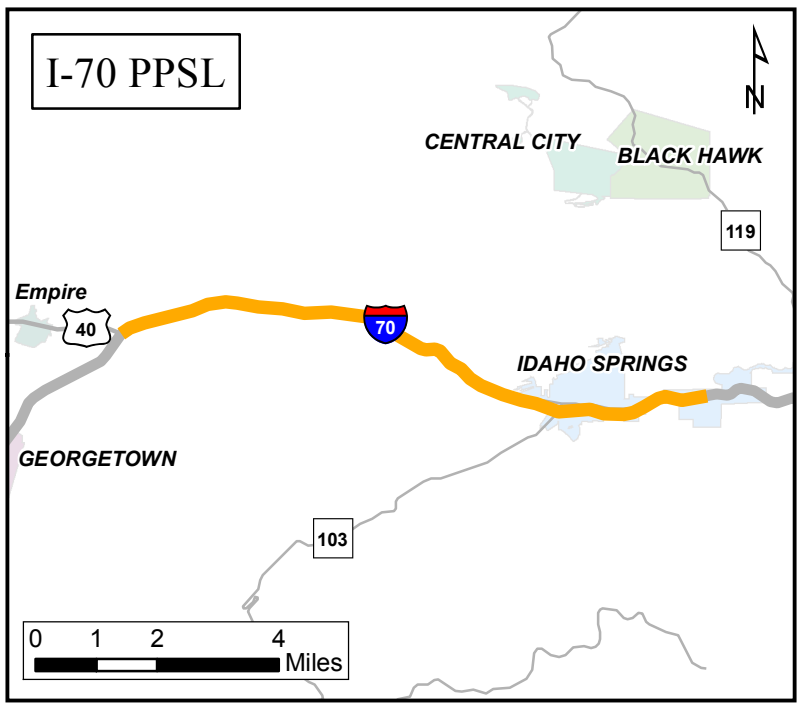
Managed Lanes - Operational or Under Construction

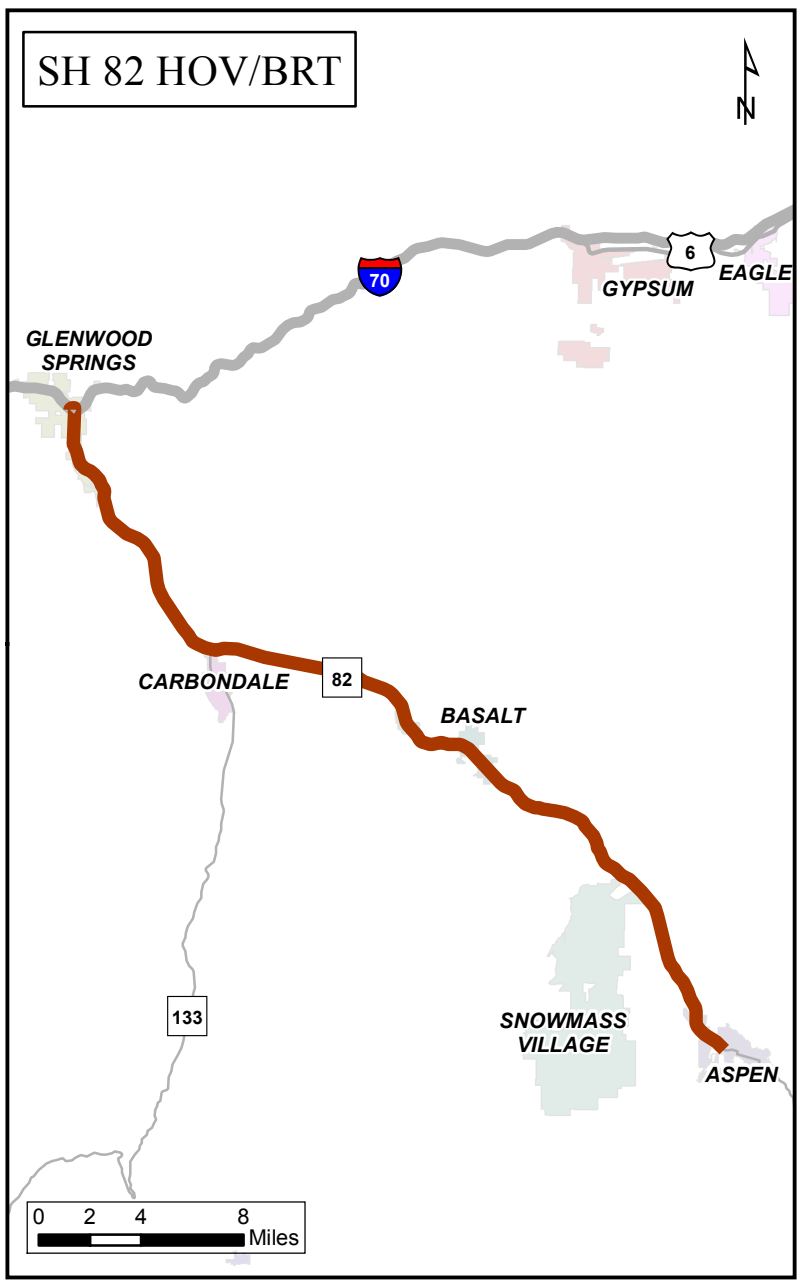
- BRT Only
- HOV Only
- HOV + BRT
- Toll Only - Transportation Authority
- Toll Only
- Toll + HOV
- Toll + HOV + BRT

Managed Lanes - Future

- TBD







COLORADO Department of Transportation

High Occupancy Vehicle (HOV) Assessment

Corridor/Project: US 36 Express Lanes

Project Description: Express lane in each direction of US 36 between Pecos and Table Mesa for BRT, HOV, and tolled vehicles.

Purpose: Provide travel time reliability and mode choice

Performance Measures:

1. Ensure motor vehicle speeds of:
    a) An average of 55 miles per hour for the portion of the US 36 Managed Lanes from Table Mesa to the Broomfield Park-n-Ride
    b) An average of 50 miles per hour for the portion of the US 36 Managed Lanes from the Broomfield Park-n-Ride to Pecos Street
2. Maintain a travel time of no more than 8.75 minutes for the portion of the Managed Lanes from Pecos Street to Denver Union Station

HOV Criteria:

Safety: No current concerns related to HOV-3+.

Performance Measures: No current concerns related to HOV-3+. Facility is currently HOV-2+. Pursuant to Resolution #TC-3052, facility will change to HOV-3+ on January 1, 2017. Concessionaire agreement also includes triggers including transit delays, average vehicle speed, and hourly volumes that could result in conversion to HOV-3+ at an earlier date.

Financial Feasibility: No current concerns related to HOV 3+.

COLORADO Department of Transportation

High Occupancy Vehicle (HOV)

Assessment

Corridor/Project: I-70 Peak Period Shoulder Lanes (PPSL)

Project Description: Upgraded shoulder that will function as an optional, tolled express lane during peak driving periods on eastbound I-70 between Exit 232 at US 40/Empire Junction 13 miles east to MP 243.5, just east of the Veteran's Memorial Tunnels. As a temporary strategy the initial implementation will be limited to 72 days per year. During non-peak times, the lane will function as an extra-wide shoulder.

Purpose: Provide travel time reliability

Performance Measures:

1. Shoulder tolled express lane operates at a speed of 45 mph or higher (congestion pricing strategy will be used to maintain travel reliability)

HOV Criteria:

Safety: No current concerns related to HOV 3+.

Performance Measures: HOV-3+ would result in performance measure not being met because of the high level of auto occupancy on the corridor during peak periods. The "I-70 Mountain Corridor PEIS Travel Demand Technical Report" (reissued March 2011) determined that the average auto occupancy on the corridor during peak periods is 2.6. If HOV-3+ were implemented, the majority of vehicles on the corridor during peak periods would be eligible to use the tolled express lanes without incurring a toll, precluding the possibility of achieving the established performance measure of 45 mph or higher speeds.

Financial Feasibility: HOV 3+ would eliminate or reduce the travel time advantage, thereby eliminating or significantly reducing the ability to toll the facility, and finance the project.

COLORADO Department of Transportation

High Occupancy Vehicle (HOV) Assessment

Corridor/Project: C-470 Express Lanes

Project Description: Addition of two tolled express lanes westbound from I-25 to approximately Colorado Blvd., one tolled express lane westbound from Colorado Blvd. to Wadsworth Blvd., and one tolled express lane eastbound from Platte Canyon Road to I-25, with future plans to extend the tolled express lanes in each direction to Kipling.

Purpose: Provide travel time reliability

Performance Measures:

1. Tolled express lane operates at 45 mph or better (congestion pricing strategy will be used to maintain travel time reliability)

HOV Criteria:

Safety: No current concerns related to HOV-3+.

Performance Measures: No current concerns related to HOV-3+.

Financial Feasibility: Accommodating HOV-3+ is not currently financially feasible as accommodation is projected to result in an initial funding gap of approximately $40M in the preferred financing scenario. HOV-3+ accommodation is also projected to reduce excess toll revenues by approximately $100M over 40 years. The Transportation Commission could choose to allocate additional funds, such as RAMP, to this project, but currently there are no other funding sources identified to close the funding gap that would result from the accommodation of HOV-3+. Additionally, the projected $100M reduction could delay additional corridor improvements outside the current construction project. Two additional improvement opportunities potentially impacted would be the ultimate buildout between I-25 & Kipling and the C-470 West Connect extending west from Kipling. More details can be found in the C-470 HOV 3+ Exemption Analysis.

COLORADO
Department of Transportation

C-470 Express Toll Lanes Project
HOV3+ Exemption Analysis
September 30, 2015

1. Summary

To support the ongoing development of the C-470 Express Lanes Project (the Project) and related toll policy discussions, the Colorado Department of Transportation (CDOT)—in partnership with the High Performance Transportation Enterprise (HPTE)—undertook an analysis to determine the potential impacts associated with a carpool exemption policy for high occupancy vehicles with three or more passengers (HOV3+).

Current and prior planning has assumed that all vehicles, regardless of occupancy, would be subject to tolls in the Express Lanes; however, a final policy recommendation regarding HOV exemptions has not yet been formulated. To support that decision, this analysis evaluates the potential traffic, revenue and financing implication associated with an HOV3+ exemption policy.

It is currently estimated that the implementation of an HOV3+ exemption policy in the Express Lanes would generate limited long-term growth in the share of HOV3+ carpools relative to other classes, and negatively impact CDOT/HPTE's project financials. Fully funding the project would necessitate a more leveraged and risky financial structure that would require, for example, additional draws on and/or a longer repayment period for the CDOT O&M loan. Depending on the type of debt and market terms and conditions at the time of financing, a financing sufficient to fund the project as designed may not be executable.

Lower net cash flows—particularly in the early years of operation when revenues are disproportionately impacted by HOV3+ exemptions—would reduce net construction proceeds by as much as $40 million. Furthermore, excess toll revenues accruing to HPTE would be reduced by approximately $100 million[1] in net present value, impacting the ability to fund future phases of the C-470 Express Lanes Project.

2. Project Background

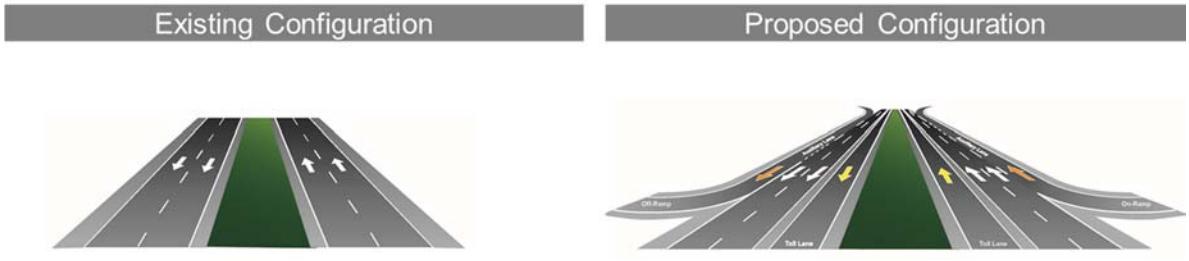
C-470 has a history of severe congestion, and for well over a decade has operated at failing levels of service. As a solution to this issue, CDOT and its partners began evaluating alternatives to improve mobility and reduce congestion along the corridor, culminating in the proposed C-470 Express Lanes Project. As analyzed in the Revised Environmental Assessment (EA), the Project will be delivered in two phases. The first phase (Interim Project) will provide managed express lanes as follows:

- Westbound: two express lanes from I-25 to approximately Colorado Boulevard, and one lane from Colorado Boulevard to Wadsworth Boulevard
- Eastbound: one express lane from Platte Canyon Road to I-25

Currently, available funding has limited construction scope the Interim project; however, future construction of the Ultimate configuration would extend and add lanes to achieve two express lanes in each direction between I-25 and Kipling Parkway. Exhibit 1 illustrates the existing and proposed corridor configurations associated with the Interim Project.

[1]Net revenues available after debt service, operations and maintenance costs and repayment of any O&M loan balances (as needed) discounted at 5%.

Exhibit 1: C-470 Lane Configurations



3. Cost and Revenue Impact

One of the key considerations in evaluating a toll exemption policy is the potential impact on the Project's cash flows, both in terms of reduced revenue collection resulting from both the exemption itself and toll evasion / occupancy violations, as well as increased operations and maintenance costs (O&M). The following sections describe each of these items and their estimated impact on project cash flows, and ultimately its financial feasibility.

a. Traffic and Revenue

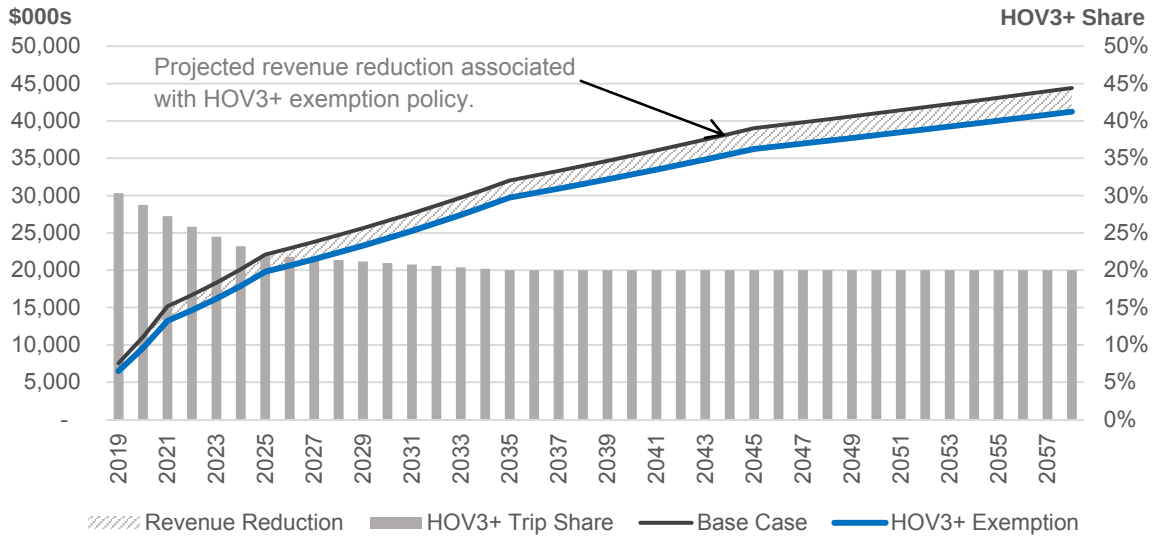
As an initial step toward understanding the impact of an HOV3+ exemption policy, the Project's investment grade T&R consultant, Louis Berger Group (LBG), prepared an estimate of the potential share of HOV3+ vehicles that would use the Express Lanes and the extent to which that usage would impact gross toll revenue. This preliminary effort, which was conducted using a traffic simulation model, indicated that HOV3+ users would account for approximately **32%** of Express Lane trips in 2018 and approximately **20%** by 2035**.** Gross revenue is anticipated to be 15% and 7% lower in 2018 and 2035, respectively, when compared to revenues forecasted without an HOV3+ exemption policy ("Base Case"). A table detailing the approximate HOV3+ trip shares and revenue impacts by model year is provided below.

Exhibit 2: Estimated HOV3+ Trip Shares and Gross Revenue (2015 $000s)

Model Year	HOV3+ Trip Share (%)	Gross Revenue (HOV3+ Exempt)	Gross Revenue (Base Case)	Gross Revenue Delta (%)
2018	32%	$9,789	$11,460	-15%
2025	22%	$19,806	$22,114	-10%
2035	20%	$29,736	$32,021	-7%

Note: Values shown in the above exhibit are expressed in 2015 dollars; gross revenues do not include ramp-up, toll collection costs, leakage, or other adjustments associated with an investment grade financing analysis.

Exhibit 3: Comparison of Gross Base Case and HOV3+ Exemption Revenue (2015 $)



Note: Values shown in the above exhibit are expressed in 2015 dollars. However, the impacts cited in the following discussion are expressed in nominal terms.

While the overall share of Express Lane toll-exempt trips is anticipated to decline over the forecast horizon, LBG also indicated that HOV3+ trips (by volume) are projected to grow by approximately 1% per year between 2018 and 2035 – well below the rate of growth in toll trips, which is anticipated to be 5% per year over the same period.

2035 Nominal Cash Flow Impact:	**-$3.2mm**	**-7%**

b. Revenue Leakage

Based on a survey of all-electronic toll facilities across the U.S., a baseline revenue leakage assumption of 10% per year was established for the Base Case (i.e., where HOVs do not receive a toll exemption in the Express Lanes) cash flows. This amount reflects a variety of factors that may result in revenue leakage, including toll equipment errors, non-payment by customers, weather-related events, etc.

As noted in the prior section, the introduction of HOV3+ exemptions would create additional opportunity for leakage resulting from occupancy violations. Data for existing CDOT HOV facilities suggests that occupancy violation rates can reach as high as 25% without routine enforcement (this is reduced to 15% with enforcement.

For the purpose of this analysis, it is assumed that an HOV3+ exemption policy would increase the 10% Base Case leakage rate to 15% per year.

2035 Nominal Cash Flow Impact:	**-$2.2mm**	**-5%**

c. Toll Collection O&M

Transaction Processing

The process of collecting tolls requires a complex system of in-lane toll equipment and back office software to record and collect the applicable toll from customers using the corridor. As an all-electronic system, customers will be encouraged to establish a prepaid transponder account, whereby readers placed throughout the corridor will automatically detect the customer's transponder and deduct the appropriate toll from that account. In cases where a transponder is not present, cameras at each toll location will automatically record the customer's license plate number and either match that license plate to a pre-registered account, or generate an invoice for non-account customers.

To handle these transactions, a third-party vendor will be procured to operate and maintain the toll collection system, interface with customers, and provide back office support. For the purpose of this analysis, it is assumed that the cost of such services will be transaction-based, whereby the selected vendor will charge CDOT each time a transaction in the C-470 Express Lanes is processed (similar to existing contracts for the US-36 and I-25 Express Lanes with the E-470 Public Highway Authority). Depending on the type of transaction that is incurred (i.e., transponder or license plate), a different price will be charged to CDOT.

Toll rates on C-470 will be designed, at a minimum, to offset transaction processing costs to remain "net revenue neutral," even during periods of low usage. This pricing methodology is only possible when all vehicles in the Express Lanes are required to pay a toll. In an HOV3+ exemption scenario, transaction processing would still be required, but a toll would not be collected to offset the cost. In effect, these transactions are net revenue negative, since they only generate a cost but not an offsetting revenue.

Exhibit 4: Hypothetical Revenue of Base Case and HOV3+ Exemption Policy

Scenario	Transponder Toll (Hypothetical)	Transponder Processing Cost[2]	Net Revenue
Base Case (HOV3+ Tolled)	$1.00	($0.18)	**$0.82**
HOV3+ (Toll Free)	$0.00	($0.001)	**($0.001)**

As illustrated in the above table, each HOV3+ toll transaction generates a net loss of $0.001 on a simple comparison of average revenue to average cost, before any losses (leakage) associated with intentional or unintentional occupancy violations.

2035 Nominal Cash Flow Impact:	**+$0.1mm**	**<1%**

Enforcement

Similar to the US-36 and I-25 Express Lanes, customers who are eligible to receive an HOV3+ toll exemption would be required to install a multi-switch transponder in order to declare their HOV3+ status each time they use the corridor. By default, non-switchable transponders and license plate transactions would be treated as full toll customers, since the system would have no way to determine the occupancy of those vehicles.

However, by allowing customers to self-declare their HOV3+ status (and thus toll exemption), this introduces the risk that customers will intentionally or unintentionally select the incorrect transponder occupancy setting.

[2] 2010 dollars (Parsons Brinckerhoff, 2015)

In the case of unintentional user error, a vehicle may travel as an HOV3+ in one direction, then re-enter the corridor as a single occupant vehicle (SOV) without changing the transponder setting. As a result, the toll is waved and revenue is not collected for that transaction.

To counteract these situations, visual enforcement at select locations throughout the corridor would be provided by Colorado State Patrol (CSP), the cost which would paid out of toll revenues. While the annual cost of CSP enforcement will vary according to violation trends, it is assumed that C-470 would allocate approximately $250,000 (2015 dollars) for targeted and routine enforcement activities within the corridor.

Although violators will be ticketed and fined for occupancy violations, it is not assumed that any violation revenue will flow back to the Project. Enforcement would be provided with the sole purpose of reducing losses (revenue leakage) attributed to occupancy violations.

2035 Nominal Cash Flow Impact:	**-$0.2mm**	**<1%**

d. Capital Costs

Beyond increased operating costs and financing adjustments, HOV3+ exemptions would also necessitate additional upfront capital to cover:

- Additional engineering/design/construction to accommodate “toll enforcement zones”
- Additional in-lane toll equipment to support visual enforcement efforts

The total combined cost of these items is estimated to be approximately $1 million (about 0.4% of the Project’s base capital costs), requiring additional upfront financing and associated debt service.

2035 Nominal Cash Flow Impact:	**-$0.1mm**	**<1%**

4. Financing & Credit Impact

a. Credit Rating Implications

Toll exemption policies are generally viewed as a credit negative due to the direct impact those vehicles have on lane performance, travel reliability, and available capacity for toll paying vehicles. In a November 2013 report titled *U.S. Managed Lanes: Empirical Data Steers Credit Analysis*, Fitch Ratings notes that the “nature of the HOV and transit policies can significantly impact revenues” and that “a key rating driver going forward will be the HOV policy and other policies governing access to [managed lanes].” The report further explains that exemption policies for HOV2+ vehicles are inherently more risky than facilities with HOV3+ policies; however, despite lower upfront revenue risk, it should be noted that as demand for the corridor increases with population and employment, an increasing number of toll-free HOV3+ vehicles will absorb Express Lane capacity, thus decreasing capacity available for toll-paying vehicles.

A similar outlook report by Moody’s Investor Service in May 2013 suggests that “a small diversion of traffic onto tolled lanes frees up capacity on non-tolled alternative, hence decreasing the incentive for additional users to move to the tolled lane.” In the context of C-470, providing toll exemptions may cause a portion of those vehicles to shift to the Express Lanes, which would reduce capacity for toll paying vehicles and open capacity in the general purpose (GP) lanes. The increased capacity in the GP lanes could induce vehicles that would have otherwise paid to enter the Express Lanes.

To compensate for the increased revenue variability associated with the implementation of a toll exemption policy (e.g. the risk of additional HOV 3+ traffic above projected levels using the lanes, potential unforeseen impacts on overall corridor congestion and mobility), rating agencies and investors would be expected to take a slightly more conservative view on the credit (manifested through increased coverage ratios, additional liquidity measures, and/or an additional haircut to revenues). The total impact of these considerations has been assumed to be equivalent to a 5% additional reduction in toll revenues. This would result in a cash flow reduction of $2.2 million in 2035 for debt sizing purposes.

2035 Nominal Cash Flow Impact:	**-$2.2mm**	**-5%**

5. Summary of Impacts

a. Project Cash Flows

The table below summarizes all impacts to project cash flows in 2035.

Exhibit 4: Revenue Impact Summary

2035 Nominal Impacts	Amount ($mm)
Gross Revenue	-$3.2
Rev. Adjustments: Leakage	-$2.2
O&M: Transaction Processing	+$0.1
O&M: Enforcement	-$0.2
Additional Debt Service: Increase Capital Cost	-$0.1
Credit: T&R Risk Adjustment	-$2.2
Total of Individual Impacts	-$7.8
Total Combined Impacts*	**-$7.3**

*Nominal impacts noted above are not additive, given the interrelated nature of gross revenues, leakage, and the T&R risk adjustment factor. As such, the "total combined impacts" row provides a bottom line summary of all impacts in the HOV3+ exemption scenario.

b. Funding Impact

Design and construction funding for the C-470 Express Lanes Project will be provided in the form of public monies (RAMP, FASTER, HSIP, and other public contributions) as well debt backed by toll revenues. The extent to which debt can be raised for the project is primarily a function of the near- and mid-term cash flow available for interest and principal payments on project debt. Based on the anticipated Project cash flow under an HOV3+ exemption policy, it is estimated that debt capacity could be reduced by as much as **$40 million**, requiring a substantial amount of additional funding to be identified to fully fund the Project (which is also based on an estimated capital cost of $269 million).

In addition, the HOV3+ financial structures would place added risks on CDOT in case of revenue shortfalls or cost overruns as the CDOT O&M loan amount increases and/or is repaid over a longer period of time.

Finally, In addition to the reduction of net proceeds available to fund project construction, the present value of excess toll revenues accruing to HPTE would diminish significantly – by as much as $100 million (assuming a 5% discount rate) – under an HOV3+ toll exemption policy. Excess cash flow, or surplus revenue after debt service and operating costs, is a key indicator of potential funding that could be contributed to future projects, including the second phase of the C-470 Express Lanes or other corridor improvements.

Resolution #TC-~~3052~~XXXX
Adopting a requirement that as of January 1, 2017, toll-free travel offered to High Occupancy Vehicles on all tolled managed lanes that are part of the state highway system shall be limited to vehicles with three or more occupants.

Adopting an approach for the consideration of toll-free travel for High Occupancy Vehicles with three or more occupants on all tolled managed lanes that are part of the state highway system; and

Approved by the Transportation Commission on: ~~February~~ October 15~~21~~, 2015~~3~~

WHEREAS the Transportation Commission is responsible, pursuant to C.R.S. 43-1-106(8), for formulating the general policy of the Colorado Department of Transportation (CDOT); and

WHEREAS the Transportation Commission recognizes the importance of consistency among tolled managed lane corridors with regard to High Occupancy Vehicle exceptions; and

WHEREAS the Transportation Commission recognizes the benefits of toll-free travel for vehicles carrying three or more occupants (HOV-3+) to increasing person throughput and encouraging carpooling and transit use, with resulting reductions in vehicle emissions, to reduce congestion, and improve the safety, capacity, and accessibility of the surface transportation system; and

WHEREAS the General Assembly created the Colorado High Performance Transportation Enterprise (HPTE) as a government-owned business within CDOT, pursuant to Section 43-4-806 C.R.S., to aggressively pursue innovative means of more efficiently financing important surface transportation projects that will improve the safety, capacity, and accessibility of the surface transportation system; and

WHEREAS to facilitate the financing of important transportation projects, the HPTE Board of Directors has recommended that the Transportation Commission require toll-free travel offered to High Occupancy Vehicles on tolled managed lanes that are part of the state highway system to be limited to ~~vehicles carrying three or more occupants (~~HOV-3+~~)~~; and~~.~~

WHEREAS, the Transportation Commission recognizes the benefits of toll-free HOV-3+ and the importance of considering toll-free HOV-3+ on all planned or future tolled managed lanes that are part of the state highway system; and

WHEREAS, the Transportation Commission recognizes that the feasibility of toll-free HOV-3+ must be considered with respect to its impacts on safety, the

ability to achieve established performance measures on tolled managed lanes, financial feasibility, and other factors that may be applicable.

NOW THEREFORE BE IT RESOVLED, the Transportation Commission hereby requires that as of January 1, 2017 toll-free travel offered to High Occupancy~~t~~ Vehicles on tolled managed lanes that are part of the state highway system shall be limited to ~~vehicles with three or more total occupants (~~HOV 3+~~)~~; and~~.~~

NOW THEREFORE BE IT FURTHER RESOLVED, the Transportation Commission hereby requires that all planned or future tolled managed lanes that are part of the state highway system consider the feasibility of offering toll-free HOV-3.

_____ _____

Herman Stockinger, Secretary
Transportation Commission of Colorado

Date