

## **Appendix 2(a) – Traffic and Revenue Study Summary**

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This appendix provides the details associated with the traffic and revenue portion of the Eastside Corridor Tolling Study conducted to respond to legislative direction in ESSB 5352. WSDOT developed traffic forecasts which were provided to our consultants Wilbur Smith Associates who conducted analysis on the use of express toll lanes and potential toll rates and revenue. WSDOT then conducted operational analysis on the express toll lanes to assess their performance. A summary of our approach and results are provided in this appendix. A detailed report from Wilbur Smith Associates on the work they performed for this study is included as Appendix 2(b).

### **Operational and Econometric Modeling Approach**

WSDOT used the Puget Sound Regional Council's (PSRC) regional travel demand forecasting model to forecast traffic volumes for the Eastside Corridor tolling study. Information from PSRC's model relevant to the Eastside Corridor was extracted from PSRC's model. This information was then post-processed to account for differences between model traffic volumes and actual traffic counts and for capacity limitations on the facility not captured in the regional model. This information was then used in the econometric modeling conducted by Wilbur Smith Associates to estimate the number of people willing to pay to use express toll lanes and project the tolls they would pay. In addition, micro-simulation traffic modeling was used to capture the operational performance of the freeway facility with and without express toll lanes.

This type of operational and econometric modeling approach is typically conducted at three levels of specificity.

- A programmatic level analysis is used to capture general impacts on a facility or to compare and contrast different operational concepts.
- A planning level analysis is used to assess feasibility of express toll lanes and provide general estimates of rates, usage, and revenue.
- A finite level analysis, typically referred to as an investment level analysis, provides detailed usage, toll rate, revenue, and operation information.

This study was conducted at a planning level. The information generated by this study is intended to provide information on general toll rates and how alternatives compare to each other. It is not intended to specifically determine toll rates or assess toll rate sensitivities.

### **Modeling Assumptions**

Our modeling looked at five study options for implementation of Eastside Corridor express toll lanes. Each of the five study options improves upon the previous option to build an increasingly robust express toll lane system. The assumptions below were used for our traffic modeling for the five study options. Many of these assumptions are based on policy decisions that have yet to be made, and which will ultimately be determined by the Washington State Transportation Commission, the Legislature, or WSDOT executives. However, for this study, the assumptions used for our modeling were:

- Minimum toll rate when the facility opens is \$1 (Year of Expenditure dollars).
- No maximum toll rate. The rate is not capped, nor the lanes closed to buy-in, at an arbitrary point.

- Eligible vehicles are the same as current HOV policy, with the exception of SOV buy-in. That is, no trucks or trailers will be permitted in the system.
- 3+ HOV vehicles will be able to use the system toll free.
- Minimum toll rates will increase with inflation over the life of the facility.
- The facility will operate from 5 a.m. to 8 p.m., an extension of the current HOV lane hours of 7 p.m. to 8 p.m., due to traffic congestion continuing past 7 p.m.
- The user will see rates rounded to the nearest nickel.

The five study options assumed a HOV 3+ toll-free designation for the express toll lanes. This assumption was used because previous analysis of the SR 520 to I-5 project showed that an HOV 2+ toll-free designation does not allow for sustainable performance in the future years as growth in HOV2+ toll free volumes produced congestion in the express toll lanes (See Appendix 7(c) – 2007 Wilbur Smith Associates – SR 520 to I-5 Widening: Express Toll Lanes Alternative Traffic and Revenue Study.)

The goal of express toll lanes is to maximize the use of the express toll lanes within the parameters listed above. Maximum use is defined as not exceeding 1,600 to 1,750 vehicles per hour per lane in the express toll lanes depending on the specific in and out volume movements associated with each tolling segment. Limiting the number of vehicles in the lane to these levels allows the express toll lanes to operate at 60 mph and not drop below 45 mph.

In addition to analyzing the five study options based on the assumptions listed above, additional sensitivity tests were performed on two of the study options to examine the impacts of changing certain assumptions. We looked at 1) using an HOV 2+ toll-free occupancy requirement, and 2) imposing a toll cap of \$12, at which the lanes would be closed to toll-paying vehicles. The results of these tests are described after the results of the base study options.

### **Traffic Forecasts**

The PSRC travel demand forecasting model Version 1.0B was used to develop all traffic forecasts for the five study options. The traffic forecasts were generated for year 2020, 2035, and 2045 conditions. While year 2045 forecasts were prepared for and used in the econometric modeling, no results beyond year 2035 are being used in this study or the findings.

Three separate forecasts scenarios were generated from the PSRC model and are shown in Figure 1 below:

- **A1** forecasts included the capacity improvements associated with study options 1-3 (Study options 1-3 all have similar levels of physical capacity improvements, so a single set of forecasts are applied to all three.)
- **A3** forecasts reflect the capacity improvements associated with study option 4
- **A5** forecasts reflect the improvements associated with study option 5

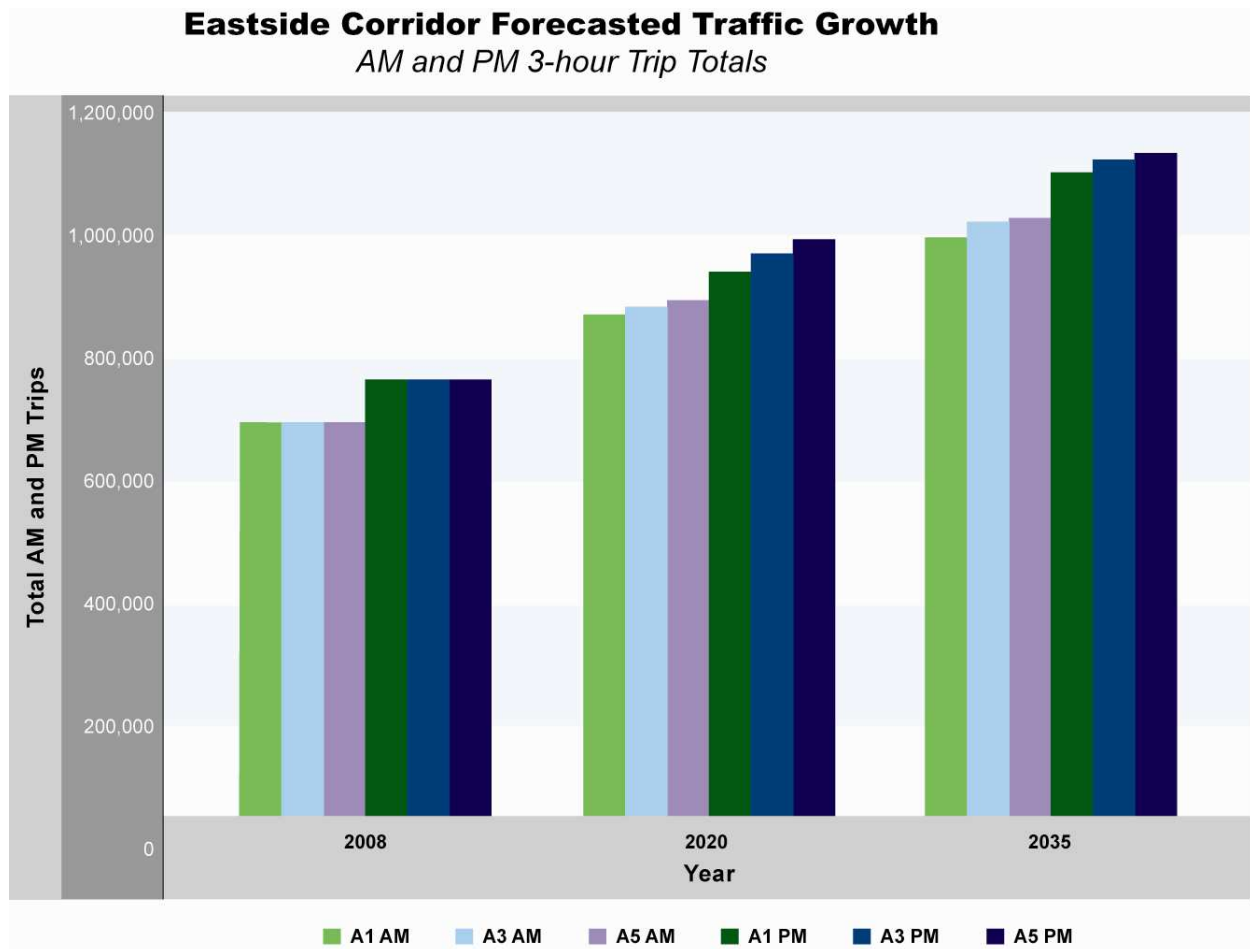


Figure 1: Traffic forecasts generated from PSRC 2040 travel demand model

While the regional model is useful in generating initial travel demand forecasts, post processing (refinement) of these is typically required before they can be used in operational and tolling analyses. All the traffic forecasts were post processed (refined) to reflect roadway capacity constraints present on the eastside corridor. The capacity post processing focused on four corridor screen line locations:

- SR 167 –north of 277<sup>th</sup>,
- I-405 – south of SR 169,
- I-405 –at NE 44<sup>th</sup> Street,
- I-405 – north of 85<sup>th</sup>

At each one of these locations, all forecasted origin-destination trips passing that point were limited to a volume to capacity ratio of 1.2 times the capacity of the lanes (for each scenario). This allowed for the regional forecasts to be recognized, but also reflected the physical capacity of the freeway to accept volumes. This was conducted for six a.m. (5:00 a.m. to 11:00 a.m.) and six p.m. (2:00 p.m. to 8:00 p.m.) hours and used as an input to the econometric modeling.

## **Traffic Diversions**

The PSRC travel demand forecasts included information on traffic diversion associated with the I-405 improvements. When compared to a no-build option, all five study options show an increase in I-405 traffic volumes and diversion off of local streets due to added capacity. The added I-405 capacity attracts longer distance trips to the freeway system and off of local streets. The PSRC model places these additional trips to the freeway because the additional freeway capacity provides greater speeds than the local streets. The following locations show examples of how local street volumes are reduced during the 2020 a.m. peak three hours when trips move to the freeway:

- Study options 1-3 reduce traffic on 124th Ave NE (Kirkland) by 15%
- Study option 4 reduces traffic on 118th SE and Lake Hills Connector/Richards Rd. (Bellevue) by 15%
- Study option 4 reduces traffic on Lake Washington Blvd. N (Renton) by 30%
- Study option 5 reduces traffic on Filbert Rd. by 10% and Woodinville-Snohomish Rd. (Bothell) by 30%

These diversion numbers reflect the additional I-405 capacity; however, the PSRC model does not reflect the improved operations obtained through the implementation of express toll lanes over just adding additional general purpose lanes. With express toll lanes, it is likely that additional diversion would occur onto I-405 because of improved operation of the freeway with express toll lanes. We have not assumed this additional diversion in our analysis.

## **Econometric Modeling Approach**

Wilbur Smith Associates conducted econometric (application of economic principles to conduct analysis) modeling based on the traffic forecasts developed by WSDOT. Wilbur Smith used the post-processed traffic forecasts in their micro traffic models to capture all trips and travel patterns in the corridor for the five study options. This analysis was performed for both the general purpose lanes and the express toll lanes including the operational interactions they have on each other. The traffic analysis, and travel differences between the general purpose and express toll lanes were then coupled with the willingness to pay modeling. We conducted econometric analyses specific to the corridor and each trip movement to determine individual willingness to pay tolls based on the express toll lane travel benefits. Based on these results, the model assigned trips to the express toll lanes, and calculated lane usage, toll rate, and revenue information.

Wilbur Smith Associates I-405 / SR 167 Express Toll Lanes Report included as Appendix 2(b) discusses the econometric modeling approach and traffic and revenue results in detail. Again, no information beyond year 2035 was used in the operational analysis nor was it used in the financial analysis included in Appendix 4.

## **Traffic Flow Fundamentals**

In order to understand how express toll lanes perform differently than general purpose lanes, a basic understanding of traffic flow theory is helpful. Figure 2 shows how traffic volumes and speeds interact with each other, forming the fundamental concept of freeway traffic operations.

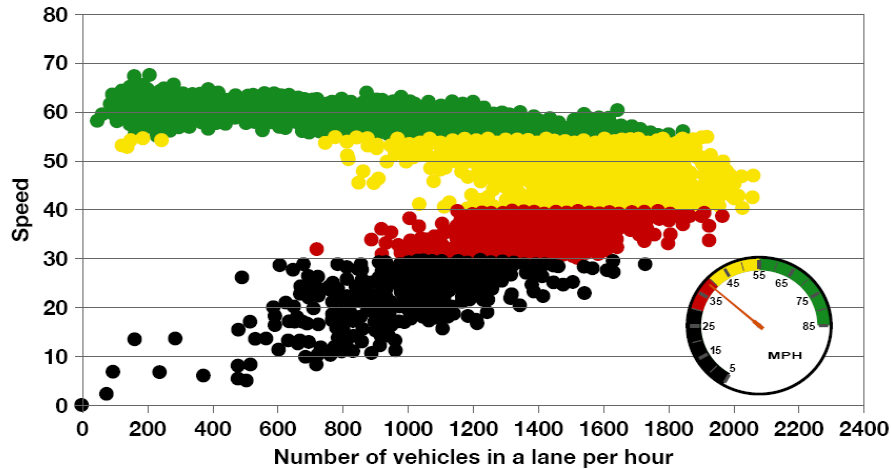


Figure 2: Traffic performance based on actual I-405 traffic data.

The graphic in Figure 2 shows actual traffic data collected on the I-405 corridor. The boomerang curve shape developed from these data points is consistent with curves on general purpose lane freeway sections throughout the country.

Starting at the upper left of this curve, low traffic demand (low number of vehicles in a lane) results in speeds at the 60 mph limit. As demand starts to increase, speeds remain high, above 45 mph. However, as demand increases beyond approximately 1,800 vehicles per hour in a lane, speeds drop quickly. When demand exceeds this 1,800 range, not only do speeds drop, but actual traffic volumes drop as well. The lower half of the curve shows how high traffic demand results in low throughput and low speeds. When the 1,800 range is exceeded, we see stop and go traffic, and eventually gridlock conditions as the freeway comes to a standstill. This movement beyond the optimal 1,800 value is often described as “lost capacity” as the freeway system loses its ability to efficiently move vehicles.

Express toll lanes are able to manage the volume in the lanes by dynamically adjusting pricing to avoid overuse of the lanes. Using the same curve in an express toll lane example, we can see how pricing would be used to achieve high volumes, high speeds, and avoid the lost capacity issue.

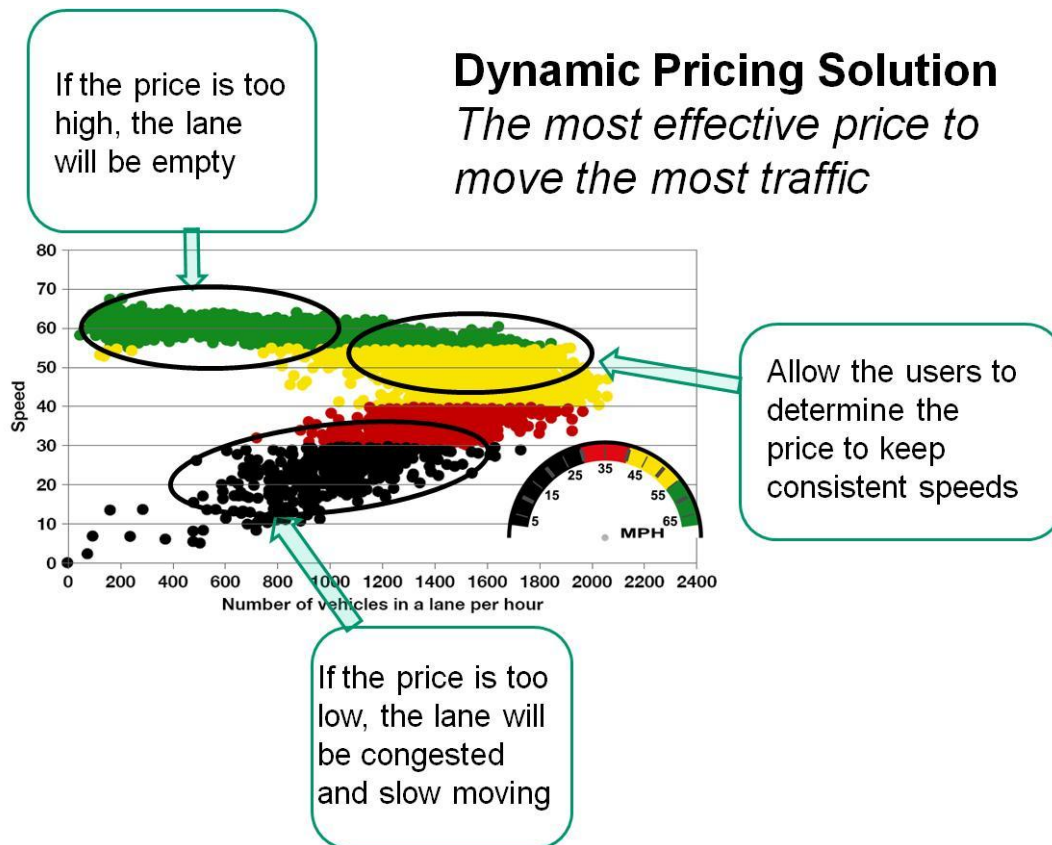


Figure 3: Dynamic pricing can optimize traffic speeds in the express toll lanes

Dynamically adjusting toll rates to entice or discourage express toll lane use allows the lanes to operate in the optimal high speed and high volume range. If demand drops, toll rates are dropped to increase more people to use the lanes. Conversely, if demand increases and approaches the 1,800 range, toll prices are increased to limit use and avoid a loss of capacity. Because there is variability in speeds at this 1,800 range, express toll lanes are often optimized to operate in the 1,600 to 1,800 range depending on the specific associated with each facility.

This ability to operate in the optimal range allows express toll lanes to remain efficient and avoid the lost capacity and slow speeds that general purpose lanes experience.

### Express Toll Lane Tolls

The next section of this appendix summarizes the potential toll amounts that drivers might pay to use the express toll lanes under each of the five study options. The toll amounts are based on the results of our traffic modeling for each of the five study options as previously discussed. We looked at average tolls, tolls per mile, the average length of tolled trips for 2020 conditions, but in 2008 dollars, and how toll rates compare to gross toll revenues. In addition, to provide a more realistic example of what drivers could expect to pay to use the express toll lanes, we also developed information on what tolls might be in 2013 for the express toll lane system built under study option 1.

### Average Tolls

Unlike toll bridges or other tolled facilities where all vehicles must pay a toll to use the facility, express toll lanes provide non-HOV vehicles the choice to pay a toll to use the lanes for a quicker and more reliable trip. Toll rates are not a set amount, but dynamically adjust based on the space available in the lanes and the demand to occupy that space. Dynamic tolls manage demand for travel in the express toll lanes to keep traffic free-flowing. With dynamic tolls, real-time traffic speed and volume in the express toll lanes are used to determine the toll amount and manage the number of vehicles that enter the lanes. As traffic volumes change constantly throughout the day, tolls can vary significantly throughout the day. Vehicles entering the express toll lanes pay the toll amount at the time they enter the express toll lanes and will not be charged more if the toll increases while they are driving in the lane.

Figures 4-8 show the distribution of tolls over the course of a typical weekday in year 2020 for each of the five study options. They also show the average toll and the number of projected trips.

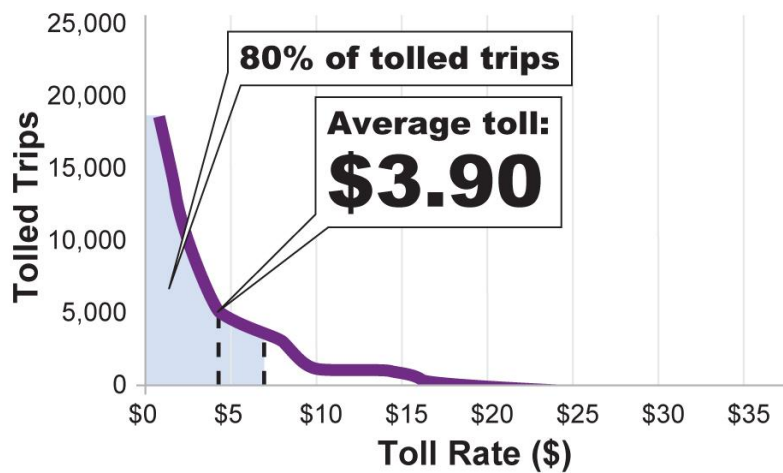


Figure 4: Study Option 1 – Number of tolled trips by toll rates (Typical Weekday in 2020 – 2008 dollars)

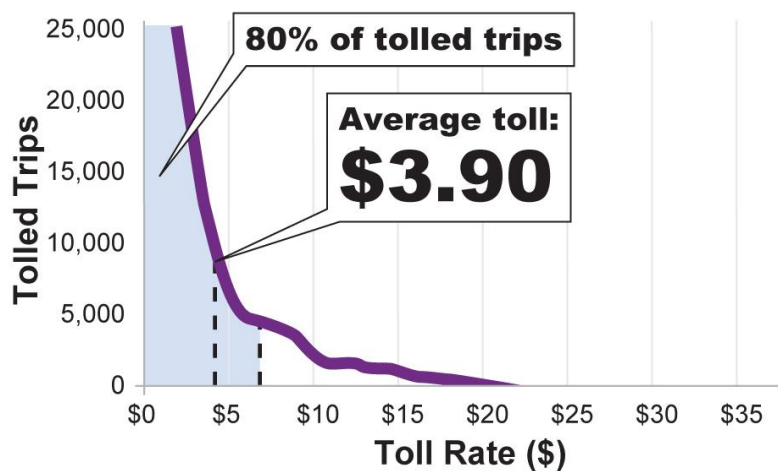


Figure 5: Study Option 2 – Number of tolled trips by toll rates (Typical Weekday in 2020 – 2008 dollars)

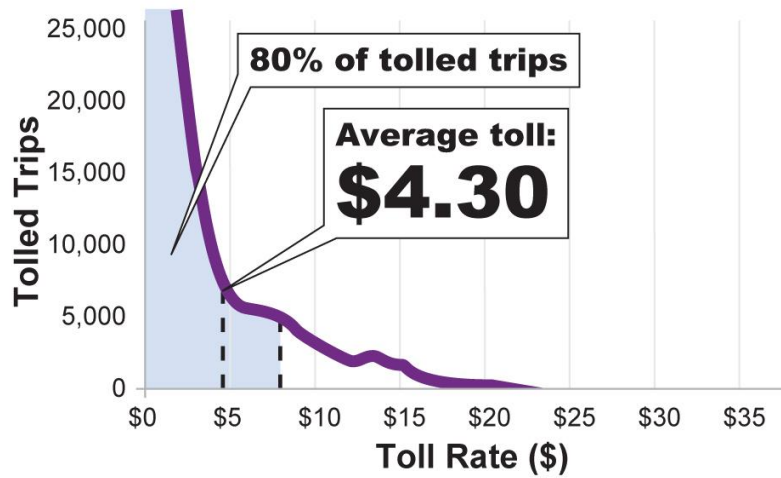


Figure 6: Study Option 3 – Number of tolled trips by toll rates (Typical Weekday in 2020 – 2008 dollars)

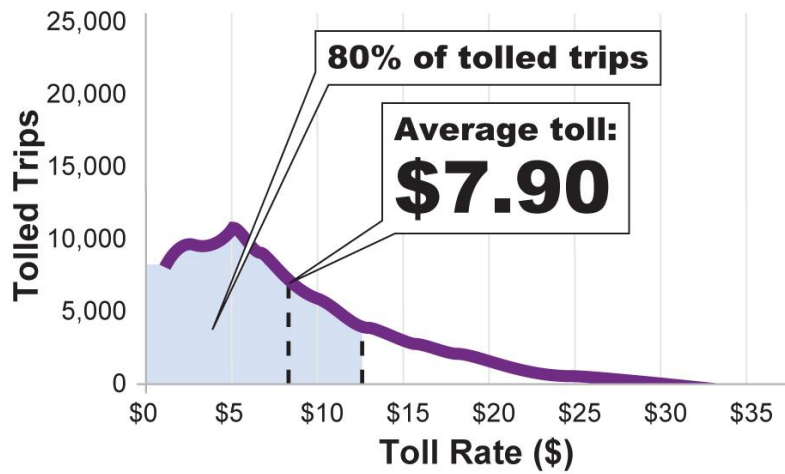


Figure 7: Study Option 4 – Number of tolled trips by toll rates (Typical Weekday in 2020 – 2008 dollars)

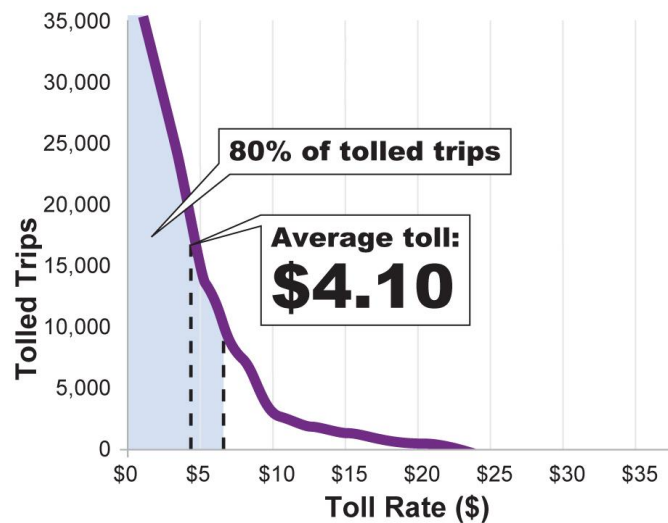


Figure 8: Study Option 5 – Number of tolled trips by toll rates (Typical Weekday in 2020 – 2008 dollars)



Figures 4 – 8 show a range of average toll amounts from \$3.90 to \$7.90 in 2008 dollars. For all study options, 80% of the tolls paid are less than \$12.00. Study option 4 has a higher average toll rate than the others for two reasons. First, the average trip length is longer than the other options, which raises the average toll paid. Secondly, the demand for these longer trips displaces the shorter length trips found in the other study options.

Study option 5 has a moderate toll rate compared to the other options and also has the highest number of tolled vehicles in the system. This is because option 5 has the greatest amount of express toll lane capacity as well as the greatest amount of general purpose capacity. This directly reflects the supply and demand nature of express toll lanes relative to toll rates. Study option 5 has the greatest supply of space available and lowest demand as more general purpose lane trips are available.

### Toll amounts per mile

Another way to understand express toll lane use is on a per-mile rate basis. Figure 9 shows the distribution of tolled trip per-mile rates in year 2020 for each option.

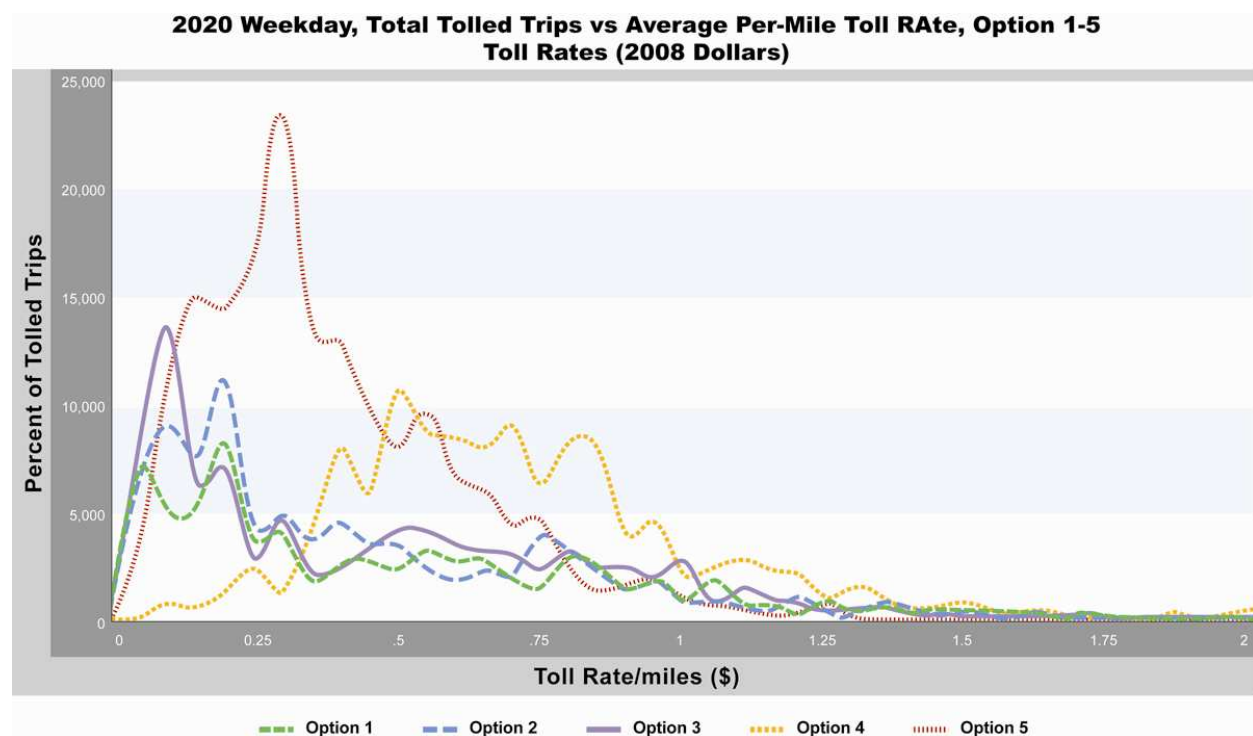


Figure 9: Total Tolled Trips vs. Average Per-Mile Toll, Study Options 1 – 5 – 2020 Weekday

All study options follow a similar pattern:

- there are fewer tolled trips as the per mile rate increases, and
- the majority of tolled trips are less than \$1.00 per mile in year 2020.

In addition, only a small percentage of tolled trips are projected to be greater than \$2.00 per mile as shown in Table 1 below.

Study Option	Percent of Trips Over \$2.00 per mile
Option 1	< 0.25%
Option 2	< 0.30%
Option 3	< 0.20%
Option 4	< 1.00%
Option 5	< 0.10%

Table 1: Percent of Trips Over \$2.00 per Mile (Year 2020 in 2008 dollars)

### Length of tolled trips

Yet another way to understand how tolled trip pricing compares between study options is to look at the length of tolled trips.

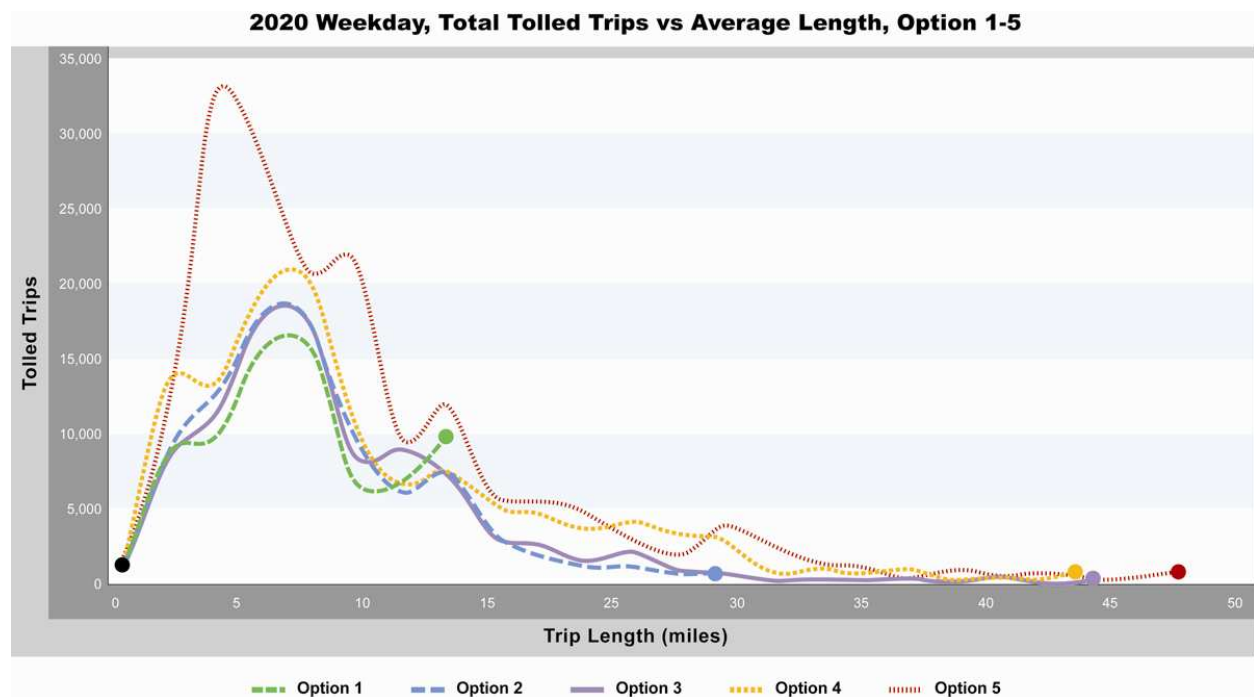


Figure 10: Total Tolled Trips vs. Average Trip Length, Study Options 1 – 5 (2020 Weekday)

Figure 10 shows how the distribution of toll rates by trip length is similar for all study options. For all study options, the majority of tolled trips are less than 10 miles, with much fewer occurring beyond 15 miles.

It is also important to understand that the ingress and egress locations specific to each study option have an influence on the distribution of these curves. The ranges of trip lengths are predetermined by the specific locations to enter and exit the express toll lanes, so the distribution of trip length reflects these constraints.

### Toll Rate Comparison to Gross Revenue

To understand how the range of toll rates influence the gross revenue generated by express toll lanes, we compared the percentage of daily gross revenue to the toll rates. These results for each study option are shown in Figures 11 – 15 below.

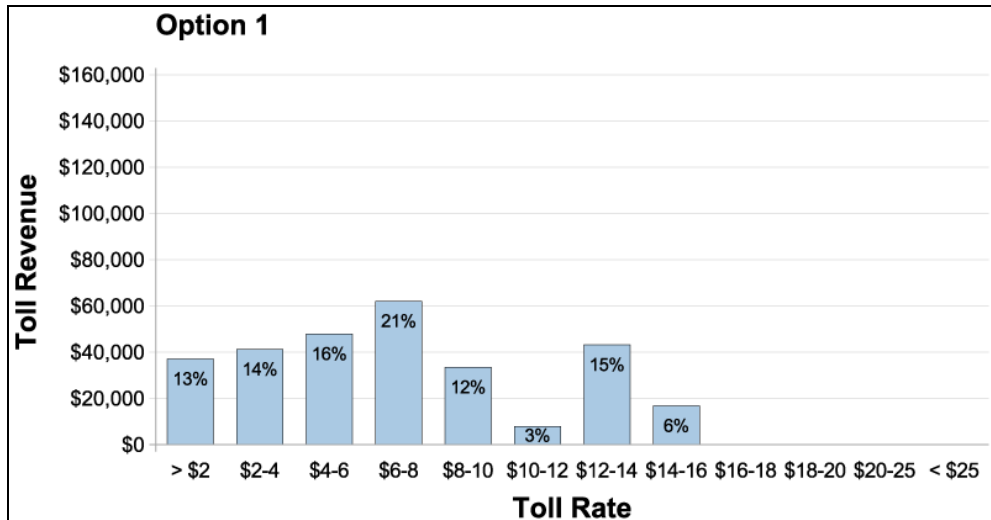


Figure 11: Study Option 1 – Daily Gross Revenue by Toll Rate

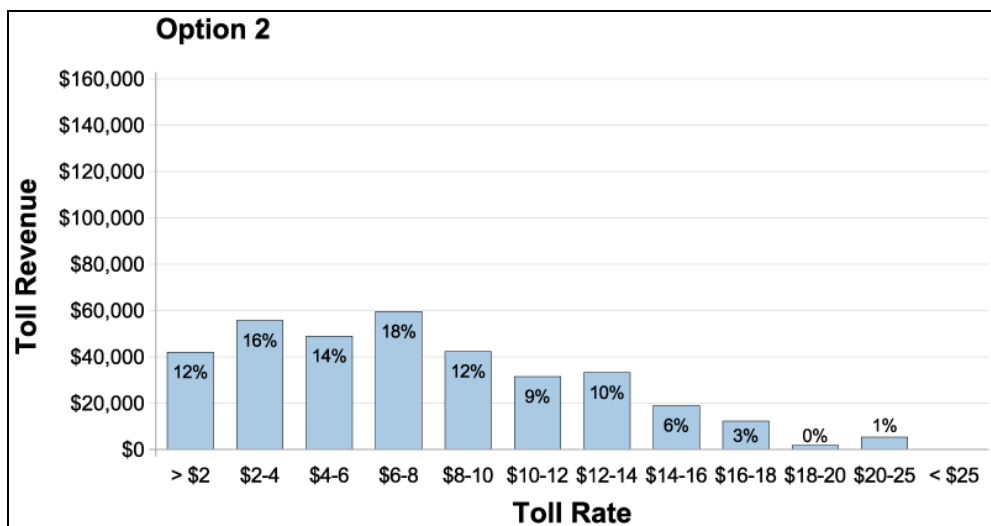


Figure 12: Study Option 2 – Daily Gross Revenue by Toll Rate

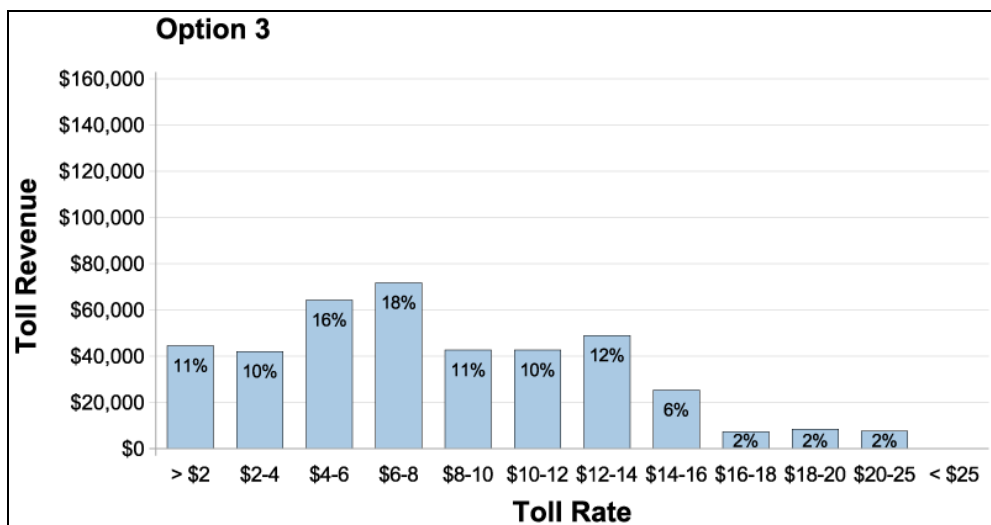


Figure 13: Study Option 3 – Daily Gross Revenue by Toll Rate

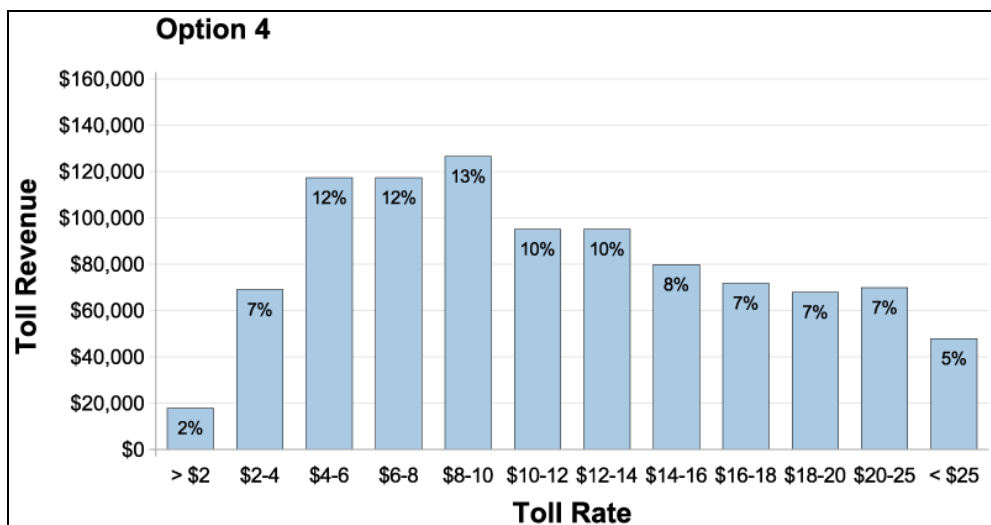


Figure 14: Study Option 4 – Daily Gross Revenue by Toll Rate

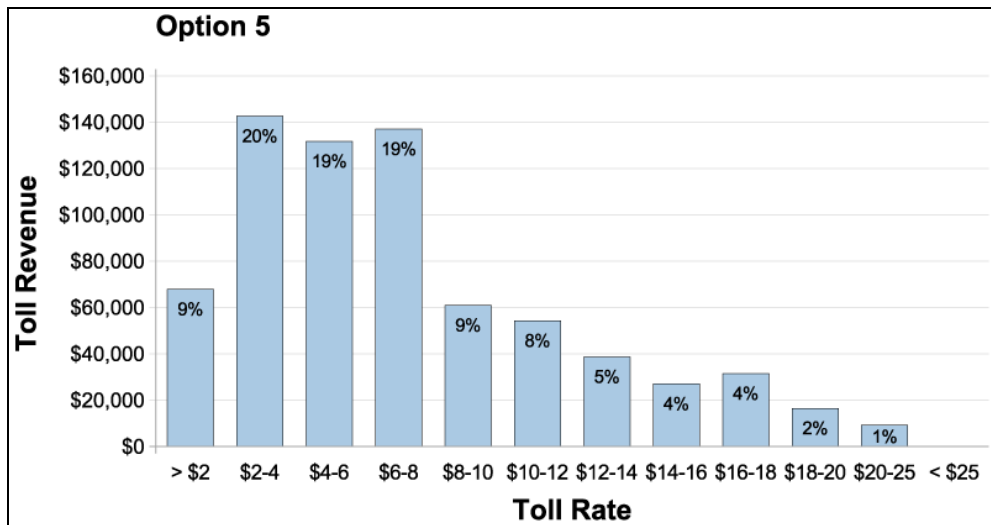


Figure 15: Study Option 5 – Daily Gross Revenue by Toll Rate

For study options 1, 2, 3, 5, the majority of the revenue is generated at toll rates less than \$25 in 2008 dollars. Study option 4 has higher toll rates because of the increased trip length, so a greater percentage of the gross revenue is generated by higher toll rates. Option 4 has 5% of the gross revenue is generated by toll rates higher than \$25.

### Average Tolls in 2013 for Study Option 1

To provide a more realistic and meaningful example of what the public might expect to pay to use the express toll lanes, we estimated average tolls for a typical commute day for study option 1 in the year 2013. Study option 1 includes currently funded projects on the north end of I-405 between SR 520 and I-5 in Lynnwood. We are using 2013 as this is the year a north end express toll lane system could reasonably be completed and open to traffic. For study option 1, in the year 2013, on a typical commute day, the average toll is estimated to be \$2.30 in 2008 dollars. The average toll per mile in 2013 is estimated to be 23 cents per mile in 2008 dollars. These average tolls are less than those shown for the year 2020 above because overall traffic demand for the corridor is less in 2013 than it will be in 2020. As traffic congestion grows, demand for use of the express toll lanes will increase resulting in higher average tolls required to manage express toll lane volume.

Another way to understand potential toll amounts is to look at a sample commute. Figure 16 shows two sample commutes for study option 1. Both are for the morning commute from the north end of I-405 into Bellevue on a typical commute day. Study option 1 includes two express toll lanes between Bellevue and Bothell and one express toll lane between Bothell and Lynnwood. Unlike the average toll amounts provided above, the tolls presented for these two sample commutes are estimated average tolls during peak commute times. Average peak time tolls are higher than daily average tolls because of increased demand for use of the express toll lanes during peak commute times.

Figure 16 shows that a commute from Lynnwood to Bellevue in 2013 is estimated to cost an average of \$4.30 between the hours of 6 and 7 a.m. This average toll increases to \$6.60 between 7 and 8 a.m. as demand for express toll lane increases. Also shown is the time saved when drivers choose to pay to use the express toll lanes. Between 6 and 7 a.m. drivers save 21 minutes on their commute from Lynnwood to Bellevue, and 30 minutes if traveling between 7 and 8 a.m.

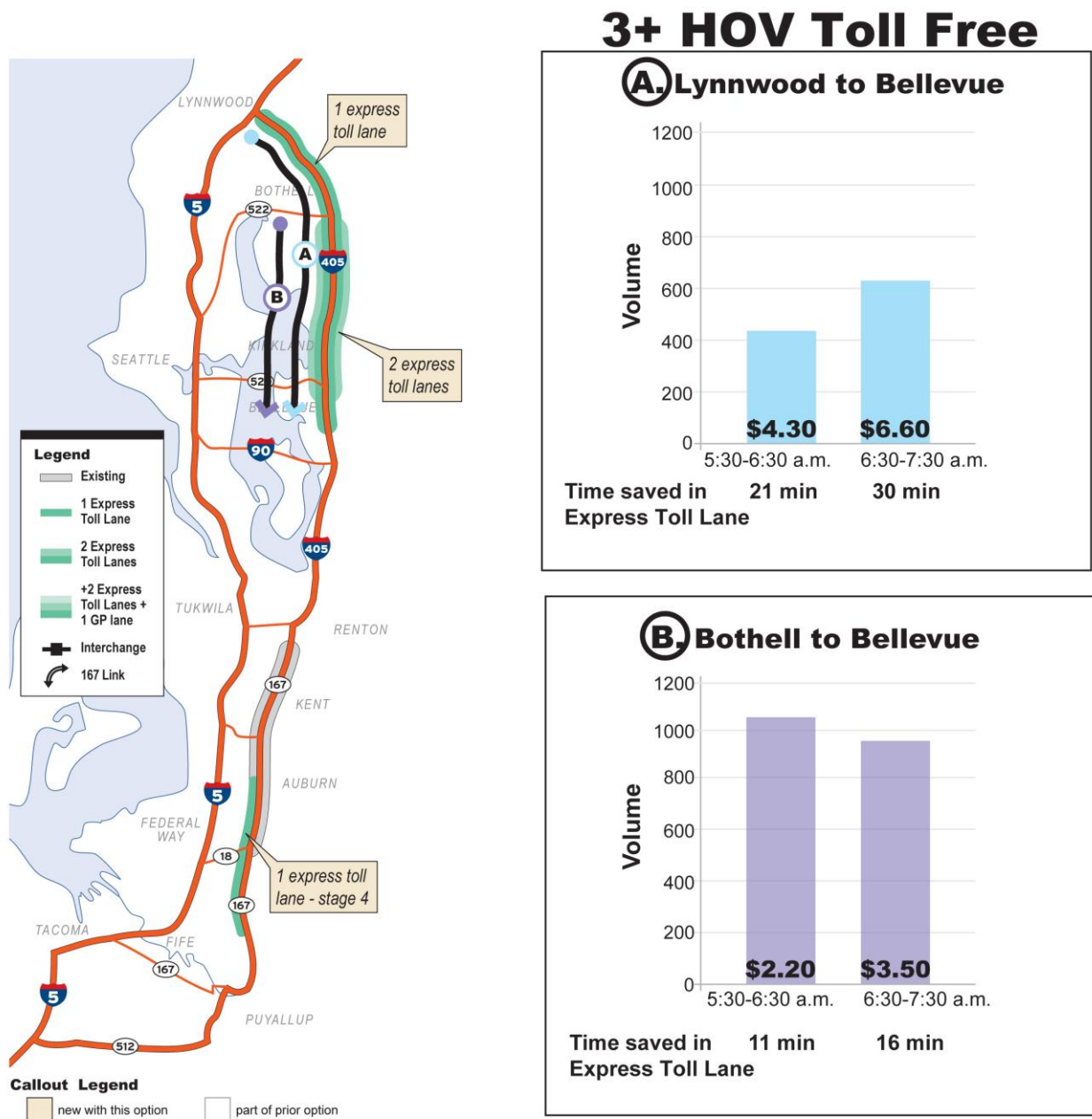


Figure 16: Study Option 1 Sample Commutes in 2013 (2008 dollars)

Figure 16 also shows that to commuting from Bothell to Bellevue in 2013 is estimated to cost an average of \$2.20 between the hours of 6 and 7 a.m. This average toll increases to \$3.50 between 7 and 8 a.m. as demand for express toll lane increases. Also shown is the time saved when drivers choose to pay to use the express toll lanes. Between 6 and 7 a.m. drivers save 11 minutes on their commute from Lynnwood to Bellevue, and 16 minutes if traveling between 7 and 8 a.m. Tolls amounts are less for this commute due to a shorter distance traveled in the express toll lanes and more space available in the two lane express toll system. . This additional space allows a greater volume of drivers to choose to use the express toll lanes for this commute trip versus the longer Bothell to Bellevue commute.

## Traffic Performance Results

In addition to estimating the 2020 tolls and the resulting gross revenue for the study options, we assessed operational performance of the express toll lanes. The operational analysis was conducted for year 2020 conditions for two AM peak hours. Due to time constraints other time periods were not modeled; however these time periods provide insightful information on performance of the each study option, and it is anticipated that PM performance patterns would follow similar trends.

Our operational analysis was conducted using Vissim, a micro-simulation freeway model that captures performance of the freeway network. To measure performance of the express toll lanes, we calculated the number of vehicles and persons moving at free-flow (45 to 60 mph) speeds. This metric captures not only the number moved, but more importantly the number of vehicles and people moved at high speeds.

Seven screen lines, as shown in Figure 17, were used to capture the number of vehicles and persons moved at free-flow speeds. Each screen line location captured the number moving in the general purpose and express toll lanes and aggregated them. The following screen line locations were used:

- I-405
  - South of SR 527
  - North of 85<sup>th</sup>
  - North of I-90
  - North of SR 169
- SR 167
  - South of I-405



Figure 17: Eastside Corridor Tolling Study Traffic and Revenue Screen Lines



- South of 15<sup>th</sup> St. SW
- North of SR 410

These screen lines capture the major areas where improvements are proposed for the study options and combined provide a measure of corridor performance.

By adding up all seven screen line locations for the peak directions during the 2020 AM peak two hours, we can compare the overall ability of each option to move persons and vehicles at high speeds.

Figure 18 shows that study options 1-5 provide increasingly higher traffic performance. This is consistent with the additional express toll lane capacity being added in each option. On this corridor-wide comparison, study option 3 only shows a marginal increase in performance over study option 2; however the traffic performance in the vicinity of the SR 167/I-405 interchange does increase markedly in study option 3 because of the new direct connector ramp.

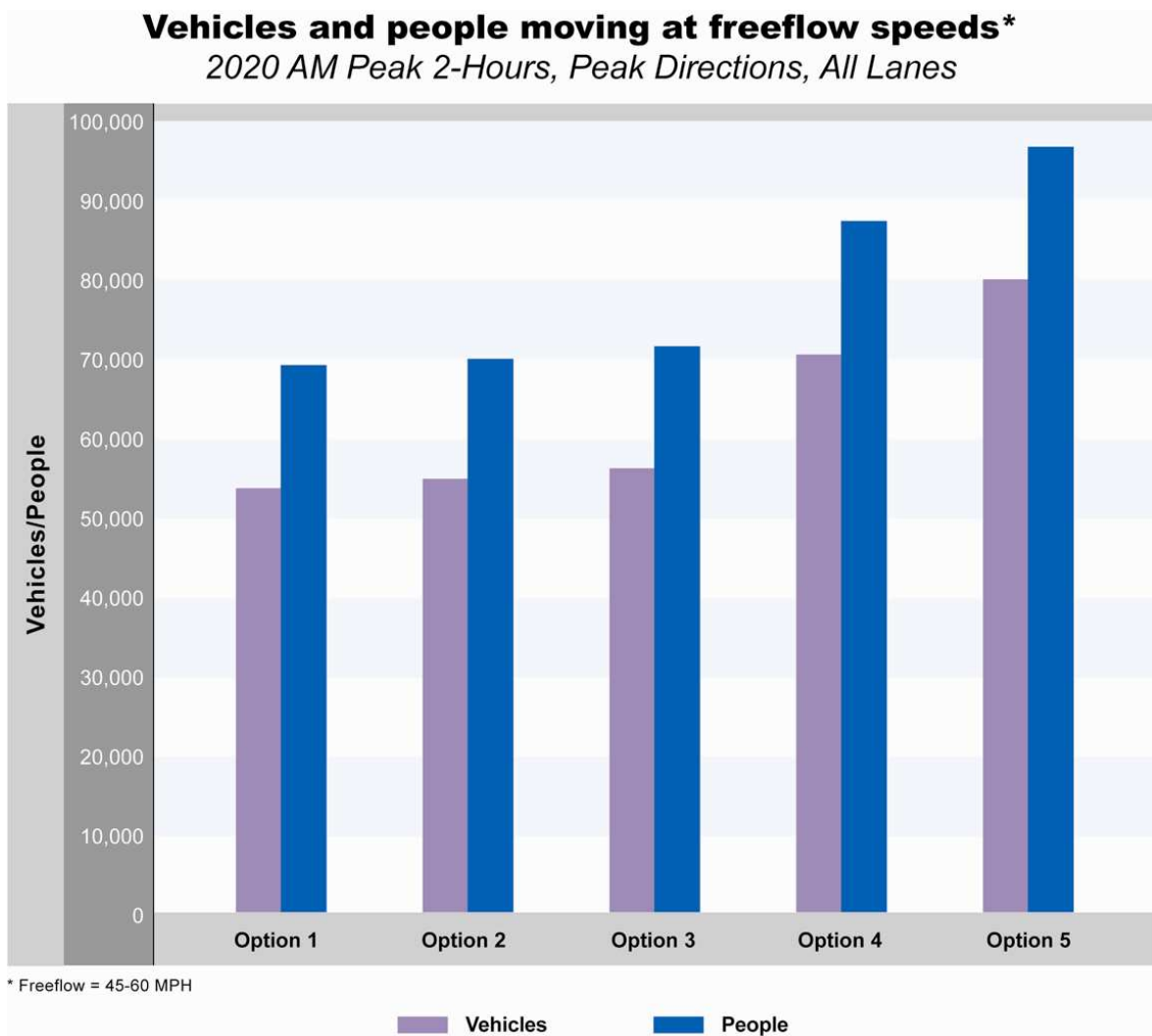


Figure 18: Eastside Corridor Traffic Performance in 2020 AM Peak Travel Time – Study Options 1 - 5



Another way to understand these performance numbers is to also compare them against the total vehicle demand at each location. Figure 19 shows the same performance information with the corresponding vehicle demand numbers. Vehicle demand is a measure of all demand for travel across all travel lanes – express toll lanes and general purpose lanes. Figure 12 shows that total vehicle demand number for travel in all lanes compared to the percentage of vehicles and persons traveling at free-flowing speeds (45 to 60 mph) in all travel lanes.

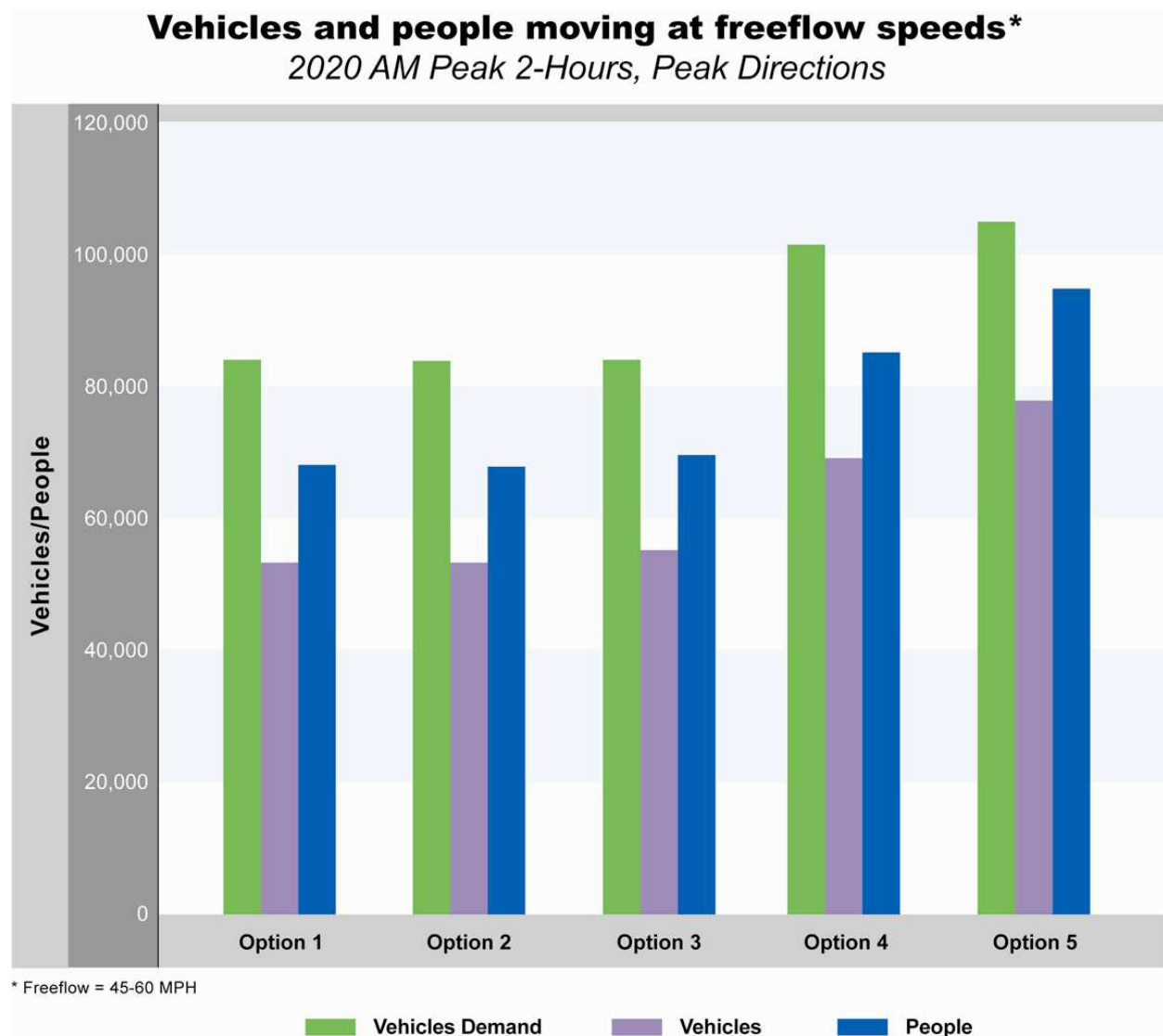


Figure 19: Traffic Performance with Vehicle Demand by Study Option (2020 AM Peak Hour Travel)

As discussed earlier, study options 1-3, 4, and 5 have distinct vehicle demand numbers because they have differing numbers of corridor travel lanes. The screen line totals serve between 65-75% of the vehicle demand at high speeds depending on the option.

The five study options were also compared against a comparable investment in general purpose lanes. In other words, instead of building an express toll lane to be coupled with the existing HOV lane, general purpose lanes are constructed and the HOV lane remains unmodified.

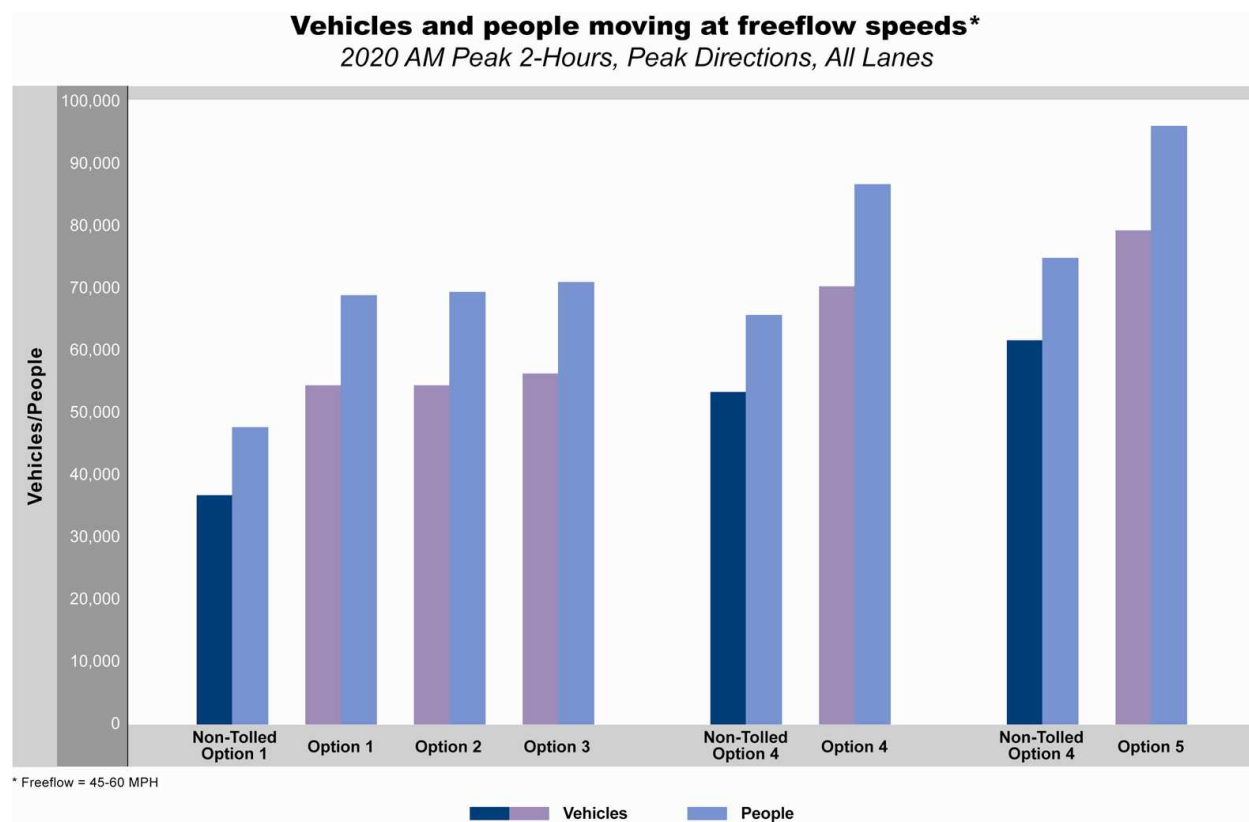


Figure 20: Traffic Performance for Non-Tolled vs. Tolerated Improvements (2020 AM Peak Hour Travel)

Figure 20 shows the comparison of each study option to the corresponding investment in general purpose lanes. In all cases the express toll lanes move more vehicles and more people than the general purpose investment alternative. This is because the express toll lanes are able to be managed in a manner that allows them to perform at high volumes and high speeds without breaking down. When compared to a non-tolled option, the majority of the overall increase in vehicles and persons moving at high speeds can be attributed to the express toll lanes as they perform at speeds greater than 45 mph and are therefore able to move more vehicles and people.

### Sensitivity Tests (2+ and Toll Cap)

As discussed earlier, all the study options were evaluated assuming a 3+ HOV toll free requirement and no cap on the maximum tolls to use the express toll lanes. To understand how these factors influence the results above, sensitivity tests were conducted to evaluate a 2+ toll free requirement and a \$12 toll cap, both for study option 1.

### HOV 2+ toll-free implications

To work well, express toll lanes must have space available to provide non-HOV drivers the choice to pay a toll to use the express toll lanes. Currently, I-405 HOV 2+ lanes do not meet WSDOT performance standards in many segments during peak-hour travel times because of high demand. Therefore, the HOV lanes do not always have space available for non-HOV vehicles to pay a toll to drive in the express toll lanes.

The additional capacity added in study option 1 between SR 520 and SR 522 does create new HOV space in that area and could allow HOV2+ toll-free operations with express toll lanes. However, this would result in higher toll rates than 3+ and eventually require closure of the express toll lanes to HOV-only during peak periods. This closure would be necessitated to avoid overuse and slowdown of speeds in the lanes.

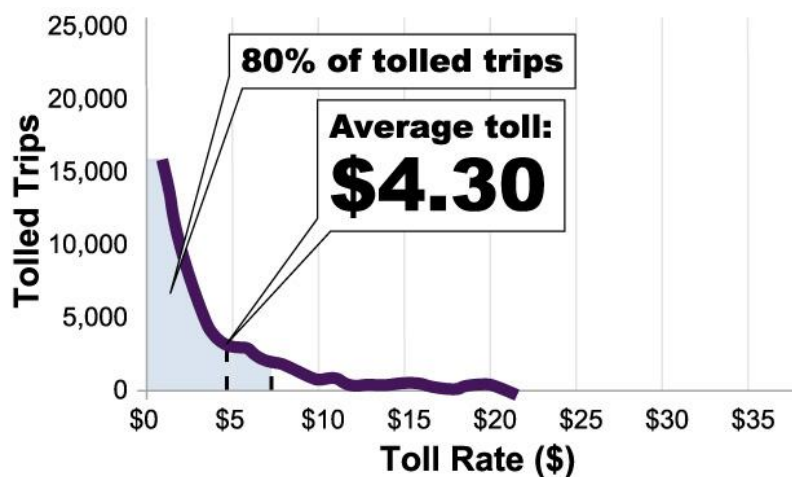


Figure 21: Study Option 1- HOV 2+ Average Toll

As shown in Figure 21, the average toll for option 1 at HOV 2+ toll-free in 2020 would be \$4.30, compared to \$3.90 at HOV 3+ toll-free, both in 2008 dollars. Tolls above \$20 would be necessary to manage the demand in the express toll lanes. Higher tolls will result in a higher percentage of gross revenue being generated by rates above \$16 as shown in Figure 22.

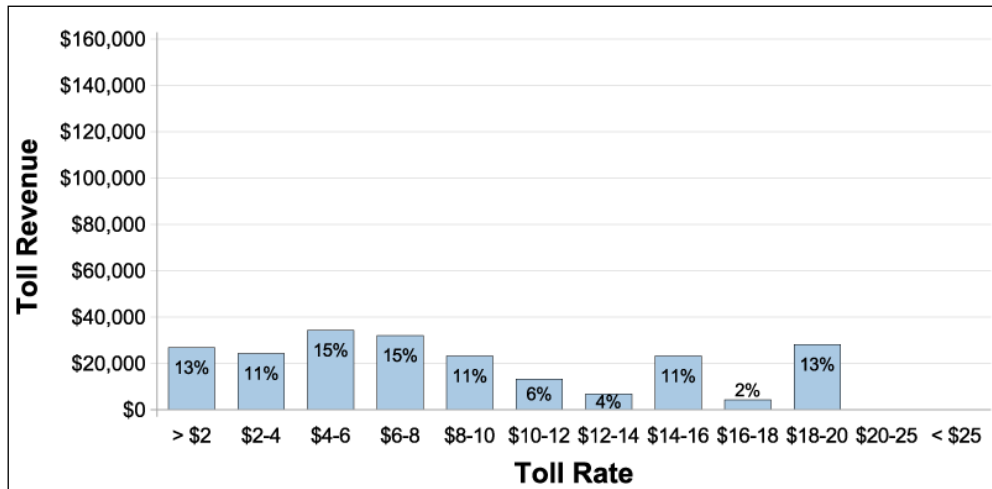


Figure 22: Study Option 1 – HOV 2+ Toll-Free Gross Revenue by Toll Rate

Figure 22 shows how approximately 15% of the daily gross revenue is generated at tolls above \$16 with the HOV 2+ toll-free designation. This is much higher than the 1% of tolls above \$16 with a HOV 3+ toll-free designation.

Figure 23 illustrates how a HOV 2+ toll-free designation would affect toll amounts and traffic volumes in the express toll lanes during the morning commute from Lynnwood to Bellevue on an estimated typical commute day in 2013. It shows how fewer non-HOV vehicles are able to buy into the express toll lanes for HOV 2+, resulting in higher tolls than under the HOV 3+ scenario.

## 2+ HOV Toll Free\*\*

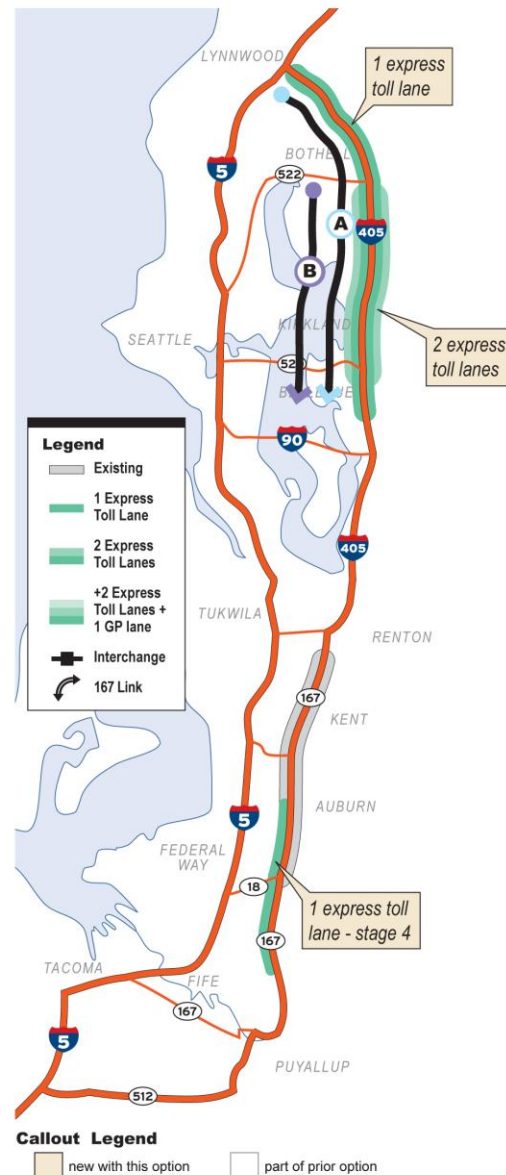
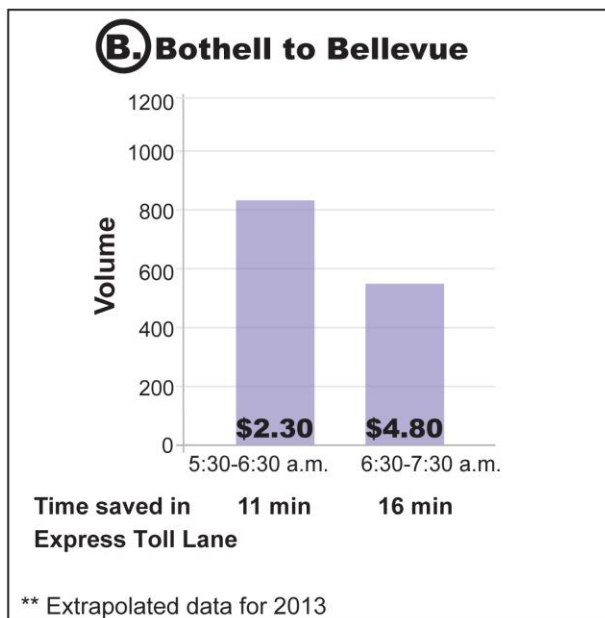


Figure 23: Typical Lynnwood to Bellevue morning commute in 2013. HOV 3+ toll-free provides a greater opportunity to buy in to the express toll lanes and lower tolls

Demand for HOV 2+ travel in the express toll lanes will continue to increase. Our traffic modeling shows that by 2020, demand during peak periods is so high that the express toll lanes will be restricted to HOV-only some of the time to assure free-flowing speeds (45 to 60 mph). This further reduces toll revenues and prohibits the choice to pay a toll for a reliable trip. In the long-term, effective Eastside Corridor express toll lanes operation will require an HOV 3+ toll-free designation.

### Toll cap implications

Express toll lanes work best when toll amounts are adjusted dynamically based on demand for space in the express toll lanes. With dynamic tolls, supply and demand for space in the express toll lanes determines the toll amount. During peak hour travel, WSDOT may consider capping the toll amount if traffic demand would raise the toll rate to unreasonable levels. If a maximum toll rate, or toll cap, is set too low, the lane will close to all vehicles except HOVs, which negatively impacts traffic performance. To understand the impacts to traffic performance and toll collections, WSDOT reviewed study option 1 operations in 2013. We assumed a toll cap of \$12 in 2008 dollars with an HOV 3+ toll-free designation.

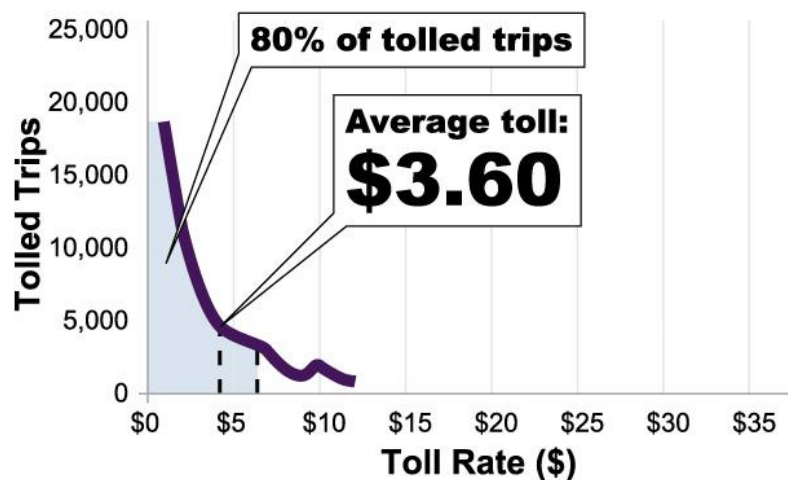


Figure 24: Study Option 1 – HOV 3+ with \$12 Toll Cap

Figure 24 shows how the toll cap slightly decreased the average toll rate compared to the non-capped study option 1 shown in Figure 21. The average toll amount decreased because of the \$12 cap on the toll rates and because it necessitated closure of the express toll lanes to HOV 3+ only during some 2020 peak periods.

In 2013, on a typical commute day, a \$12 toll cap would have virtually no affect on average toll amounts and the ability for non-HOV vehicles to buy into the express toll lane. However, by 2020, traffic models show that peak-hour travel demand for express toll lanes is so high that the toll cap cannot effectively control traffic flow. Under these conditions, maintaining free-flow traffic in the express toll lanes will require making the lanes open to HOV 3+ only during some peak-hour travel times. Toll-paying users would be prohibited from use. By the year 2035, the toll cap would result in an HOV 3+ only requirement to maintain free flow speeds during almost all peak-hour travel times. Limiting potential toll paying vehicles from using the express toll lanes impacts the amount of toll revenue and eliminates the choice for a reliable trip by paying a toll. While the \$12 toll cap would have few impacts in 2013, it would eventually reduce the amount of time express toll lanes are available for toll-paying non-HOV 3+ vehicles, also reducing toll revenues.

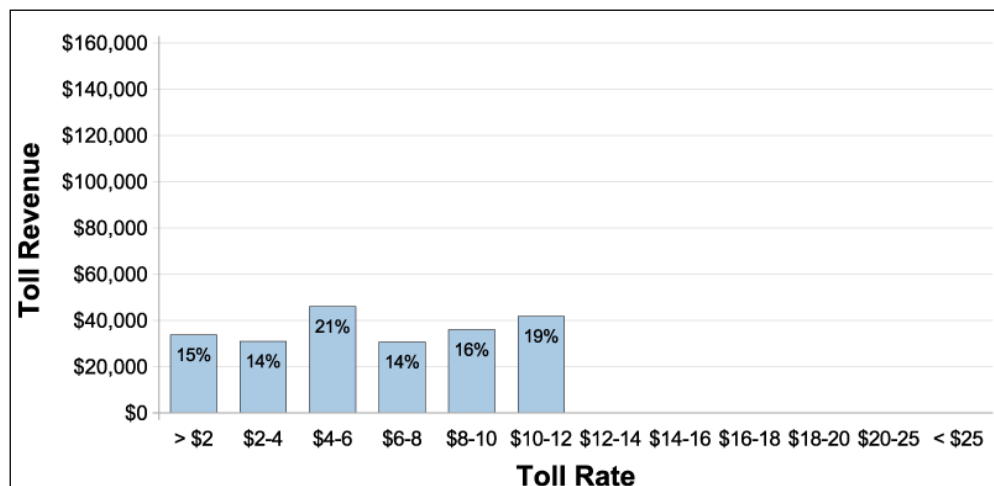


Figure 25: Study Option 1 with \$12 Toll Cap – Gross Revenue by Toll Rate

Figure 25 shows how the toll cap has a similar breakdown of toll rates and their contribution to the gross revenue as a non-capped option 4. The total gross revenue with the toll cap is approximately 25% lower than the non-capped amount. This is due to the limitation on toll rates and the 2.5% reduction in the number of daily tolled trips with the cap. All of the reduction occurred during the peak periods to manage the operations of the express toll lanes.

## Conclusions

The traffic and revenue analysis of express toll lanes projected toll rates, gross revenue, and traffic operations for future years. The analysis found the following:

- Future projections using the PSRC model found that diversion off the local street and onto the freeway occurred when I-405 capacity was added.
- When compared to a similar investment in general purpose lanes, express toll lanes moved more people and vehicles at high speeds.
- Express toll lane rates are based on the optional use of the lane and follow a supply and demand relationship; toll rates are not predetermined.
- A 2+ HOV toll-free designation is not sustainable and has high toll rates because of limited space available.
- A toll cap could have impacts on revenue and ability to operate depending on the level the cap is set at.