CONGESTION PRICING PROPOSALS

5/27/11

An Evaluation of Congestion Pricing Proposals in the Portland Metro Area

The Oregon State Legislature directed the Oregon Department of Transportation (ODOT) to implement a congestion pricing pilot project in the Portland Metropolitan Area by September 2012. Candidate proposals were evaluated for their traffic, financial and economic effects. ODOT led the study with support by a consultant team.

Congestion Pricing Proposals

AN EVALUATION OF CONGESTION PRICING PROPOSALS IN THE PORTLAND METRO AREA

EXECUTIVE SUMMARY

Congestion pricing solutions have been implemented in metropolitan areas across the world to influence how, when and where motor vehicles travel. These solutions represent one element of a larger initiative to balance traffic system management with growing urban transportation needs.

Study Purpose

This study is one phase of the response to state legislation that directed the Oregon Department of Transportation (ODOT) to implement a congestion pricing pilot project in the Portland Metropolitan Area by September 2012.[1] Two committees composed of local agency staff and elected officials developed candidate projects for consideration. The committees recommended two roadway pricing projects, NW Cornelius Pass Road and Oregon Highway 217, and one parking pricing project in Central Portland. The study technical team then evaluated how implementation of these proposed projects would affect transportation conditions in the influence area of the pricing plan, the financial burdens of the responsible agency, and the economic and social impacts to the traveling public.

Effects of Congestion Pricing Considered in this Study

Implementing a congestion pricing plan in the Portland Metropolitan Area most directly affects the facilities that are priced, but it also can have secondary effects that need to be considered. At this stage of the evaluation process, the most significant issues include:

- Estimated traffic volumes using the facility and how many travelers would be diverted to other routes
- Resulting traffic conditions on the tolled facility and on nearby non-tolled facilities
- Estimated revenues generated by toll payers
- Net revenues collected by the responsible tolling agency, after deducting capital, operating and maintenance costs
- Economic impacts to system users in addition to any tolls paid
- Air quality impacts associated with net changes in miles and hours of travel caused by the toll scheme

The traffic, revenue and economic impacts of the proposed congestion pricing proposals were evaluated. The findings reported in the following sections apply to the two roadway pricing projects only. The parking pricing proposal for Central Portland is still under investigation.

[1] Oregon House Bill 2001, Section 3. http://www.leg.state.or.us/09reg/measpdf/hb2000.dir/hb2001.en.pdf

NW Cornelius Pass Road Toll

NW Cornelius Pass Road is seven miles in length between US 30 in Multnomah County to US 26 in Hillsboro. The proposed toll facility would be located in the rural area near the northern end, just south of the junction with US 30 where the average weekday traffic volume is about 8,000 vehicles. NW Cornelius Pass Road is the designated truck route in this corridor, and by provision of the 2009 Oregon Jobs and Transportation Act (JTA), trucks would not be tolled.

The primary objective of the toll charge is to generate funds for safety improvements. A separate study by ODOT identified that the best value safety improvements in this corridor would cost about $8 million. This analysis answers the question: would a toll at this location generate enough funds to deliver these safety improvements without significant offsetting impacts or costs?

Summary of Findings

- Auto traffic volumes on NW Cornelius Pass Road decrease by 60 to 90 percent with tolls because these vehicles would divert to other routes.
- As auto volumes decrease, the travel experience for toll payers on NW Cornelius Pass Road is improved (e.g., better travel time and reliability, less congestion).
- In the long-term (by 2035), the net potential revenues collected by the tolls range from $3 to $6 million.
- Automobiles that divert away from NW Cornelius Pass Road dramatically increase traffic on alternative rural routes such as NW Rocky Point Road, NW Logie Trail Road, NW Newberry Road, and sections of NW Skyline Boulevard.
- At least $30 million in safety improvements may be required on these alternative rural routes to serve the additional diverted traffic.
- The traffic diversion increases overall greenhouse gas (GHG) emissions.
- The cumulative economic impacts due to increased vehicle miles traveled (VMT) are estimated to cost the region $40 to $65 million by 2035.

Overall, it was concluded that the potential revenues do not cover priority safety needs identified for NW Cornelius Pass Road. The potential costs (to the economy and for safety mitigations) significantly exceed potential revenues. Furthermore, the public does not support the primary objectives, or the use of tolling to meet those objectives.

Oregon Highway 217

Oregon Highway 217 (OR 217) is six miles in length between US 26 and Interstate 5 in Washington County. The proposed toll facilities would be located on the on-ramps at three interchanges: SW Wilshire Street, SW Walker Road and SW Denney Road. No off-ramps would be tolled, and all trucks would be exempted from tolls.

The primary objective of the OR 217 on-ramp tolls is to manage congestion on this regional route and thereby improve performance on the freeway facility. Secondary objectives included reducing merging conflicts on OR 217 and reducing the number of local trips that use OR 217 that could otherwise use surface streets.

Summary of Findings

- Auto traffic volumes on the tolled on-ramps decrease by 70 to 95 percent with tolls in place.
- As auto volumes decrease, the travel experience on OR 217 improves.
- For the high toll scenario, recovery of capital investments in the toll system takes about 15 years to recover, and the potential net revenues by 2035 are just under $1 million. Lower toll levels do not generate positive net revenues.
- Automobiles avoiding tolls on OR 217 use parallel surface streets, resulting in increases of approximately 3 to 7 percent on arterial corridors.
- Many of these streets are already congested (or forecasted to be by 2035) and may require significant mitigation improvements that could exceed $100 million for identified corridor improvement projects, depending on the policy objectives of jurisdictions.
- Automobile diversion results in overall increases in VMT, vehicle hours traveled (VHT) and GHG emissions.
- Economic impacts due to increased VMT are estimated to cost the region $95 to $140 million through 2035.
- Public does not support the toll concept or see project objectives as a priority.
- Potential costs significantly exceed potential revenues.
- Although merge conflicts on OR 217 are reduced, the need for planned capital projects is not removed.

STUDY PURPOSE

The 2009 Oregon Jobs and Transportation Act (JTA) requires the Oregon Department of Transportation (ODOT) and partner jurisdictions to implement a congestion pricing pilot project in the Portland metropolitan area by September 2012. In response, ODOT developed a work program in collaboration with partner jurisdictions and formed two committees to guide the process. The executive oversight committee, referred to as the Congestion Pricing Advisory Committee (CPAC), was comprised of elected officials from the City of Portland, Multnomah County, Clackamas County, Washington County, and Metro as well as the Region 1 ODOT Manager. The Technical Advisory Committee (TAC) included key staff from each of these agencies, who were responsible for identifying and recommending to the CPAC project proposals that could meet the intent of the JTA. Congestion pricing project proposals were solicited from the TAC and CPAC beginning in 2009. The initial proposals were screened using the following four criteria to select which would move forward for evaluation:

1. One or more local jurisdictions must sponsor the proposal for further study and be willing to take an active role in responding to media inquiries about the proposal.
2. The other local jurisdictions affected by the proposal must support its advancement for further study.
3. The proposal should be feasible to implement as a pilot by September 2012.
4. The proposal should reflect CPAC direction at the December 2009 meeting that the TAC pursue proposals with a high likelihood of success.

Three congestion pricing project proposals emerged from the screening process: the two roadway projects analyzed in this report and a parking pricing proposal by the City of Portland that is being studied separately. This study addresses six components of the technical performance and public acceptance of the proposed roadway congestion pricing projects:

- Effectiveness at achieving policy objectives
- Affected areas and stakeholders
- Social costs and benefits
- Direct highway user effects
- Public support for policy objectives
- Public support of proposed projects

TECHNICAL METHODS AND ASSUMPTIONS

The transportation analyses for the proposed roadway pricing projects are based on the regional travel demand forecast models prepared by Metro. These models estimate how traffic patterns will change with the pricing proposals in place. The models were used to forecast traffic and truck volumes on the tolled facilities and predict how travelers change routes to avoid the tolls. Forecasts were made for the year the facilities were expected to open (2012) and for the regional plan horizon year (2035) during the morning (AM), Mid-day and evening (PM) peak periods.

Model Network Assumptions

The starting point for the technical evaluation required minor modifications to the base regional models for 2005 and 2035. Metro staff updated the 2005 model to represent 2012 by adding in street and highway projects that have been built or will be ready by 2012. Staff also updated land use assumptions to account for growth between 2005 and 2012. The 2035 model network selected for this study includes projects from the Federal Regional Transportation Plan Financially Constrained Project list. Several additional refinements were made in the area of NW Cornelius Pass Road, for both the 2012 and 2035 networks, to make sure the model network included enough local streets to provide a better understanding of the possible diversion routes and impacts.

Tolling Assumptions

Tolls were modeled by applying a time penalty equivalent to the toll rate, an approach consistently utilized by Metro and other regional agencies for recent tolling and pricing analyses. The Value of Time (VOT) assumptions developed and applied for the Columbia River Crossing study were used. Toll locations for the scenarios are:

- NW Cornelius Pass Road – Point toll located south of US 30 intersection (both travel directions)
- OR 217 Tolled Ramps – Highway on-Ramps tolled at SW Wilshire Street, SW Walker Road, and SW Denney Road (both travel directions on the highway)

According to the JTA requirements, vehicles over 10,000 pounds gross vehicle weight are not subject to tolls. Network and modeling assumptions are further detailed in the Task 3.3 Memorandum.[2]

Four scenarios, including no-build, were identified for each pricing project. The toll rates were based on the length of the tolled facility and the relative distance to alternative routes. In general, the toll rates for the on-ramps to OR 217 were about half the rate for NW Cornelius Pass Road, because of the relatively shorter distance and greater availability of alternative routes. The scenarios for each pricing project and applicable toll rate are presented in Table 1.

[2] Congestion Pricing Proposals Analysis Tasks 3.3 Technical Approach for Traffic and Transportation Analysis Memorandum, DKS Associates, July 9, 2010

TABLE 1: CONGESTION PRICING TOLL RATES EVALUATED

Scenario	Toll Level	OR 217 On-Ramp Pricing (Peak / Off-Peak)	NW Cornelius Pass Road (Peak / Off-Peak)
1	No-Toll	--	--
2	Low Toll	$0.25 / $0.15	$1.00 / $0.50
3	Medium Toll	$0.50 / $0.25	$2.00 / $1.00
4	High Toll	$2.00 / $1.00	$4.00 / $2.00

Note: The toll rate refers to the cost of a single trip passing that point at the specified time period.

Limitations of Technical Approach

This section documents key limitations to the traffic and revenue analyses conducted for this study. The assumptions and inherent uncertainty associated with these analyses should be considered in the decision-making process for the proposed congestion pricing projects.

Cost and Revenue Analysis Limitations

The planning-level costs for design, construction and operations of proposed toll facilities are estimates and subject to change. Tolling costs can vary widely depending on equipment and systems selected.[3,4] The variability of tolling implementation costs is heightened because projected usage of the proposed projects is relatively low.

Administrative and back office operations costs include transaction processing, accounts management, traffic monitoring, billing, violations, and information storage. Customer service channels may also be required and may include website design and kiosks. Transponders needed for the toll system will have to be provided to users. Operating costs will vary depending on toll usage, which also influences how many transponders are needed. Operating costs may vary widely for different toll levels.

All of the costs identified above depend on toll policy, business rules, and violation processing procedures, which remain undetermined at this stage. Key issues that require more detailed analysis include:

- *Authority:* The project may be managed by an existing authority or future governmental body. The degree of out-sourcing or long-term privatization for all or part of operations (e.g., information kiosks, transponder distribution) would need to be considered further.

- *Legality:* The managing authority (or designated private entity) will have to identify its legal and jurisdictional ability to set tolls, fines, administration fees and/or violation fees, including the potential to withhold licenses or registration for those unwilling to pay tolls, fees and/or fines. The manner in which fees and fines are accrued and distributed would need to be clarified as well.

- *Business Rules*: In general, costs increase with additional flexibility in operations. Rules and procedures will need to be established, including such issues as recouping capital costs of transponders, the amount of money held in escrow for the transponders, how accounts will be managed (e.g., on-line

[3] OR 217 Capital Costs (CAPX) and Operating Costs (OPX) - Oregon Congestion Pricing Memorandum, Stantec Corp, September 24, 2010
[4] Cornelius Pass Project Capital Costs (CAPX) and Operating Costs (OPX) - Oregon Congestion Pricing Memorandum, Stantec Corp, November 23, 2010

and/or physical facilities for customer support), if cash payments will be allowed, and how they might be processed.

- *Violation Processing*: Effective toll agencies typically have legislative and legal support for their revenue collection. Non-payment violations are generally considered to be an administrative transaction (like a parking ticket) where escalating administrative fees accompany each level of non-payment. The strategy for processing (or ignoring) violations, including "one-time" offenders and out-of-state users, needs to be further identified. One-time offenders can often be the majority of violators. It is estimated that the costs to identify a license plate, find the owner and contact that owner for a one-time violation is in the range of $1 to $2 per transaction, assuming enough activity (i.e., several thousand transactions per day) to keep the unit prices low.

- *Administration Oversight:* The level of oversight will be influenced by statutory reporting requirements, treasury function to account for revenue stream, contract administration, auditing, and internal control of transponders. The level of detail required for these functions will affect administrative costs. Costs of administrative oversight may be significant, particularly if there is a private or semi-public authority managing the proposed projects.

Potential net revenues generated in this report may be overstated because of the uncertainty of operating costs. In addition, the cost estimates do not explicitly identify costs for (state or other agency) staffing needs to manage, administer and operate all elements of the proposed projects. Furthermore, potential borrowing costs to construct and implement the proposed projects are not included in the analysis. Further study would better identify administrative and financing costs related to these projects.

As discussed above, costs to mitigate diversion impacts are also planning-level estimates. They do not reflect refined operations or safety analysis, but rather are intended to offer a range of potential costs to be considered against any potential revenues generated from the proposed projects.

Traffic Analysis Limitations

The traffic analysis for the proposed pricing projects is based on Metro travel demand forecast models. The Metro model forecasts applied to this type of screening-level toll analysis are useful for understanding major trends and patterns.[5] However, they do not address more finely-detailed roadway user issues associated with the proposed toll facilities. The Metro travel demand forecast models make a variety of assumptions that limit the effectiveness of accurately representing traveler responses to toll rates.[6]

The models represent travel activity during three time periods of the day: AM peak period (7-9 AM), Mid-day (12-1PM), and PM peak period (4-6 PM). Information for other time periods is not available; therefore daily estimates are based on factoring. This approach may limit accuracy for estimating congestion pricing impacts, particularly during uncongested times of the day. Furthermore, travelers sensitive to congestion and toll rates may alter their schedules, particularly when toll rates vary significantly by time of day. The opposite effect may occur for truck trips, which may increase with less congestion on tolled routes as auto traffic is diverted. As a result, there may be a change in the number of vehicle trips at a given time of day. These time of day shifts in travel demand are not represented in the model.

[5] Congestion Pricing Proposals Analysis Technical Memorandum 1B: Benefits/Limitations of Travel Demand Modeling for Concept Viability Analysis, DKS Associates, June 22, 2010

[6] ODOT Congestion Pricing Proposals relative to the Portland Metro model and Tolling White Paper 3 - Travel Demand Model Sufficiency, John Parker Consulting, LLC, March 2010

The model also does not capture the ability and willingness to pay by income and trip purpose (toll sensitivity). Driver response is expected to be less sensitive to toll levels than indicated by the initial results of the model forecasts. For example, some drivers will avoid even a marginal toll, while others will be willing to pay any of the toll rates identified. Other potential toll route users will not install a transponder and therefore will either travel via an alternate route or be subject to fines. In addition, travelers may change their destination choice altogether to avoid paying a toll. The model takes a simpler approach by applying a uniform time penalty equivalent (based on value of time) to all tolled vehicles and does not alter destination choices in response to tolling. A more refined analysis would consider these important toll sensitivity issues within the model framework.

The original objectives of the Metro regional travel demand model differ from those of the congestion pricing proposals in some cases. The Metro models are developed primarily to identify vehicle volumes on roadways, with an emphasis on the PM peak period. The models do not fully capture operational details of the street system such as traffic signal timings and queuing effects. The models use generalized delay functions based on intersection volumes and estimated capacities. It is important to note that model-derived speeds do not fully capture driver-to-driver interactions or driver-to-environment interactions and, therefore, may not represent actual travel speeds as well as an operations model that better accounts for traffic signal timings and phasing.

The shortcomings of using the regional model for this evaluation may be particularly significant for the air quality and economic analyses, which rely heavily on travel model outputs such as vehicle speeds, delays and volumes. As is generally acknowledged, the regional model does not fully account for operating speeds and intersection delay, so the absolute values of VMT and VHT may not be as precise as would be reflected in operational traffic models. However, the regional model outputs are still useful for relative comparisons between alternatives and for understanding general impacts.

Metro Travel Forecast Adjustments for Tolled Conditions

In this study, the limitations of the model forecasts are addressed by making manual adjustments to better match up with toll facility usage observed on other systems. In particular, the Metro model forecasts indicate a high level of sensitivity to toll rates, with relatively small diversions at lower toll levels and 100 percent diversion at high toll levels. Historical evidence on other systems indicates that at least 50 percent diversion is likely to occur at any toll level[7,8] and 100 percent diversion is unlikely to occur given variance in cost sensitivities exhibited in other tolling systems. Therefore, during development of the toll revenue forecasts, the level of automobile traffic diversion was revised to reflect observed driver responses under tolled conditions. The revised forecasts represent a narrower range of diversion (as illustrated in Figure 1), reflecting less cost sensitivity in driver response to toll levels. The differences in auto diversion rates in modeled forecasts compared to (adjusted) revenue forecasts are detailed in Tables 2 and 3 for the two roadway pricing proposals.

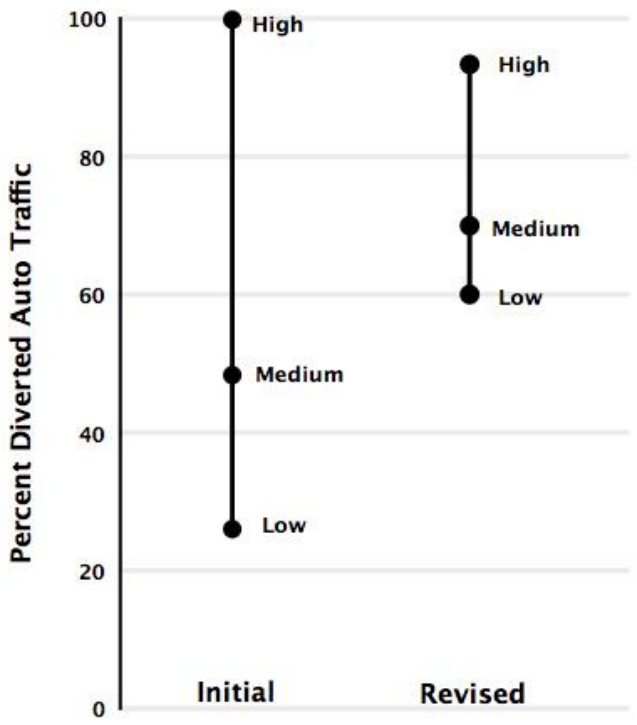

FIGURE 1: AUTO DIVERSION ADJUSTMENT FOR CORNELIUS PASS ROAD

TABLE 2: ESTIMATED AUTOMOBILE DIVERSION AT CORNELIUS PASS ROAD TOLL LOCATION

Toll Level	2012 Auto Diversion		2035 Auto Diversion	
	Metro Model	Revenue Forecast	Metro Model	Revenue Forecast
Low Toll	26%	60%	24%	60%
Medium Toll	53%	76%	51%	76%
High Toll	100%	91%	100%	90%

Source: Stantec & DKS Associates

TABLE 3: ESTIMATED AUTOMOBILE DIVERSION AT OR 217 ON-RAMPS TOLL LOCATIONS

Toll Level	2012 Auto Diversion		2035 Auto Diversion	
	Metro Model	Revenue Forecast	Metro Model	Revenue Forecast
Low Toll	42%	72%	30%	72%
Medium Toll	83%	83%	50%	83%
High Toll	100%	96%	100%	95%

Source: Stantec & DKS Associates

[7] Cornelius Pass Project – Oregon Congestion Pricing Memorandum, Stantec Corp., September 22, 2010
[8] SR 217 Project – Oregon Congestion Pricing Memorandum, Stantec Corp., November 23, 2010

Although the traffic patterns represented by the revenue forecasts are not precisely replicated, the overall diversion levels are used to "post-process" volumes within the travel demand model. These post-processed volumes can be used to approximate the overall diversion levels identified in the revenue forecasts.[9] As a result, the transportation measures of effectiveness (MOE) are representative of the revenue forecast volumes, unless noted otherwise.

Measures of Effectiveness

Tolling proposals were evaluated against their stated objectives by calculating performance values from model outputs. These MOEs for the pricing proposals were documented in Task 3.3 Memorandum. Other MOEs (system effectiveness, accident rates, and air emissions) were added after the Task 3.3 Memorandum was completed. Some MOEs are specific to the NW Cornelius Pass Road or OR 217 pricing proposal.

TABLE 4: ASSESSMENT MEASURES OF EFFECTIVENESS

Category	Measures of Effectiveness
General Transportation	Traffic volume (autos and trucks reported separately)
	Traffic speed and reliability
	Traffic delay
	Traffic congestion (demand / capacity ratio)
	System effectiveness (e.g., vehicle miles traveled [VMT], vehicle hours traveled [VHT])
	Safety (crash rates)
	Air emissions
General Economic	Estimated cost to construct and maintain (annualized)
	Estimated annual operating costs
	Estimated annual toll revenue
	Estimated net revenue available for safety improvements
	Regional economic impact assessment
OR 217 Ramp Pricing	Net change in traffic entering the corridor
	Change in mainline weaving conditions
	Congestion impacts on diversion routes serving non-tolled ramps
	Change in corridor travel time

Variation of Findings by Year and Time of Day

The model outputs for the two forecast years, three time-of-day periods, and four tolling scenarios were reviewed in detail to identify the most significant conditions to consider for screening-level purposes. Based on this review, the 2035 PM period was identified as the most significant time period because it has the most impacts compared to the no toll scenario. The review also found that the 2012 AM or Mid-day scenarios generally follow similar patterns to the 2035 PM scenario across different toll levels.

All PM volumes and results are identified for the 2-hour PM peak period (4-6 PM). AM and Mid-day volumes are identified for the 2-hour AM peak period (7-9 AM) and the 1-hour Mid-day peak (12-1 PM),

[9] All Metro model scenarios for high toll levels depict 100 percent diversion. Comparing differences in link volumes from the high toll scenarios to other scenarios allows the diversion level (represented by the difference in link volume) to be scaled (down from 100 percent) to the targeted level.

respectively. For some measures of effectiveness, a daily estimate is made. In these cases the AM, Mid-day and PM model outputs are factored and combined, based on methodology identified in a previous ODOT study.[10]

Public Attitude Research Methods

The attitudes of the public toward the two congestion pricing project proposals were measured following surveys conducted by phone and at focus groups. The phone surveys covered questions about demographics, commuting habits, perceived corridor issues, priorities, experience with tolls, and general attitudes towards tolling. The focus groups met for OR 217 only, with topics centered on experiences with OR 217, benefits and downsides to tolling (in general), and views on an OR 217 tolling proposal. The surveys and focus groups were conducted in September and October 2010.

The phone surveys were designed to focus on potential users of the project proposals. The methodology included random digit dialing of targeted populations, with quotas for age and gender. The NW Cornelius Pass Road project survey sample covered communities in Columbia and Multnomah Counties (Burlington/Linnton; Rainier/Prescott; St. Helens/Deer Island; Scappoose; Warren), Washington County (unincorporated Washington County near NW Cornelius Pass Road), and Washington State (Longview and Kelso.) The OR 217 phone surveys covered Metro-area populations (Multnomah, Washington, and Clackamas Counties). The total sample size was 300 for each phone survey, with the sub-samples of 150 split between toll levels ($1 and $3 for NW Cornelius Pass Road and $0.50 and $1.00 for OR 217).

In addition to the phone survey for OR 217, three focus group meetings with business owners and residents near OR 217 were conducted October 19-20, 2010. Business owners were contacted at random from a list of businesses near OR 217. Regular and occasional users of OR 217 where contacted using random digit dialing. Quotas for ramp use, gender, and education were used to ensure a representative mix of participants. The business group focus meetings lasted 90 minutes, while the regular user and occasional user focus groups met for 2 hours.

The methodology and results of the analysis are detailed in the Congestion Pricing Survey Reports.[11,12] Results from the phone surveys and focus groups are summarized in the sections of this report that describe findings for each of the proposed projects.

[10] ODOT Region 1 Hours of Congestion, DKS Associates, March 2010
[11] ODOT Congestion Pricing Survey (Hwy 217), DHM Research, October 2011
[12] ODOT Congestion Pricing Survey (Cornelius Pass), DHM Research, March 2011

CORNELIUS PASS ROAD PRICING PROPOSAL FINDINGS

NW Cornelius Pass Road is an important regional route that connects US 30 in Multnomah County to US 26 near Hillsboro, in Washington County. It is a designated truck route that carries over 1,000 trucks each day. The northernmost section of NW Cornelius Pass Road, between US 30 and Skyline Boulevard, is a rural two-lane highway. There are several routes that parallel NW Cornelius Pass Road, including NW Logie Trail Road, NW Newberry Road, and NW Rocky Point Road. These parallel routes are generally narrow (18- to 20-feet wide) paved roads with little to no shoulder and a winding alignment. The amount of traffic that would be diverted away from NW Cornelius Pass Road depends on the toll rate applied. Figure 2 shows a map of NW Cornelius Pass Road and the surrounding area including parallel routes.

Proposal Objectives

The objectives of the NW Cornelius Pass Road pricing proposal are to:

- Generate toll revenues
- Apply net proceeds to fund corridor safety improvements
- Increase travel reliability on the regional route

A total of $8.3 million in safety improvement projects has been identified for NW Cornelius Pass Road.[13]

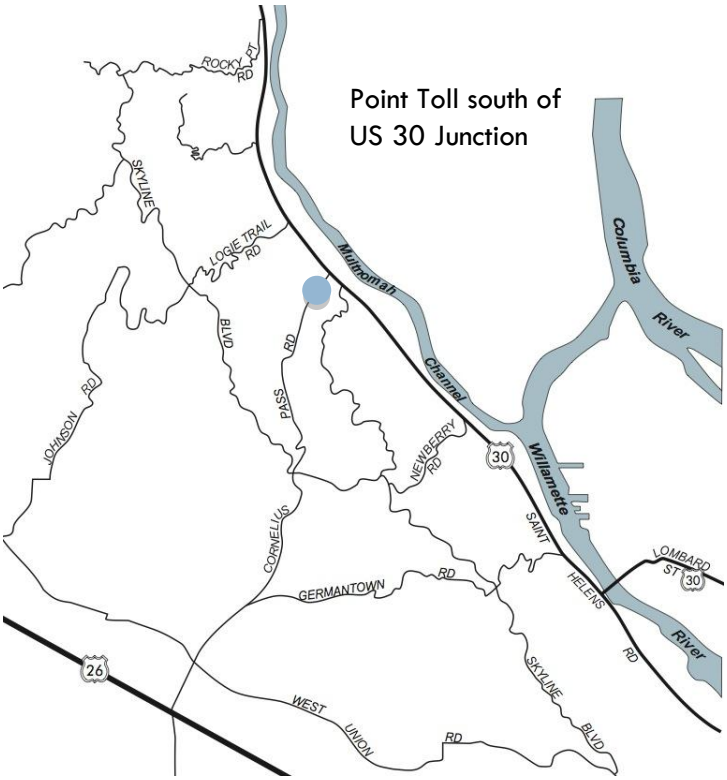

FIGURE 2: CORNELIUS PASS ROAD STUDY AREA

Summary of Findings

- Auto traffic volumes on the northern portion of NW Cornelius Pass Road decrease by 60 to 90 percent in response to tolling.
- With decreased traffic on NW Cornelius Pass Road, travel time, reliability, and congestion are improved and the route becomes more attractive to trucks (not subject to tolls).
- Potential net revenues of $3 to $6 million may be generated through 2035. Capital costs will require a minimum of five years to be recovered.
- Automobiles diverting from tolls on NW Cornelius Pass Road will use parallel rural routes, potentially resulting in dramatic increases in traffic to NW Rocky Point Road, NW Logie Trail Road, NW Newberry Road, and NW Skyline Boulevard.
- These rural routes may require significant improvements of at least $30 million to safely accommodate diversion volumes.
- Automobile diversion to longer and slower routes means overall increases in VMT, VHT and GHG emissions.

[13] Cornelius Pass Road Safety Evaluation JTA - Final Report, DKS Associates and Kittelson & Associates Inc., January 2011

- The cumulative economic impacts due to increased VMT are estimated to cost the region $40 to $65 million by 2035.
- Public does not generally support toll concept or express significant support for project objectives.
- Potential costs (to economy and for potential safety mitigations) significantly exceed potential revenues.
- Potential revenues do not cover identified priority safety needs for NW Cornelius Pass Road ($8.3 million).

Traffic Volumes

An estimated baseline volume of approximately 9,000 and 14,000 daily vehicles (including trucks) on NW Cornelius Pass Road is forecasted in 2012 and 2035, respectively. Traffic diversion under tolled conditions varies depending on the assumed toll rate. According to initial Metro model results, nearly all automobiles will divert from NW Cornelius Pass Road to parallel routes in the high toll scenario.

Initial model results for the low, medium,[14] and high toll scenarios represent automobile diversion of approximately 25 percent, 50 percent, and 100 percent, respectively. The revised diversion rates used for revenue forecasts, as shown in Table 2, identified a narrower range of diversion among the three toll levels ranging from 60 to 90 percent. Table 5 shows automobile volumes in the revenue forecasts for 2012 and 2035.

TABLE 5: AUTOMOBILE VOLUMES AT NW CORNELIUS PASS TOLL LOCATION

Toll Level	Weekday Autos 2012	Weekday Autos 2035
No Toll	8,000	9,700
Low	3,200	3,900
Medium	1,900	2,350
High	750	950

Source: Stantec

Truck volumes increase in response to reduced automobile volumes on NW Cornelius Pass Road. Though more trucks will use NW Cornelius Pass Road, far more automobiles will divert to alternative routes. Comparing the 2035 high toll scenario to the no-build scenario, an increase of 100 trucks is estimated in the PM peak period, compared to a decrease of nearly 1,200 automobiles.

Automobiles will divert onto NW Logie Trail Road, NW Newberry Road, and NW Rocky Point Road (via NW Skyline Road) to avoid the tolled segment of NW Cornelius Pass Road. Of the approximately 1,200 automobiles diverting from NW Cornelius Pass Road in the 2035 PM Peak high toll scenario, the most impacted roadway is NW Logie Trail Road (850 automobiles), followed by NW Newberry Road (150 automobiles), and NW Rocky Point Road (100 automobiles). The remaining 100 diverted vehicles are spread to other locations. Although the model identifies NW Logie Trail Road as receiving most of the diverted automobiles, the expected distribution among the three alternative routes is uncertain. The travel model does

[14] The initial medium toll scenario model indicated approximately 100 percent diversion from the toll location, resulting in little differentiation in traveler response between the high toll level ($4.00/$2.00 in peak/off-peak) and the medium toll level ($2.00/$1.00 in peak/off-peak). Therefore, an 'intermediate' scenario representing a $1.50/$0.75 toll in peak/off-peak hours was used to represent adequate sensitivity between the high and medium toll levels.

not consider the character of these roadways in terms of road quality or perceived safety. NW Logie Trail Road, in particular, has numerous sharp turns and a steep grade that may discourage some travelers from using it. A sketch-level analysis of mitigations to address the impacts of diversion volume on NW Logie Trail Road and NW Newberry Road found approximately $30 million in safety project costs.

Traffic Speed

Little change in vehicle speed is expected on NW Cornelius Pass Road as a result of tolling. Between the no toll and high toll rate scenarios for the 2035 PM period, average traffic speed increases from 29.0 mph to 29.5 mph. Other streets within the project influence area decrease from 37.8 mph to 37.0 mph on average. The project influence area, illustrated in Figure 3, represents where most significant volume changes occur. The area is generally bounded by the regional facilities (US 30, US 26) loop route formed by connections with NW Cornelius Pass Road, including local parallel routes to the east and west. As noted previously, it is possible that speed changes could be understated because the model does not specifically reflect actual operational conditions on these rural roads.

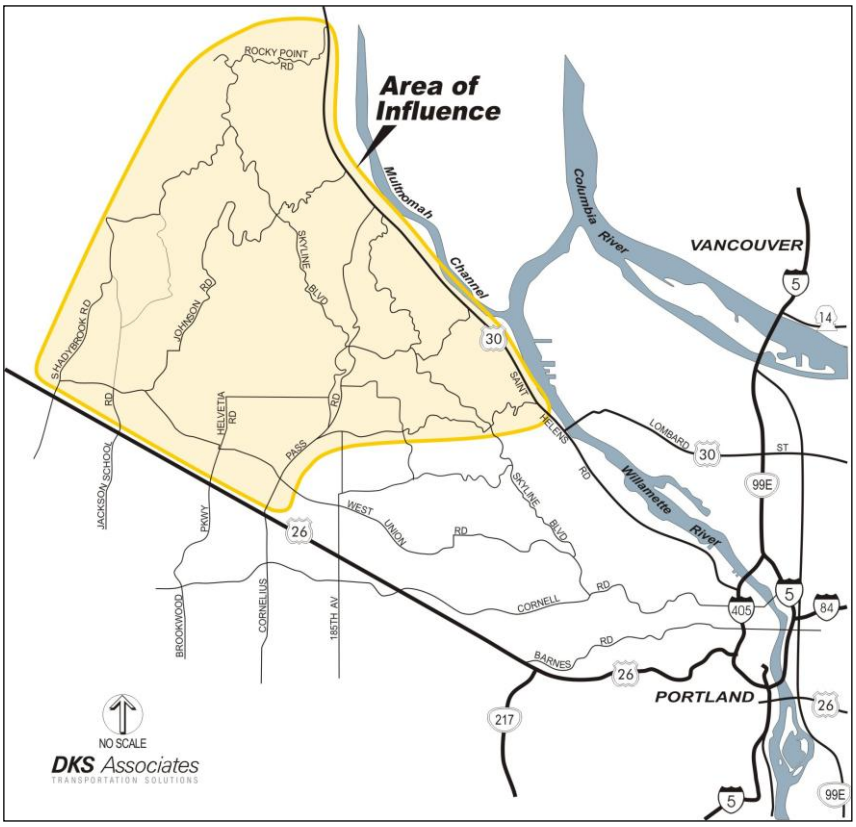

FIGURE 3: CORNELIUS PASS ROAD INFLUENCE AREA

Traffic Congestion

The impacts to traffic congestion on NW Cornelius Pass Road and other roadways within the project influence area are relatively small. The total number of lanes where demand exceeds capacity would be unchanged, even in the 2035 PM peak high toll scenario. NW Cornelius Pass Road would have 0.3 fewer lane miles without significant congestion (greater than 0.90 demand to capacity ratio), while the total congested lane miles for all other roadways in the project influence area would be unchanged. The shifts in congestion levels between the no toll and high toll scenarios are primarily between roadway segments with minor congestion (in the range of 0.80 to 0.90 demand to capacity ratio) improving to no congestion (below 0.80 demand to capacity ratio) and vice versa.

An additional measure of congestion is the total hours of congestion experienced along a roadway segment in a typical weekday. The methodology for estimating duration of congestion was identified in a previous project.[15] Congestion is defined in this analysis as being at or above 0.90 demand to capacity ratio. For the NW Cornelius Pass Road corridor, the high toll scenario has the potential to reduce the average duration of congestion by approximately 45 minutes per day in 2035 (from 5.7 to 4.9 hours per day). In 2012, the

[15] ODOT Region 1 Hours of Congestion, DKS Associates, March 2010

impacts to daily hours of congestion are not significant. These estimates reflect average impacts across the corridor; congestion at specific locations may vary significantly.

Traffic Delay

The change in total hours of delay experienced in the project influence area during the 2035 PM peak period between the no toll and high toll scenario is relatively small. PM peak period models indicate that total delay on NW Cornelius Pass Road decreases by approximately 6 percent (8 hours), while increasing on other roadways in the project influence area increases by about 1 percent (2 hours). Total delay in the project influence area is estimated to decrease by approximately 2 percent.

System Effectiveness

Using adjusted traffic volumes from the revenue forecasts, project influence area VMT and VHT increase with higher toll rates. Daily VMT for automobiles and trucks in 2035 is summarized in Table 6, which includes the change for each toll level relative to the no toll scenario. Table 7 illustrates the same information for VHT.

TABLE 6: STUDY AREA DAILY VEHICLE MILES TRAVELED (VMT) - 2035

Vehicle Type	No Build Total	Change versus No Build under Low Toll	Change versus No Build under Medium Toll	Change versus No Build under High Toll
Auto	780,000	4,500	5,500	7,000
Truck	90,000	6,000	7,500	9,000
Total	870,000	10,500	13,000	16,000

Source: DKS Associates

TABLE 7: STUDY AREA DAILY VEHICLE HOURS TRAVELED (VHT) - 2035

Vehicle Type	No Build Total	Change versus No Build under Low Toll	Change versus No Build under Medium Toll	Change versus No Build under High Toll
Auto	24,000	250	350	450
Truck	2,500	150	200	200
Total	26,500	400	550	650

Source: DKS Associates

The above tables illustrate that diverting automobiles tend to travel farther and take more time to reach their destinations than otherwise. This effect increases with diversion resulting from higher toll rates.

Increases in truck VHT are counter-intuitive since trucks are not subject to any tolls. Trucks would be expected to benefit from decreased travel time as automobiles divert from NW Cornelius Pass Road. However, as noted earlier, overall truck volumes on the corridor increase to take advantage of improved travel time. This is referred to as induced demand. Project area VHT is a function of both travel time and total volume. So while travel time may improve for individual trucks, the overall volume of trucks in the project influence may increase enough to offset travel time savings. VHT for trucks in the regional network as a whole is slightly improved as a result of auto diversion.

Safety

Changes to both accident frequency and severity were estimated from the shift of traffic volumes for specific roadway facility types across different tolling scenarios. The shift in traffic is measured via VMT changes from one facility type to another. For NW Cornelius Pass Road tolling scenarios, the shift is classified as moving volume from Principal Arterials to Minor Arterials (in suburban areas).

The accident estimates for this analysis are extracted from ODOT statewide data for overall crash rates for facility types,[16] severity for different facility types depending on location,[17] and estimated annual VMT on different facility types. While the difference in crash and severity rates is small, generally higher facility types, such as highways, will have lower crash and severity rates per mile driven than surface streets. However, these increases may be offset by reductions in overall VMT.

Overall, the aggregate change in estimated accidents is small, even in the high toll scenario, where accidents are estimated to increase 1.2 percent (three per year). The medium toll and low toll scenarios reflect a 0.4 percent increase and no change, respectively. There is no change to the estimated number of annual fatalities at any toll level.

Air Emissions

The proposed projects' effects on air emissions were analyzed using the Environmental Protection Agency's (EPA) Mobile Vehicle Emission Simulator (MOVES) software program. GHG emissions are based on output data from Metro travel demand models; these include traffic volumes, distances travelled along each roadway type, operating speeds, and traffic stream composition (proportions of each vehicle class).

Changes to GHG emissions across tolling scenarios are largely influenced by VMT and therefore frequently follow the same trend as VMT. As tolls increase, the number of longer (diverted) trips increases, which increases both daily VMT and GHG emissions. This conclusion is applicable for both 2012 and 2035. The annualized increase in emissions between the high toll and no-build scenarios will range between 500 to 2,000 metric tonnes of equivalent CO_2 from 2012 to 2035. Further details are included in the Technical Memorandum on Air Emissions.[18]

Economic Impacts

The economic analysis estimates the change in earnings, output, employment, and overall economic costs or benefits expected as a result of traffic impacts due to the proposed project. The analysis focuses on how tolling redistributes money through the regional economy and on the net economic impact to travelers from toll-related diversion. Economic costs, benefits and impacts are derived from vehicle miles and vehicle hours of travel by trip purpose and facility type. Reliability effects are based on the percentage of VMT and VHT occurring under congested conditions. All traffic impacts are derived from Metro travel demand model outputs. The methodology and results of the analysis are detailed in the Economic Analysis Technical Memorandum.[19]

The economic modeling monetizes changes in travel time, safety, reliability, environmental, and vehicle operating costs directly attributable to toll-related diversion to assess how these changes affect regional

[16] 2009 Crash Rates by Jurisdiction and Functional Classification, ODOT, 2010
[17] 2009 Crashes by Road Type, Rural and Urban, Transportation Data Section – Crash Analysis and Reporting Unit, ODOT, 2010
[18] Congestion Pricing Proposals Analysis - Greenhouse Gas Analysis Technical Memorandum, Parametrix, April 15, 2011
[19] ODOT Tolling Economic Analysis, Economic Development Research Group, March 11, 2011

earnings, output, and employment. The results closely follow the previously identified changes in VMT and VHT. The results of the economic analysis show that with increased diversion resulting from tolling, there is an increasingly negative cost to the regional economy. Despite some benefits for trucks, the overall economic impact is negative due to increased operating costs for automobiles. The results are summarized in Table 8.

TABLE 8: PRESENT VALUE OF CUMULATIVE ECONOMIC EFFECTS TO 2035 (IN 2010 MILLION $)

Economic Effect of Tolling (Cost or Benefit)	Low Toll	Medium Toll	High Toll
Annual Direct Effects (Including O&M & Toll Collection)	-$2.7	-$2.0	-$1.3
Vehicle Operating (Car)	-$17.6	-$22.5	-$26.2
Vehicle Operating (Truck)	-$4.5	-$5.7	-$6.8
Business Time & Reliability (Car)	-$4.2	-$6.4	-$8.8
Business Time & Reliability (Truck)	$0.8	$0.8	$0.8
Personal Time & Reliability (Car)	-$6.6	-$10.1	-$13.8
Safety (Car)	-$5.1	-$6.5	-$7.6
Safety (Truck)	-$0.1	-$0.2	-$0.2
Shipper/Logistics (Truck)	$0.3	$0.2	$0.2
Social/Environmental	-$1.1	-$1.4	-$1.6
TOTAL SOCIETAL ECONOMIC EFFECT	**-$40.8**	**-$53.8**	**-$65.3**

Source: EDR Group

Estimated Cost to Construct and Maintain

Implementation of tolling on NW Cornelius Pass Road would include an estimated $2.3 million in capital costs (see Table 9), which can vary widely depending upon the hardware and software specifications of the system installed. Roadway implementation costs include the construction of toll point infrastructure (plazas and overhead gantries) and the installation of electronic equipment and communication systems. This study assumed a single tolling point with a double gantry 30 feet wide over a two-lane roadway with a modest pull-off area near the gantry for maintenance. No reconstruction of the roadway is assumed, except during installation of the gantry. All tolling would be done electronically, with no cashier for toll collection.

Administrative costs for implementation include installing hardware and software for transaction processing, accounts management, traffic monitoring, billing, violations, and information storage as well as office space for associated staff. Customer service channels also would be required including website design and kiosks as appropriate. The toll policy, business rules, and violation processing procedures would all influence costs.

TABLE 9: ESTIMATED CAPITAL COSTS

Category	Cost Item	Cost Estimate
Construction Costs	Mobilization, PM, CPM	$150,000
	Gantries	$300,000
	Electrical	$100,000
	Communications	$100,000
	Civil	$300,000
	Construction Contingency (10%)	$95,000
	Subtotal	*$1,045,000*
Toll Collection System Price	Mobilization, PM, CPM	$150,000
	System Software	$350,000
	Workstations	-
	System Hardware	$50,000
	Subtotal	*$550,000*
Other Costs	Training and Documentation	$50,000
	Marketing	$50,000
	Transponders	$200,000
	Overall Contingency (20%)	$400,000
	Subtotal	*$700,000*
Total		$2,295,000

Source: Stantec[20]

Operating costs of toll schemes vary widely because some costs are lump sum, some are transaction-based, and others are revenue-based. A range of operating costs is estimated based on the low toll and high toll scenario assumptions. The estimated annual operating costs range from $126,000 to $307,000 and are summarized in Table 10. Costs include software and equipment maintenance, transaction processing, account management, customer service, and transponder issuance. These costs are net of any fees recoverable from customers such as monthly account fees and low usage charges.

TABLE 10: ESTIMATED ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Low Toll	High Toll
Software / Equip. Maintenance	$55,000	$55,000
ETC Trip Processing (1)	$240,000	$60,000
Video Trip Processing (2)	$0	$0
Credit Card Fees (2% gross revenue)	$12,000	$11,000
Total O & M Costs	$307,000	$126,000

Source: Stantec

Notes:

[20] Cornelius Pass Project Capital Costs (CAPX) and Operating Costs (OPX) – Oregon Congestion Pricing Memorandum, Stantec Corp., November 23, 2010

1. Electronic Toll Collection (ETC) processing variable by number of vehicles.

2. Fines, administrative fees, and recovered tolls are assumed to be sufficient to offset the majority of non-revenue transactions as well as the cost of violation enforcement.[21]

Estimated Toll Revenue

Toll revenues vary depending on the volume of automobiles and the toll rate. Table 11 summarizes estimated automobile volumes and annual toll revenues at different toll levels.

TABLE 11: ESTIMATED TOLL REVENUES

Toll Level	Weekday Autos - 2012	Annual Toll Revenue - 2012	Weekday Autos - 2035	Annual Toll Revenue - 2035
No Toll	8,000	0	9,700	0
Low	3,200	$610,000	3,900	$740,000
Medium	1,900	$730,000	2,350	$880,000
High	750	$550,000	950	$700,000

Source: Stantec

Estimated Net Revenue for Improvements

Net revenues are calculated based on the estimated toll revenues, operating and maintenance costs, and capital costs. Net annual revenue does not include a discount to depreciate upfront capital construction and toll system set-up costs. As shown in Table 12, between $300,000 and $500,000 in year 2012 net revenues could be generated for corridor safety improvements. Table 13 shows the estimated net revenues and overall benefit-cost ratio for each toll level for 2012-2035.

TABLE 12: ESTIMATED NET REVENUE (2012)

Toll Level	Annual Cost	Annual Toll Revenue	Potential Net Revenue
Low	$307,000	$610,000	$303,000
Medium	$220,000	$730,000	$510,000
High	$126,000	$550,000	$424,000

Source: Stantec and DKS Associates

[21] Cornelius Pass and SR 217 Projects Violation Revenues and Expenses – Oregon Congestion Pricing Memorandum, Stantec Corp., September 24, 2010

TABLE 13: ESTIMATED TOTAL NET REVENUES FOR IMPROVEMENTS TO 2035 (IN 2010 MILLION $)

Toll Level	2010 Capital Cost (1)	Present Value of Net Toll Revenues (2)	Potential Net Revenue	Benefit – Cost Ratio
Low	$2.3	$5.0	$2.7	2.2
Medium	$2.3	$8.6	$6.3	3.8
High	$2.3	$7.3	$5.0	3.2

Source: Stantec and DKS Associates

Notes:

1. Does not include borrowing costs.
2. Assumes 3.8 percent discount rate.

Public Attitude

Phone survey results generally indicate that getting public support for tolling will be a significant challenge. In general the public views congestion and safety as important issues, but tolling is not popular nor is tolling viewed as an effective method for reducing congestion and improving safety. Key findings from NW Cornelius Pass Road project phone surveys include:

- More than half of those surveyed (57 percent) already consider NW Cornelius Pass Road to be a very safe or somewhat safe roadway.
- Most survey respondents (66 to 74 percent, depending on the toll rate) somewhat oppose or strongly oppose tolling NW Cornelius Pass Road.
- Most survey respondents (74 percent) somewhat oppose or strongly oppose allowing commercial trucks to be exempt from payment of the proposed toll fees.

Conclusions

Potential net revenues of as much as $6.3 million may be realized from the NW Cornelius Pass Road pricing proposal, assuming toll operations continue through 2035. However, it would take several years to pay back financing and capital costs before there would be a net revenue gain. In addition, revenue gains may be offset by new safety needs on parallel rural routes. Major traffic diversion is expected to lessen the quality of rural routes, which may impact safety and raise livability issues. Benefits to corridor travel time and congestion are minor, as many automobiles may be able to bypass the toll before returning to NW Cornelius Pass Road via parallel routes. In addition, the decrease in automobile traffic is partially offset by an increase in truck traffic. At the regional level, the traffic diversion would result in increased air emissions and negative economic impacts estimated to be between $40 and $65 million through 2035. Because the primary objective of funding safety improvements on the corridor is not considered a priority to those polled, gaining public approval for tolling NW Cornelius Pass Road would take significant effort.

OR 217 RAMP PRICING PROPOSAL

The OR 217 Ramp Pricing proposal would place tolls on the northern portion of the freeway at three interchanges: SW Wilshire Street, SW Walker Road, and SW Denney Boulevard. The amount of traffic diverted away from OR 217 on-ramps (to the parallel surface street system and other on-ramps) would vary depending on the toll rate applied.

Proposal Objectives

The objectives of the OR 217 pricing proposal are to:

- Manage congestion on the OR 217 corridor
- Reduce merge conflicts on OR 217
- Remove or defer the need for construction of select planned capital projects
- Reduce short local trips on OR 217

Summary of Findings

- Traffic volumes on tolled on-ramps on the north portion of OR 217 decrease by 70-95% in response to tolling. Traffic diverts primarily to surface streets.
- As a result of decreased traffic on OR 217, highway travel time, reliability, and congestion is improved.
- Net potential revenues of $800,000 may be generated through 2035 in the high toll scenario. The low and medium toll scenarios would not generate positive net revenues. Capital costs require a minimum of 15 years to be recovered.
- Automobiles diverting from tolls on OR 217 use parallel surface streets, resulting in increases of approximately 3 to 7 percent on corridors such as SW Hall Boulevard, SW Allen Boulevard, SW Canyon Road, SW Cedar Hills Boulevard, SW Beaverton-Hillsdale Highway and SW Scholls Ferry Road.
- Many of these parallel routes are already congested (or forecasted to be by 2035) and may require significant mitigation improvements. The cost of mitigation for diversion is difficult to estimate, since it depends on the policy objectives of the local jurisdictions and how effectively extra capacity could be integrated into already identified long-range projects. The local cost estimate to meet growth needs is over $100 million. The cost share attributed to diversion from tolling the ramps would be some fair share of that amount.
- Automobile diversion results in overall increases in VMT, VHT and GHG emissions.
- The cumulative economic impacts due to increased VMT are estimated to cost the region $95 to $140 million by 2035.
- The public does not support the toll concept or see project objectives as a priority.
- Potential costs significantly exceed potential revenues.
- Although merge conflicts on OR 217 are reduced, the need for planned capital projects is not removed.

Traffic Volumes

Traffic volume estimates in the revenue forecasts were adjusted to reflect the high sensitivity of model outputs in response to toll levels. The auto diversion rate across toll levels in the Metro model compared to the diversion rate for (adjusted) revenue forecasts are identified in Table 3. Table 14 shows automobile volumes in the revenue forecasts for 2012 and 2035.

TABLE 14: REVENUE FORECAST AUTOMOBILE VOLUMES AT TOLLED ON-RAMPS

Toll Level	Weekday Autos - 2012	Weekday Autos - 2035
No Toll	26,000	37,700
Low	7,300	10,600
Medium	4,400	6,300
High	1,100	1,900

Source: Stantec

Automobile diversion away from tolled on-ramps varies by toll level and by time of day. Corresponding to the higher peak period toll rate, the diversion is much higher during the commute peaks. For example, diversion in the high toll scenario for 2012 is approximately 2,400 vehicles in the AM peak hour, 1,500 in the Mid-day, and 2,200 in the PM peak hour.

Most travelers diverting from tolled on-ramps do not simply exit at the next available interchange; instead, they travel via surface streets. While usage increases at non-tolled on-ramps, the effect is largely offset by off-ramp reductions from travelers who divert away from the corridor entirely. As a result, tolling the OR 217 on-ramps would remove a significant number of automobiles from the freeway without significantly increasing overall volume on non-tolled interchange ramps. Changes to total volume at non-tolled interchanges (ramp traffic only) are relatively minor across different times of day and 2035 scenarios, regardless of the fee level at tolled interchanges.

The decrease in automobile traffic at tolled locations and the fact that trucks are not subject to tolls makes truck travel more attractive. The number of trucks at tolled interchanges is expected to increase from approximately 150 to 400 in the 2035 PM peak period. However, overall motor vehicle volumes would decline at both tolled and non-tolled interchanges and on the highway as a whole.

Net Change in Traffic Entering the Corridor

In the 2035 PM peak period high toll model scenario, traffic entering OR 217 from all interchange on-ramps would decrease by approximately 4,500 vehicles (automobiles and trucks), or approximately 18 percent, compared to the no toll scenario. Tolled on-ramps (at SW Wilshire Street, SW Walker Road, and SW Denney Road interchanges) would decrease by approximately 90 percent (5,100 vehicles) in the high toll scenario PM peak period and non-tolled on-ramps would increase volume by approximately 3 percent (600 vehicles).

The increase in on-ramp traffic at non-tolled interchanges (resulting from travelers rerouting to avoid a tolled on-ramp) is small compared to the decrease at tolled interchanges, as users avoid tolled ramps and shift primarily to surface streets. This general pattern of much larger decreases on tolled on-ramps (compared to smaller increases at non-tolled on-ramps) is replicated across different times of day and horizon years. As a result, there is less traffic on OR 217, but the corridor-wide total (highway plus local streets) stays approximately the same. The magnitude of potential decrease in vehicles entering OR 217 during the PM peak period in 2012 is approximately 70 to 80 percent that of 2035.

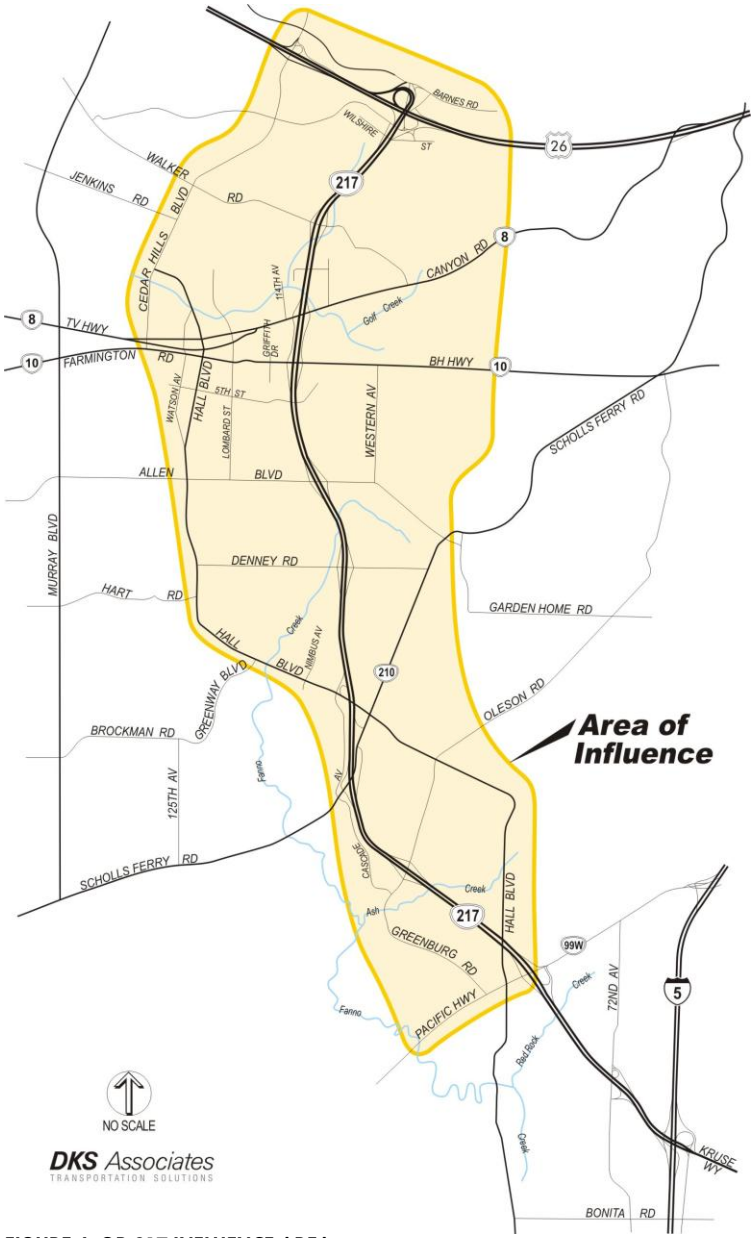

FIGURE 4: OR 217 INFLUENCE AREA

Traffic Speed

Between the no toll and high toll rate scenarios developed in the model, average traffic speed in 2035 would increase on OR 217 from approximately 27 mph to 28 mph. Speeds on surface streets within the influence area would decrease slightly (less than 1 mph) from an average of 25 mph. Figure 4 illustrates the project influence area where the most significant volume changes occur.

Corridor Travel Time

Because tolled interchange ramps cause a decrease in traffic volume on OR 217, the end-to-end travel time would improve slightly. The high toll rate scenario could reduce 2035 PM peak travel time by approximately one minute from the no-build scenario travel time of 16 minutes northbound and 20 minutes southbound. The travel time improvement would be smaller in 2012 AM and Mid-day scenarios because there would be less congestion and fewer automobiles would divert to surface streets.

Traffic Congestion

Diverting traffic away from OR 217 would increase traffic congestion on surface streets in the project influence area. Surface streets experiencing congestion (those with demand to capacity ratios greater than 0.90) would increase by 3.6 lane miles between the no toll scenario and high toll scenario in the 2035 PM peak. There is a corresponding improvement on OR 217, where 1.4 fewer lane miles (out of 170 total lane miles) would be congested. The change in traffic congestion on OR 217 is illustrated in Figure 5.

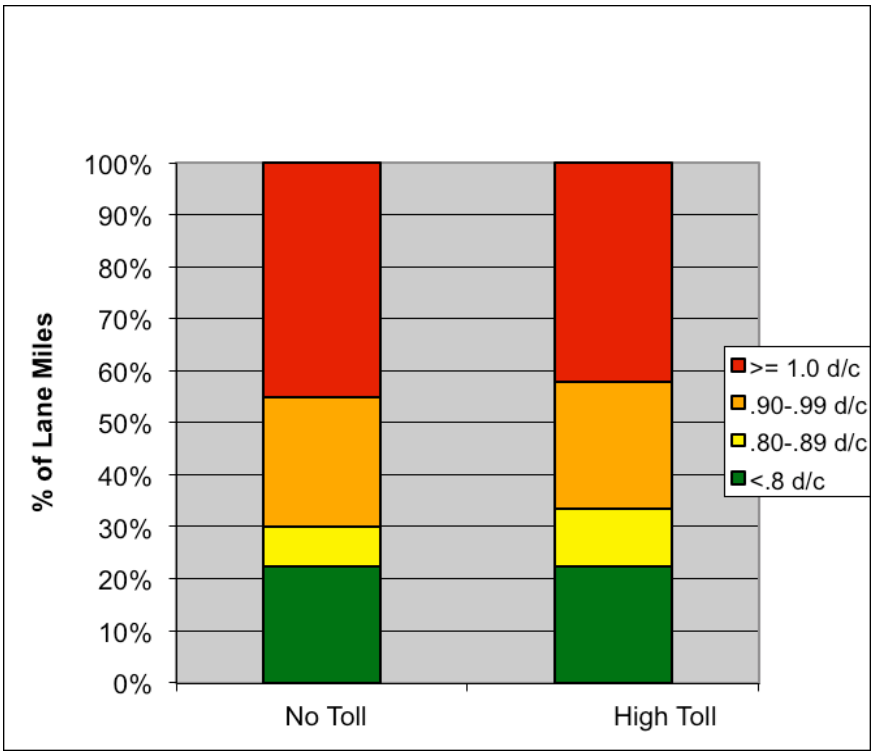

FIGURE 5: 2035 CONGESTION LEVELS ON OR 217

An additional measure of congestion (defined in this analysis as being at or above 0.90 demand to capacity ratio), is the duration of congestion experienced along the highway (i.e., total hours of the day with congested conditions). For OR 217, the no toll scenario is estimated to have an average of 5.3 hours of congestion in 2012 and 7.8 hours in 2035. The high toll scenario has the potential to reduce congestion for approximately 30 minutes per day in 2012 and 90 minutes in 2035. These estimates reflect average impacts across the corridor; congestion impacts at specific locations may vary significantly.

Traffic Delay

The total hours of delay experienced in the project influence area during the 2035 PM peak period would be relatively unchanged between the no-build and high toll scenario. Total delay on OR 217 would decrease by approximately 10 percent, with a corresponding increase of 11 percent of total delay on surface streets in the project influence area.

System Effectiveness

Using adjusted traffic volumes from the revenue forecasts, both VMT and VHT would increase with higher toll rates. Daily VMT for automobiles and trucks in 2035, summarized in Table 15, includes the change for each toll level relative to the no toll scenario. Table 16 illustrates the same for VHT. The totals are for the full Metro model area because the previously identified project influence area does not fully capture all significant VMT and VHT impacts.

TABLE 15: REGIONAL DAILY VEHICLE MILES TRAVELED (VMT) - 2035

Vehicle Type	No Build Total	Change versus No Build under Low Toll	Change versus No Build under Medium Toll	Change versus No Build under High Toll
Auto	66,700,000	10,600	12,000	13,700
Truck	3,400,000	-550	-650	-700
Total	70,100,000	10,050	11,350	13,000

Source: DKS Associates

TABLE 16: REGIONAL DAILY VEHICLE HOURS TRAVELED (VHT) - 2035

Vehicle Type	No Build Total	Change versus No Build under Low Toll	Change versus No Build under Medium Toll	Change versus No Build under High Toll
Auto	2,410,000	730	980	1,290
Truck	95,500	-20	-25	-30
Total	2,505,500	710	955	1,260

Source: DKS Associates

The two tables illustrate that diverting automobiles travel farther and take more time to reach their destinations. This effect increases with increased diversion from higher toll rates. In contrast, truck VHT and VMT decrease; as trucks are not subject to any tolls and benefit from decreased travel time and more direct travel as automobiles divert from OR 217. The VMT and VHT savings for trucks is much smaller than the corresponding VMT and VHT increase for automobiles. Overall, total VMT and VHT increase significantly with the OR 217 pricing proposal.

Safety

Changes to both accident frequency and severity were estimated from the shift of traffic volumes for specific roadway facility types across different tolling scenarios. The shift in traffic is measured via VMT changes from one facility type to another. For OR 217 tolling scenarios, the shift is classified as moving volume from Freeways to Non-Freeways (in urban areas).

The accident estimates for this analysis are extracted from ODOT statewide data for overall crash rates for facility types,[22] severity for different facility types depending on location,[23] and estimated annual VMT on different facility types. While the difference in crash and severity rates is small, in general facility types such as limited access highways will have lower crash and severity rates per mile driven than surface streets. However, these increases may be offset by reductions in overall VMT.

Overall, the change in estimated accidents is small, even in the high toll scenario, where an increase of 1.5 percent of total accidents is estimated (18 additional accidents in a year). The medium toll and low toll scenarios reflect smaller increases. There is no change to the estimated number of annual fatalities at any toll level.

[22] 2009 Crash Rates By Jurisdiction and Functional Classification, ODOT, 2010
[23] 2009 Crashes by Road Type, Rural and Urban, Transportation Data Section – Crash Analysis and Reporting Unit, ODOT, 2010

Mainline Weaving at On-Ramps

Changes in traffic volumes entering the on-ramps would affect congestion. Table 17 and 18 summarize the level of service (LOS) for weaving sections on OR 217 in the southbound and northbound sections, respectively. The tolling scenarios would improve weaving operations, but the improvements would be modest, even in the high toll scenario. The weaving analysis assumes existing geometry and therefore does not include the planned construction of braided ramps between SW Canyon Road and SW Allen Boulevard.

TABLE 17 – WEAVING LEVEL OF SERVICE ON OR 217 SOUTHBOUND

Weaving Section	Existing	2012			2035		
		No Toll	Low Toll	High Toll	No Toll	Low Toll	High Toll
Wilshire to Walker	C	D	D	C	F	E	D
Walker to BH/Canyon	D	F	E	C	F	F	E
BH/Canyon to Allen	E	F	F	F	F	F	F
Allen to Denney	E	F	F	F	F	F	F
Denney to Hall	C	E	D	D	E	E	E

Source: DKS Associates

TABLE 18 – WEAVING LEVEL OF SERVICE ON OR 217 NORTHBOUND

Weaving Section	Existing	2012			2035		
		No Toll	Low Toll	High Toll	No Toll	Low Toll	High Toll
BH/Canyon to Walker	E	F	F	F	F	F	F
Allen to BH/Canyon	D	D	D	D	F	F	E
Denney to Allen	D	E	D	C	F	F	D

Source: DKS Associates

Air Emissions

An analysis of the proposed project effects on air emissions was conducted using the EPA's Mobile Vehicle Emission Simulator (MOVES) software program. The estimated GHG emissions are based on output data from Metro travel demand models, including traffic volumes, distances travelled along each roadway type, operating speeds, and traffic stream composition (proportions of each vehicle class).

Changes to GHG emissions across tolling scenarios are largely influenced by VMT and therefore they frequently follow the same trend. As tolls increase, the number of longer (diverted) trips increases, which increases both daily VMT and GHG emissions. This conclusion is applicable for both 2012 and 2035. The annualized increase in emissions between the high toll and no-build scenarios will range between 1,500 to 2,000 metric tonnes of equivalent CO_2 from 2012 to 2035. Further details are included in the Technical Memorandum on Air Emissions.[24]

[24] Congestion Pricing Proposals Analysis - Greenhouse Gas Analysis Technical Memorandum, Parametrix, April 15, 2011

Economic Impacts

The economic analysis estimates the expected change in earnings, output, employment, and overall economic costs or benefits resulting from traffic impacts due to the proposed project. The analysis focuses on how tolling redistributes money through the regional economy and the net economic impacts travelers from toll-related diversion. Economic costs, benefits, and impacts are derived from vehicle miles and vehicle hours of travel by trip purpose and facility type. Reliability effects are based on the percentage of VMT and VHT occurring under congested conditions. All traffic impacts are derived from Metro travel demand model outputs. The methodology and results of the analysis are detailed in the Economic Analysis Technical Memorandum.[25]

The economic modeling monetizes changes in travel time, safety, reliability, environmental, and vehicle operating costs directly attributable to toll-related diversion to assess how these changes affect regional earnings, output, and employment. The results closely follow the previously identified changes in VMT and VHT. The economic analysis shows that, with increased diversion from tolling, there would be an increasingly negative cost to the regional economy. Despite some benefits for trucks, the overall economic impact would be negative due to increased costs for automobiles, particularly for vehicle operating costs. The results are summarized in Table 19.

TABLE 19: PRESENT VALUE OF CUMULATIVE ECONOMIC EFFECTS TO 2035 (IN 2010 MILLION $)

Economic Effect of Tolling (Cost or Benefit)	Low Toll	Medium Toll	High Toll
Annual Direct Effects (Including O&M & Toll Collection)	-$12.00	-$7.60	-$2.90
Vehicle Operating (Car)	-$21.30	-$24.20	-$27.50
Vehicle Operating (Truck)	$2.3	$2.7	$3.1
Business Time & Reliability (Car)	-$23.7	-$31.7	-$41.7
Business Time & Reliability (Truck)	$2.7	$3.2	$3.8
Personal Time & Reliability (Car)	-$37.3	-$49.9	-$65.5
Safety (Car)	-$6.2	-$7.0	-$7.9
Safety (Truck)	$0.3	$0.4	$0.4
Shipper/Logistics (Truck)	$0.9	$1.0	$1.2
Social/Environmental	-$0.9	-$1.0	-$1.2
TOTAL SOCIETAL ECONOMIC EFFECT	**-$95.2**	**-$114.10**	**-$138.2**

Source: EDR Group

Estimated Cost to Construct and Maintain

Implementation of OR 217 tolling would include $4.1 million of capital costs (see Table 20), based on experience with other toll facilities. Toll system implementation costs can vary widely depending on hardware and software specifications. Roadway implementation costs include the construction of toll point infrastructure (plazas and overhead gantries), electronic equipment, and communication systems. The estimated costs assume three tolled interchanges, each with a 20-foot-wide gantry over a single lane at each freeway on-ramp. Each gantry would include a modest pull-off area nearby for maintenance. No reconstruction of the roadway is assumed, except during installation of the gantry. All tolling will be conducted electronically, with no cashier for toll collection.

[25] ODOT Tolling Economic Analysis, Economic Development Research Group, March 11, 2011

Administrative costs for implementation includes installing hardware and software for transaction processing, accounts management, traffic monitoring, billing, violations, and information storage as well as office space for associated staff. Customer service channels also would be required, including website design and kiosks as appropriate. The toll policy, business rules, and violation processing procedures would all influence costs. As most of the capital costs are estimated as lump sums, the increased costs for tolling additional interchanges would be marginal. For example, tolling five interchanges would increase capital costs from $4.1 million to approximately $4.6 million.

TABLE 20: ESTIMATED CAPITAL COSTS

Category	Cost Item	Cost Estimate
Construction Costs	Mobilization, PM, CPM	$150,000
	Gantries	$600,000
	Electrical	$300,000
	Communications	$300,000
	Civil	$900,000
	Construction Contingency (10%)	$225,000
	Subtotal	*$2,475,000*
Toll Collection System Price	Mobilization, PM, CPM	$150,000
	System Software	$350,000
	Workstations	-
	System Hardware	$150,000
	Subtotal	*$650,000*
Other Costs	Training and Documentation	$50,000
	Marketing	$50,000
	Transponders	$500,000
	Contingencies	$400,000
	Subtotal	*$1,000,000*
Total		$4,125,000

Source: Stantec

The operating costs of toll schemes vary widely because some costs are lump sum, some are transaction-based, and others are revenue-based. A range of operating costs is estimated, based on the low toll, medium toll and high toll scenario assumptions. The annual costs are estimated to range from $150,000 to $625,000 and are summarized in Table 21. Annual operating costs include software and equipment maintenance, transaction processing, account management, customer service, and transponder issuance. These costs are net of any fees recoverable from customers such as monthly account fees and low usage charges.

TABLE 21: ESTIMATED ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Low Toll	Medium Toll	High Toll
Software / Equip. Maintenance	$65,000	$65,000	$65,000
ETC Trip Processing (1)	$549,000	$330,000	$79,000
Video Trip Processing (2)	$0	$0	$0
Credit Card Fees (2% gross revenue)	$8,000	$9,000	$9,000
Total O & M Costs	**$622,000**	**$404,000**	**$153,000**

Source: Stantec

Notes:

1. Electronic Toll Collection (ETC) processing variable by number of vehicles.

2. Fines, administrative fees, and recovered tolls are assumed to be sufficient to offset the majority of non-revenue transactions as well as the cost of violation enforcement.[26]

Estimated Toll Revenue

Toll revenues vary depending on the estimated volume of automobiles and the toll rate assumed. Table 22 summarizes the annual toll revenues and automobile volumes estimated at different toll levels.

TABLE 22: ESTIMATED TOLL REVENUES

Toll Level	Weekday Autos - 2012	Annual Toll Revenue - 2012	Weekday Autos - 2035	Annual Toll Revenue - 2035
No Toll	14,000	0	37,700	0
Low	7,500	$410,000	10,600	$570,000
Medium	4,500	$450,000	6,300	$620,000
High	1,000	$445,000	1,900	$745,000

Source: Stantec

Estimated Net Revenue For Improvements

Estimates of net revenues are based on the estimated toll revenues, operating and maintenance costs, and capital costs. Net annual revenue does not include discounting to depreciate upfront capital construction and tolls system set-up costs. Up to $300,000 in net annual revenues could be generated from tolling OR 217 on-ramps at the three identified interchanges.

[26] Cornelius Pass and SR 217 Projects Violation Revenues and Expenses – Oregon Congestion Pricing Memorandum, Stantec Corp., September 24, 2010

TABLE 23: ESTIMATED NET REVENUE (2012)

Toll Level	Annual Cost	Annual Toll Revenue	Potential Net Revenue
Low	$622,000	$410,000	($212,000)
Medium	$404,000	$450,000	$46,000
High	$153,000	$445,000	$292,000

Source: Stantec and DKS Associates

TABLE 24: ESTIMATED TOTAL NET REVENUES FOR IMPROVEMENTS TO 2035 (IN 2010 MILLION $)

Toll Level	2010 Capital Cost (1)	Present Value of Net Toll Revenues (2)	Potential Net Revenue	Benefit – Cost Ratio
Low	$4.1	($9.7)	($13.9)	(2.4)
Medium	$4.1	($2.7)	($6.8)	(0.7)
High	$4.1	$4.9	$0.8	1.2

Source: Stantec and DKS Associates

Notes:

1. Does not include borrowing costs.
2. Assumes 3.8 percent annual discount rate.

Public Attitude

Phone survey and focus group results generally indicate that getting public support for tolling will be a significant challenge. Although in general the public views congestion as an important issue, tolling is not considered a popular or effective solution. Key findings from OR 217 project phone surveys and focus groups include:

- The public wants a balanced transportation system. In a budgeting exercise, the public identified maintenance, repair, and reconstruction of existing streets (23 percent) and bridges (23 percent) as approximately equal in significance to reducing congestion (22 percent), with improvements for public transit service (19 percent) and pedestrian and bicycle access (14 percent) similarly significant.
- Most survey respondents (58 to 61 percent depending on the toll rate) somewhat oppose or strongly oppose the proposed tolling project.
- Of those who oppose tolling, most (66 percent) would continue to oppose tolling even if it was the only way to fund improvements for OR 217.
- Focus group participants (with business or residences near OR 217) were much more supportive of tolling if revenues were used to fund roadway improvements adjacent to OR 217 (37 percent support) and not just on OR 217 (18 percent support). However, many respondents (40 to 52 percent) were not influenced by the location of potential projects funded by tolling.

Conclusions

At the low and medium toll levels, the OR 217 pricing proposal would not generate sufficient revenue to offset capital costs over the 23-year lifespan of the project. At the high toll level, potential net revenues of up to $800,000 may be generated. However, it would take at least 15 years of revenue before financing and capital costs could be paid back.

Tolling at any level would result in a significant diversion of automobiles away from OR 217. That diversion would result in benefits to travel along OR 217, including reduced travel time, less congestion, and fewer accidents. Travel time savings resulting from the proposal would favor longer-distance travelers (e.g., vehicles traveling the entire length of the OR 217 corridor) and trucks (not subject to any tolls).

The benefits to OR 217 travel are offset by impacts to surface streets, onto which most vehicles diverting from tolled on-ramps would reroute. Parallel surface routes would experience higher volumes, increased congestion, and more accidents. Traffic diversion to parallel surface street route may also raise economic and livability issues in the project influence area.

Overall, when considering both OR 217 and the surrounding surface streets, the OR 217 pricing proposal would increase travel time and total distance traveled for the transportation system. Traffic diversion would result in increased VMT and VHT for the transportation system. Regional air emissions are estimated to increase and negative economic impacts are expected to be between $95 and $140 million through 2035.

While additional capacity improvements to the surface street system could potentially accommodate the additional vehicle demand, the estimated revenue generated from the pricing proposal is unlikely to be large enough to fund projects that return the surface system performance back to no-build conditions. Furthermore, the public does not approve of tolling and is skeptical about the effectiveness of this tolling project to be a solution to transportation issues in the area.

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