

REVISED DRAFT

*I-5 Columbia River Crossing Partnership:
Traffic and Tolling Analysis*

Evaluation of I-5 Tolling Alternatives

Working Paper 11.1

Prepared by

Vollmer Associates

Date

Revised Draft January 27, 2005

TABLE OF CONTENTS

	Page
OVERVIEW	1
APPROACH AND ASSUMPTIONS	1
2020 TRAFFIC CHARACTERISTICS	1
TOLL I-5 ONLY SCENARIO	1
TOLL I-5 AND I-205 SCENARIO.....	3
IMPACTS ON ETC MARKET SHARE AND HOV3+ UTILIZATION.....	5
TRAFFIC AND REVENUE STREAM IMPACTS FOR VARIOUS GROWTH RATES	6
TRAFFIC AND REVENUE STREAM IMPACTS FOR VARIOUS TOLL RATES	6
TOLL I-5 ONLY SCENARIO	6
TOLL I-5 AND I-205 SCENARIO.....	9
ELASTICITY.....	12
GROSS AND NET REVENUES	13
CONCLUSION	15

List of Tables

	Page
Table 1. Toll I-5 Only Scenario - \$2.00 Base Toll Each Way	2
Table 2. Toll I-5 Only Scenario - Period Breakdown - \$2.00 Base Toll	3
Table 3. Toll I-5 and I-205 Scenario - \$2.00 Base Toll	3
Table 4. Toll I-5 and I-205 Scenario - Period Breakdown - \$2.00 Base Toll	5
Table 5. Growth Rate Sensitivity - \$2.00 Base Toll	6
Table 6. Toll I-5 Only Scenario - Traffic and Revenue Stream - \$2.00 Base Toll	7
Table 7. Toll I-5 Only Scenario - Traffic and Revenue Stream - \$3.00 Base Toll	8
Table 8. Toll I-5 Only Scenario - Traffic and Revenue Stream - \$4.00 Base Toll	9
Table 9. Toll I-5 and I-205 Scenario - Traffic and Revenue Stream - \$2.00 Base Toll	10
Table 10. Toll I-5 and I-205 Scenario - Traffic and Revenue Stream - \$3.00 Base Toll	11
Table 11. Toll I-5 and I-205 Scenario - Traffic and Revenue Stream - \$4.00 Base Toll	12
Table 12. Net Revenue	14

OVERVIEW

The purpose of this Working Paper (WP) is to evaluate the impacts of toll rate structures and toll system options on:

- traffic volumes and traffic diversions
- elasticity of differing toll rates
- gross and net revenues

APPROACH AND ASSUMPTIONS

As summarized in WP 10.2, output from Metro's Emme/2 travel demand model was used to estimate future traffic volumes on the Columbia River Crossings. Various tolling alternatives were screened and two alternatives were analyzed and presented in WP 10.2. The first alternative, the Toll I-5 Only Scenario, assumed that tolls would be incurred in both directions of I-5. The second alternative, the Toll I-5 and I-205 Scenario, assumed that tolls would be placed on both I-5 and I-205, but in one direction only.

Average weekday traffic volumes for the 2020 model year as well as a traffic and revenue stream from 2013 through 2025 were estimated and presented. This WP provides more detailed information about the 2020 model year traffic volumes and traffic diversions for the base toll rate, and also evaluates the impacts of different toll amounts on the traffic and revenue stream. The base toll rate is defined as an initial toll rate (e.g. \$2.00, \$3.00, or \$4.00) beginning in 2004 with a toll escalation rate of 3 percent increase per year for revenue projections, adjusted incrementally.

The analysis assumes electronic toll collection (ETC) customers would receive a 15 percent discount off the regular cash fare, and high occupancy vehicles (HOV) with three or more passengers (HOV3+) equipped with ETC would receive an additional 50 percent discount. In 2013, ETC market share is assumed to be about 30 percent. Over time, the ETC market share was assumed to increase to almost 65 percent in 2020. For HOV3+, the market share during the peak period would be just over 1 percent and off-peak about half that. In 2020, the daily share of HOV3+ is assumed to increase to 2 percent.

2020 TRAFFIC CHARACTERISTICS

This portion of the WP focuses on the traffic characteristics of toll-free and tolled vehicle volumes on a daily basis as well as by period of the day. Passenger vehicles and trucks are considered separately and in combination. The first section focuses on the Toll I-5 Only Scenario (tolling I-5 both directions) followed by the Toll I-5 and I-205 Scenario (tolling in one direction only).

Toll I-5 Only Scenario

Under this tolling scenario, I-5 is tolled at a \$2.00 base rate in two directions and I-205 is left as a toll-free alternative. Projected 2020 traffic volumes are shown in Table 1. As detailed in WP 10.2, origin-destination pairs and their toll-free bridge use distribution as forecast from the travel demand model were used as a surrogate for travel time savings in determining which trips would use the tolled facilities.

Comment [RD1]: This section is too brief. It should at the least remind the reader that the basic question this work is seeking to answer is: Is tolling a feasible financing strategy worthy of further study during the DEIS.

Comment [RD2]: On page 5 the ETC percentage is stated to be 63% - this needs to be consistent

Comment [RD3]: This forces the reader to refer back to WP 10.2 Should these be one paper?

Table 1. Toll I-5 Only Scenario - \$2.00 Base Toll Each Way

2020 Traffic Volumes	I-5			I-205			Total River Crossing		
	Pass Car	Truck	Total	Pass Car	Truck	Total	Pass Car	Truck	Total
FORECAST CONDITION									
No Build Toll Free	124,800	15,600	140,400	145,400	9,800	155,200	270,200	25,400	295,600
Build Toll Free	162,100	16,500	178,600	126,500	9,600	136,100	288,600	26,100	314,700
Build Tolloed	120,500	10,900	131,400	153,200	14,000	167,200	273,700	24,900	298,600
PERCENTAGE CHANGE									
No-Build to Build Toll-Free	29.9%	5.8%	27.2%	-13.0%	-2.0%	-12.3%	6.8%	2.8%	6.5%
Build Toll-Free to Build Tolloed	-25.7%	-33.9%	-26.4%	21.1%	45.8%	22.9%	-5.2%	-4.6%	-5.1%

The No-Build scenario describes what is expected to happen in the year 2020 if the Region builds only the currently funded projects. The currently funded projects include the recently completed Interstate Max light rail line from the Rose Garden to the Expo Center in Portland; widening of I-5 to three lanes in each direction between 99th and Main in Vancouver; and other transit and highway projects outside the I-5 Corridor that have funding for construction over the next several years.

The Build scenario, assumed to be opened in 2013, would add vehicle capacity on I-5 across the Columbia River. With the additional vehicle-carrying capacity, average weekday traffic crossing the Columbia River is expected to increase by about 6.5 percent over No-Build conditions for the 2020 model. I-5 traffic would increase by about 27 percent while the traffic on I-205 crossing would decrease by just over 12 percent in the toll-free condition.

In 2020, the total river crossing would consist of about 91 percent passenger cars and 8 percent trucks in both the No-Build and Build toll-free conditions as well as in the Build Tolloed condition. Looking more closely at the I-5 river crossing, the No-Build condition projects 89 percent passenger cars and 11 percent trucks. When additional capacity is added, the share of passenger cars would increase to just under 91 percent in the toll-free condition.

When I-5 is tolled in both directions, overall traffic on I-5 would decrease by 26.4 percent, while traffic on I-205 would increase by almost 23 percent. The overall river crossing volumes would decrease by approximately 5 percent (16,100 vehicles), due to the consolidation and/or elimination of the trips that neither want to pay the toll on I-5 nor want to divert to I-205. The tolled passenger car share would increase to about 92 percent since commercial vehicles operate on very tight profit margins and are more sensitive to paying tolls. Truck traffic on I-5 would decrease by 34 percent when tolls are applied.

The impact of tolling would vary by time period, as shown in Table 2. As detailed in WP 10.2, the tolling model assumed that peak period trips were less likely to divert than the off-peak trips, and therefore, a 50 percent diversion reduction factor was applied. The result is that the AM and PM peak periods have a lower diversion (between 15 and 20 percent for passenger car trips) than the off-peak passenger car trips whose diversion rates are about 35 percent. The truck tolling reduction was between 32 and 35 percent during all time periods of travel.

Comment [RD4]: This entire page is poorly written. It appears the modeling data indicates three things about tolling I-5 alone:
 1. Added capacity appears to draw trips from I-205 to I-5;
 2. Tolling I-5 alone is diverts a significant number of trips to I-205;
 3. Tolling I-5 alone impacts auto and truck trips differently based upon time of day and the amount of toll.

The trips diverted from the tolled I-5 river crossing would either switch to I-205 or be eliminated altogether. For work and truck trips, it was assumed 15 percent of the trips that would otherwise be diverted would actually be eliminated, and for the non-work trips 30 percent would be eliminated. The net result is that overall, about 5 percent of all trips crossing the river would be eliminated, and this percentage would be relatively constant throughout different periods of the day.

Table 2. Toll I-5 Only Scenario - Period Breakdown - \$2.00 Base Toll

2020 Traffic Volumes	I-5 NB			I-5 SB			I-205 NB	I-205 SB	Total River Crossing
	Pass Car	Truck	Total	Pass Car	Truck	Total	Total	Total	
AM PEAK PERIOD									
No-Build Toll-Free	7,400	1,000	8,400	15,600	800	16,400	9,300	23,400	57,500
Build Toll-Free	9,500	1,100	10,600	22,000	950	22,950	10,200	18,100	61,850
Build Tolled	8,000	750	8,750	18,200	650	18,850	10,800	20,700	59,100
% Change with Toll	-16%	-32%	-17%	-17%	-32%	-18%	6%	14%	-4%
PM PEAK PERIOD									
No-Build Toll-Free	22,900	1,300	24,200	13,500	1,700	15,200	33,900	15,300	88,600
Build Toll-Free	32,000	1,600	33,600	17,900	1,850	19,750	26,900	15,300	95,550
Build Tolled	27,200	1,050	28,250	14,300	1,200	15,500	29,700	17,600	91,050
% Change with Toll	-15%	-34%	-16%	-20%	-35%	-22%	10%	15%	-5%
OFF-PEAK PERIOD									
No-Build Toll-Free	32,300	5,400	37,700	33,100	5,300	38,400	34,200	39,100	149,400
Build Toll-Free	38,400	5,500	43,900	42,300	5,500	47,800	32,200	33,300	157,200
Build Tolled	25,000	3,650	28,650	27,800	3,600	31,400	43,200	45,200	148,450
% Change with Toll	-35%	-34%	-35%	-34%	-35%	-34%	34%	36%	-6%
24-HOUR									
No-Build Toll-Free	62,600	7,700	70,300	62,200	7,800	70,000	77,400	77,800	295,500
Build Toll-Free	79,900	8,200	88,100	82,200	8,300	90,500	69,300	66,700	314,600
Build Tolled	60,200	5,450	65,650	60,300	5,450	65,750	83,700	83,500	298,600
% Change with Toll	-25%	-34%	-25%	-27%	-34%	-27%	21%	25%	-5%

Toll I-5 and I-205 Scenario

This section details the one-direction tolling scenario in which I-5 and I-205 are both tolled \$2.00 base rate (in 2004 dollars) in one direction. Since no free alternative would be available, motorists would not have a choice to divert; rather, trips would simply be eliminated/reduced in this alternative due to the application of the toll. This information is detailed in WP 10.2, and additional discussions for the 2020 model output are provided below in Table 3.

Table 3. Toll I-5 and I-205 Scenario - \$2.00 Base Toll

2020 Traffic Volumes	I-5			I-205			Total River Crossing		
	Pass Car	Truck	Total	Pass Car	Truck	Total	Pass Car	Truck	Total
FORECAST CONDITION									
No Build Toll-Free	124,800	15,600	140,400	145,400	9,800	155,200	270,200	25,400	295,600
Build Toll-Free	162,100	16,500	178,600	126,500	9,600	136,100	288,600	26,100	314,700
Build Tolled	150,400	15,400	165,800	117,400	9,000	126,400	267,800	24,400	292,200
PERCENTAGE CHANGE									
No-Build to Build Toll-Free	29.9%	5.8%	27.2%	-13.0%	-2.0%	-12.3%	6.8%	2.8%	6.5%
Build Toll-Free to Build Tolled	-7.2%	-6.7%	-7.2%	-7.2%	-6.3%	-7.1%	-7.2%	-6.5%	-7.1%

In 2020, the total traffic crossing the river is forecast to increase by 6.5 percent when comparing the No-Build to the Build conditions before tolls are applied. **As previously mentioned,** the additional capacity on I-5 would allow the traffic to increase by just over 27 percent overall (car volumes would increase almost 30 percent and trucks by 5.8 percent), while I-205 volumes would decrease by just over 12 percent (cars - 13 percent and trucks - 2 percent).

Comment [RD5]: If capacity is added to the I-5 corridor, projected traffic will increase 6.5% over that projected under the No Build scenario is clearer than the statement to the left.

The total river crossing would be made up of 91 percent passenger cars and 9 percent trucks in the 2020 No-Build condition, changing slightly to 92 percent passenger cars and 8 percent trucks when for the 2020 Build toll-free condition. The share of trucks on I-5 would be greater than that on I-205, and the No-Build truck percentage would be 11 percent on I-5 and 6 percent on I-205. In the Build condition, the truck share on I-5 is diluted by the large increase in passenger cars (many shifted from the I-205), and the split would be 91 percent passenger car and 9 percent truck.

When one-direction tolls are applied to both I-5 and I-205, overall traffic for the total river crossing would decrease by slightly over 7 percent (by almost 22,500 vehicles). Vehicles would not have a toll-free alternative in this option and therefore the total reduction would be higher than in the two-direction tolling alternative. Trucks and passenger cars would be reduced at similar rates since there would be no tolling benefit from using alternate routes.

As shown in Table 4, the impact of tolling would vary only slightly by time period for this tolling scenario. For convenience, some trips beginning and ending on the same side of the river now use a route that travels across both bridges, and the variation is due to the assumed elimination of these trips. A 5 percent overall reduction was applied to all trips to estimate the tolling impact, and this would not vary between peak and off-peak periods.

Table 4. Toll I-5 and I-205 Scenario - Period Breakdown - \$2.00 Base Toll

2020 Traffic Volumes	I-5 NB			I-5 SB			I-205 NB			I-205 SB			Total River Crossing
	Pass Car	Truck	Total	Pass Car	Truck	Total	Pass Car	Truck	Total	Pass Car	Truck	Total	
AM PEAK PERIOD													
No-Build Toll-Free	7,400	1,000	8,400	15,600	800	16,400	8,600	700	9,300	22,700	650	23,350	57,450
Build Toll-Free	9,500	1,100	10,600	22,000	950	22,950	9,500	750	10,250	17,500	600	18,100	61,900
Build Tolloed	8,900	1,050	9,950	20,100	900	21,000	8,300	700	9,000	16,500	550	17,050	57,000
% Change with Toll	-6%	-5%	-6%	-9%	-5%	-8%	-13%	-7%	-12%	-6%	-8%	-6%	-8%
PM PEAK PERIOD													
No-Build Toll-Free	22,900	1,300	24,200	13,500	1,700	15,200	32,800	1,100	33,900	14,200	1,100	15,300	88,600
Build Toll-Free	32,000	1,550	33,550	17,900	1,850	19,750	26,000	1,000	27,000	14,200	1,150	15,350	95,650
Build Tolloed	30,100	1,450	31,550	15,900	1,700	17,600	23,500	900	24,400	13,400	1,050	14,450	88,000
% Change with Toll	-6%	-6%	-6%	-11%	-8%	-11%	-10%	-10%	-10%	-6%	-9%	-6%	-8%
OFF-PEAK PERIOD													
No-Build Toll-Free	32,300	5,400	37,700	33,100	5,300	38,400	31,100	3,200	34,300	36,000	3,100	39,100	149,500
Build Toll-Free	38,400	5,500	43,900	42,300	5,500	47,800	29,100	3,150	32,250	30,300	3,000	33,300	157,250
Build Tolloed	36,100	5,200	41,300	39,300	5,150	44,450	27,000	2,950	29,950	28,700	2,850	31,550	147,250
% Change with Toll	-6%	-5%	-6%	-7%	-6%	-7%	-7%	-6%	-7%	-5%	-5%	-5%	-6%
24-HOUR													
No-Build Toll-Free	62,600	7,700	70,300	62,200	7,800	70,000	72,500	5,000	77,500	72,900	4,850	77,750	295,550
Build Toll-Free	79,900	8,150	88,050	82,200	8,300	90,500	64,600	4,900	69,500	62,000	4,750	66,750	314,800
Build Tolloed	75,100	7,700	82,800	75,300	7,750	83,050	58,800	4,550	63,350	58,600	4,450	63,050	292,250
% Change with Toll	-6%	-6%	-6%	-8%	-7%	-8%	-9%	-7%	-9%	-5%	-6%	-6%	-7%

Impacts on ETC Market Share and HOV3+ Utilization

Preliminary analysis shows minimal impact on ETC market share and HOV3+ utilization when comparing the two tolling scenarios. For this analysis, assumptions were provided that allowed 15 percent toll discounts for ETC customers off the regular cash fare, and an additional 50 percent discounts for HOV3+ users that use ETC. In 2013, ETC market share is assumed to be about 27 to 29 percent for the 24-hour period, with slightly higher market shares during the peak periods (30 to 31 percent). The market shares increase over time due to user benefits, and in 2020 the market share is assumed to be about 63 percent for the 24-hour period and 65 percent during the peaks.

Comment [RD6]: 65% on page 1

HOV3+ customers that are equipped with an electronic transponder would receive an additional 50 percent off of the ETC rate (a 57.5 percent discount off the regular cash fare). During the opening year, between 0.8 and 1 percent of all daily trips on tolled facilities are expected to be HOV3+ based on projections from existing HOV use. The HOV3+ share would be greatest during the peak periods at just over 1 percent and lowest during the off-peak when HOV3+ trips at approximately 0.5 percent. In 2020, the HOV3+ shares are projected to increase to a daily rate between two and 2.3 percent (up to 3.3 percent during the peaks and 1.3 percent during the off-peak periods). The increase would be due to increasing congestion and the user benefits from discounted ETC fares.

TRAFFIC AND REVENUE STREAM IMPACTS FOR VARIOUS GROWTH RATES

The base model analysis discussed up to this point has assumed that the growth rates for the 2020 model years do not change. This sensitivity discussion analyzes the revenue impact on the 2020 model year of halving and doubling the average annual growth rates.

The average annual growth rate between 2002 and the 2020 No Build is approximately 0.7 percent growth per year. Table 5 shows the estimated impact of reducing the average annual growth rate by 50 percent, to 0.35 percent, and increasing it by 50 percent, to 1.05 percent, for both tolling scenarios. The sensitivity analysis shows that a 50 percent reduction in the *rate* of growth results in close to a 10 percent reduction in revenue, while a 50 percent increase in the *rate* of growth results in close to a 10 percent increase in revenue.

Table 5. Growth Rate Sensitivity - \$2.00 Base Toll

	Toll I-5 Only Scenario			Toll I-5 and I-205 Scenario		
	I-5 AWD	I-205 AWD	Total Annual Revenue	I-5 AWD	I-205 AWD	Total Annual Revenue
Base Growth Rate: 0.7%	131,400	167,200	\$150,654,200	165,800	126,400	\$168,435,400
Reduced Growth Rate: 0.35%	123,900	156,200	\$136,784,500	154,600	117,600	\$152,431,100
Increased Growth Rate: 1.05%	139,600	179,000	\$166,909,500	175,100	134,500	\$184,401,400

AWD = Average Weekday Daily Traffic

TRAFFIC AND REVENUE STREAM IMPACTS FOR VARIOUS TOLL RATES

The base model output has focused on the 2020 model output assuming a \$2.00 base toll rate with 15 percent discount for ETC and an *additional* 50 percent discount for HOV3+. There are many permutations of toll rate structures and toll rates that can be evaluated. This portion of the WP evaluates the impact on the traffic and revenue stream of charging a \$2.00, \$3.00, or \$4.00 base toll in 2004 dollars and adjusted for a 3 percent annual inflation. The ETC discount relationships for regular ETC users and HOV3+ have not been changed for this analysis.

Toll I-5 Only Scenario

The traffic and revenue stream presented in Table 6 is the base scenario presented in WP 10.2 expanded through 2025. A \$2.00 toll is assumed in 2004 dollars, which adjusts, based on a 3 percent inflation rate applied in \$.25 increments, into an opening year toll rate of \$2.75 in 2013 and a 2025 toll rate of \$3.75. In all of these tables, the 2020 model year output is shown in bold font. During years when tolls are raised, there is a reduction in traffic to account for patrons’ reaction to the toll change.

Table 6. Toll I-5 Only Scenario - Traffic and Revenue Stream - \$2.00 Base Toll

Year	Tolled I-5 AWD Volume	Toll-Free I-205 AWD Volume	I-5 Annual Revenue	I-205 Annual Revenue	Total Annual Revenue
2002	124,000	136,000	\$ -	\$ -	\$ -
2003	124,800	137,000	\$ -	\$ -	\$ -
2004	125,600	138,000	\$ -	\$ -	\$ -
2005	126,400	139,000	\$ -	\$ -	\$ -
2006	127,300	140,000	\$ -	\$ -	\$ -
2007	128,100	141,100	\$ -	\$ -	\$ -
2008	129,000	142,100	\$ -	\$ -	\$ -
2009	129,900	143,100	\$ -	\$ -	\$ -
2010	130,800	144,200	\$ -	\$ -	\$ -
2011	131,600	145,200	\$ -	\$ -	\$ -
2012	132,600	146,300	\$ -	\$ -	\$ -
2013	127,400	157,800	\$ 127,406,700	\$ -	\$ 127,406,700
2014	128,100	158,700	\$ 127,619,600	\$ -	\$ 127,619,600
2015	129,000	159,900	\$ 127,848,400	\$ -	\$ 127,848,400
2016	129,800	161,100	\$ 128,093,400	\$ -	\$ 128,093,400
2017	128,800	163,400	\$ 138,100,100	\$ -	\$ 138,100,100
2018	131,600	163,700	\$ 140,327,400	\$ -	\$ 140,327,400
2019	132,400	165,000	\$ 140,650,000	\$ -	\$ 140,650,000
2020	131,400	167,200	\$ 150,654,200	\$ -	\$ 150,654,200
2021	134,200	167,500	\$ 153,132,200	\$ -	\$ 153,132,200
2022	133,100	169,800	\$ 163,105,500	\$ -	\$ 163,105,500
2023	136,000	170,100	\$ 165,824,200	\$ -	\$ 165,824,200
2024	136,900	171,400	\$ 166,316,300	\$ -	\$ 166,316,300
2025	135,800	173,800	\$ 176,330,900	\$ -	\$ 176,330,900

AWD = Average Weekday Daily Traffic

Table 7 shows the traffic and revenue stream when a \$3.00 base toll rate is assumed in 2004 dollars. By adjusting for inflation, the opening year (2013) toll rate would be \$4.00 and the 2025-year toll rate would be \$5.50. The opening year traffic volumes on the tolled I-5 bridge would be 5 percent lower than the base \$2.00 toll scenario, while the revenues would be about 39 percent higher. In 2025, tolled traffic would be 3.5 percent lower than the \$2.00 scenario and revenues would be 42 percent higher.

Comment [RD7]: I would suggest that there be some indication in these charts, such as an *, of the year when the tolls are increased, with a note at the base of the chart, to clarify why volumes apparently drop every few years

Comment [RD8]: Where does this number come from?

Table 7. Toll I-5 Only Scenario - Traffic and Revenue Stream - \$3.00 Base Toll

Year	Tolled I-5 AWD Volume	Toll-Free I-205 AWD Volume	I-5 Annual Revenue	I-205 Annual Revenue	Total Annual Revenue
2002	124,000	136,000	\$ -	\$ -	\$ -
2003	124,800	137,000	\$ -	\$ -	\$ -
2004	125,600	138,000	\$ -	\$ -	\$ -
2005	126,400	139,000	\$ -	\$ -	\$ -
2006	127,300	140,000	\$ -	\$ -	\$ -
2007	128,100	141,100	\$ -	\$ -	\$ -
2008	129,000	142,100	\$ -	\$ -	\$ -
2009	129,900	143,100	\$ -	\$ -	\$ -
2010	130,800	144,200	\$ -	\$ -	\$ -
2011	131,600	145,200	\$ -	\$ -	\$ -
2012	132,600	146,300	\$ -	\$ -	\$ -
2013	120,800	162,500	\$ 177,116,800	\$ -	\$ 177,116,800
2014	121,600	163,400	\$ 177,442,100	\$ -	\$ 177,442,100
2015	120,700	165,500	\$ 186,305,200	\$ -	\$ 186,305,200
2016	123,200	165,900	\$ 189,296,200	\$ -	\$ 189,296,200
2017	122,200	168,300	\$ 198,124,100	\$ -	\$ 198,124,100
2018	124,800	168,600	\$ 201,346,600	\$ -	\$ 201,346,600
2019	123,900	170,800	\$ 210,151,500	\$ -	\$ 210,151,500
2020	126,500	171,200	\$ 213,615,100	\$ -	\$ 213,615,100
2021	125,500	173,500	\$ 222,410,000	\$ -	\$ 222,410,000
2022	128,300	173,900	\$ 226,124,700	\$ -	\$ 226,124,700
2023	127,300	176,200	\$ 234,922,800	\$ -	\$ 234,922,800
2024	128,100	177,600	\$ 246,893,600	\$ -	\$ 246,893,600
2025	131,000	177,800	\$ 251,101,400	\$ -	\$ 251,101,400

AWD = Average Weekday Daily Traffic

Table 8 shows the traffic and revenue stream when a \$4.00 base toll rate is assumed in 2004 dollars. Adjusting for inflation, the opening year (2013) toll rate would be \$5.50 and the 2025 toll rate would be \$7.50. The opening year traffic volumes for the \$4.00 toll would be reduced by just over 8 percent compared to the \$2.00 base rate volumes, while the revenue increases would be just under 85 percent. In 2025, tolled traffic would be 8.2 percent lower than the \$2.00 scenario and revenues would be 85 percent higher.

Table 8. Toll I-5 Only Scenario - Traffic and Revenue Stream - \$4.00 Base Toll

Year	Tolled I-5 AWD Volume	Toll-Free I-205 AWD Volume	I-5 Annual Revenue	I-205 Annual Revenue	Total Annual Revenue
2002	124,000	136,000	\$ -	\$ -	\$ -
2003	124,800	137,000	\$ -	\$ -	\$ -
2004	125,600	138,000	\$ -	\$ -	\$ -
2005	126,400	139,000	\$ -	\$ -	\$ -
2006	127,300	140,000	\$ -	\$ -	\$ -
2007	128,100	141,100	\$ -	\$ -	\$ -
2008	129,000	142,100	\$ -	\$ -	\$ -
2009	129,900	143,100	\$ -	\$ -	\$ -
2010	130,800	144,200	\$ -	\$ -	\$ -
2011	131,600	145,200	\$ -	\$ -	\$ -
2012	132,600	146,300	\$ -	\$ -	\$ -
2013	116,700	165,600	\$ 235,479,900	\$ -	\$ 235,479,900
2014	117,400	166,500	\$ 235,924,300	\$ -	\$ 235,924,300
2015	118,300	167,800	\$ 236,399,600	\$ -	\$ 236,399,600
2016	117,200	169,900	\$ 244,280,300	\$ -	\$ 244,280,300
2017	119,800	170,500	\$ 248,238,800	\$ -	\$ 248,238,800
2018	118,800	172,700	\$ 256,109,800	\$ -	\$ 256,109,800
2019	119,600	174,000	\$ 267,466,600	\$ -	\$ 267,466,600
2020	120,500	175,400	\$ 278,918,100	\$ -	\$ 278,918,100
2021	123,100	175,800	\$ 283,561,500	\$ -	\$ 283,561,500
2022	122,100	178,100	\$ 291,336,400	\$ -	\$ 291,336,400
2023	122,900	179,400	\$ 303,070,900	\$ -	\$ 303,070,900
2024	123,800	180,800	\$ 314,920,800	\$ -	\$ 314,920,800
2025	124,700	182,200	\$ 326,892,000	\$ -	\$ 326,892,000

AWD = Average Weekday Daily Traffic

Toll I-5 and I-205 Scenario

The traffic and revenue stream presented in Table 9 is the same as the one-direction tolling summary presented in WP 10.2 expanded through the year 2025. This scenario assumes that a \$2.00 (2004 equivalent) toll is collected in one direction on both I-5 and I-205 and there is no toll-free alternative. However, a round-trip across the bridge would cost half as much as under the Toll I-5 in Both Directions scenario. The toll collected on opening day would be \$2.75 and would increase based on a 3 percent inflation rate to \$3.75 in 2025. Total tolled traffic across the river in 2013 would be 280,400 vehicles per day, growing to 303,000 tolled daily trips in 2025. As Table 9 shows, in comparison to Table 6, collecting half the toll (but on both bridges) for a round trip actually increases total revenue because total cross-river traffic volumes are slightly higher and all traffic pays a toll.

Table 9. Toll I-5 and I-205 Scenario - Traffic and Revenue Stream - \$2.00 Base Toll

Year	Tolled I-5 AWD Volume	Tolled I-205 AWD Volume	I-5 Annual Revenue	I-205 Annual Revenue	Total Annual Revenue
2002	124,000	136,000	\$ -	\$ -	\$ -
2003	124,800	137,000	\$ -	\$ -	\$ -
2004	125,600	138,000	\$ -	\$ -	\$ -
2005	126,400	139,000	\$ -	\$ -	\$ -
2006	127,300	140,000	\$ -	\$ -	\$ -
2007	128,100	141,100	\$ -	\$ -	\$ -
2008	129,000	142,100	\$ -	\$ -	\$ -
2009	129,900	143,100	\$ -	\$ -	\$ -
2010	130,800	144,200	\$ -	\$ -	\$ -
2011	131,600	145,200	\$ -	\$ -	\$ -
2012	132,600	146,300	\$ -	\$ -	\$ -
2013	159,800	120,600	\$ 81,956,700	\$ 59,794,100	\$ 141,750,800
2014	160,800	121,200	\$ 82,140,400	\$ 59,712,600	\$ 141,853,000
2015	161,800	122,200	\$ 82,335,000	\$ 59,730,600	\$ 142,065,600
2016	162,900	123,100	\$ 82,540,600	\$ 59,750,000	\$ 142,290,600
2017	162,500	123,600	\$ 89,503,200	\$ 65,106,500	\$ 154,609,700
2018	165,200	125,100	\$ 90,529,700	\$ 65,421,800	\$ 155,951,500
2019	166,300	126,000	\$ 90,791,400	\$ 65,449,300	\$ 156,240,700
2020	165,800	126,400	\$ 97,812,900	\$ 70,622,500	\$ 168,435,400
2021	168,700	127,900	\$ 98,966,700	\$ 70,961,200	\$ 169,927,900
2022	168,200	128,300	\$ 106,024,200	\$ 76,113,400	\$ 182,137,600
2023	171,000	129,900	\$ 107,298,500	\$ 76,481,200	\$ 183,779,700
2024	172,200	130,800	\$ 107,682,200	\$ 76,514,700	\$ 184,196,900
2025	171,800	131,200	\$ 114,830,200	\$ 81,658,400	\$ 196,488,600

AWD = Average Weekday Daily Traffic

Table 10 shows the traffic and revenue stream when a \$3.00 base toll rate is assumed in 2004 dollars. The opening year (2013) toll rate would be \$4.00 and the 2025-year toll rate would be \$5.50. The opening year traffic volumes on tolled I-5 and I-205 would be 1.5 percent less than the base \$2.00 toll scenario, while the revenues would be about 43 percent higher. In 2025, tolled traffic would be 0.6 percent lower than the \$2.00 scenario and revenues would be 46 percent higher.

Table 10. Toll I-5 and I-205 Scenario - Traffic and Revenue Stream - \$3.00 Base Toll

Year	Tolled I-5 AWD Volume	Tolled I-205 AWD Volume	I-5 Annual Revenue	I-205 Annual Revenue	Total Annual Revenue
2002	124,000	136,000	\$ -	\$ -	\$ -
2003	124,800	137,000	\$ -	\$ -	\$ -
2004	125,600	138,000	\$ -	\$ -	\$ -
2005	126,400	139,000	\$ -	\$ -	\$ -
2006	127,300	140,000	\$ -	\$ -	\$ -
2007	128,100	141,100	\$ -	\$ -	\$ -
2008	129,000	142,100	\$ -	\$ -	\$ -
2009	129,900	143,100	\$ -	\$ -	\$ -
2010	130,800	144,200	\$ -	\$ -	\$ -
2011	131,600	145,200	\$ -	\$ -	\$ -
2012	132,600	146,300	\$ -	\$ -	\$ -
2013	157,600	119,000	\$ 117,641,200	\$ 85,828,900	\$ 203,470,100
2014	158,700	119,600	\$ 117,904,900	\$ 85,711,700	\$ 203,616,600
2015	158,200	120,000	\$ 124,482,900	\$ 90,691,800	\$ 215,174,700
2016	160,900	121,500	\$ 125,884,200	\$ 91,125,800	\$ 217,010,000
2017	160,400	121,900	\$ 132,488,300	\$ 96,374,800	\$ 228,863,100
2018	163,100	123,400	\$ 134,007,800	\$ 96,841,500	\$ 230,849,300
2019	162,600	123,700	\$ 140,647,100	\$ 101,813,400	\$ 242,460,500
2020	165,300	125,300	\$ 142,290,600	\$ 102,310,300	\$ 244,600,900
2021	164,900	125,600	\$ 148,974,800	\$ 107,260,300	\$ 256,235,100
2022	167,600	127,200	\$ 150,748,600	\$ 107,776,600	\$ 258,525,200
2023	167,200	127,500	\$ 157,487,300	\$ 112,715,100	\$ 270,202,400
2024	168,400	128,500	\$ 165,581,400	\$ 118,134,700	\$ 283,716,100
2025	171,200	130,100	\$ 167,609,200	\$ 118,710,000	\$ 286,319,200

AWD = Average Weekday Daily Traffic

Table 11 shows the traffic and revenue stream when a \$4.00 base toll rate is assumed in 2004 dollars. The opening year (2013) toll rate would be \$5.50 and the 2025-year toll rate would be \$7.50. The opening year traffic volumes for the \$4.00 toll would be reduced by just over 3 percent compared to the \$2.00 base rate volumes, while the revenue would increase by just under 94 percent. In 2025, tolled traffic would be about 3 percent lower than the \$2.00 scenario and revenues would be almost 94 percent higher.

Table 11. Toll I-5 and I-205 Scenario - Traffic and Revenue Stream - \$4.00 Base Toll

Year	Tolled I-5 AWD Volume	Tolled I-205 AWD Volume	I-5 Annual Revenue	I-205 Annual Revenue	Total Annual Revenue
2002	124,000	136,000	\$ -	\$ -	\$ -
2003	124,800	137,000	\$ -	\$ -	\$ -
2004	125,600	138,000	\$ -	\$ -	\$ -
2005	126,400	139,000	\$ -	\$ -	\$ -
2006	127,300	140,000	\$ -	\$ -	\$ -
2007	128,100	141,100	\$ -	\$ -	\$ -
2008	129,000	142,100	\$ -	\$ -	\$ -
2009	129,900	143,100	\$ -	\$ -	\$ -
2010	130,800	144,200	\$ -	\$ -	\$ -
2011	131,600	145,200	\$ -	\$ -	\$ -
2012	132,600	146,300	\$ -	\$ -	\$ -
2013	154,700	116,800	\$ 158,737,100	\$ 115,811,600	\$ 274,548,700
2014	155,700	117,400	\$ 159,093,000	\$ 115,653,700	\$ 274,746,700
2015	156,800	118,300	\$ 159,469,800	\$ 115,688,600	\$ 275,158,400
2016	156,300	118,600	\$ 165,691,100	\$ 120,450,200	\$ 286,141,300
2017	158,900	120,200	\$ 167,573,700	\$ 121,383,700	\$ 288,957,400
2018	158,400	120,500	\$ 173,836,200	\$ 126,151,800	\$ 299,988,000
2019	159,500	121,500	\$ 181,607,600	\$ 131,464,300	\$ 313,071,900
2020	160,700	122,400	\$ 189,448,200	\$ 136,784,600	\$ 326,232,800
2021	163,300	123,900	\$ 191,682,800	\$ 137,440,600	\$ 329,123,400
2022	162,900	124,200	\$ 198,018,100	\$ 142,154,700	\$ 340,172,800
2023	164,000	125,200	\$ 206,063,400	\$ 147,481,400	\$ 353,544,800
2024	165,200	126,100	\$ 214,192,100	\$ 152,816,200	\$ 367,008,300
2025	166,400	127,100	\$ 222,408,100	\$ 158,159,500	\$ 380,567,600

AWD = Average Weekday Daily Traffic

ELASTICITY

Elasticity, for the purposes of this study, is defined as the relationship between changes in traffic brought about by varying the toll rate.

$$e = (\text{percent change in volume}^*) \div (\text{percent change in toll}^{**})$$

* relative to the volume at the lower toll

** relative to the lower toll

The factor e represents the relative decrease in traffic corresponding to a given increase in toll. The higher the factor, which is a negative figure, the more apt the facility will be to lose traffic (i.e., diversions to competing facilities, switches in travel modes and consolidation and elimination of trips) due to increased tolls. For toll facilities:

- e values from 0 to -0.1 are relatively inelastic
- e values from -0.1 to -0.25 are considered in lower range of moderate elasticity
- e values from -0.26 to -0.4 are considered moderately elastic, but in the upper range
- e values higher than -0.4 are relatively elastic and, therefore, quite sensitive to tolls

The Toll I-5 Only Scenario (with two-direction tolls) is assumed to be relatively inelastic, with elasticity rates varying from -0.08 to -0.1. The rates vary in this scenario based on the change in the origin-destination pairs over time

The Toll I-5 and I-205 Scenario (with one-direction tolls) is assumed to be inelastic (with elasticity values assumed at -0.03), since there are no other alternatives to crossing the river but to pay a toll. (The assumptions regarding elasticity rates are based on project experience elsewhere in the country.)

GROSS AND NET REVENUES

The estimated toll revenues presented to this point represent total potential revenues collected or gross revenue. There are costs associated with toll collection in both operating and maintenance (O&M) costs. If the costs of toll collection as well as maintenance totaled 20 percent of the gross revenues, the net revenues for the \$2.00 base toll scenario would range from \$101.9 million in 2013 to \$141.1 million in 2025 for the Toll I-5 Only Scenario. The Toll I-5 and I-205 Scenario net revenues would be higher, ranging from \$113.4 million in 2013 to \$157.2 million in 2025. In this analysis, we have assumed that the violation enforcement system will gather enough revenue in fines to make up for any loss in revenue during collection.

Table 12 details the net revenue streams for both tolling scenarios using three different base toll rates. A thirty-year revenue stream has been assumed for this analysis. The average annual growth rate from 2013 through 2025 is 2.8 percent in both of the tolling scenarios. Between 2026 and 2035, a 2 percent growth rate is applied, and beyond 2035 is grown at a 1 percent rate. The model year output (2020) is shown in bold text. Emme/2 data projections were used up to 2020 with projections to 2025. Beyond 2025, the growth rates are conservative assumptions.

Toll facilities typically are required, as part of their financial analyses and in order to respond to rating agencies and insurers, to maintain a higher net revenue than the minimum amount to meet debt service obligation. The ratio of the net revenue to debt service is known as “coverage,” and is expressed as ratios, such as a 1.5X. As an example, assuming a project size in the \$1-1.5 billion range with a coverage ratio of 1.3X, the net revenue from the facility would have to provide \$110 million to \$165 million annually to pay the debt service with coverage. This analysis is extremely simplistic, as it is very rare that bonds are sold using level debt service, but rather the debt service is structured to match annual revenue levels, allowing a lower early starting toll level. For early planning studies, the level debt service review is appropriate to determine the likely future range of possible future tolls.

Comment [RD9]: This is an extremely cursory discussion of elasticity with no data to support the numbers – they have to do better than this. Could this calculation be demonstrated in a footnote so the reader can understand how they got to this conclusion?

Comment [RD10]: Is this a reasonable number based upon other programs? If “yes” then say so!

Comment [RD11]: Does this mean that the violation enforcement system will cover its costs from its own collections or make up for all revenues lost due to scofflaws?

Comment [RD12]: “X” being the debt service and coverage being 1.5 times the debt service – is this correct?

Comment [RD13]: And the reason the coverage ratio example in the last sentence was 1.5X while the coverage ratio for this \$1-1.5B project is 1.3X is...what?

Table 12. Net Revenue

Year	Toll I-5 Only Scenario			Toll I-5 and I-205 Scenario		
	\$2.00 Base Toll Net Revenue	\$3.00 Base Toll Net Revenue	\$4.00 Base Toll Net Revenue	\$2.00 Base Toll Net Revenue	\$3.00 Base Toll Net Revenue	\$4.00 Base Toll Net Revenue
2002	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2003	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2004	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2005	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2006	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2007	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2008	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2009	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2010	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2011	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2012	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2013	\$ 101,925,360	\$ 141,693,440	\$ 188,383,920	\$ 113,400,640	\$ 162,776,080	\$ 219,638,960
2014	\$ 102,095,680	\$ 141,953,680	\$ 188,739,440	\$ 113,482,400	\$ 162,893,280	\$ 219,797,360
2015	\$ 102,278,720	\$ 149,044,160	\$ 189,119,680	\$ 113,652,480	\$ 172,139,760	\$ 220,126,720
2016	\$ 102,474,720	\$ 151,436,960	\$ 195,424,240	\$ 113,832,480	\$ 173,608,000	\$ 228,913,040
2017	\$ 110,480,080	\$ 158,499,280	\$ 198,591,040	\$ 123,687,760	\$ 183,090,480	\$ 231,165,920
2018	\$ 112,261,920	\$ 161,077,280	\$ 204,887,840	\$ 124,761,200	\$ 184,679,440	\$ 239,990,400
2019	\$ 112,520,000	\$ 168,121,200	\$ 213,973,280	\$ 124,992,560	\$ 193,968,400	\$ 250,457,520
2020	\$ 120,523,360	\$ 170,892,080	\$ 223,134,480	\$ 134,748,320	\$ 195,680,720	\$ 260,986,240
2021	\$ 122,505,760	\$ 177,928,000	\$ 226,849,200	\$ 135,942,320	\$ 204,988,080	\$ 263,298,720
2022	\$ 130,484,400	\$ 180,899,760	\$ 233,069,120	\$ 145,710,080	\$ 206,820,160	\$ 272,138,240
2023	\$ 132,659,360	\$ 187,938,240	\$ 242,456,720	\$ 147,023,760	\$ 216,161,920	\$ 282,835,840
2024	\$ 133,053,040	\$ 197,514,880	\$ 251,936,640	\$ 147,357,520	\$ 226,972,880	\$ 293,606,640
2025	\$ 141,064,720	\$ 200,881,120	\$ 261,513,600	\$ 157,190,880	\$ 229,055,360	\$ 304,454,080
2026	\$ 143,886,010	\$ 204,898,742	\$ 266,743,872	\$ 160,334,700	\$ 233,636,467	\$ 310,543,162
2027	\$ 146,763,730	\$ 208,996,720	\$ 272,078,750	\$ 163,541,390	\$ 238,309,200	\$ 316,754,020
2028	\$ 149,699,000	\$ 213,176,650	\$ 277,520,330	\$ 166,812,220	\$ 243,075,380	\$ 323,089,100
2029	\$ 152,692,980	\$ 217,440,180	\$ 283,070,740	\$ 170,148,460	\$ 247,936,890	\$ 329,550,880
2030	\$ 155,746,840	\$ 221,788,980	\$ 288,732,150	\$ 173,551,430	\$ 252,895,630	\$ 336,141,900
2031	\$ 158,861,780	\$ 226,224,760	\$ 294,506,790	\$ 177,022,460	\$ 257,953,540	\$ 342,864,740
2032	\$ 162,039,020	\$ 230,749,260	\$ 300,396,930	\$ 180,562,910	\$ 263,112,610	\$ 349,722,030
2033	\$ 165,279,800	\$ 235,364,250	\$ 306,404,870	\$ 184,174,170	\$ 268,374,860	\$ 356,716,470
2034	\$ 168,585,400	\$ 240,071,540	\$ 312,532,970	\$ 187,857,650	\$ 273,742,360	\$ 363,850,800
2035	\$ 170,271,250	\$ 242,472,260	\$ 315,658,300	\$ 189,736,230	\$ 276,479,780	\$ 367,489,310
2036	\$ 171,973,960	\$ 244,896,980	\$ 318,814,880	\$ 191,633,590	\$ 279,244,580	\$ 371,164,200
2037	\$ 173,693,700	\$ 247,345,950	\$ 322,003,030	\$ 193,549,930	\$ 282,037,030	\$ 374,875,840
2038	\$ 175,430,640	\$ 249,819,410	\$ 325,223,060	\$ 195,485,430	\$ 284,857,400	\$ 378,624,600
2039	\$ 177,184,950	\$ 252,317,600	\$ 328,475,290	\$ 197,440,280	\$ 287,705,970	\$ 382,410,850
2040	\$ 178,956,800	\$ 254,840,780	\$ 331,760,040	\$ 199,414,680	\$ 290,583,030	\$ 386,234,960
2041	\$ 180,746,370	\$ 257,389,190	\$ 335,077,640	\$ 201,408,830	\$ 293,488,860	\$ 390,097,310
2042	\$ 182,553,830	\$ 259,963,080	\$ 338,428,420	\$ 203,422,920	\$ 296,423,750	\$ 393,998,280
2043	\$ 184,379,370	\$ 262,562,710	\$ 341,812,700	\$ 205,457,150	\$ 299,387,990	\$ 397,938,260

CONCLUSION

In reviewing Table 12 above, it can be seen that the net revenues for the \$2.00 base toll scenario (in 2004 dollars) would range from \$101.9 million in 2013 to \$184.4 million in 2043 for the Toll I-5 Only Scenario. This \$2.00 base toll would generate revenues in the \$1 billion to \$1.5 billion range.

For the Toll I-5 and I-205 Scenario, net revenues are somewhat higher, ranging from \$113.4 million in 2013 to \$205.5 million in 2043 with a \$2.00 base toll. Again, this toll appears to be a suitable match for the relative capital size of \$1 billion to \$1.5 billion.

The tables also indicate there is ample room to establish a higher toll rate for either scheme that is capable of generating additional net revenue, and therefore able to fund a capital program greater than the \$1 billion to \$1.5 billion noted.