

REVISED DRAFT

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

Traffic and Revenue Forecasts for Tolling Options

Working Paper 10.2

Prepared by

Vollmer Associates LLP
Parisi and Associates

DRAFT December 22, 2004

TABLE OF CONTENTS

	Page
PURPOSE	1
FORECAST TRAFFIC VOLUMES.....	1
TOLLING METHODOLOGY.....	2
SELECT LINK ANALYSIS	3
I-5 TWO-DIRECTION TOLL SCENARIO.....	5
<i>Diversion Criteria</i>	5
<i>Eliminated Trips</i>	7
I-5 AND I-205 ONE-DIRECTION TOLL SCENARIO	8
<i>Diversion Criteria</i>	8
<i>Elimination Criteria</i>	8
TOLL RATES AND VEHICLE CLASSIFICATION.....	9
<i>Toll Rates</i>	9
<i>Vehicle Classification</i>	9
FORECAST YEAR TRAFFIC AND REVENUE.....	10
<i>I-5 Two-Direction Toll Scenario</i>	10
<i>I-5 and I-205 One-Direction Toll Scenario</i>	12
INTERIM YEAR FORECAST	13
GROWTH RATES	13
TRAFFIC AND REVENUE STREAM.....	14

List of Tables

Table 1. Columbia River Bridge Two-Way Traffic Volume Projections, Toll-Free Conditions.....	2
Table 2. 2020 Build Origin/Destination Sample Output – I-5 Bridge – Work Autos – PM Four-Hour Period.....	3
Table 3. 2020 Build Superzone O/D Sample Pairs – I-5 Bridge – Work Autos – PM Four-Hour Period.....	4
Table 4. 2020 Sample Bridge Use – 2020 Build PM Four-Hour Northbound Work Trips	6
Table 5. Diverted Trip Reduction	7
Table 6. 2004 Equivalent Toll Charges	9
Table 7. Total Forecast Market Share.....	10
Table 8. I-5 Two-Direction Toll Forecast Year Traffic and Revenue	10
Table 9. Time of Day and Vehicle Classification Traffic and Revenue	11
Table 10. I-5 and I-205 One-Direction Toll Forecast Year Traffic and Revenue.....	12
Table 11. Time of Day and Vehicle Classification Traffic and Revenue	13
Table 12. I-5 Two-Direction Toll Forecast Year Traffic and Revenue	14
Table 13. I-5 and I-205 One-Direction Toll Scenario Forecast Year Traffic and Revenue.....	15

List of Figures

Figure 1. 2020 Build Select Link Origins and Destinations – I-5 Bridge - 24-Hour Weekday Total Trips – Northbound – Toll-Free	5
Figure 2. Tolled Traffic Retention.....	7
Figure 3. Tolled Traffic Retention –2020 Build PM Four-Hour Peak Work Auto Trips – Southwest to Northeast Superzones	8
Figure 4. I-5 Two-Direction Toll Scenario Annual Revenue	15
Figure 5. I-5 and I-205 One Direction Toll Scenario Annual Revenue	16

PURPOSE

The purpose of this Working Paper (WP) is to discuss the methodology and to present the results of the traffic and revenue forecasting for [the study investigating the feasibility for](#) tolling the I-5 and possibly the I-205 Columbia River Crossings. The revenue forecasts were developed based on the toll rate structure assumptions summarized in Technical Memorandum 5.5 (TM 5.5).

A detailed tolling analysis was performed using Emme/2 regional travel demand model origin/destination information as the foundation of the study. AM Peak, PM Peak, and off-peak periods were treated separately, and each of the time periods were broken down into work trips, non-work trips, and truck trips to estimate which drivers would likely pay a toll to cross the river and which would either divert or eliminate the trip.

Analyses were performed using 2002 Existing, 2020 No-Build, and 2020 Build traffic volumes to generate toll-free and then tolled traffic estimates for two different tolling scenarios. The first tolling scenario assumed that only I-5 [may be](#) tolled in both northbound and southbound directions, [leaving providing](#) a toll-free alternative route on I-205. The second tolling scenario assumed that both I-5 and I-205 [may be](#) tolled, but only in one direction – either northbound or southbound.

This WP discusses how the year 2002 river crossing volumes for I-5 and I-205, as well as the forecast year 2020 No-Build and Build conditions were used for this tolling study. The bridge origin and destination volumes for these years were used for the basis of the tolling analysis, as presented in this discussion. Interim year traffic and revenue estimates were generated in order to create a traffic and revenue stream.

FORECAST TRAFFIC VOLUMES

The first step in estimating traffic and revenue forecasts for tolling one or both of the Columbia River Crossings is to project future peak period and all day traffic volumes across both the I-5 and I-205 bridges assuming that no tolls would be applied to either bridge. As discussed later in this WP, these toll-free forecasts will be used along with select link analysis for various vehicle-trip types to estimate traffic volume shifts and tolling revenue if one or both bridges operated as toll bridges.

Metro's Emme/2 regional travel demand model was used during the Portland/Vancouver I-5 Transportation and Trade Partnership study to estimate year 2020 travel demands along I-5 and I-205 for several scenarios, including a No-Build scenario and a Build scenario. Under the No-Build condition, no additional vehicle capacity would be added across the Columbia River. For the Build condition, I-5's six lanes crossing the Columbia River [were assumed to](#) be replaced with up to 10 lanes. Various capacity and operational improvements [were](#) also [assumed to](#) be made to I-5 within the Bridge Influence Area (BIA), the segment of I-5 extending from SR 500 in Vancouver to Columbia Boulevard in Portland.

The results from the Emme/2 model were post-processed to account for differences between actual existing traffic count data and the model's prediction of existing volumes, as well as to consider the corridor's maximum carrying capacity. In some cases, the Emme/2 model predicted peak hour travel demands that could not be theoretically met based on existing or future capacity considerations. It is standard practice to conduct post-processing since travel demand models are generally developed for

regional forecasting and usually not calibrated for specific highway links. Table 1 summarizes the post-processed year 2002 and 2020 traffic volume projections.

Table 1. Columbia River Bridge Two-Way Traffic Volume Projections, Toll-Free Conditions

Scenario	Daily - Weekday			AM Peak 3 Hours - Weekday			PM Peak 4 Hours - Weekday		
	I-5	I-205	Total	I-5	I-205	Total	I-5	I-205	Total
TRAFFIC VOLUMES									
Existing (2002)	124,000	136,000	260,000	22,500	28,700	51,200	35,800	43,100	78,900
2020 No-Build	140,400	155,200	295,600	24,800	32,700	61,100	39,400	49,200	88,600
2020 Build	178,600	136,100	314,700	33,600	28,300	61,900	53,300	42,250	95,550
PERCENTAGE CHANGE									
Existing to No-Build	13%	14%	14%	10%	14%	19%	10%	14%	12%
Existing to Build	44%	0%	21%	49%	-1%	21%	49%	-2%	21%
No-Build to Build	27%	-12%	6%	35%	-13%	1%	35%	-14%	8%

As shown in Table 1, total daily volumes across both bridges are anticipated to increase by 14 percent over an 18-year period under the No-Build condition. With additional capacity across the I-5 bridge, the forecast total daily volumes across both bridges would increase about 21 percent, a 6 percent increase for Build versus No-Build. Compared to No-Build conditions, under the Build scenario, I-5's daily volumes would increase 27 percent, while I-205's daily volumes would decrease by 12 percent to the level currently experienced. In summary, the added capacity in the I-5 corridor would result in some trips shifting from I-205 to I-5.

The I-205 traffic volumes are forecast to increase at a lower growth rate from 2002 to 2020 than has been experienced over the past ten years. Between 1993 and 2003, I-205's daily volumes increased an average of 4.3 percent per year. However, between 2002 and 2020, I-205's volumes are expected to increase an average of about one percent per year. The rate of traffic growth along I-205 is likely to be lower than was experienced in the past decade because of projected shifts in land use patterns and because of peak hour capacity conditions that will be experienced on the river crossings. Nonetheless, it is possible that I-205's traffic volumes could reach over 300,000 per day before 2020, under the No-Build scenario, if actual growth exceeds an average of one percent a year and the regional travel demand model's predictions. Therefore, it should be recognized that the remaining tolling analysis could be somewhat conservative.

TOLLING METHODOLOGY

This section of the WP summarizes the steps that were taken to develop tolled traffic forecasts from the toll-free traffic volumes. Two different tolling scenarios were analyzed for this study: 1) tolling just the I-5 bridge in both directions, and 2) tolling both the I-5 and the I-205 bridges, but just in one direction. As discussed previously, the analysis is based on traffic volumes estimated for three points in time for both the I-5 and I-205 crossings; 2002 Existing, the 2020 No-Build and 2020 Build toll-free volumes. The 2020 No-Build and Build volumes were analyzed to determine the impact that tolling would have in the forecast year, and then interim year traffic and revenue were estimated based on average annual growth rates. The following sections detail this analysis.

Select Link Analysis

A select link analysis was performed for both river crossings for 2002 Existing, 2020 No-Build and Build conditions. Select link analyses identify where modeled trips using a selected roadway segment start and end. The select link analysis breaks down the trips on each bridge by the individual origin and destination (O/D) pairs using I-5 and the I-205 under toll-free conditions.

The Emme/2 travel demand model also provides trip type output, including work, non-work and truck trips. For the entire tolling study, the AM, PM, and Off-peak periods were analyzed separately by the three trip purposes since the behavior for each trip type varies. Work trips are generally made at a certain time every day, whereas non-work trips may be more flexible and can often be combined with other trips. In general, truck trips behave differently than passenger car trips since truck drivers are paid by the mile and many drivers operate under tight timeframes and even tighter profit margins.

A sample analysis will be provided throughout this working paper, detailing the tolling analysis as applied to the 2020 Build PM peak period work trips. The same steps are taken for all of the other time periods and trip purposes.

Table 2 shows a portion of the detailed O/D table. There are 22 origins and 22 destinations in the trip tables (484 O/D pairs) covering the Portland/Vancouver metropolitan region. These pairs are first consolidated into nine “superzones” (Far North, Downtown, etc.), with four zones covering the area north of the Columbia River and five covering the area to the south.

**Table 2. 2020 Build Origin/Destination Sample Output –
I-5 Bridge – Work Autos – PM Four-Hour Period**

Origin District	Destination District																					SUM	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22
1	0	0	0	0	0	0	0	0	0	0	0	0	0	122	283	175	94	612	124	85	50	0	1,544
2	0	0	0	0	0	0	0	0	0	0	0	0	0	43	97	37	25	267	90	20	22	0	602
3	0	0	0	0	0	0	0	0	0	0	0	0	0	89	188	174	173	376	145	73	19	0	1,236
4	0	0	0	0	2	0	0	0	28	163	0	0	75	209	422	613	393	804	296	155	39	6	3,204
5	0	0	0	9	0	0	0	0	0	0	0	0	0	111	206	208	130	383	117	58	27	0	1,246
6	0	0	0	0	0	0	0	0	0	0	0	0	0	179	359	495	362	706	265	135	40	0	2,541
7	0	0	0	1	0	0	0	0	0	0	0	0	0	43	65	15	4	122	27	4	10	0	290
8	0	0	0	0	0	0	0	0	0	0	0	0	0	54	106	156	105	200	76	39	8	0	744
9	0	0	0	6	0	0	0	0	0	0	0	0	0	45	69	11	4	137	34	5	12	0	323
10	0	0	0	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52
11	0	0	0	0	0	0	0	0	0	0	0	0	0	25	47	35	25	89	33	16	4	0	275
12	0	0	0	0	0	0	0	0	0	0	0	0	0	109	215	189	173	421	154	79	17	0	1,358
13	0	0	0	13	0	0	0	0	0	0	0	0	0	17	28	10	4	52	14	5	4	0	148
14	18	8	20	93	29	106	77	22	34	0	25	63	20	0	0	0	0	0	0	0	0	130	646
15	38	15	32	109	38	119	61	25	31	0	24	70	16	0	0	0	0	0	0	0	0	106	683
16	21	5	32	118	34	119	9	29	4	0	13	56	3	0	0	0	0	0	0	0	0	95	539
17	5	3	20	56	18	53	0	15	1	0	3	27	1	0	0	0	0	0	0	0	0	11	211
18	80	36	53	136	60	136	50	33	35	0	22	81	16	0	0	0	0	0	0	0	0	76	815
19	16	13	19	42	18	39	7	11	7	0	6	23	3	0	0	0	0	0	0	0	0	14	216
20	13	5	10	25	8	25	2	6	2	0	4	15	1	0	0	0	0	0	0	0	0	19	137
21	19	8	7	15	12	16	4	3	4	0	2	7	1	0	0	0	0	0	0	0	0	0	98
22	0	0	0	2	0	0	0	0	0	0	0	0	0	36	29	29	4	21	4	5	0	0	130
SUM	211	91	194	675	218	613	211	144	146	163	98	341	136	1,081	2,113	2,147	1,498	4,191	1,378	678	252	457	17,036

Source: I-5 Partnership Districts summarized 9/27/04 from I-5 Partnership Data for Columbia River Tolling Project - 2020 LRT/3-Lane PM 4-Hour I-5 Bridge Select Link OD Volumes Work Autos

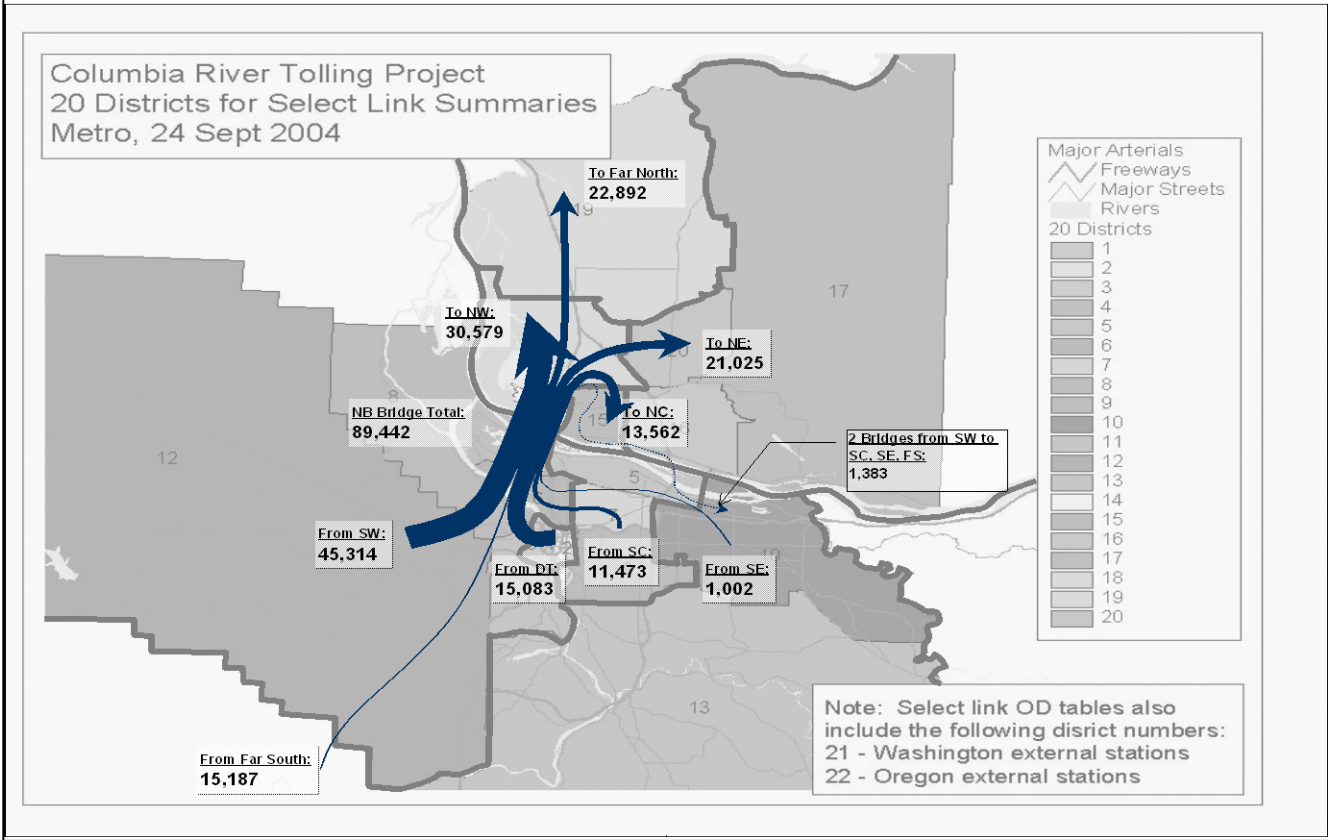
Table 3 shows a summary of superzone origins and destinations for the 2020 Build PM peak period work auto trips on the I-5 bridge, while Figure 1 graphically represents the O/D superzone pairs for the 2020 Build 24-hour weekday northbound work auto trips on the I-5 bridge. Both examples are for the toll-free condition.

**Table 3. 2020 Build Superzone O/D Sample Pairs –
I-5 Bridge – Work Autos – PM Four-Hour Period**

Origin Superzone	Destination Superzone									
	Far North	Northwest	North Central	Northeast	Downtown	Southwest	South Central	Southeast	Far South	SUM
Far North	0	0	0	0	85	169	54	4	14	326
Northwest	0	0	0	0	222	740	294	37	213	1,506
North Central	0	0	0	0	88	358	134	17	109	706
Northeast	0	0	0	0	118	582	81	5	129	915
Downtown	465	1,558	586	884	0	0	0	0	0	3,493
Southwest	962	2,887	1,186	3,066	0	0	31	246	6	8,384
South Central	234	868	351	453	0	17	0	0	0	1,923
Southeast	19	71	29	20	0	67	0	0	0	205
Far South	4	59	30	39	0	2	0	0	0	134
SUM	1,684	5,443	2,183	4,462	512	1,936	594	309	472	17,594

**Figure 1. 2020 Build Select Link Origins and Destinations –
I-5 Bridge - 24-Hour Weekday Total Trips – Northbound – Toll-Free**

I-5 Columbia River Crossing Origin-Destination Chart
24 hr Weekday Total Trips
Year 2020 - Build, No Toll
Total Trips - Northbound



I-5 Two-Direction Toll Scenario

Diversion Criteria

It is common in tolling studies to use “time saved” criteria to estimate which users will be likely to pay a toll to use a facility and which will change travel patterns. However, a slightly different methodology was used to develop diversion criteria for the I-5 bridge, as discussed below.

For the scenario in which the I-5 bridge would be tolled in two directions and the I-205 bridge would remain free, we used a surrogate for time saved by analyzing the existing and forecasted use of each facility by trip O/D pair. By summarizing total river crossing traffic by O/D and trip type and then determining the toll-free forecast share of each facility, we were able to estimate which route is the most efficient for any given O/D pair. For some of the O/D pairs, 90 to 100 percent of all trips crossing the river can be directly assigned to using specifically one bridge or the other. In this tolling scenario, where the I-5 bridge would be tolled in two directions and the I-205 bridge would be free, the time required for many trips to divert to the toll-free I-205 bridge would be significant, and the driver would be more likely to pay a toll on the more convenient bridge. For the O/D pairs in which more

than half of the trips are forecast to use the I-5 bridge and the other half the I-205 bridge, the diversion rates for trips switching to the I-205 in order to avoid the toll on the I-5 were estimated to be higher.

Table 4 provides samples of some of the O/D pairs and their toll-free bridge use shares for a 2020 PM peak period work auto trips. In this example, 89 percent (3,066) of the northbound work trips from Southwest (SW) to the Northeast (NE) would use the I-5 crossing. If the I-5 bridge were tolled, a large share of this traffic would remain on I-5 and pay the toll since the I-5 bridge is obviously the most efficient route for travel between these two locations. Similarly, 46 percent (884) of the trips from Downtown (DT) to the Northeast (NE) use the I-5 crossing. If the I-5 were tolled, it is logical to assume that a large number of these 884 trips would change their travel pattern to use the I-205.

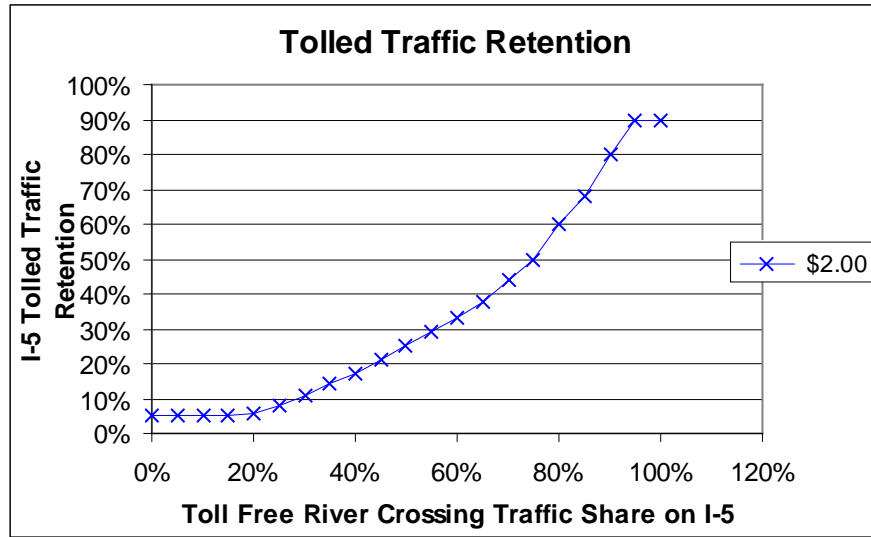
Table 4. 2020 Sample Bridge Use – 2020 Build PM Four-Hour Northbound Work Trips

Origin	Destination	Toll-Free Trips			% I-5 Traffic	Potential Tolled Trips
		I-5	I-205	Total		
Downtown	Far North	465	17	481	97%	481
	Northwest	1,558	0	1,558	100%	1,558
	North Central	586	0	586	100%	586
	Northeast	884	1,032	1,915	46%	1,915
Southwest	Far North	962	0	962	100%	962
	Northwest	2,887	0	2,887	100%	2,887
	North Central	1,186	0	1,186	100%	1,186
	Northeast	3,066	371	3,438	89%	3,438
South Central	Far North	234	551	786	30%	786
	Northwest	868	621	1,490	58%	1,490
	North Central	351	336	687	51%	687
	Northeast	453	4,389	4,842	9%	4,842
Southeast	Far North	19	415	433	4%	433
	Northwest	71	519	590	12%	590
	North Central	29	281	300	10%	300
	Northeast	20	2,688	2,708	1%	2,708
Far South	Far North	4	3	7	55%	7
	Northwest	59	23	82	72%	82
	North Central	30	14	44	67%	44
	Northeast	39	70	109	36%	109

In summary, the percentage of total toll-free cross-river traffic using the I-5 bridge is an indicator of the potential travel times savings for each O/D pair using that bridge. Those O/D pairs that have a high percentage of total cross-river traffic using the I-5 bridge are assumed to have a relatively high travel time savings as compared to using the I-205 bridge to cross the river. Therefore, these pairs have a low potential diversion rate if tolls were implemented. Those O/D pairs that have a lower percentage of total cross-river traffic using the I-5 bridge are assumed to have a lower times savings as compared to using the I-205 bridge to cross the river. Therefore, these pairs have a higher potential diversion rate if tolls were implemented.

Using the percentage of forecast toll-free cross-river traffic using the I-5 Bridge as an indicator of travel times savings, we developed the retention curve shown in Figure 2 for a \$2.00 (2004 equivalent to \$3.25 in 2020) toll rate.

Figure 2. Tolloed Traffic Retention



Based on the previous example, 3,066 of the 3,438 SW to NE river crossings (89 percent) use the I-5 toll-free. Under a tolloed scenario, a 68 percent retention rate would be the base retention rate to be applied for this cash toll with a diversion rate of 32 percent to I-205. However, during peak periods, the diversion rate is assumed to be 50 percent of the base rate (is there a reason for this assumption?); therefore, the peak-period diversion rate would be 16 percent and the 68 percent retention would become an 84 percent retention. The retention curves do not reach 0 percent or 100 percent retention, since there will always be trips that are made that are not completely logical. Some trips will always pay a toll (following directions, etc), while some trips will never pay a toll.

Eliminated Trips

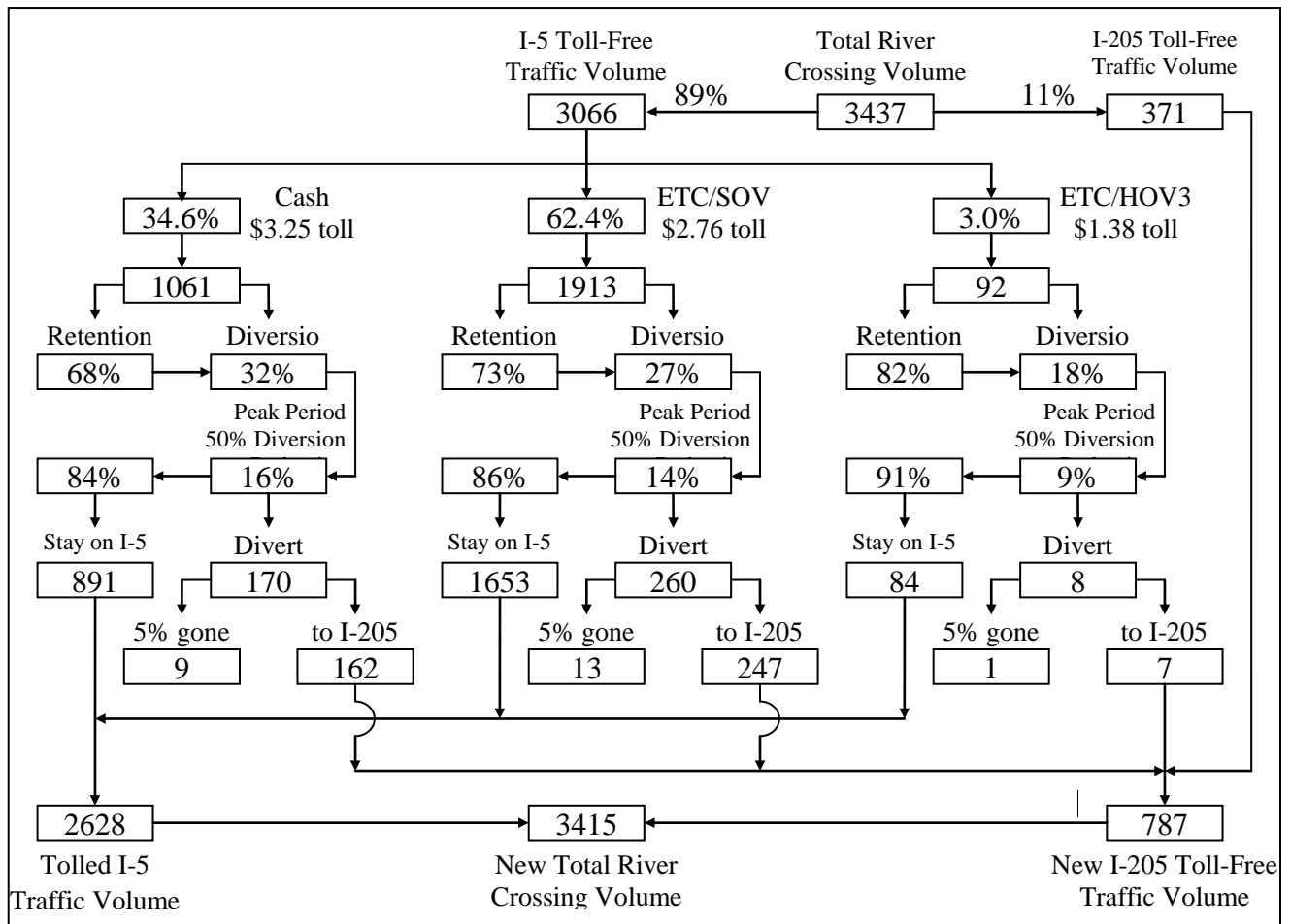
The above curve shows the relationship of trips that are *retained* on the I-5 bridge under a tolloed condition. Of the trips that are diverted, some switch to the I-205 bridge for a toll-free ride, while other trips are either eliminated or consolidated with another trip, and therefore the total number of trips is reduced. As mentioned previously, each of the trip purposes are analyzed separately, and the share of diverted trips that are eliminated vary for work, non-work and truck trips. Table 5 shows the difference in eliminated trips for the different trip purposes.

Table 5. Diverted Trip Reduction

Trip Purpose	% Diverted Trips Eliminated	
Work	5%	Diverted trips eliminated
Non-Work	10%	Diverted trips eliminated
Truck	5%	Diverted trips eliminated

Figure 4 (shouldn't this be #3?) summarizes the various steps taken during the two-direction toll analysis, focusing on the 2020 Build PM Peak work trip example.

Figure 3. Tolloed Traffic Retention –2020 Build PM Four-Hour Peak Work Auto Trips – Southwest to Northeast Superzones



I-5 and I-205 One-Direction Toll Scenario

Diversion Criteria

The analysis performed for tolling both I-5 and the I-205 in one direction is significantly different from the previous discussion of tolling only I-5 in two directions since no toll-free alternative would exist for a round trip made across the river. In this scenario, one-way tolls would be collected in either the southbound or the northbound direction on both I-5 and the I-205, and trips could not easily divert to another route to avoid the toll. Therefore, the previously shown retention curves cannot be applied to this analysis.

Elimination Criteria

Since a toll-free route is not an option in this scenario, a greater number of trips would be eliminated due to trip consolidation and/or reduction that would occur when the tolls are applied. Based on similar studies performed, we have assumed that 5 percent of *all* trips will be eliminated when both the I-5 and the I-205 are tolled in one direction. This is significantly different than the previous scenario

in which the I-5 is tolled in two directions, since between 5 and 10 percent of the *diverted* trips were assumed eliminated.

Toll Rates and Vehicle Classification

The tolling analyses have been segmented by vehicle classification and payment methodology. The frequency of use of the facility is a large factor in determining how likely a user is to be carpooling or to take advantage of the ETC discount rates.

Toll Rates

As discussed in TM 5.5 and WP 5.1, ETC discounts and HOV discounts have been assumed to will be available to ETC customers, and truck tolls have been assumed to will be charged at the N-1¹ rate times the passenger car tolls. This tolling analysis assumed that the toll charged would be \$2.00 in 2004 terms, and the toll rate would increase in 25-cent increments along with a 3 percent inflation rate, and there would be no “real” toll increases above the inflation rate for the duration of this estimate. This assumption can be modified during sensitivity and other financing model runs. It has also been assumed that the new river crossing would be open and tolls would be charged beginning in 2013, so although we discuss 2004 toll rates, collection would actually begin in 2013.

The analysis in which the I-5 is tolled in both directions assumes a \$2.00 cash toll (in 2004 dollars) is collected from passenger cars in each direction, and an \$8.00 truck toll is collected on average (assuming an average truck has 5 axles).

The one-way tolling analysis in which tolls are collected on both the I-5 and the I-205 assumes that \$2.00 is collected from passenger cars in either the southbound or northbound direction on both the I-5 and the I-205. Table 6 details the 2004 equivalent toll collected for each vehicle payment type.

Table 6. 2004 Equivalent Toll Charges

Tolling Scenario	Vehicle Type	Cash	ETC	ETC/HOV
I-5 Two-Direction Toll Scenario	Passenger Car	\$2.00	\$1.70	\$0.85
	Truck (avg. toll)	\$8.00	\$6.80	N/A
I-5 and I-205 One-Direction Toll Scenario	Passenger Car	\$2.00	\$1.70	\$0.85
	Truck (avg. toll)	\$8.00	\$6.80	N/A

Vehicle Classification

The makeup of traffic during different times of the day can vary greatly. During the AM peak period, work trips constitute a large share of the traffic on the river crossings. During the PM peak period, the same work trips are being made, but there are also shopping and other trips occurring at the same time. In addition, the peak commuting periods are more likely to have carpool opportunities than other times of the day. Commercial vehicle trips occur throughout the day, with many trucks trying to avoid congested peak periods of traffic.

¹ The N-1 rate is the passenger car toll rate times one less than the total number of truck axles.

Table 7 shows the shift in ETC market penetration and change in HOV activity between the opening year and the 2020 build year conditions. The overall ETC market share is estimated at approximately 30 percent in the opening year, and is expected to grow to almost 66 percent in the 2020 Build condition.

Table 7. Total Forecast Market Share

Travel Period	Trip Type	Opening Year			2020 Build		
		Cash	ETC	ETC/HOV	Cash	ETC	ETC/HOV
PM Peak	Work	70.0%	28.8%	1.2%	34.6%	62.4%	3.0%
	Non-Work	70.0%	28.8%	1.2%	34.6%	62.4%	3.0%
	Truck	70%	30%	0%	40%	60%	0%
AM Peak	Work	70.0%	28.8%	1.2%	34.6%	62.4%	3.0%
	Non-Work	70.0%	28.8%	1.2%	34.6%	62.4%	3.0%
	Truck	70%	30%	0%	40%	60%	0%
Off Peak	Work	75.0%	24.5%	0.5%	39.8%	58.8%	1.4%
	Non-Work	75.0%	24.5%	0.5%	39.8%	58.8%	1.4%
	Truck	75%	25%	0%	40%	60%	0%

Forecast Year Traffic and Revenue

Applying the methodologies and assumptions outlined above, we used the forecast toll-free traffic to determine the tolled traffic and revenue for the years 2002 (No-Build) and 2020 in the Build and No-Build conditions. The two tolling scenarios (two-direction toll scenario and the one-direction toll scenario) were analyzed.

I-5 Two-Direction Toll Scenario

Build and No-Build traffic volumes were tolled in both directions on the I-5 for this tolling scenario. Table 8 details the resulting tolled traffic and revenue numbers, assuming that a hypothetical \$2.00 toll was applied to the No-Build 2002 traffic volumes. The “tolled” rows show the tolled traffic on the I-5 and the resulting toll-free traffic on the I-205.

Table 8. I-5 Two-Direction Toll Forecast Year Traffic and Revenue

Scenario		I-5 (AWD) tolled	I-205 (AWD) (toll-free)	Total (AWD)	Revenue (Annual)
2002	Toll-Free	124,000	136,000	260,000	
	Tolled	90,400	165,600	256,000	\$64.6 m
2020 No-Build	Toll-Free	140,400	155,200	295,600	
	Tolled	99,600	191,700	291,300	\$111.1 m
2020 Build	Toll-Free	178,600	136,100	314,700	
	Tolled	133,300	173,100	306,400	\$152.7 m

In 2002, the I-5 traffic would be reduced by 33,600 vehicles per day (27 percent) when the tolls are theoretically applied. I-205 would gain 29,600 vehicles per day, which is 88 percent of the I-5 diverted traffic. The remaining 4,000 vehicles would either be combined with another trip or eliminated.

Using 2020 No-Build projections, applying a toll to I-5 would reduce the traffic by 40,800 vehicles per day (29 percent reduction). Approximately 89 percent of these diverted trips would be reassigned to the I-205 crossing, which would increase by 36,500 vehicles per day. The total river crossing traffic in the 2020 No-Build would be reduced by 4,300 vehicles per day due to eliminated trips.

In the 2020 build condition, additional capacity on the I-5 bridge would increase the overall daily river crossing by about 6.5 percent over the toll-free No-Build (peak period percentage increases are forecast to be even greater). If I-5 were tolled, traffic volumes would decrease by 45,300 vehicles per day (25 percent reduction). Approximately 82 percent of those diverted trips (37,000 vehicles per day) would relocate onto the I-205 bridge, while the overall river crossing volumes would be reduced by 8,300 vehicles per day when tolls were applied to I-5.

The forecast year traffic and revenue is further broken down into period of the day and vehicle classification. Table 9 details the detailed breakdown for the two-direction toll scenario for the Build condition. While the tolling analysis was performed for both the Build and No-Build conditions, the analysis focused on generating the revenue streams for the Build condition only.

Table 9. Time of Day and Vehicle Classification Traffic and Revenue

2020Build I-5 Two-Direction	PM (4-7pm)						AM (6-9am)						
	Volume (AWD)			Revenue (Annual)			Volume (AWD)			Revenue (Annual)			
	I-5	I-205	Both	I-5	I-205	Both	I-5	I-205	Both	I-5	I-205	Both	
Work	NB	11,896	13,094	24,990	\$ 10,810,211	\$ -	\$ 10,810,211	2,755	4,161	6,916	\$ 2,500,074	\$ -	\$ 2,500,074
	SB	2,947	4,316	7,263	\$ 2,674,214	\$ -	\$ 2,674,214	11,122	12,610	23,732	\$ 10,106,153	\$ -	\$ 10,106,153
	Both	14,843	17,410	32,253	\$ 13,484,426	\$ -	\$ 13,484,426	13,877	16,771	30,648	\$ 12,606,227	\$ -	\$ 12,606,227
Non-Work	NB	15,684	15,740	31,424	\$ 14,254,849	\$ -	\$ 14,254,849	5,390	5,786	11,176	\$ 4,895,521	\$ -	\$ 4,895,521
	SB	11,544	12,014	23,558	\$ 10,492,926	\$ -	\$ 10,492,926	7,343	7,564	14,907	\$ 6,671,292	\$ -	\$ 6,671,292
	Both	27,228	27,755	54,983	\$ 24,747,774	\$ -	\$ 24,747,774	12,733	13,349	26,082	\$ 11,566,814	\$ -	\$ 11,566,814
Passenger	NB	27,580	28,835	56,415	\$ 25,065,060	\$ -	\$ 25,065,060	8,145	9,946	18,091	\$ 7,395,596	\$ -	\$ 7,395,596
	SB	14,491	16,330	30,821	\$ 13,167,140	\$ -	\$ 13,167,140	18,465	20,174	38,639	\$ 16,777,445	\$ -	\$ 16,777,445
	Both	42,071	45,164	87,235	\$ 38,232,200	\$ -	\$ 38,232,200	26,610	30,121	56,731	\$ 24,173,041	\$ -	\$ 24,173,041
Trucks	NB	1,050	1,409	2,459	\$ 3,911,544	\$ -	\$ 3,911,544	753	1,033	1,786	\$ 2,805,280	\$ -	\$ 2,805,280
	SB	1,222	1,684	2,906	\$ 4,552,616	\$ -	\$ 4,552,616	641	870	1,511	\$ 2,387,180	\$ -	\$ 2,387,180
	Both	2,272	3,093	5,365	\$ 8,464,160	\$ -	\$ 8,464,160	1,394	1,904	3,298	\$ 5,192,460	\$ -	\$ 5,192,460
Total Vehic	NB	28,630	30,244	58,874	\$ 28,976,604	\$ -	\$ 28,976,604	8,898	10,980	19,878	\$ 10,200,875	\$ -	\$ 10,200,875
	SB	15,713	18,013	33,726	\$ 17,719,756	\$ -	\$ 17,719,756	19,106	21,045	40,151	\$ 19,164,626	\$ -	\$ 19,164,626
	Both	44,343	48,257	92,600	\$ 46,696,360	\$ -	\$ 46,696,360	28,004	32,024	60,028	\$ 29,365,501	\$ -	\$ 29,365,501

2020Build I-5 Two-Direction	OffPeak (12mid-6am, 9am-4pm, 7pm-12mid)						24 HR						
	Volume (AWD)			Revenue (Annual)			Volume (AWD)			Revenue (Annual)			
	I-5	I-205	Both	I-5	I-205	Both	I-5	I-205	Both	I-5	I-205	Both	
Work	NB	6,142	9,049	15,191	\$ 5,662,105	\$ -	\$ 5,662,105	20,793	26,304	47,097	\$ 18,972,391	\$ -	\$ 18,972,391
	SB	6,920	9,205	16,125	\$ 6,383,056	\$ -	\$ 6,383,056	20,989	26,131	47,120	\$ 19,163,423	\$ -	\$ 19,163,423
	Both	13,062	18,255	31,317	\$ 12,045,161	\$ -	\$ 12,045,161	41,782	52,436	94,218	\$ 38,135,814	\$ -	\$ 38,135,814
Non-Work	NB	19,278	31,463	50,741	\$ 17,781,872	\$ -	\$ 17,781,872	40,352	52,989	93,341	\$ 36,932,242	\$ -	\$ 36,932,242
	SB	21,287	33,541	54,828	\$ 19,635,269	\$ -	\$ 19,635,269	40,174	53,119	93,293	\$ 36,799,487	\$ -	\$ 36,799,487
	Both	40,565	65,004	105,569	\$ 37,417,141	\$ -	\$ 37,417,141	80,526	106,108	186,634	\$ 73,731,729	\$ -	\$ 73,731,729
Passenger	NB	25,420	40,512	65,932	\$ 23,443,977	\$ -	\$ 23,443,977	61,145	79,293	140,438	\$ 55,904,633	\$ -	\$ 55,904,633
	SB	28,207	42,746	70,953	\$ 26,018,325	\$ -	\$ 26,018,325	61,163	79,250	140,413	\$ 55,962,910	\$ -	\$ 55,962,910
	Both	53,627	83,259	136,886	\$ 49,462,302	\$ -	\$ 49,462,302	122,308	158,543	280,851	\$ 111,867,543	\$ -	\$ 111,867,543
Trucks	NB	3,675	4,838	8,513	\$ 13,686,719	\$ -	\$ 13,686,719	5,478	7,281	12,759	\$ 20,403,542	\$ -	\$ 20,403,542
	SB	3,633	4,705	8,338	\$ 13,530,085	\$ -	\$ 13,530,085	5,496	7,259	12,755	\$ 20,469,881	\$ -	\$ 20,469,881
	Both	7,308	9,543	16,851	\$ 27,216,803	\$ -	\$ 27,216,803	10,974	14,539	25,513	\$ 40,873,424	\$ -	\$ 40,873,424
Total Vehic	NB	29,095	45,350	74,445	\$ 37,130,696	\$ -	\$ 37,130,696	66,623	86,574	153,197	\$ 76,308,175	\$ -	\$ 76,308,175
	SB	31,840	47,451	79,291	\$ 39,548,409	\$ -	\$ 39,548,409	66,659	86,509	153,168	\$ 76,432,791	\$ -	\$ 76,432,791
	Both	60,935	92,801	153,736	\$ 76,679,105	\$ -	\$ 76,679,105	133,282	173,083	306,365	\$ 152,740,966	\$ -	\$ 152,740,966

I-5 and I-205 One-Direction Toll Scenario

Build and No-Build condition traffic volumes are assumed tolled on the I-5 and I-205 for this scenario.

Table 10 details the resulting tolled traffic and revenue numbers, assuming that a hypothetical toll was applied to the No-Build 2002 traffic volumes.

Table 10. I-5 and I-205 One-Direction Toll Forecast Year Traffic and Revenue

Scenario		I-5 (AWD) (toll one direction)	I-205 (AWD) (toll one direction)	Total (AWD)	Revenue (Annual)
2002	Toll-Free	124,000	136,000	260,000	
	Tolled	117,300	128,600	245,900	\$88.2 m
2020 No-Build	Toll-Free	140,400	155,200	295,600	
	Tolled	133,000	147,000	280,000	\$162.3
2020 Build	Toll-Free	178,600	136,100	314,700	
	Tolled	167,500	127,000	294,500	\$169.6 m

Traffic ~~is projected to~~ would change on I-5 and I-205 about 5 to 6 percent between the toll-free and tolled conditions. This reduction in river crossing traffic would be greater than in the two-direction toll scenario because there is no toll-free alternate route for the trips. A 5 percent reduction in trips was applied to trips with O/Ds on opposite sides of the river. Some O/D pairs were both located on the same side of the river, but the trips were assigned to use both bridges to travel from the southeast area to just north of downtown. ~~(don't understand this sentence)~~ These trips would be rerouted under tolled conditions, and that is why the reduction in trips is slightly greater than 5 percent.

The forecast year traffic and revenue is further broken down into period of the day and vehicle classification. Table 11 ~~sets out~~ details the detailed breakdown for the one-direction tolling scenario in the build condition.

Table 11. Time of Day and Vehicle Classification Traffic and Revenue

2020 Build One-Direction 2 Bridges		PM (4-7pm)						AM (6-9am)					
		Volume (AWD)			Revenue (Annual)			Volume (AWD)			Revenue (Annual)		
		I-5	I-205	Both	I-5	I-205	Both	I-5	I-205	Both	I-5	I-205	Both
Work	NB	13,083	10,755	23,838	\$ 5,954,483	\$ 4,894,812	\$ 10,849,295	3,066	3,538	6,604	\$ 1,395,302	\$ 1,610,399	\$ 3,005,701
	SB	3,281	3,654	6,935	\$ 1,493,196	\$ 1,663,006	\$ 3,156,202	12,225	10,414	22,640	\$ 5,564,107	\$ 4,739,973	\$ 10,304,080
	Both	16,364	14,409	30,772	\$ 7,447,679	\$ 6,557,817	\$ 14,005,497	15,291	13,953	29,244	\$ 6,959,409	\$ 6,350,372	\$ 13,309,781
Non-Work	NB	17,285	12,820	30,105	\$ 7,866,846	\$ 5,834,939	\$ 13,701,785	5,958	4,754	10,712	\$ 2,711,558	\$ 2,163,799	\$ 4,875,358
	SB	12,751	9,819	22,570	\$ 5,803,601	\$ 4,468,967	\$ 10,272,568	8,076	6,207	14,283	\$ 3,675,548	\$ 2,825,180	\$ 6,500,728
	Both	30,036	22,639	52,675	\$ 13,670,447	\$ 10,303,906	\$ 23,974,353	14,033	10,962	24,995	\$ 6,387,106	\$ 4,988,979	\$ 11,376,085
Passenger	NB	30,368	23,575	53,943	\$ 13,821,329	\$ 10,729,751	\$ 24,551,079	9,023	8,293	17,316	\$ 4,106,861	\$ 3,774,198	\$ 7,881,059
	SB	16,032	13,473	29,505	\$ 7,296,797	\$ 6,131,973	\$ 13,428,770	20,301	16,622	36,923	\$ 9,239,655	\$ 7,565,153	\$ 16,804,807
	Both	46,400	37,048	83,448	\$ 21,118,126	\$ 16,861,723	\$ 37,979,850	29,324	24,914	54,239	\$ 13,346,515	\$ 11,339,351	\$ 24,685,866
Trucks	NB	1,475	895	2,370	\$ 2,747,635	\$ 1,667,858	\$ 4,415,493	1,045	677	1,722	\$ 1,947,674	\$ 1,261,088	\$ 3,208,762
	SB	1,721	1,075	2,796	\$ 3,206,649	\$ 2,003,513	\$ 5,210,162	896	563	1,459	\$ 1,668,875	\$ 1,049,814	\$ 2,718,689
	Both	3,196	1,970	5,166	\$ 5,954,285	\$ 3,671,371	\$ 9,625,655	1,941	1,240	3,181	\$ 3,616,549	\$ 2,310,901	\$ 5,927,450
Total Vehicles	NB	31,842	24,470	56,312	\$ 16,568,964	\$ 12,397,608	\$ 28,966,572	10,069	8,969	19,038	\$ 6,054,535	\$ 5,035,286	\$ 11,089,821
	SB	17,753	14,548	32,301	\$ 10,503,447	\$ 8,135,485	\$ 18,638,932	21,197	17,185	38,382	\$ 10,908,530	\$ 8,614,966	\$ 19,523,496
	Both	49,596	39,018	88,614	\$ 27,072,411	\$ 20,533,094	\$ 47,605,505	31,265	26,155	57,420	\$ 16,963,064	\$ 13,650,252	\$ 30,613,317

2020 Build One-Direction 2 Bridges		OffPeak (12mid-6am, 9am-4pm, 7pm-12mid)						24 HR					
		Volume (AWD)			Revenue (Annual)			Volume (AWD)			Revenue (Annual)		
		I-5	I-205	Both	I-5	I-205	Both	I-5	I-205	Both	I-5	I-205	Both
Work	NB	7,862	6,681	14,543	\$ 3,637,200	\$ 3,090,526	\$ 6,727,726	24,011	20,974	44,985	\$ 10,986,985	\$ 9,595,737	\$ 20,582,723
	SB	8,454	6,966	15,420	\$ 3,910,973	\$ 3,222,298	\$ 7,133,271	23,960	21,034	44,994	\$ 10,968,276	\$ 9,625,276	\$ 20,593,552
	Both	16,317	13,646	29,963	\$ 7,548,173	\$ 6,312,824	\$ 13,860,997	47,971	42,008	89,979	\$ 21,955,261	\$ 19,221,013	\$ 41,176,275
Non-Work	NB	28,657	20,495	49,152	\$ 13,256,818	\$ 9,481,080	\$ 22,737,899	51,899	38,069	89,969	\$ 23,835,223	\$ 17,479,819	\$ 41,315,041
	SB	31,255	21,843	53,098	\$ 14,458,790	\$ 10,104,948	\$ 24,563,738	52,082	37,870	89,952	\$ 23,937,938	\$ 17,399,095	\$ 41,337,033
	Both	59,912	42,338	102,250	\$ 27,715,608	\$ 19,586,028	\$ 47,301,637	103,981	75,939	179,921	\$ 47,773,161	\$ 34,878,913	\$ 82,652,074
Passenger	NB	36,519	27,176	63,695	\$ 16,894,018	\$ 12,571,607	\$ 29,465,625	75,910	59,043	134,953	\$ 34,822,208	\$ 27,075,556	\$ 61,897,764
	SB	39,709	28,809	68,518	\$ 18,369,763	\$ 13,327,246	\$ 31,697,008	76,042	58,904	134,946	\$ 34,906,215	\$ 27,024,371	\$ 61,930,585
	Both	76,228	55,985	132,213	\$ 35,263,781	\$ 25,898,852	\$ 61,162,633	151,953	117,947	269,899	\$ 69,728,422	\$ 54,099,927	\$ 123,828,349
Trucks	NB	5,226	2,958	8,184	\$ 9,736,492	\$ 5,511,440	\$ 15,247,932	7,746	4,530	12,276	\$ 14,431,801	\$ 8,440,386	\$ 22,872,187
	SB	5,163	2,854	8,017	\$ 9,619,118	\$ 5,317,674	\$ 14,936,792	7,779	4,493	12,272	\$ 14,494,642	\$ 8,371,000	\$ 22,865,643
	Both	10,388	5,812	16,200	\$ 19,355,610	\$ 10,829,114	\$ 30,184,724	15,525	9,023	24,548	\$ 28,926,444	\$ 16,811,386	\$ 45,737,830
Total Vehicles	NB	41,745	30,134	71,878	\$ 26,630,510	\$ 18,083,047	\$ 44,713,557	83,656	63,573	147,229	\$ 49,254,009	\$ 35,515,941	\$ 84,769,951
	SB	44,872	31,663	76,535	\$ 27,988,880	\$ 18,644,920	\$ 46,633,800	83,822	63,396	147,218	\$ 49,400,857	\$ 35,395,371	\$ 84,796,228
	Both	86,617	61,797	148,413	\$ 54,619,391	\$ 36,727,967	\$ 91,347,357	167,478	126,969	294,447	\$ 98,654,866	\$ 70,911,313	\$ 169,566,179

INTERIM YEAR FORECAST

Up to this point in the traffic and revenue study, we have presented data that have been provided to us as toll-free model year output. The toll-free volumes have been analyzed to determine the 2020 build and No-Build tolled traffic volumes for tolling I-5 in two directions and for tolling I-5 and I-205 in one direction. The next step in this analysis is to determine what the interim year traffic and revenue numbers are, assuming that the tolls begin in 2013.

Growth Rates

Using 2002 as the starting point and No-Build 2020 toll-free volumes as an ending point, the average annual growth rate calculated between the two years is 0.69 percent for I-5 and 0.74 percent for I-205. This rate was applied to the interim year No-Build volumes to generate a traffic stream from 2002 through 2025. For the Build condition, it is assumed that these same No-Build growth rates are applied to the traffic streams between 2002 and 2012, just prior to the opening of the new I-5 river crossing (the Build and No-Build volumes between 2002 and 2012 are identical). For simplicity, these same growth rates are applied to the higher 2020 Build volumes to determine the volumes in 2013 through 2025 in both the tolled and toll-free analyses.

Traffic and Revenue Stream

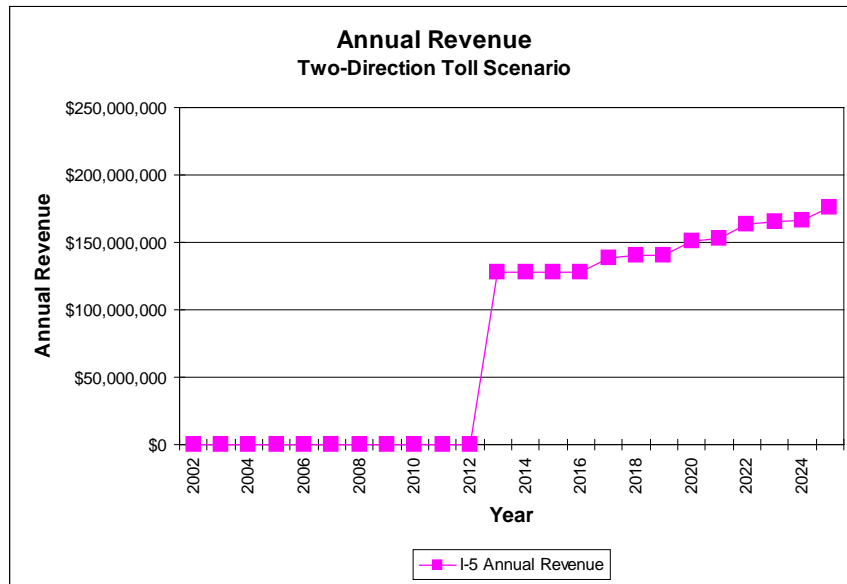
The resulting traffic volumes for the two tolling scenarios are shown in Table 12 and Table 13 and illustrated in Figure 4 and Figure 5. The new crossing is assumed open and tolled in 2013. It is assumed there is latent demand that would be met with the opening of the new crossing and its higher capacity; therefore the river crossing volumes would increase between 2012 and 2013. In reality, there may be a ramp up period of a year or two, but we have assumed that the growth due to the increased capacity of the new crossing would occur in year one. The No-Build river crossing volume in 2013 is estimated at 280,900, and the Build volume is estimated at 299,500 under toll-free conditions, which is an increase of approximately 6.6 percent.

The two-direction toll scenario assumes that I-5 is tolled in both the northbound and southbound directions, and I-205 is toll-free. The 2013 Build total river crossing in this tolled scenario is estimated at 291,500, a difference of 8,000 trips compared to the toll-free. Some trips that would normally use I-5, would switch to I-205 to avoid the toll, and other trips would be consolidated or eliminated. Table 12 and Figure 4 show the interim year traffic and revenue streams for the build condition.

Table 12. I-5 Two-Direction Toll Forecast Year Traffic and Revenue

Year	I-5 Traffic (AWD) (tolled)	I-205 Traffic (AWD) (toll-free)	Total Revenue (Annual)
2013	127,300	164,200	\$127,407,000
2014	128,200	165,200	\$127,620,000
2015	129,000	166,400	\$127,848,000
2016	129,800	167,700	\$128,093,000
2017	128,800	170,100	\$138,100,000
2018	131,500	170,500	\$140,327,000
2019	132,400	171,800	\$140,650,000
2020	131,300	174,100	\$150,654,000
2021	134,200	174,400	\$153,132,000
2022	133,100	176,700	\$163,106,000
2023	136,000	177,100	\$165,824,000
2024	136,900	178,400	\$166,316,000
2025	135,900	180,900	\$176,331,000

Figure 4. I-5 Two-Direction Toll Scenario Annual Revenue



Under the one-direction tolling scenario, the 2013 No-Build and Build toll-free numbers are the same as in the above situation. However, a greater number of trips would be eliminated or consolidated in this one-direction tolling scenario since both crossings would be tolled and there would be no free alternative. The traffic volume growth due to the latent demand served by the increased bridge capacity would be offset due to the tolling impact. The total tolled build river crossing volume is estimated at 280,400 vehicles per day, compared to the toll-free volumes of 299,500 vehicles per day.

Table 13 and Figure 10 detail the annual traffic and revenue values for the two-way (isn't this the two bridge, one way) tolling scenario.

Table 13. I-5 and I-205 One-Direction Toll Scenario Forecast Year Traffic and Revenue

Year	I-5 Traffic (AWD) (tolled 1-way)	I-205 Traffic (AWD) (tolled 1-way)	Total Revenue (Annual)
2013	159,800	120,600	\$141,751,000
2014	160,800	121,300	\$141,853,000
2015	161,900	122,200	\$142,066,000
2016	163,000	123,100	\$142,291,000
2017	162,500	123,500	\$154,610,000
2018	165,200	125,100	\$155,951,000
2019	166,300	126,000	\$156,241,000
2020	165,900	126,400	\$168,435,000
2021	168,600	127,900	\$169,928,000
2022	168,200	128,300	\$182,138,000
2023	171,000	129,800	\$183,780,000
2024	172,200	130,800	\$184,197,000
2025	171,800	131,200	\$196,489,000

Figure 5. I-5 and I-205 One Direction Toll Scenario Annual Revenue

