RSG INC.
TRANSPORTATION

Columbia River Crossing Stated Preference Travel Study

Prepared for Stantec Inc.

September 2009

DATA ■ ANALYSIS ■ SOLUTIONS

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1.0 INTRODUCTION AND APPROACH

In July 2009, Resource Systems Group Inc. (RSG) conducted the Columbia River Crossing Stated Preference Travel survey for automobile travelers and commercial vehicle drivers and non-driver decision-makers in the Portland-Vancouver region. RSG teamed with Stantec Inc. to conduct the stated preference (SP) travel survey as part of Stantec's work for the Columbia River Crossing (CRC) team.

At the time this report was written, CRC was evaluating a plan to build a replacement I-5 bridge over the Columbia River. Potential improvements would include:

- Increased safety and capacity for vehicles by adding additional lanes in each direction.
- Additional light rail service to the bridge from the Expo Center in Portland to Clark College in Vancouver.
- Improved safety and ease of travel for cyclists and walkers by adding a wider and state-of-the-art pedestrian and bicycle pathway.

The purpose of the SP survey was to estimate values of the toll sensitivity, or "values of time (VOT)," of travelers who currently use one of the existing interstate bridges over the Columbia River, I-5 and I-205. Estimates of travelers' toll price sensitivities are used to support estimates of traffic and toll revenue.

RSG developed and implemented an SP survey questionnaire that gathered information from automobile travelers and commercial vehicle drivers and non-driver decision-makers who use one or both of the facilities being studied. The questionnaire collected data on current travel behaviors, presented respondents with information about the proposed bridge improvements, and used SP experiments to collect data that were used to estimate travelers' VOT and propensity to use the updated toll facilities under a range of possible future conditions.

The SP survey instrument was a computer-assisted self-interview (CASI) developed using RSG's own proprietary software. The customized survey software adapted to respondents' previous answers by modifying question wording and stated preference tradeoff values. Dynamic features provided an accurate and efficient means of data collection and allowed presentation of realistic future conditions that corresponded with the respondents' reported experiences.

The survey was programmed for administration on laptop computers at a wide variety of activity sites in the Portland-Vancouver area. Automobile users were intercepted at shopping and retail areas, hospitals, libraries, and other local institutions and recreational centers. The survey was also administered online via email invitation to targeted audiences, including travelers in the region whose vehicles were observed using one of the bridges. Commercial vehicles drivers were intercepted at truck stops and travel centers, while decision-makers were recruited via telephone.

This report documents the development and administration of the survey questionnaires (both auto and commercial), presents survey results, and summarizes the discrete choice model estimation methodology and findings. The survey questionnaires, survey screen captures, response tabulations, and respondents' comments about the proposed project appear as appendices to this report.

2.0 SURVEY QUESTIONNAIRE

2.1 Automobile Questionnaire

Two separate questionnaires were developed for administration: one for automobile travelers and one for commercial vehicle drivers and commercial vehicle non-driver decision-makers. The automobile questionnaire contained questions grouped into four main sections:

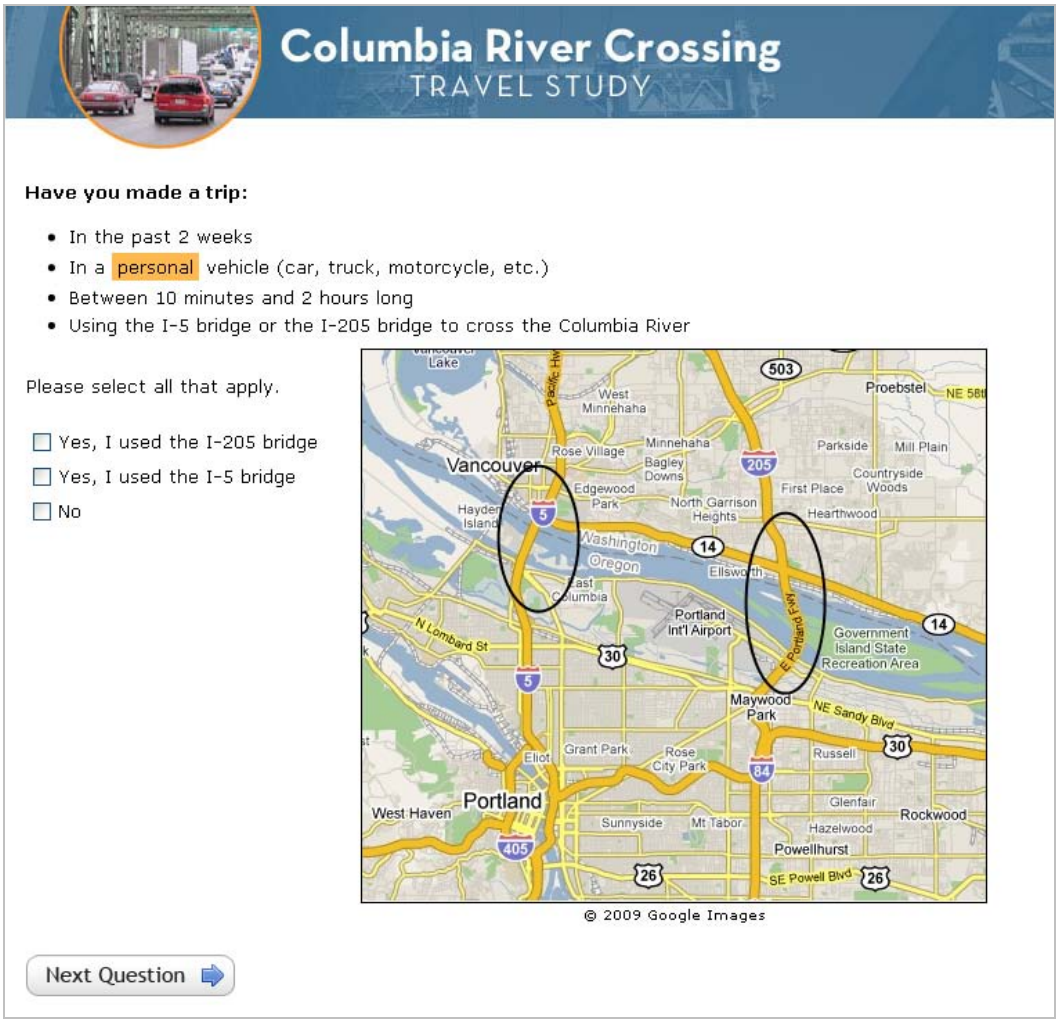
1. Context and screening questions
2. Stated preference questions
3. Debrief and opinion questions
4. Demographic questions

The text of the automobile questionnaire is included in Appendix A and example survey screens are included in Appendix B.

2.1.1 Context and Screening Questions

To begin the survey, respondents were presented with a brief introduction to the project and basic instructions about how to navigate the computer-based survey. Respondents were then asked if they had made a trip in an automobile within the past two weeks that crossed the Columbia River between Portland, OR and Vancouver, WA using the I-205 or I-5 bridge with a duration between 10 minutes and two hours. Responses to this question were used to screen respondents for survey participation. Respondents who had used at least one of the bridges were qualified to take the survey. Figure 1 shows an image of the automobile-related screener question.

Figure 1: Automobile Screener Question



Respondents who indicated that they had used not used either bridge were asked to indicate why they had not used one of the bridges within the past two weeks before being terminated from the survey. In order to target frequent users or potential frequent users of the proposed changes respondents who reported a residential zip code outside of Washington or Oregon were also terminated from the survey.

Qualifying respondents were then asked to focus on their most recent trip using the I-205 bridge or the I-5 bridge. If respondents reported using both bridges, they were asked about the bridge they used most recently. This recent trip, referred to as the respondent's reference trip, formed the basis for the rest of the survey. All of the remaining questions focused exclusively on this one-way trip.

Respondents were next asked details about their reference trip, including day of the week and trip purpose. If the reference trip was a trip to or from the airport, respondents were asked for additional details, including whether or not they were a passenger on a flight, and if so whether or not the flight was mainly for business.

All respondents were asked to provide the total number of passengers in the car during the reference trip. Focusing on the trip in one direction only, respondents were asked where their trip began and ended. If the beginning and ending locations were the same, the respondent either confirmed that their origin and destination were physically different locations or selected the option to go back and change one or both of their previous answers.

After confirming that they had correctly entered the details of their trip, respondents provided the geographic locations of where their trip began and ended. Respondents could identify their origin and destination by either entering an address (Figure 2) or using an interactive map (Figure 3). If the locations suggested an invalid trip that did not involve a Columbia River crossing, respondents either changed the origin or destination or the respondent was asked to think of another trip where they used either the I-205 or the I-5 bridge.

This valid location information was geocoded to provide a latitude and longitude for both origin and destination. The latitude and longitude coordinates were used to assign each location to a traffic analysis zone (TAZ). Skim data from a regional network model provided peak and off-peak travel times and distances between all TAZs in the Portland-Vancouver region. The locations of the origin and destination TAZs were used to validate trips by ensuring that they could have reasonably used one of bridges to cross the Columbia River.

Figure 2: Screen for Entering Beginning Location Address

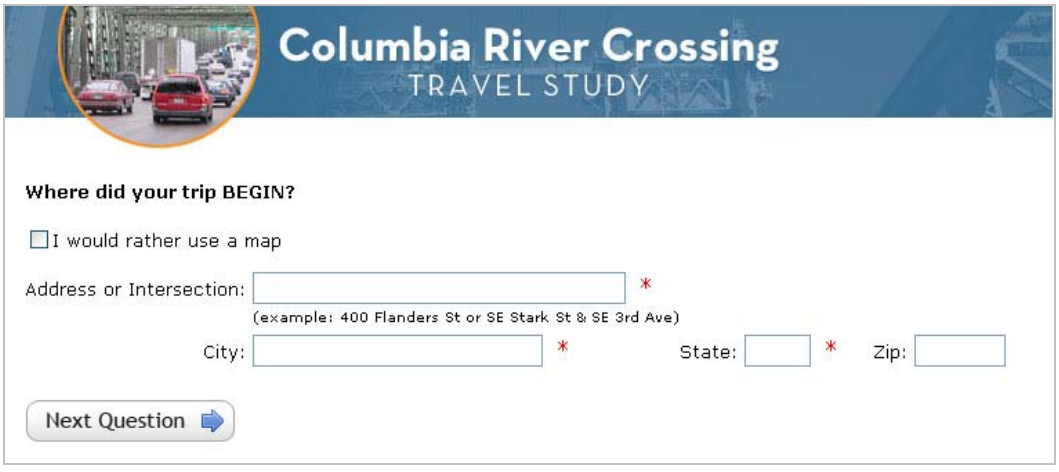
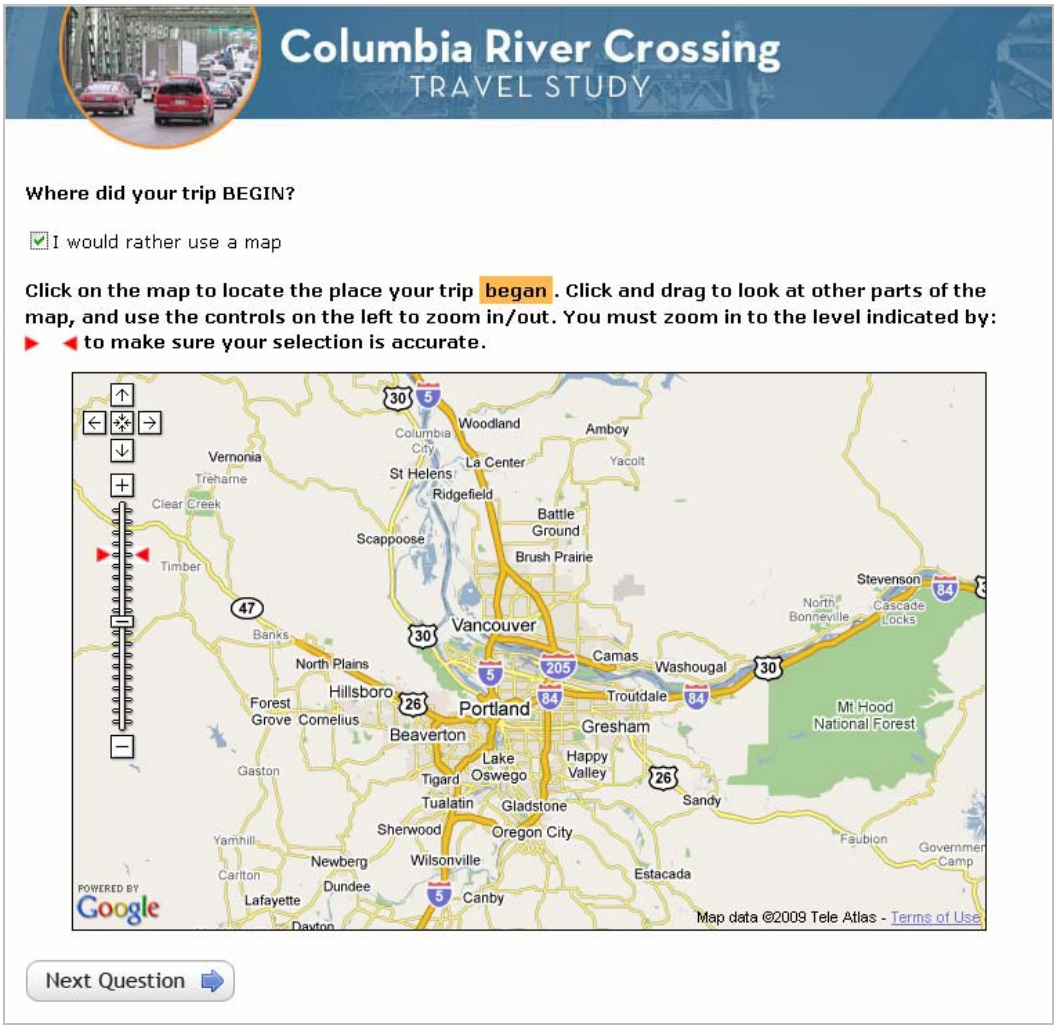


Figure 3: Screen for Selecting Origin or Destination Location Using a Map



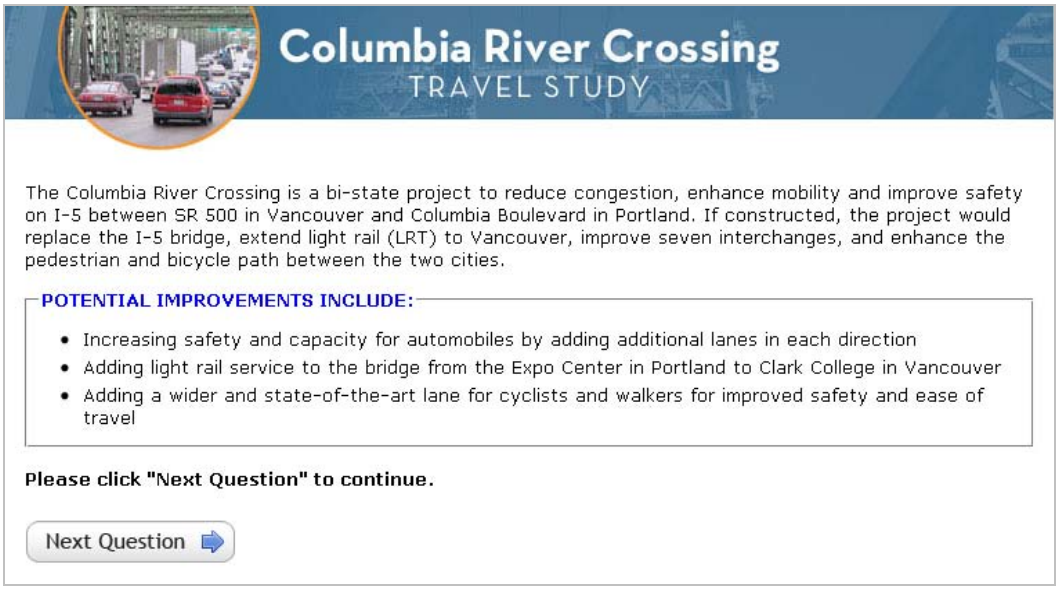
After entering their origin and destination locations, respondents were asked when the trip began and how much time they spent traveling. Reference trips between 10 minutes and two hours in length were validated. Travel time responses were compared to travel times from the skim data. Respondents who had entered either unusually long or short travel times were asked to confirm or correct their trip duration. Next, respondents were also asked to provide information on the cost of their trip, including gas estimates and parking prices, as well as the amount spent on their shopping trip, if applicable.

After confirming the day of the week, purpose, origin, destination, begin time, travel time, and number of passengers in the car for their trip, respondents were asked to estimate any traffic delay they experienced during their trip. Those who reported a delay were asked to provide an estimate of the portion of the delay caused by congestion specifically on the bridge or on the approach of the bridge. The remaining questions addressed respondents' flexibility in trip timing, and the total frequency with which the respondent made all types of trips using the same bridge in the same direction.

2.1.2 Stated Preference Questions

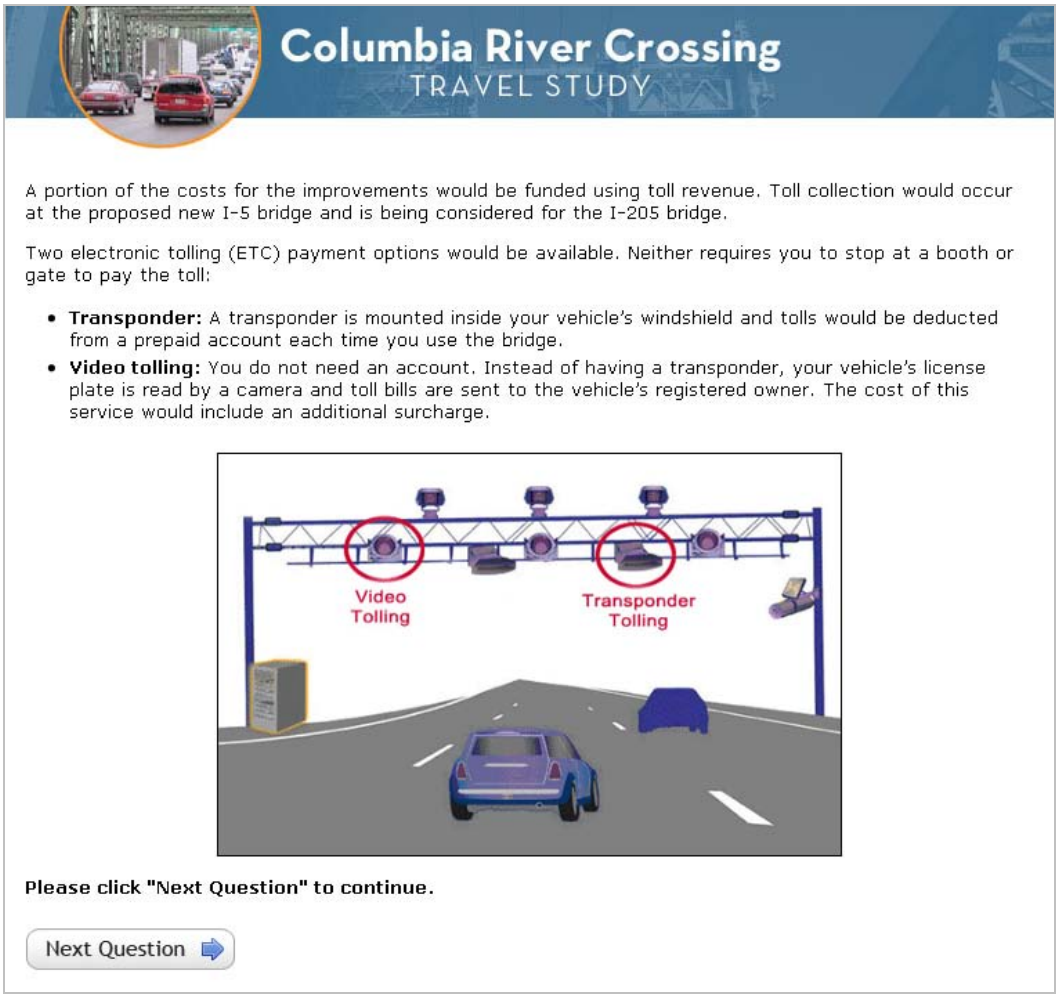
Before beginning the SP trade-off questions, automobile respondents were presented with descriptive information about the potential improvements to the I-5 bridge over the Columbia River between Portland, OR and Vancouver, WA (Figure 4).

Figure 4: Introduction to Stated Preference Section



Respondents were also presented with an explanation of electronic and video toll collection options that would be available on the proposed facility (Figure 5).

Figure 5: Explanation and Schematic of Toll Collection Options

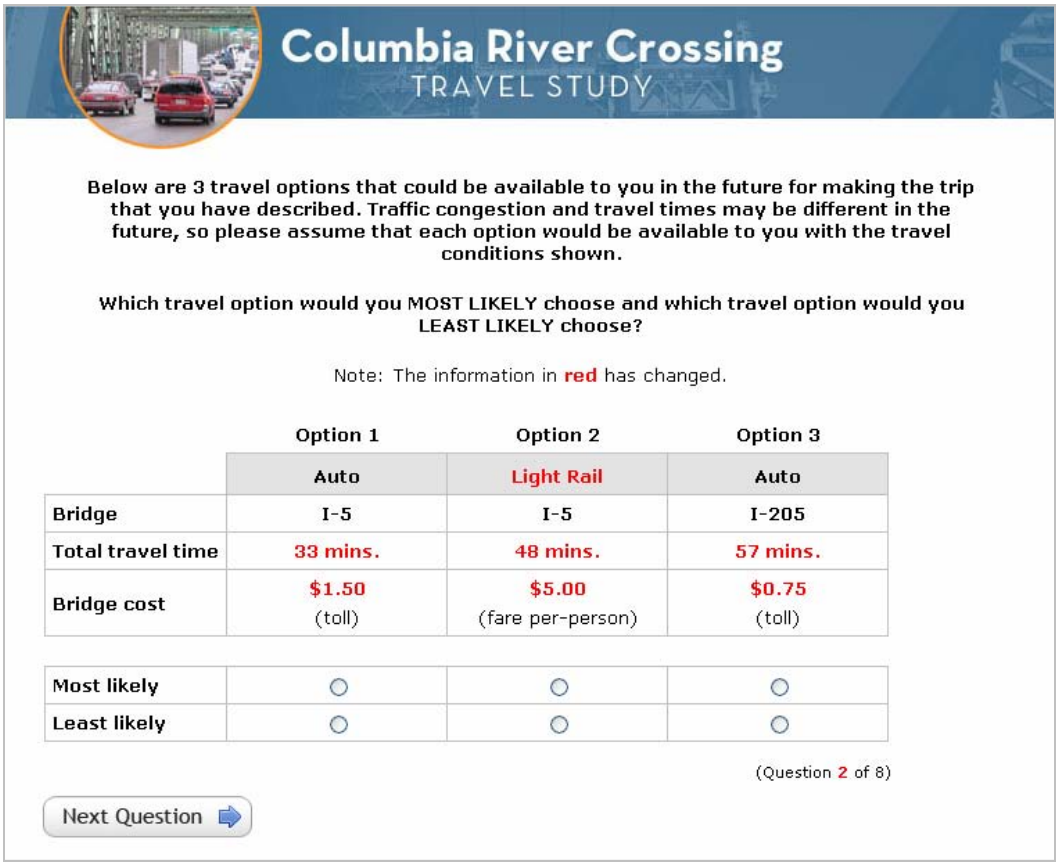


The stated preference section of the questionnaire was designed to construct quantitative experiments to estimate respondents' preferences for travel under hypothetical future conditions. The survey presented each respondent with eight stated preference tradeoff scenarios designed as choice experiments with three travel alternatives:

1. I-5 crossing by auto
2. I-205 crossing by auto
3. I-5 crossing by transit

The alternatives were described by attributes of travel time and toll cost or transit fare. Each stated preference experiment presented respondents with all three alternatives under varying travel time and cost conditions, and asked respondents to make a choice based on the values presented (Figure 6). The specific values of each attribute varied around a base value between each experiment. The base values were customized using the information from each respondent's reference trip.

Figure 6: Format of Automobile Stated Preference Questions 1-8



The specific values assigned in each stated preference scenario were determined by using an orthogonal experimental design, which ensured that information was collected from respondents in a statistically efficient manner. This technique is commonly used in constructing experimental plans. The experimental design for this survey contained sixty-four experiments, which were divided into eight groups of eight. One of the eight groups was chosen for each respondent and the eight experiments were shown to the respondent in a randomized order.

The base values for the attributes were varied by multiplying, adding, or subtracting one of several factors to give the level required by the experimental design for that particular scenario. By varying the travel times and costs in each scenario, respondents could demonstrate their travel preferences across a range of conditions. The experimental design, which details the calculations used for setting each of the variables' levels, is included in Appendix A.

2.1.3 Debrief and Opinion Questions

At the conclusion of the SP scenarios, respondents were asked specific debrief questions based on their choices in the stated preference section.

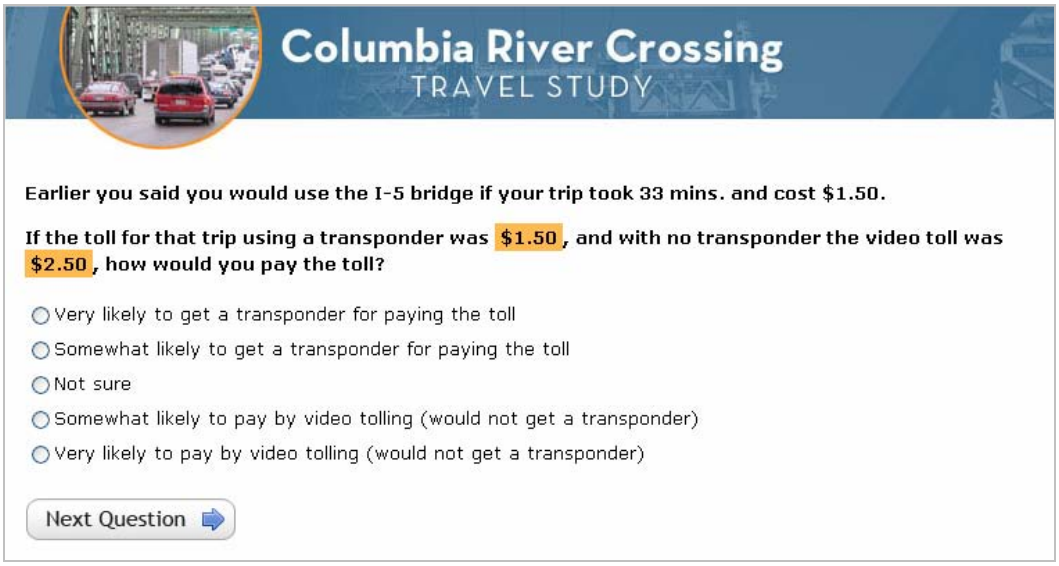
Respondents who never chose the transit option in the stated preference section were asked for a reason why. Unless the respondent did not select "not familiar with transit" as a reason why they never chose the public transit option in the stated preference section, all respondents were asked if they were familiar with the public transit systems in and around Portland and Vancouver. If they were familiar, respondents were then asked about the frequency with which they use the public transit in the Portland-Vancouver area.

If the respondent never selected the current bridge or never selected the alternate bridge in the stated preference section, they were prompted for a specific reason. The orders of the answer options in each of these questions were randomized to mitigate order bias.

Next, all respondents were asked how often they rode their bike for transportation. Those who bike at least once a week were informed that a wider and state-of-the-art lane for cyclist would be added to the I-5 bridge, and were asked how likely they would be to bike across the new I-5 bridge.

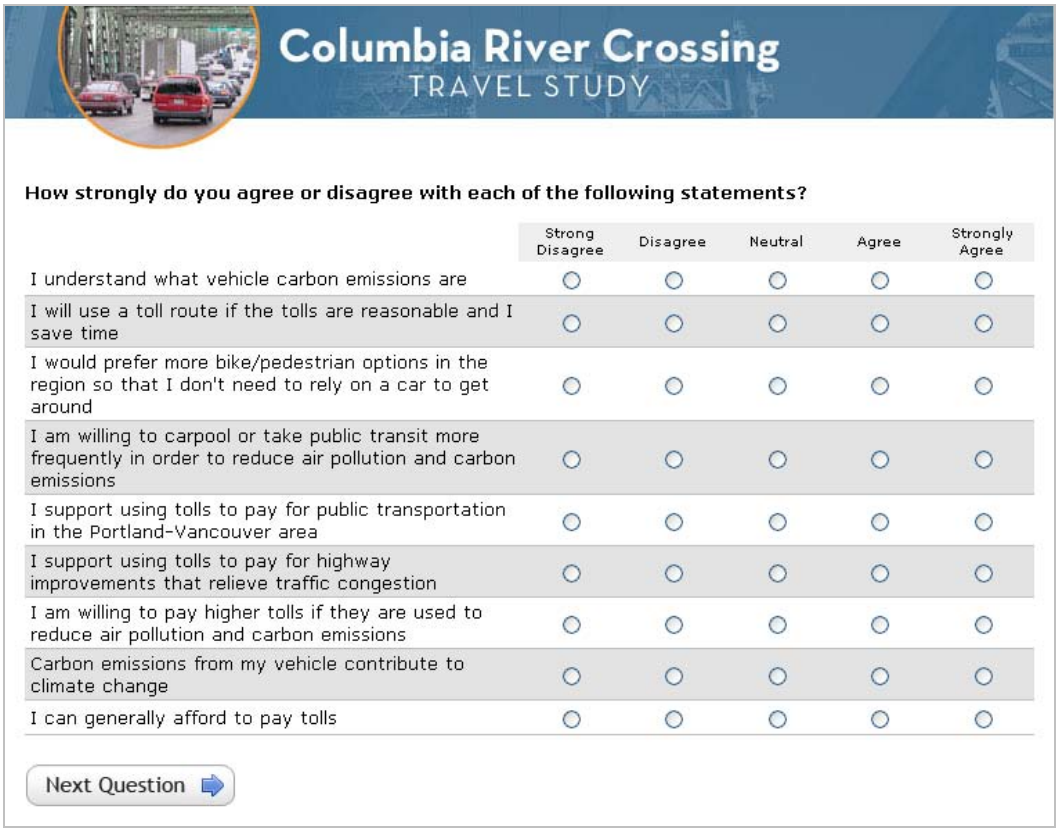
To gauge the discount in tolls required to provide adequate incentive for purchasing an ETC transponder, respondents who chose at least one tolled option in the SP portion of the survey were asked how likely they would be to use video tolling rather than transponder tolling for a given scenario. The scenario presented was selected from among those for which the respondent chose a tolled option in the SP section of the survey. The tolling rate presented when using a transponder remained the same as it had been in the stated preference section, but the tolling rate without using a transponder was increased by one dollar ($1) (Figure 7). Those respondents who said that they were somewhat unlikely or very unlikely to purchase an ETC were asked to choose among several options or enter their own reason for why they would be unlikely to pay the toll with a transponder.

Figure 7: Likelihood of Purchasing a Transponder



In the final part of this section of the questionnaire, respondents were asked how strongly they agreed or disagreed with a series of statements in order to gauge their attitudes toward climate change and carbon emissions; familiarity with public transport; and potential biases toward paying tolls, using toll roads, and changing travel behavior (Figure 8).

Figure 8: Attitudinal Statements



2.1.4 Demographic Questions

To conclude the survey, several demographic questions were asked to identify differences in responses among traveler segments and to verify that the sample contained a diverse cross section of the population that crosses the Columbia River. Demographic information collected included household size, vehicle and bicycle ownership, gender, age, employment status, and annual pre-tax income. Finally, respondents were given the opportunity to leave comments about the survey or the proposed improvements. These responses are provided in Appendix C.

2.2 Commercial Vehicle Questionnaire

Like the automobile questionnaire, the commercial vehicle questionnaire also consisted of four parts:

1. Context and screening questions
2. Stated preference questions
3. Debrief and opinion questions
4. Company background questions

The text of the commercial vehicle questionnaire is included in Appendix A and example survey screens are included in Appendix B.

2.2.1 Context and Screening Questions

Eligible commercial respondents fell into two categories: commercial vehicle drivers and commercial vehicle non-driver decision-makers. These groups were assigned using responses to a question about the respondent's role in their company and how often they drive commercial vehicles; those that reported being commercial vehicle drivers or owner-operators were classified as drivers, and those that were dispatchers or managers were classified as non-driver decision-makers.

Commercial vehicle respondents were asked screener questions to determine their eligibility to complete the survey. Both drivers and non-driver decision-makers had to be responsible for making some or all of the routing decisions for their vehicles. Respondents who did not make any routing decisions were not eligible to continue in the survey. Additionally, non-driver decision-makers were asked if they could describe the details of typical trips that commercial vehicles in their company make, which is essential to answer the remaining questions in the survey. Those that could not provided details about their drivers' trips were not eligible to continue.

Finally, only respondents who made a commercial trip, or reported that one of their drivers made a commercial trip, using either the I-205 bridge or the I-5 bridge to cross the Columbia River were eligible to complete the survey. Respondents were asked to focus on their or their driver's most recent trip using one of the two facilities. This most recent trip, or the reference trip, formed the basis for the rest of the questions in the survey.

Respondents who met the screener criteria went on to provide detailed information about their reference trip, such as:

- whether they completed the trip in less than one day
- the day of the week on which they used the relevant facility
- reason(s) for using a certain bridge during reference trip
- addresses of their origin (last commercial stop before crossing the bridge) and destination (first commercial stop after crossing the bridge)

Respondents preferring to use the map option instead of providing a specific address were able to do so, just as they were in the automobile survey. Additionally, the commercial vehicle survey, like the automobile survey, necessitated valid trips, meaning trips in one direction only that crossed one of the two bridges. If the respondent did not enter a valid trip, they were asked to change their origin or destination or to think of another reference trip that used either the I-205 bridge or the I-5 bridge.

After the reference trip was validated, respondents were asked for additional information about their reference trip, such as:

- the time when they left their last stop prior to using the facility
- the time at which they arrived at the facility
- the total trip duration

Respondents needed to report a travel time that was consistent with skim data travel times from the regional network model. Next, respondents provided information about their vehicle type and total number of axles.

All respondents were then shown a screen summarizing the information they had provided about their trip and vehicle and were asked to confirm or correct the information.

After confirming their trip information, commercial vehicle respondents provided additional details about the trip, including:

- whether they had experienced any delay on their trip and, if so, how much of the delay was due to congestion relating to the bridge they had used to cross the Columbia River
- whether they paid tolls and if so, the total toll cost and why they chose to use a tolled facility
- how flexible they were with respect to timing their trip
- how frequently they make a trip using the same bridge in the same direction
- whether their vehicle had an electronic toll collection transponder

2.2.2 Stated Preference Questions

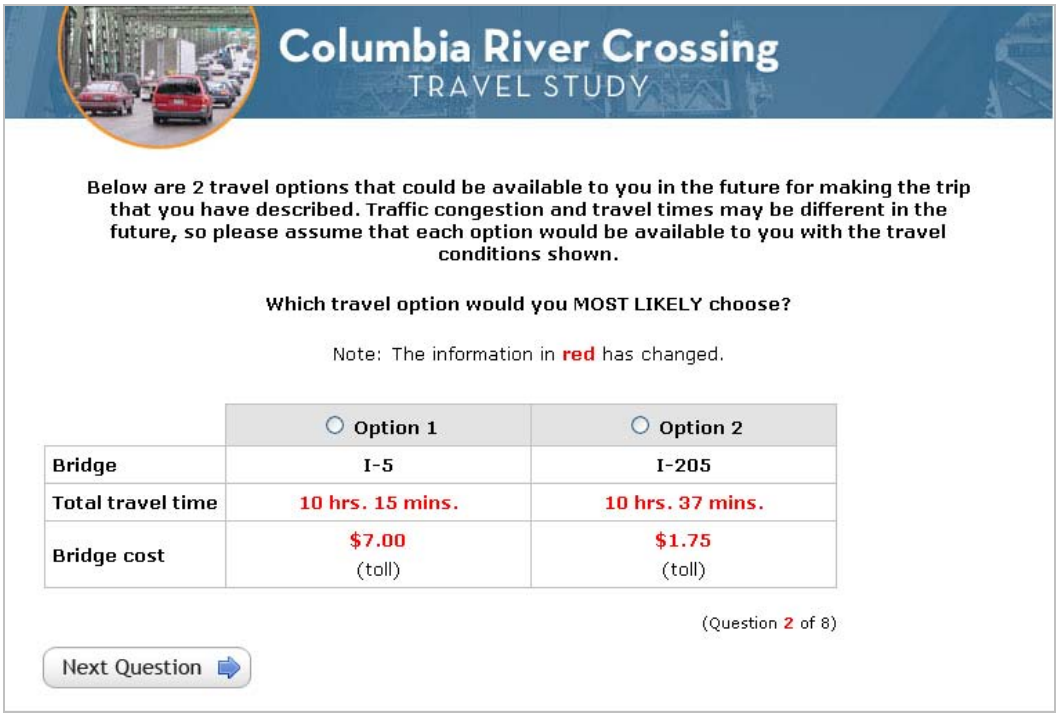
Before beginning the SP trade-off questions, commercial vehicle respondents were presented with the same descriptive information about the proposed facility improvements and tolling options as was presented to automobile respondents.

As with the automobile survey, the stated preference section of the commercial questionnaire was designed to construct quantitative experiments to estimate respondents' preferences for travel under hypothetical future conditions. The survey presented each respondent with eight stated preference tradeoff scenarios designed as choice experiments with two travel alternatives:

1. I-5 crossing
2. I-205 crossing

The alternatives were described by attributes of travel time and toll cost. Each stated preference experiment presented respondents with both alternatives under varying travel time and cost conditions, and asked respondents to make a choice based on the values presented (Figure 9). The specific values of each attribute varied around a base value between each experiment. The base values were customized using the information from each respondent's reference trip.

Figure 9: Format of Commercial Vehicle Stated Preference Questions 1-8



The specific values assigned in each stated preference scenario were determined by using an orthogonal experimental design, which ensured that information was collected from respondents in a statistically efficient manner. This technique is commonly used in constructing experimental plans. The experimental design for this survey contained sixty-four experiments, which were divided into eight groups of eight. One of the eight groups was chosen for each respondent and the eight experiments were shown to the respondent in a randomized order.

Like the values for the automobile survey, the base values for the attributes were varied by multiplying, adding, or subtracting one of several factors to give the level required by the experimental design for that particular scenario. The commercial vehicle experimental design is also included in Appendix A.

2.2.3 Debrief and Opinion Questions

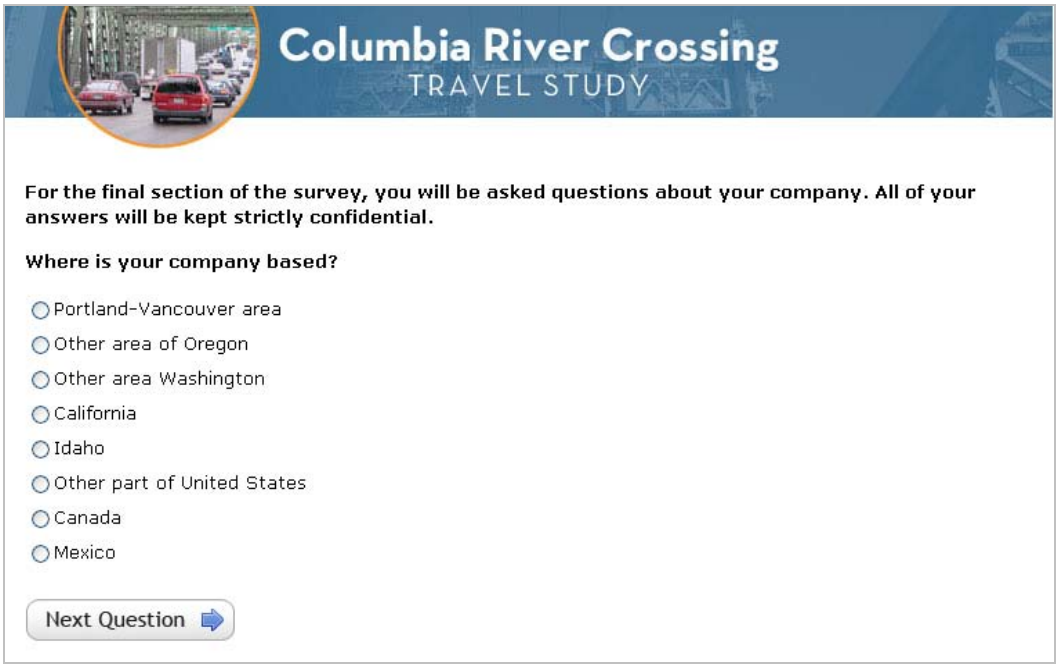
At the conclusion of the SP questions, respondents who never selected the current bridge in any of the SP scenarios were asked to indicate their primary reason why by selecting from a list of reasons or entering their own. Similarly, respondents who never chose the alternate bridge option in the SP scenarios were asked to select from or write their own reason for their choice. For both of these questions, the order of the answer options was randomized to minimize order bias.

As in the automobile survey, respondents who chose at least one tolled option in the SP portion of the survey were asked how likely they would be to use video tolling rather than transponder tolling for a given scenario. The purpose of this question was to gauge the discount in tolls required to provide adequate incentive for purchasing an ETC transponder. The scenario presented was selected from among those for which the respondent chose a tolled option in the SP section of the survey. The ETC toll cost presented was the same as the cost shown in the SP exercise, while the video tolling rate presented was two dollars higher. Those respondents who said that they were somewhat or very likely to pay by video tolling were asked why they would be unlikely to pay the toll with a transponder.

2.2.4 Company Background Questions

To conclude the survey, respondents answered several company background questions. These questions asked each respondent to provide the location of their company headquarters (Figure 10) and zip code

Figure 10: Location of Company Headquarters



Decision-maker respondents were also asked to select from a list of ranges of values to indicate the number of trucks their company operates. Both vehicle-drivers and decision-makers were asked to provide the average length of trips they typically make.

All respondents were asked to provide the type of goods typically carried by their company, the company's delivery schedule (fixed or flexible), and the timeframe structure (penalty or incentive). Decision-maker respondents were then asked to provide contact information so that they could receive their $20 incentive for taking the survey. Finally, all respondents were given the opportunity to leave comments about the survey or the proposed improvements. These responses are provided in Appendix C.

3.0 SURVEY ADMINISTRATION

3.1 Pre-Test Survey Administration

RSG conducted a pre-test of the automobile survey. Administration was conducted from 16 July to 18 July 2009. A total of 98 individuals participated. The pre-test participants were recruited through an online sample provider. Preliminary data analysis was conducted on the pre-test data to ensure survey usability and stated preference attribute levels.

Online sample providers offer access to a large sample of potential survey respondents who could be targeted by area of residence. This method served to provide access to a broad geographic sample of individuals using one of the two study facilities. Email invitations with an embedded link to the survey were sent to previously screened residents within the direct market area of Portland, OR.

3.2 Automobile Survey Administration

Automobile survey data were collected in July and August 2009. Travelers who made a trip in the previous two weeks (at the time of taking the survey) between Vancouver, WA and Portland, OR across the Columbia River that was at least 10 minutes long were recruited in one of three phases of automobile survey administration:

1. Laptop-based administration to respondents intercepted at activity sites in Portland, OR and Vancouver, WA.
2. Online administration through a postcard mail-out invitation.
3. Online administration through an online member panel.

A total of 1,942 respondents completed the automobile survey. The total number of complete responses by survey administration method is tabulated in Figure 11.

Figure 11: Automobile Administration Results

		Completed Surveys	
		Count	Percent
Sample Source	License Plate Capture	1,445	74%
	Activity Sites	399	21%
	Online Sample	98	5%
Total		1,942	100%

3.2.1 Administration at Activity Sites

The auto version was administered at nine unique activity sites in Portland, OR and Vancouver, WA July 20 - 25, 2009. Overall, computer-based administration to respondents intercepted at activity sites during

this period yielded 399 completed auto surveys. Nine surveys were completed at designated commercial vehicle activity sites by automobile drivers, including five at Paradise Truck Stop and four more at Travel Centers of America. Additionally, 10 of the 399 completed the survey at a later time, using the unique password from a postcard they received at one of the activity sites.

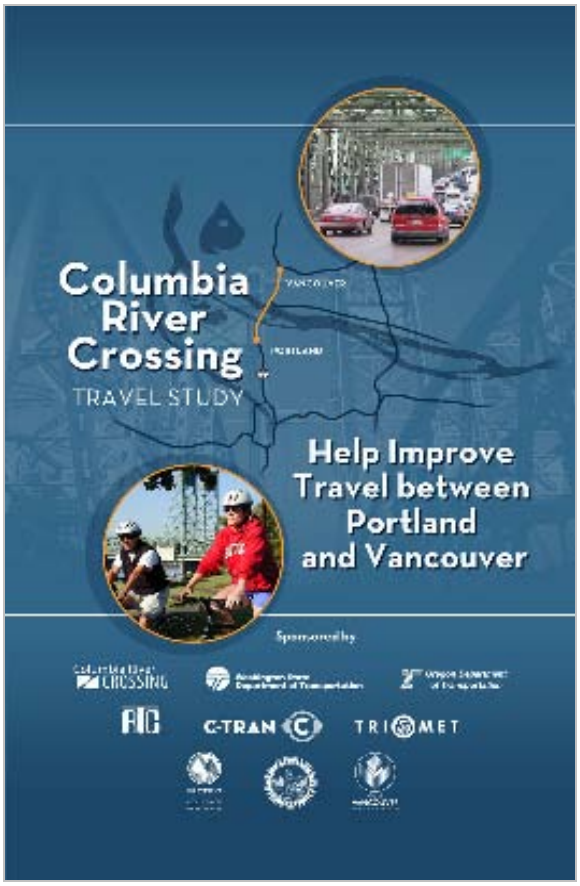
The survey was administered at sites with high pedestrian traffic and a high incidence of people likely to meet the screening criteria. Sites were chosen that would allow a cross-section of the population to be intercepted in terms of both trip purposes and demographics. Activity sites included shopping areas, a library, an airport, and a hospital (Figure 12).

Figure 12: Automobile Survey Activity Sites

Intercept Location or Type	Completed Surveys
OHSU	90
Vancouver Library	87
Clackamas Town Center Mall	61
PDX	58
Westfield Mall	49
Lloyd Center Mall	19
Bridgeport Mall	16
Intercept Postcard Recruits	10
Paradise Truck Stop	5
Travel Centers of America	4
Total	399

Survey administration consisted of 20 laptop computers distributed across 2-3 activity sites per day. Each activity site was staffed by three interviewers who were responsible for approaching and screening potential respondents, escorting respondents to interview stations, and assisting those respondents who had questions or required computer assistance. A framed poster mounted on an easel was positioned near the interview stations to help attract respondents (Figure 13). Great care was taken by the attendants to represent the project team in a polite and courteous manner at all times.

Figure 13: Activity Site Poster

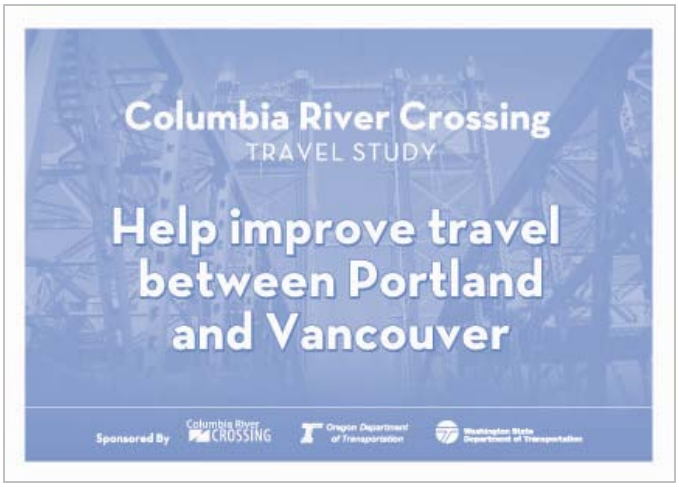


When taking the survey, respondents sat in front of a laptop computer and primarily used a mouse to record answers and navigate through the questionnaire. The median amount of time to complete the survey was 18 minutes. Data for each individual were automatically saved to the computer for later analysis.

3.2.2 Postcard Mail-Out Survey Administration

Online survey administration through a postcard invitation offered direct access to travelers currently using the facilities (Figure 14). Stantec provided address information from a license plate capture of travelers crossing the Columbia River.

Figure 14: Postcard for Mail-Out Survey Administration



Based on the captured license plate information, almost 54,000 invitation postcards were sent to residents of the Portland-Vancouver area. The postcard invitation directed respondents to the online Columbia River Crossing travel survey and provided each respondent with a unique password to prevent multiple completed surveys from one respondent.

A total of 1,445 surveys were completed through postcard invitation administration between July and August 2009, making up 74% of the automobile sample.

3.3 Commercial Vehicle Survey Administration

Commercial vehicle drivers and decision-makers who had made or directed a trip to use the I-5 bridge of the I-205 bridge were recruited. Only commercial drivers with at least some routing decision authority qualified for the survey. A total of 318 respondents completed the commercial driver survey as outlined in

Figure 15: Commercial Vehicle Survey Responses

		Completed Surveys	
		Count	Percent
Intercept Location or Type	Jubitz Truck Stop	146	46%
	Travel Centers of America	124	39%
	Telephone Recruit	34	11%
	Paradise Truck Stop	14	4%
Total		318	100%

3.3.1 Administration at Activity Sites

The computer-based survey regarding commercial vehicle travel was administered at three truck stop locations: Jubitz Truck Stop (Portland, OR), Travel Centers of America (Aurora, OR) and Paradise Truck Stop (Ridgefield, WA). Commercial truck drivers were intercepted as they were entering or exiting the port. A total of 312 respondents completed the survey via this method. Twenty-eight of the intercept respondents completed the survey at a later time, using the unique password from a postcard they received at one of the activity sites.

Data collection for commercial vehicles was conducted concurrently with the automobile survey from July 20-24, 2009.

3.3.2 Internet-Based Survey Administration

The commercial vehicle survey was also administered online via email invitation to employees of commercial vehicle companies that operate vehicles that cross the Columbia River between Portland, OR and Vancouver, WA. RSG contacted a list of commercial truck companies that operate in the region. Upon reaching an appropriate employee—a dispatcher, manager, or someone responsible for routing—the RSG representative would ask a series of screening questions over the phone to ensure that the employee qualified for the decision-maker survey. The RSG representative would then request permission to send an email invitation to participate in the online survey. A total of 34 respondents completed the survey via this method.

4.0 SURVEY RESULTS

4.1 Automobile Survey Results

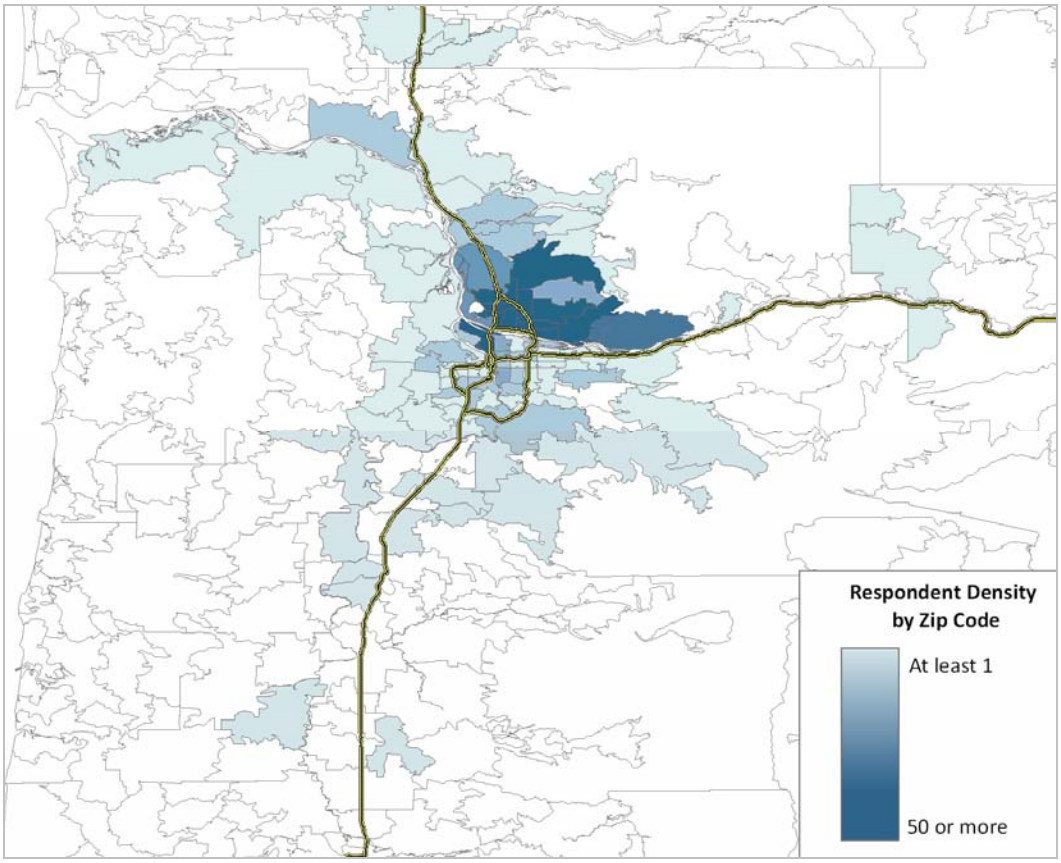
A total of 1,942 automobile drivers completed the questionnaire. The number of records used to estimate the discrete choice models was reduced to 1,744 after removing pre-test respondents, travelers who did not complete the stated preference portion of the survey, and respondents who were flagged after completing data checks and outlier analyses during the model estimation phase (described later in the modeling section of this report). The descriptive analysis of the data presented in this section of the report is based on 1,744 responses and is provided in three sections: context questions, stated preference questions, debrief and opinion questions, and demographic questions. A complete set of tabulations of survey questions is shown in Appendix D.

4.1.1 Context Question Results

Respondents began the survey by selecting all bridges that they had recently (in the last two weeks) traveled on in personal vehicle for a trip that was at least 10 minutes in duration. Almost 80% of respondents made a recent trip using the I-5 bridge while 75% made a trip using the I-205 bridge.

Respondents that selected both bridges were asked which bridge they used more recently. This more recent trip, or reference trip, formed the basis for the rest of the trip context questions in the survey. The distribution of reference trips included 55% for the I-5 bridge and 45% for the I-205 bridge, and 31% Oregon residents and 67% Washington residents. Figure 16 shows the distribution of respondent's home zip codes in the Portland-Vancouver area.

Figure 16: Respondent Density by Zip Code



The distribution of reference trip facility use was fairly even between respondents' state of residence. Fifty-seven percent of Oregon respondents and 54% of Washington respondents reported a trip that used the I-5 bridge. The remaining reference trips used the I-205 bridge.

Reference trips were well distributed across day of week (approximately 12-18% on each day), except that slightly more respondents (21%) described a trip on a Monday and relatively fewer respondents (7%) described a Sunday trip. Again, the distribution of the day of week was fairly even between respondents' state of residence. More than half of respondents (57%) described a trip to/from work or another business-related trip.

Almost half (48%) of Washington residents described trips to/from work and 18% reported a social or recreational trip. Similarly 46% of Oregon residents described trips to/from work, while over a quarter (26%) reported a social or recreational trip.

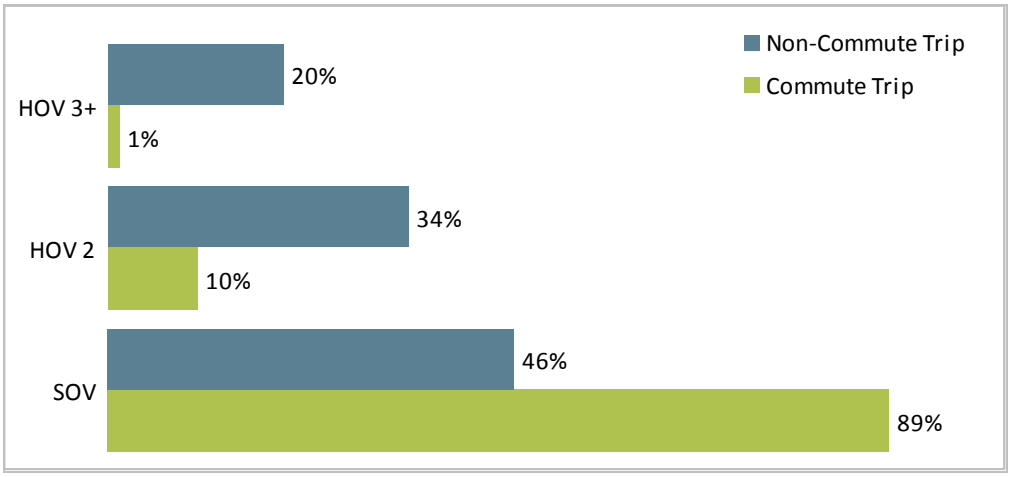
Respondents then provided the place where their trip began and ended. The majority of trips (82%) began at the respondent's home, whereas 43% of the trips ended at work (Figure 17).

Figure 17: Origin and Destination Locations

		Destination		
		Home	Work	Another Place
Origin	Home	0%	97%	89%
	Work	69%	3%	8%
	Another Place	30%	1%	3%

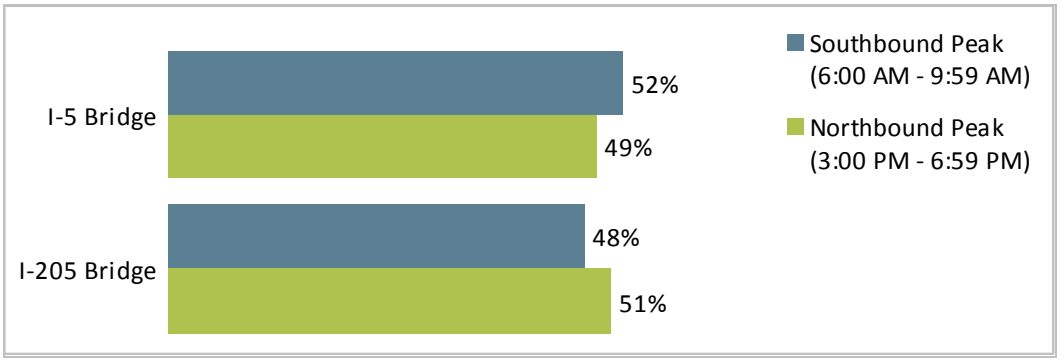
Two-thirds of the reference trips (66%) were made in single-occupant vehicles. A higher portion of work commute trips (89%) were made in single-occupant vehicles than non-work commute trips (46%).

Figure 18: Vehicle Occupancy by Trip Purpose



Respondents reported the time which their trip began. Peak-period trips (6:00 AM – 9:59 AM and 3:00 PM – 6:59 PM) represented 54% of the sample, while 27% of trips were made in the off-peak. The remaining trips were made on weekends. The distribution of time of day was fairly even among the bridge facilities.

Figure 19: Facility Use by Time of Day



After indicating when they began their trips, respondents were asked how long their trip took to complete. The majority of trips (70%) took between 20 and 50 minutes. Only 7% of trips took less than 20 minutes.

A majority of respondents (60%) reported some traffic-related delay on their trip. Of respondents who experienced a delay, more than two-thirds (62%) were delayed less than 10 minutes, 23% were delayed 10–19 minutes, and 15% were delayed 20 minutes or more. A majority of respondents (72%) attributed at least some of their delay to congestion on the bridges, and almost a fourth (23%) of respondents attributed all of their delay to these facilities. While almost half (49%) of reference trips that use I-205 experienced no delay, only 32% of trips that use I-5 experienced no delay.

Figure 20: Reported Delay by Time of Day (I-5 Reference Trips)

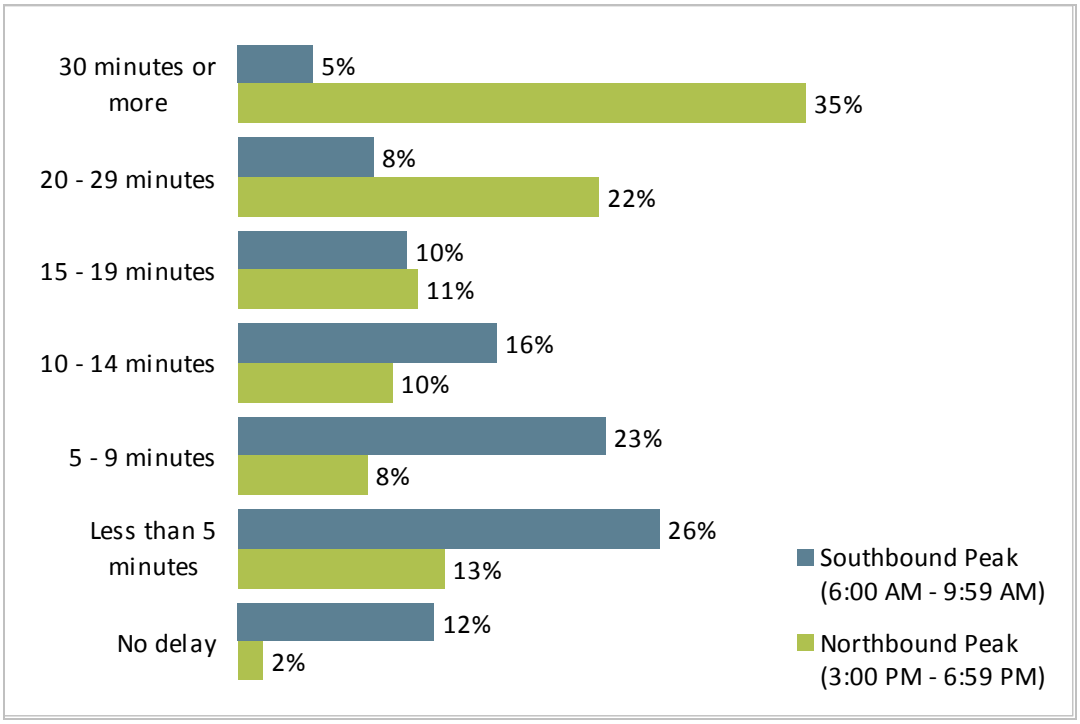
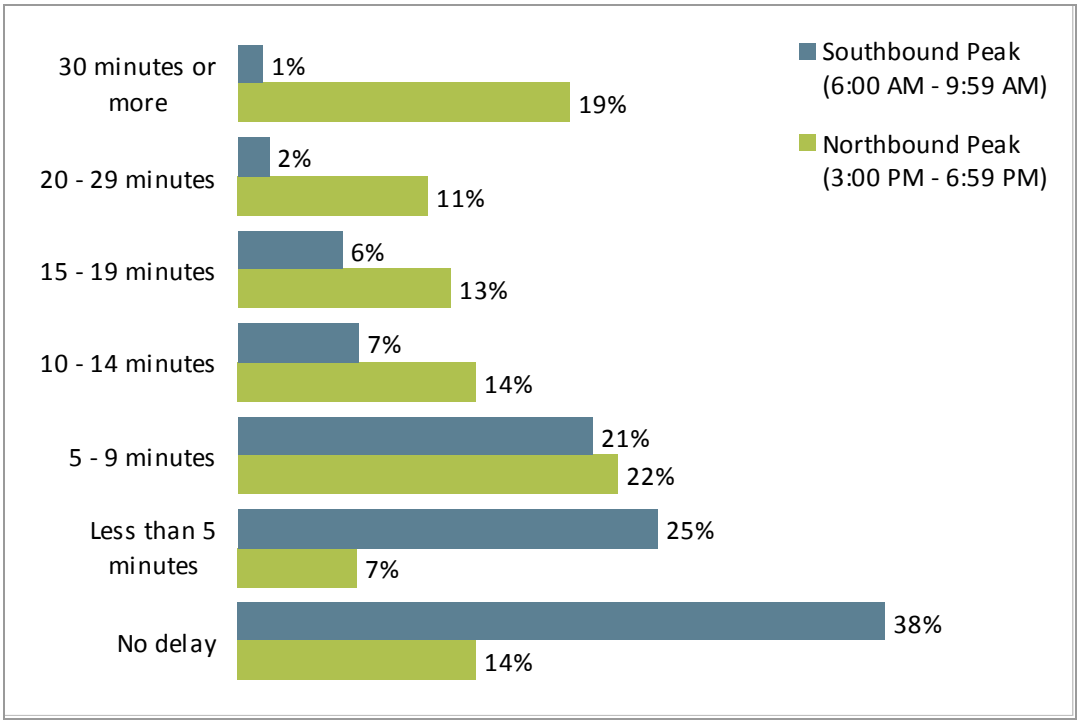


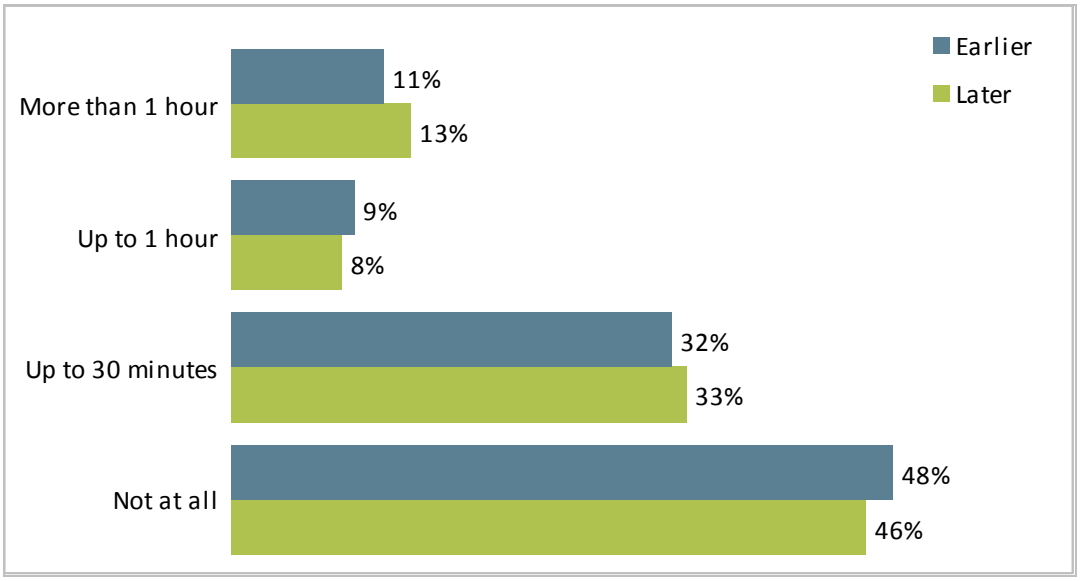
Figure 21: Reported Delay by Time of Day (I-205 Reference Trips)



Almost half (48%) of respondents reported they could not have left any earlier than their original departure time. About one-third (32%) could have left up to 30 minutes earlier, and the remaining 20% could have left more than 30 minutes earlier. Similarly, slightly more than 46% of respondents indicated

they could not have left any later, 33% percent could have left up to 30 minutes later, and only 21% could have left more than 30 minutes later.

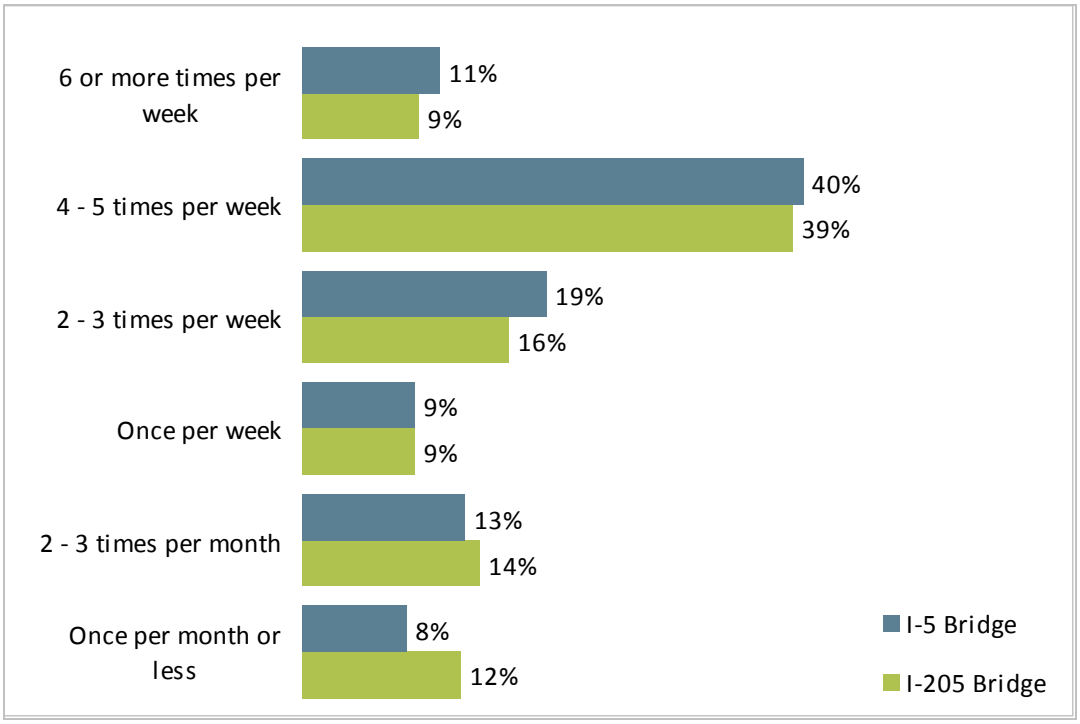
Figure 22: Schedule Flexibility by Shift Direction



Respondents were asked whether or not they paid for parking and how much they estimate gas costs were for their trip. The majority (90%) of respondents did not pay for parking, 8% paid less than $8, and 3% paid $8 or more. Over two-thirds (68%) of respondents estimated that they paid less than $5 in gas costs. Respondents who made a shopping trip estimated how much they spent on their trip. Of the respondents who reported a shopping cost 24% spent $175 or more. More than half of respondents (56%) spent between $25 and $174, while the rest of respondents (20%) spent less than $25.

The final set of questions in this part of the survey asked respondents the frequency they use the facility in question for trips in the same direction. In response to the trip frequency question, 10% responded that they make a trip less than once per month, whereas 50% make a trip four times per week or more (Figure 23). Approximately 78% of business trips were made four or more times per week; 48% of shopping, recreational, or social trips were made less than once per week.

Figure 23: Frequency of Bridge Use in Same Direction



4.1.2 Debrief Question Results

Following the stated preference (SP) section[1], respondents were asked a series of questions in order to better understand why they made the choices they did in the SP section.

Respondents who never chose one of the transit (light rail or bus) alternatives in the SP scenarios were asked why they did not. Twenty-seven percent of respondents who never chose one of the transit options in the SP scenarios indicated that they "Need the car for other reasons," while 19% of respondents indicated that the "Travel time is too long." Those and other reasons identified are shown in Figure 24. The majority of respondents (88%) indicated that they were familiar with local transit. Of those familiar with local transit over two-thirds (67%) use transit less than once per week and only 6% use transit at least 4 times per week.

[1] Results of the stated preference experiments are reported in the next section of this report.

Figure 24: Reasons for Never Selecting a Transit Alternative in the SP Section

Reason	Count	Percentage
Need car for other reasons	366	27%
Other	277	20%
Travel time is too long	260	19%
Time getting to and from transit too long	136	10%
Do not like transit	92	7%
Doesn't fit my schedule	90	7%
Cost is too high	67	5%
Schedule is not convenient	48	4%
Not familiar with transit system in the region	15	1%
Less reliable than current route	12	1%
Total	1,363	100%

Thirteen percent of respondents who reported a trip that used the I-5 bridge did not select the I-5 bridge in the SP section. A majority of these respondents (82%) indicted that they did not select their current bridge because "Toll is too high," while 8% indicated "I prefer to use the other bridge," and 3% indicated "Travel time too long." Similarly, 12% of respondents who reported a trip that used the I-205 bridge did not select the I-205 bridge in the SP section. Seventy-five percent of these respondents indicated that they did not select their current bridge because "Toll is too high," while 12% indicated "I prefer to use the other bridge," and 3% indicated "Travel time too long."

About 41% of respondents who reported a trip that used the I-5 bridge did not select an I-205 alternative in the SP section. Slightly less than one fourth (23%) of respondents who reported a trip that used the I-205 bridge and did not select an I-5 alternative in the SP section. Respondents' reasons are shown below in Figure 25 and Figure 26.

Figure 25: Reason for Never Selecting I-205 Alternative in the SP Section (I-5 Reference Trips)

Reason	Count	Percentage
Travel time is too long	99	40%
I prefer to use the current bridge	61	25%
Other	59	24%
Toll is too high	26	11%
Total	245	100%

Figure 26: Reason for Never Selecting I-5 Alternative in the SP Section (I-205 Reference Trips)

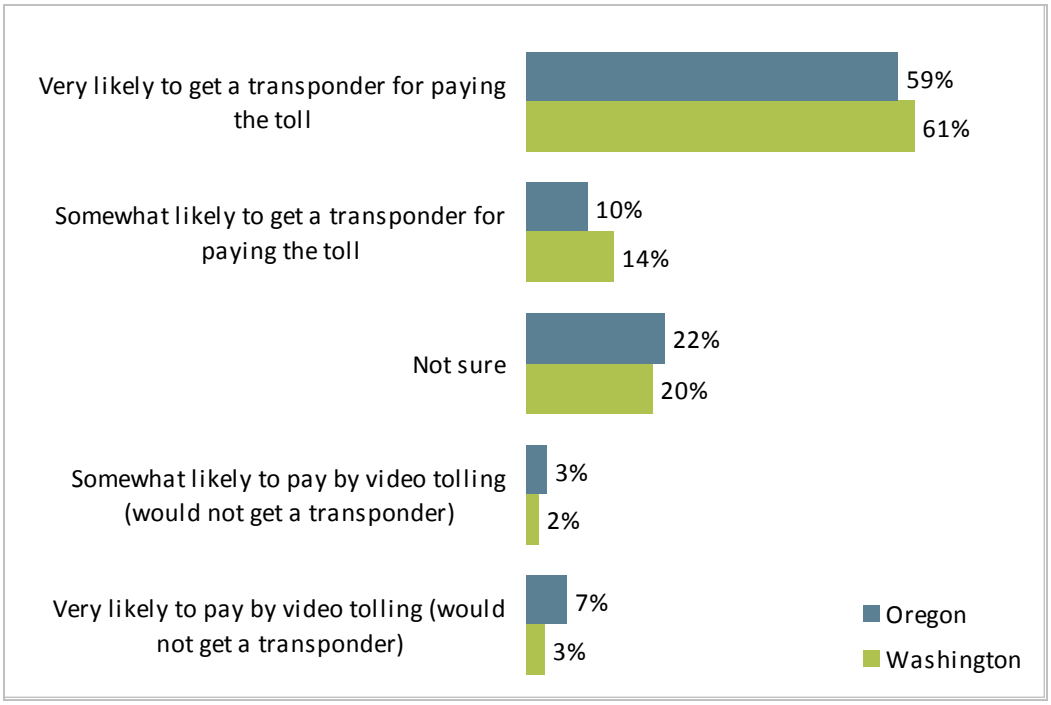
Reason	Count	Percentage
Travel time is too long	62	35%
I prefer to use the current bridge	54	31%
Other	43	24%
Toll is too high	18	10%
Total	177	100%

Respondents were next asked how often they use their bike as transportation. Over two-thirds (68%) of respondents reported that they never use a bike for transportation. Respondents who rode their bike at least once a week for transportation were then asked how likely they would be to ride their bike across the proposed I-5 bike lane. The majority (68%) reported they would never use the I-5 bike lane and a further 20% reported they would rarely use the proposed bike lane.

Respondents who selected a tolled bridge alternative at least once in the SP section were asked if they would get a transponder to pay discounted tolls (the alternative would be to pay the full amount by video tolling). Of the 1,724 respondents who saw this question, 73% said they would be very or somewhat

likely to purchase a transponder to pay the toll, 21% said they were not sure how they would pay for the toll, and 6% said they would be somewhat or very likely to pay via video tolling even if the toll were more expensive.

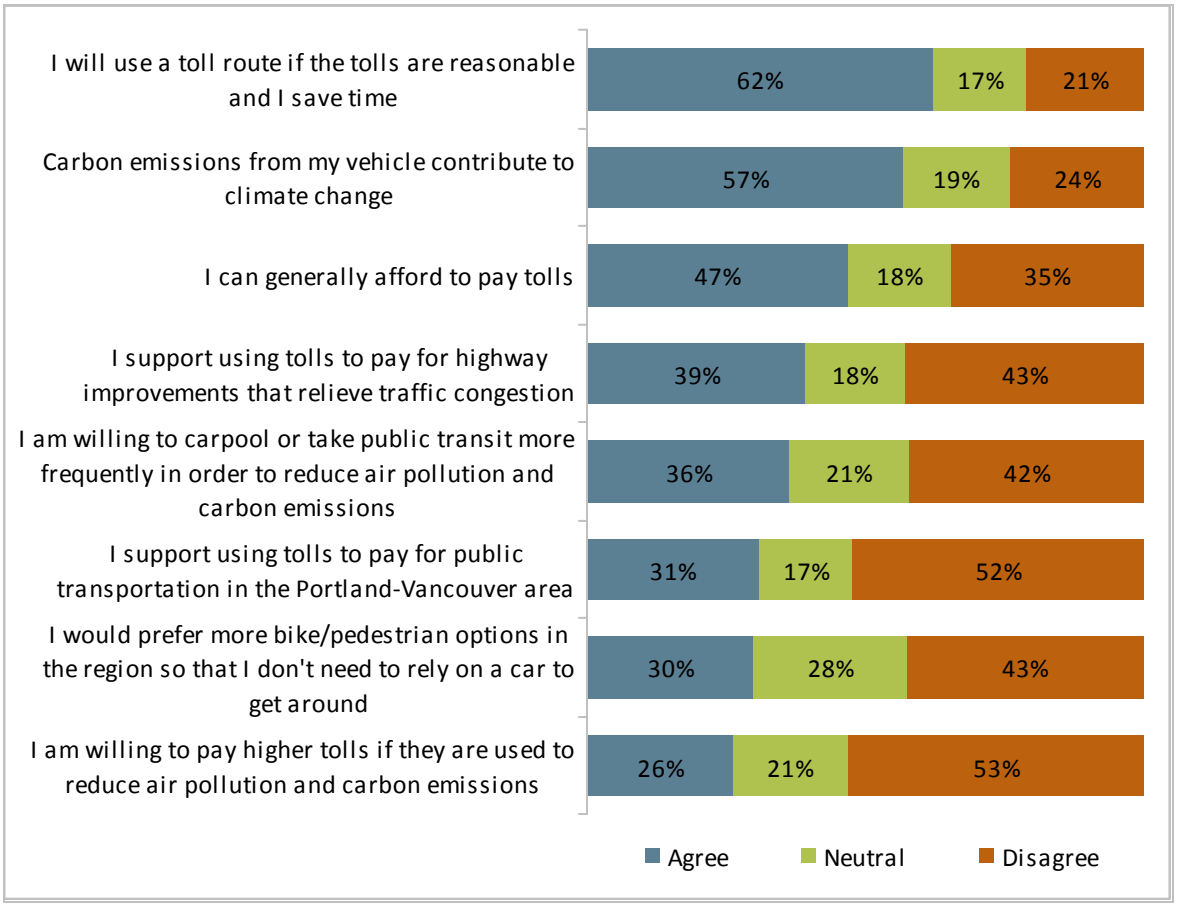
Figure 27: Likelihood of Purchasing ETC Transponder by State of Residence



Of the 110 respondents who said they were either not sure how they would pay for the toll or that they would be somewhat or very likely to pay using video tolling, 32% said they did not choose the toll transponder option because they would not use the bridges often enough. An additional 14% do not want a transponder in their cars, and 12% said they are concerned about privacy. Only 3% indicated that they would not get a transponder because they do not know enough about electronic toll collection.

The next part of the debrief section presented respondents with nine statements and asked them to state their level of agreement or disagreement using a five-point scale. Figure 28 presents the results of this question with the categories condensed to agree, neutral, and disagree.

Figure 28: Attitudinal Statements



4.1.3 Demographic Question Results

The last section of the survey asked respondents for basic demographic information. The greatest number of respondents (43%) reported a household size of two people, including themselves, and a further 18% of respondents reported living in a three-person household. One-fourth of respondents indicated they live in a house with four or more people, and 14% reported living alone. Eighteen percent of respondents reported having one household vehicle, 44% percent reported two vehicles, and 38% reported three or more vehicles. Only 1% of respondents stated they do not own a car.

Nearly one-fourth (23%) of respondents did not have a bicycle in their household, 20 % reported only one household bicycle, and 57% had two or more household bicycles.

The sample was very slightly skewed towards males (58%). The breakdown of age categories is shown below in Figure 29.

Figure 29: Respondent Age Distribution

	Count	Percentage	
16 - 24	67	4%	|||
25 - 34	260	15%	||||||||||||||
35 - 44	383	22%	||||||||||||||||||||||
45 - 54	433	25%	||||||||||||||||||||||||
55 - 64	445	26%	||||||||||||||||||||||||
65 - 74	129	7%	|||||||
75 or older	27	2%		
Total	1,744	100%	

Over two-thirds (64%) of all respondents indicated they were employed full-time, 8% stated they were employed part-time, and another 8% were self-employed. Over one-fourth of respondents (27%) indicated an annual household income of less than $50,000, before taxes. Nearly half of respondents indicated a household annual income between $50,000 and $75,000 (Figure 30).

Figure 30: Respondent Income Distribution

	Count	Percentage	
Less than $25,000	149	9%	||||||||
$25,000 - $49,999	322	19%	||||||||||||||||||
$50,000 - $74,999	392	23%	||||||||||||||||||||||
$75,000 - $99,999	361	21%	||||||||||||||||||||
$100,000 - $149,000	343	20%	||||||||||||||||||||
$150,000 - $199,999	92	5%	|||||
$200,000 - $249,999	40	2%	||
$250,000 or more	38	2%	
Total	1,737	100%	

4.2 Commercial Vehicle Survey Results

A total of 318 respondents completed the commercial vehicle survey. Several of these records were excluded during outlier analysis, which is described in the modeling section of this report. The descriptive analysis of the data presented here is based on the 232 records that were used for the modeling analysis. This section is divided into three subsections: context questions, debrief questions, and company demographic questions. A complete set of tabulations of survey questions for commercial vehicle respondents is shown in Appendix D.

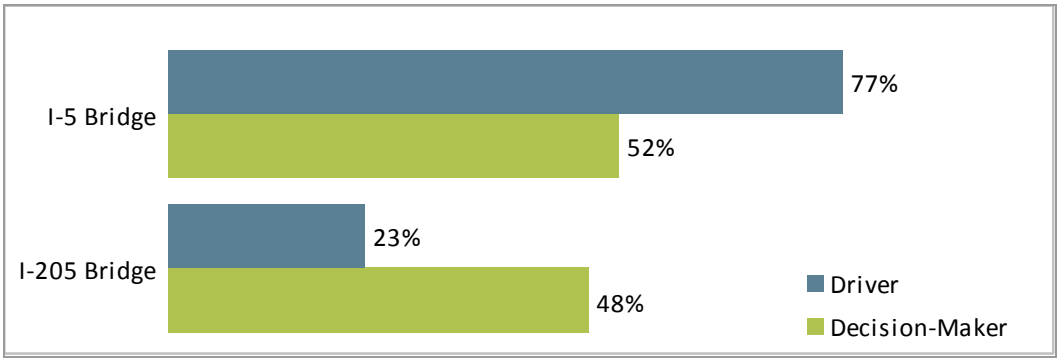
4.2.1 Context Question Results

Of the 232 respondents who completed the commercial vehicle survey, 29 (12%) were classified as non-driver decision-makers and the remaining 203 (88%) were classified as drivers. Seventy percent of drivers reported having complete autonomy for making routing decisions, while only 41% of non-driver decision-makers reported the same.

The majority of driver respondents (62%) worked for a trucking company with a multiple-vehicle fleet, while over one-third (36%) of drivers were self-employed. Forty-eight percent of driver respondents work for one private carrier, 44% work for at least one for-hire carrier, and 8% working for a combination of both types of carriers.

Sixty-two percent of respondents reported having used both bridges. Of these, about 73% had used the I-5 bridge more recently and the remaining used the I-205 bridge.

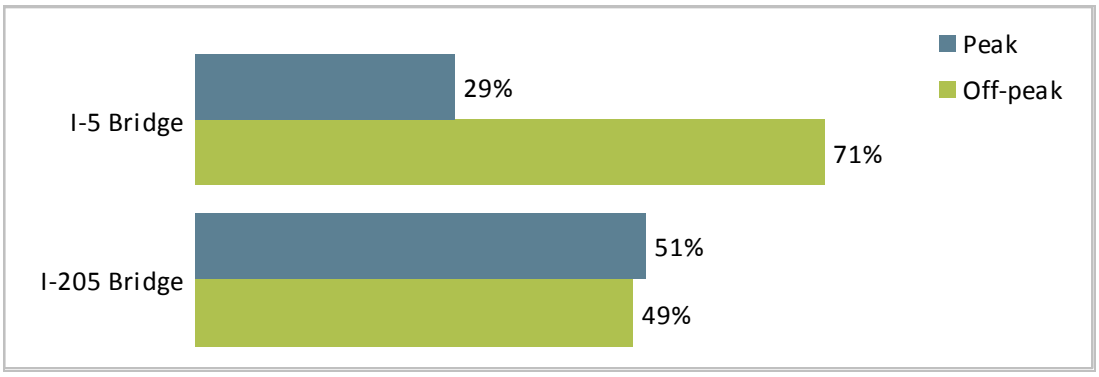
Figure 31: Bridge Used by Type of Respondent



A majority of respondents (86%) stated that they chose the facility for their reference trip because it was the most direct route between their origin and destination; all other reasons, such as less traffic congestion and route signage were selected by less than 13% of respondents.

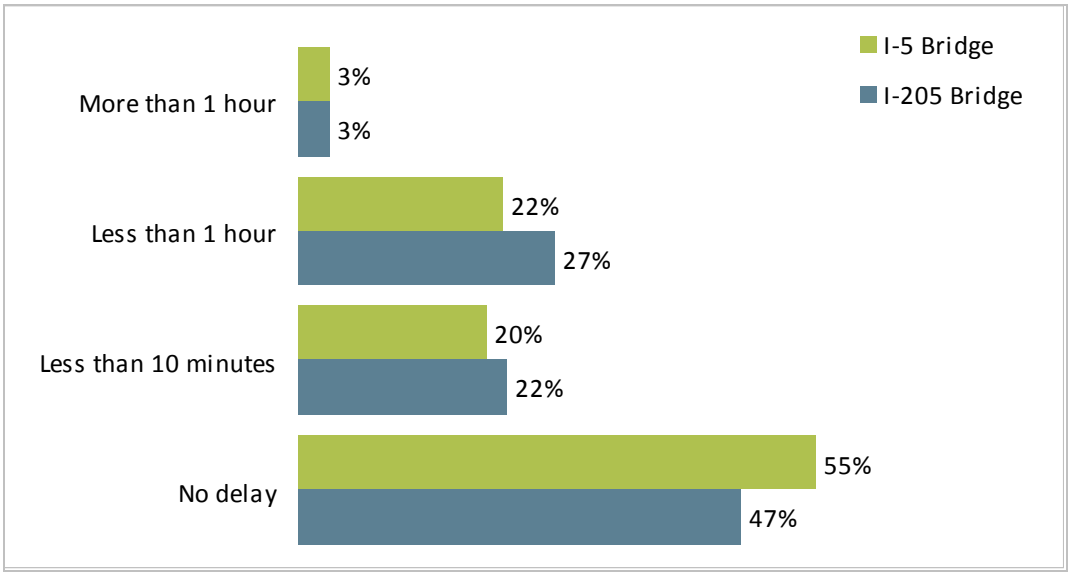
Eighty-five percent of respondents completed their trip within one day, and of those one-day trips 20% were completed in less than 1 hour, 32% were completed in less than 3 hours, 21% were completed in less than 4 hours, and the remaining 27% of trips took 4 hours or more to complete. Trips were fairly evenly distributed among weekdays, with only fifteen trips (6%) reported on the weekend. Over half of all weekday trips occurred in the peak (6:00 AM – 9:59 AM or 3:00 PM – 6:59 PM). The distribution of weekday facility cross times is shown in Figure 32.

Figure 32: Distribution of Facility Cross Times



A majority of survey respondents (51%) reported experiencing some delay on their trip, with more delay reported by those using the I-5 bridge (53%) than the I-205 bridge (45%). The distribution of delay by facility is shown in Figure 33.

Figure 33: Reported Delay Time by Facility Used



Almost all of respondents (92%) were carrying a tractor with a trailer, and almost three percent of respondents were carrying another truck type without a trailer. Overall, 78% of vehicles had five or more axles, less than ten percent of vehicles had four or fewer axles.

Only two of the 232 (1%) respondents paid tolls on their trip, and 32% of respondents owned an ETC transponder.

Half of respondents made a trip using the same facility in the same direction two times a month or less, with only 22% using the same facility at least four times a week.

4.2.2 Debrief Question Results

Following the SP section of the survey, respondents were asked a series of questions in order to better understand the reasoning behind their choices. About 40% of respondents who reported a trip that used the I-5 bridge did not select the I-5 bridge in the SP section. Almost all of these respondents (90%) indicted that they did not select their current bridge because "Toll is too high." Twenty-three percent of respondents who reported a trip that used the I-205 bridge did not select the I-205 bridge in the SP section. Similarly, 79% of these respondents indicated that they did not select their current bridge because "Toll is too high."

Less than 10% of respondents who reported a trip that used the I-5 bridge did not select an I-205 alternative in the SP section. Almost 20% of respondents who reported a trip that used the I-205 bridge and did not select an I-5 alternative in the SP section.

Of respondents who did not already have an ETC transponder in their vehicles, over half (52%) stated that they would be likely or very likely to purchase a transponder to get a discount in tolls, 33% were unsure, and 15% stated that they would somewhat or very likely to pay by video tolling.

Figure 34: Likelihood of Purchasing ETC Transponder

	Count	Percentage
Very likely to get a transponder for paying the toll	49	31%
Somewhat likely to get a transponder for paying the toll	32	20%
Not sure	52	33%
Somewhat likely to pay by video tolling (would not get a transponder)	10	6%
Very likely to pay by video tolling (would not get a transponder)	14	9%
Total	157	100%

4.2.3 Company Demographic Question Results

Almost half (47%) of survey respondents were employed by companies based in Oregon or Washington, with 19% of companies based in the Portland-Vancouver area.

Decision-makers also reported the number of vehicles their companies operated in general. Of the 29 decision-makers, 14 reported working for companies with 19 vehicles or fewer, and 93% of the companies had 99 vehicles or fewer.

The most commonly reported average trip lengths for respondents' companies were long haul (Figure 35).

Figure 35: Average Company Trip Length

	Count	Percentage
Local (less than 50 miles)	13	6%
Short haul (50 - 150 miles)	19	8%
Medium haul (150 - 300 miles)	21	9%
Long haul (more than 300 miles)	179	77%
I don't know	0	0%
Total	232	100%

Forty percent of respondents stated that they carried food products (including meat, fish, bakery, alcohol, and tobacco), and almost 35% stated that they carried lumber or wood products, including furniture. Slightly more than one half of respondents (54%) had flexible schedules, with 53% of those having less than two hours of flexibility in their delivery schedule. Most drivers (57%) had neither a penalty nor incentive time frame structure for deliveries, 10% had both, and the remaining 34% had either a penalty or incentive structure.

5.0 MODEL ESTIMATION

5.1 Methodology and Alternatives

In each auto survey stated preference experiment, respondents were presented the following three alternatives, and were asked to choose the most likely alternative and least likely alternative for making a future trip:

1. I-5 crossing by auto
2. I-205 crossing by auto

3. I-5 crossing by transit

By capturing the respondent's most likely and least likely alternatives, two choice observations were obtained from each choice experiment – the first observation including the most likely choice among all three alternatives, and the second observation including the least likely choice among the two remaining alternatives. These individual choice observations were expanded into a dataset containing sixteen observations for each of the 1,732 respondents, yielding a total of 27,712 observations. The data were used to support estimation of the coefficients of a multinomial logit (MNL)–based mode choice model[1] for the aggregate sample and for six model segments.

Respondents completing the commercial vehicle survey were shown stated preference scenarios with two alternatives:

1. I-5 crossing
2. I-205 crossing

The eight choice observations collected from 205 truck respondents yielded a dataset of 1,640 observations that underwent similar MNL analysis.

5.2 Identification of Outliers

Data were screened to ensure that all observations included in model estimation represented realistic trips and reasonable consideration of the trade-offs in the stated preference exercises. To validate trips for both auto and commercial respondents, the reported origin and destination were geocoded to TAZs, which were combined with skim data to generate an expected travel time. If the respondent's reported travel time was significantly longer or shorter than the expected travel time, the respondent's data was excluded from analysis. Additionally, the time in which the respondent completed both the stated preference exercise and the survey as a whole were analyzed and respondents with very rapid completion times were excluded from model estimation.

5.3 Model Specification

For auto trips, several utility equation structures were tested using the variables included in the stated preference experiments as well as trip characteristic and demographic variables. Specification testing included evaluation of various alternative-specific constants, bias-removing variables, and transformations of toll cost and travel time by household income. In the final specification, coefficients were determined for auto travel time, auto toll cost, transit travel time, transit cost, and transit mode. Time and cost coefficients were also specified in order to capture strategic bias in stated preference responses, an alternative-specific constant was specified for the I-5 and I-205 auto alternatives, and a scale parameter was specified for the second choice observation (least likely choice) (Figure 36).

[1] The multinomial logit model has the general form $p(i) = \frac{e^{Ui}}{\sum_{AllModes} e^{Uj}}$, where *p(i)* is the probability that mode i will be chosen and U_i is the "utility" of mode i, a function of service and other variables. See, for example, M. E. Ben-Akiva and S. R. Lerman, *Discrete Choice Analysis*, MIT Press, 1985 for details on the model structure and statistical estimations procedures.

Figure 36: Auto Model Specification

Coefficient	Units	Alternatives		
		I-5 Crossing Auto	I-205 Crossing Auto	I-5 Crossing Transit
Auto time	Minutes	X	X	
Auto cost	Dollars	X	X	
Transit time	Minutes			X
Transit cost	Dollars			X
Transit mode dummy – LRT	(0,1)			X
I-5 auto constant	(0,1)	X		
I-205 auto constant	(0,1)		X	
Strategic bias – auto time	Minutes	X	X	
Strategic bias – auto cost	Dollars	X	X	

A transformation of the auto cost coefficient by household income was tested in order to capture any systematic relationship between cost sensitivity and income. To test for this relationship, the elasticity of the auto cost coefficient relative to household income was estimated by including the following transformation of the auto time coefficient in the utility equation:

$$V_i = \cdots + \beta_c T_i \left(\frac{inc}{\overline{inc}} \right)^{\lambda_{c,inc}} + \ldots$$

Where:

- T_i gives the toll cost of alternative i
- inc gives the household income for the current respondent, with $\overline{inc}$ giving the base value, the average household income for the sample

The remaining terms are estimated in the model:

- The term β_c is the cost sensitivity (in 1/$)
- The interaction term $\lambda_{c,inc}$ gives the cost elasticity in relation to income

The cost elasticity in relation to income was estimated for the aggregate model and each of the six segments. The estimated elasticity coefficient was negative and significantly different from zero in all models, indicating that, in general, cost sensitivity decreases as household income increases. This results in an increase in value of time as household income increases.

Commercial vehicle models underwent similar specification testing, with coefficients in the final specification estimated for time and cost, and coefficients to capture strategic bias (Figure 37).

Figure 37: Commercial Vehicle Model Specification

Coefficient	Units	Alternatives	
		I-5 Crossing	I-205 Crossing
Time	Minutes	X	X
Cost	Dollars	X	X
I-5 constant	(0,1)	X	
Strategic bias –time	Minutes	X	X
Strategic bias –cost	Dollars	X	X

In the commercial vehicle models, a cost elasticity relative to trip distance was estimated to determine if a systematic relationship exists between trip distance and cost sensitivity. A transformation of the cost coefficient was also tested to evaluate whether a relationship exists between cost sensitivity and the number of vehicle axles. The transformation of the cost variable by distance and number of axles followed the form:

$$V_i = \cdots + \beta_c T_i \left(\frac{dist}{\overline{dist}} \right)^{\lambda_{c,dist}} \left(\frac{axles}{\overline{axles}} \right)^{\lambda_{c,axles}} + \ldots$$

Where:

- Ti gives the toll cost of alternative i
- dist gives the trip distance for the current respondent, with $\overline{dist}$ giving the base value, the average trip distance for the sample
- axles gives the number of truck axles reported by the current respondent, with $\overline{axles}$ giving the base value, the average number of axles for the sample

The remaining terms are estimated in the model:

- The term β_c is the cost sensitivity (in 1/$)
- The interaction terms: λ_c,dist gives the time elasticity in relation to trip distance, and λ_c,axles gives the cost elasticity in relation to the number of axles.

The distance transformation on cost sensitivity was statistically significant and negative meaning that, as trip distance increases, cost sensitivity decreases. The cost elasticity relative to the number of axles was negative and significantly different from zero demonstrating that sensitivity to toll cost decreases as the number of vehicle axles increases. This results in an increase in value of time as trip distance increases and the number of vehicle axles increases.

5.4 Segmentation

In addition to the aggregate model, segmented models were estimated for six auto traveler markets, including: time of day – peak and off-peak, trip purpose – business and non-business, and state of residence – Oregon and Washington (Figure 38).

Figure 38: Traveler Market Segments

	Segment	Description
Time of day	Peak	6:00 AM – 9:59 AM, 3:00 PM – 6:59 PM
	Off-peak	All other times
Trip purpose	Business	Work commute, business-related, airport (employee, business travel)
	Non-business	All other trips
State of residence	Oregon	Oregon home zip code
	Washington	Washington home zip code

Various segments were tested for commercial vehicles including the number of axles, the study corridor, the respondent's job position, and the company's schedule type. Using the previously described distance and axle transformations on the entire truck sample was found to provide the best model fit.

5.5 Model Coefficients

Figure 39 through 42 present the results of the aggregate and segmented MNL auto model runs using the specification described in Figure 36. For each model, coefficient values, standard errors and t-statistics are presented. The statistics included for each model are number of observations, Log Likelihood at zero and at convergence, and two model fit measures: Rho-Squared and adjusted Rho-Squared. Results from the aggregate MNL model run for commercial vehicles are shown in Figure 43.

Figure 39: Aggregate Model Coefficients

Number of observations:		27712	
Null log-likelihood:		-24826.62	
Final log-likelihood:		-17603.29	
Rho-square:		0.291	
Adjusted rho-square:		0.29	
	Value	Std error	T-stat(0)
Auto time	-0.07	0.00181	-38.71
Auto cost	-0.325	0.0119	-27.28
Auto cost-income elasticity	-0.367	0.0286	-12.84
Transit time	-0.0594	0.00193	-30.8
Transit cost	-0.356	0.0241	-14.79
LRT	0.651	0.053	12.28
I-5 constant	1.37	0.11	12.49
I-205 constant	1.3	0.109	11.88
Strategic bias – auto time	-0.0516	0.00167	-30.89
Strategic bias – auto cost	-0.432	0.0121	-35.81
Strategic bias – auto cost-income elasticity	-0.207	0.0251	-8.26
	Value	Std error	T-stat(1)
Scale parameter – first choice	1	fixed	
Scale parameter – second choice	0.692	0.0166	-18.55

Figure 40: Peak and Off-peak Model Coefficients

		Peak			Off-Peak	
Number of observations:		14960			12752	
Null log-likelihood:		-13402.36			-11424.26	
Final log-likelihood:		-9400.84			-8176.33	
Rho-square:		0.299			0.284	
Adjusted rho-square:		0.298			0.283	
	Value	Std error	T-stat(0)	Value	Std error	T-stat(0)
Auto time	-0.0729	0.00251	-29.04	-0.0667	0.00261	-25.51
Auto cost	-0.298	0.0167	-17.89	-0.35	0.0173	-20.26
Auto cost-income elasticity	-0.436	0.0439	-9.93	-0.308	0.038	-8.11
Transit time	-0.0635	0.00277	-22.89	-0.0551	0.00272	-20.22
Transit cost	-0.356	0.0318	-11.21	-0.361	0.0371	-9.73
LRT	0.637	0.0704	9.04	0.681	0.0811	8.41
I-5 constant	1.15	0.152	7.58	1.6	0.162	9.91
I-205 constant	1.12	0.152	7.39	1.5	0.162	9.26
Strategic bias – auto time	-0.0553	0.00228	-24.19	-0.0473	0.00246	-19.27
Strategic bias – auto cost	-0.414	0.0162	-25.62	-0.456	0.0182	-25.06
Strategic bias – auto cost-income elasticity	-0.22	0.0384	-5.74	-0.184	0.0344	-5.35
	Value	Std error	T-stat(1)	Value	Std error	T-stat(1)
Scale parameter – first choice	1	fixed		1	fixed	
Scale parameter – second choice	0.745	0.024	-10.62	0.631	0.023	-16

Figure 41: Business and Non-business Model Coefficients

		Business			Non-business	
Number of observations:		15984			11728	
Null log-likelihood:		-14319.74			-10506.88	
Final log-likelihood:		-10108.56			-7451.33	
Rho-square:		0.294			0.291	
Adjusted rho-square:		0.293			0.29	
	Value	Std error	T-stat(0)	Value	Std error	T-stat(0)
Auto time	-0.0754	0.00248	-30.38	-0.0647	0.00268	-24.18
Auto cost	-0.26	0.0165	-15.76	-0.388	0.0177	-21.9
Auto cost-income elasticity	-0.514	0.048	-10.71	-0.241	0.0364	-6.61
Transit time	-0.0661	0.00281	-23.54	-0.0529	0.00273	-19.38
Transit cost	-0.362	0.0321	-11.28	-0.358	0.037	-9.68
LRT	0.548	0.0694	7.89	0.8	0.0835	9.58
I-5 constant	0.976	0.155	6.29	1.79	0.159	11.24
I-205 constant	0.957	0.155	6.18	1.67	0.159	10.47
Strategic bias – auto time	-0.0539	0.00221	-24.38	-0.049	0.00257	-19.02
Strategic bias – auto cost	-0.431	0.0155	-27.72	-0.438	0.0193	-22.7
Strategic bias – auto cost-income elasticity	-0.142	0.0346	-4.12	-0.271	0.0373	-7.28
	Value	Std error	T-stat(1)	Value	Std error	T-stat(1)
Scale parameter – first choice	1	fixed		1	fixed	
Scale parameter – second choice	0.686	0.0215	-14.57	0.69	0.0259	-11.97

Figure 42: Oregon and Washington Model Coefficients

		OR			WA	
Number of observations:		8640			19072	
Null log-likelihood:		-7740.40			-17086.22	
Final log-likelihood:		-5572.12			-11966.57	
Rho-square:		0.28			0.3	
Adjusted rho-square:		0.279			0.299	
	Value	Std error	T-stat(0)	Value	Std error	T-stat(0)
Auto time	-0.0727	0.00326	-22.34	-0.0685	0.00218	-31.4
Auto cost	-0.311	0.0197	-15.8	-0.332	0.015	-22.14
Auto cost-income elasticity	-0.456	0.0424	-10.77	-0.3	0.0382	-7.85
Transit time	-0.0729	0.00357	-20.43	-0.052	0.00228	-22.79
Transit cost	-0.326	0.0406	-8.03	-0.37	0.0298	-12.43
LRT	0.8	0.091	8.8	0.572	0.0646	8.86
I-5 constant	0.71	0.185	3.83	1.75	0.136	12.9
I-205 constant	0.609	0.185	3.29	1.69	0.135	12.51
Strategic bias – auto time	-0.0539	0.00302	-17.87	-0.0506	0.00201	-25.12
Strategic bias – auto cost	-0.348	0.0222	-15.67	-0.462	0.0146	-31.54
Strategic bias – auto cost-income elasticity	-0.365	0.0582	-6.28	-0.171	0.0278	-6.14
	Value	Std error	T-stat(1)	Value	Std error	T-stat(1)
Scale parameter – first choice	1	fixed		1	fixed	
Scale parameter – second choice	0.727	0.0321	-8.49	0.683	0.0195	-16.25

Figure 43: Commercial Vehicle Model Coefficients

Number of observations:		1640	
Null log-likelihood:		-1136.76	
Final log-likelihood:		-904.65	
Rho-square:		0.204	
Adjusted rho-square:		0.196	
	Value	Std error	T-stat(0)
Time	-0.0679	0.0101	-6.76
Cost	-0.184	0.0329	-5.6
Cost-distance elasticity	-0.144	0.0492	-2.93
Cost-axles elasticity	-1.25	0.356	-3.52
I-5 constant	-0.103	0.0678	-1.52
Strategic bias – time	-0.0273	0.00662	-4.13
Strategic bias – cost	-0.344	0.0312	-11.03
Strategic bias – cost-distance elasticity	0.0917	0.0389	2.36
Strategic bias – cost-axles elasticity	-0.998	0.236	-4.24

5.6 Mean Values of Time

Mean VOTs based on the MNL results for the auto models are shown in Figure 44. The VOTs for each of the segments are estimated at the mean household income for the segment. Figure 44 also presents the mean VOT for the commercial vehicle model, which was estimated at the mean trip distance and mean number of vehicle axles.

Figure 44: Mean Values of Time

Segment	Value of Time ($/hour)
Aggregate auto	$12.92
Peak auto	$14.68
Off-peak auto	$11.43
Business auto	$17.40
Non-business auto	$10.01
Oregon auto	$14.03
Washington auto	$12.38
Aggregate commercial vehicle	$22.14