Memorandum

To: *Internal Documentation*

From: *Ron Davis*

Date: *February 11, 2013*

Subject: *Columbia River Crossing O-D Survey Review*

Introduction

An online Origin-Destination (O-D) survey was conducted as part of the Columbia River Crossing (CRC) Traffic and Revenue (T&R) Analysis by CDM Smith. The survey was used to obtain actual data on trip movements across the I-5 Bridge for the project model development. This memo is an overview of the methodology used to conduct the survey and some of the lessons learned from the process. It is intended to serve as a guide to help in future O-D survey work.

Initial Planning

The study schedule was tight in the early stages of the project. A timeline of the schedule is presented below:

- Sep 24 to Sep 27, 2012: I discussed data collection options with several other people at CDM Smith including Christopher Mwalwanda, Steve Brown, Jonathon Hart, and Stefan Reul. The discussions were mostly on how to get long distance trip data, especially for trucks. Bluetooth, cellular, license plate matching, and INRIX were all discussed. Steve and Jonathon also warned of past challenges with working with our planned data collection sub consultant All Traffic Data.

- Sep 27, 2012: I worked out a rough cost estimate for the data collection, including O-D survey.

As part of the project initial planning, a survey response estimate was made in Oct 2012. The estimate is shown in **Table 1** and can be compared to actual response rates presented later in this document.

Table 1: Survey Response Estimate for CRC O-D Survey Initial Planning

Parameter	Estimated Amount	Assumption	Source
Weekday NB Volume	36,700	Daytime (8:00am to 6:00pm) Aug 2012 data and historical Aug to Oct relationship	-
Weekday SB Volume	40,700		
Weekend NB Volume	31,600		
Weekend SB Volume	37,200		
Total Volume	146,200		-
Only Passenger Cars	131,600	10% Commercial Vehicles	I-5 Bridge data
Plates Read	85,500	65% plate read rate	Vendor discussions (conservative)
Remove Duplicates	58,100	32% multiple matches	Gut estimate
DMV/DOL Matches	52,300	90% match rate	Gut estimate
Remove "No Send"	51,800	1% prev. request to not contact	Gut estimate
Survey Responses	5,200	10% response rate	SR-520 project response

License Plate Data Collection

The license plate data collection included both getting the plate numbers and the state of plate for both an average weekday and average weekend day. Historically on studies generally only weekday collection was completed in these surveys. However one of the lessons learned from CDM Smith's work on the SR-520 project in Seattle is that the weekend was important to also consider. Eugene Ryan felt that including weekends in the data collection would help to answer various questions as they came up later. The reason for getting the state of plate was to respond to a request from the project team to determine whether vehicles crossing the bridges have Oregon, Washington, California, Canada, Mexico, or plates from other states. Additionally identifying the state of plate also streamlined the DMV/DOL address query process as we did not need to query so many plates with both states.

A timeline for the license plate data collection planning and implementation is presented below:

- Oct 11, 2012: I began discussing the data collection with Clay Carney and Eric Boivin from All Traffic Data.

- Oct 12, 2012: I sent a data collection overview memo to the CRC team and to All Traffic Data. The CRC team reviewed the plans as presented in the memo and All Traffic Data used the memo to estimate their cost for the collection. Initially we considered incorporating a through trip license plate matching survey along with the license plate collection for purposes of the O-D survey.

- Oct 15, 2012: All Traffic Data submitted their cost estimate for the project which seemed to be very high. I began to compile comparable costs for similar surveys from other projects with the help of Inshu Minocha and Jonathon Hart.

- Oct 16, 2012: Other options were considered for the through trip license plate matching survey because of its high cost including using Bluetooth, cellular, and CV weight station data. Because of All Traffic Data's high cost estimate I also worked on getting another quote for the data collection from National Data & Surveying Services (NDS), a data collection company out of California that was recommended by Jonathon Hart. I dealt with Kevin Deal and Avi Tashman with NDS. Note that NDS also owned a company called All Traffic Data that was not affiliated with the All Traffic Data company originally on the CRC project. Additionally, I contacted Quality Counts, a traffic data company out of Portland, about doing the collection. They did not have the technology to do it however.

- Oct 19, 2012: We decided to go with NDS for the data collection rather than All Traffic Data. A large part of the reason was their cost, but the negative reviews of All Traffic Data from other CDM Smith employees and the fact that they generally seemed difficult to work with in our limited correspondence also impacted our decision. We were able to request an expedited processing time from NDS at a little higher cost to meet the accelerated schedule goal of doing the data collection before the time change

- Oct 23, 2012: I traveled to Portland and met with Mark Degenhart and Daniel Teran, both of the CRC project team, in Vancouver. Jeremy Sandoz, the NDS field manager, also joined the meeting later on. We discussed the collection in general and reviewed the specific sites proposed for the data collection. Safety concerns were addressed and we ended up even moving one of the data collection locations to a more accessible and safer spot.

- Oct 24 to Oct 28, 2012: Data collection was conducted by NDS at various times during this period. Rainy conditions proved to be a challenge to the data collection as NDS' camera equipment was not waterproof and rain made plate recognition challenging anyway even if their equipment had been waterproof. It rained most of Saturday and Sunday so good weekend data was not obtained. It was decided that NDS would return the following weekend to again try to get data. I flew out of Portland on Friday morning but was in contact with Jeremy on both Saturday and Sunday.

- Nov 4 to Nov 5, 2012: NDS returned to get the weekend. Sunday Nov 5 ended up having good weather and the collection went well. There was also a concern that the I-5 drawbridge would be up that day and impact our data collection (Mark emailed me that they were planning to do maintenance). However, this ended up not happening for unknown reasons.

- Dec 20, 2012: A memo documenting the results of the state of plate collection and analysis was delivered to Terri Slack and Carley Francis

One of the general lessons learned from the data collection is that it is important to very early on understand the safety and paper trail type requirements of the jurisdiction operating the roadway. In this case this was both the Oregon DOT and Washington State DOTs. We communicated to the DOTs through the Columbia River Crossing Project Office. It was made more complicated because of the bridge being involved (security issues). There were a large number of people who needed to be notified when data collectors were out in the field. The NDS people were not used to working in an area with so many hoops to jump through and so much scrutiny. There were no major problems but a few minor issues did come up including that the CRC team needed to know exactly when NDS was in the field. The rain made it challenging as schedules of being in the field had to be altered on the fly. It really helped that I was on site for the data collection to work through a few of the minor issues that came up.

Since commercial vehicle response rates to O-D surveys are nearly always too low to be significant, we made the decision early on to only get license plates numbers for passenger cars only. Both PCs and CVs were to be included in state of plate analysis however. The vendor ended up getting plate numbers for both PCs and CVs as it was easier for them to do this. However, we only used the PC plate numbers for the DMV/DOL queries and it saved money in mailing out fewer post cards. We were satisfied with this decision. For the purposes of this data collection, passenger cars were assumed to be FHWA classes 1, 2, or 3 and commercial vehicles were assumed to be classes 4 or above.

We were very happy with the decision to switch to use NDS for the data collection. They were good to work with, their costs were competitive, and their analysis of the results was thorough and appeared to be very accurate. **Table 2** gives a comparison of the costs of license plate number collections on a cost per plate basis. Note that All Traffic Data also would have charged an additional $30,000 for state of plate identification which was included in NDS's cost. The CJ Hensch cost was provided by Inshu Minocha as a comparison and fell between the NDS and All Traffic Data cost estimates.

Table 2: Comparative Costs for License Plate Number Collection for DMV Queries

Company	Date	Project	Cost (000's)	Total Plates	Cost Per Plate	Notes
All Traffic Data	Fall 2012	CRC	$138.0	138,000	$1.00	$138 for 24 hour license plate numbers in one direction on a weekday and weekend
National Data & Surveying Services	Fall 2012	CRC	$53.5	129,101	$0.41	For daytime video recording in both directions on a weekday and weekend with state of plate identification. Base cost $46 with $1.5 for ramp counts, $4.5 for expedited delivery, and $1.5 if additional weather related setups are needed, ended up being $53.5
CJ Hensch	April-May 2011	Grand Parkway (TX)	$85.0	122,181	$0.70	License plate numbers only, cost supplied by Inshu Minocha

The weekday plate numbers and state/country of plate (broken down by passenger car and commercial vehicle) were delivered to CDM Smith on Wednesday, November 14. The weekend results were delivered on Wednesday, November 21. **Table 3** shows the collection days of the plate data delivered to CDM Smith. Weekday data was generally collected from 8:15am to 5:30pm and weekend data from 8:00am to 5:00pm. **Table 4** gives license plate collection statistics.

Table 3: Collection Days of Plate Data Delivered to CDM Smith

Day	Plate Data From	Proportion
Weekday	Wed, Oct 24	95%
Weekday	Thu, Oct 25	5%
Weekend	Sun, Nov 4	Nearly all
Weekend	Sat, Oct 27	Small amount
Weekend	Sun, Oct 28	Small amount

Table 4: License Plate Data Collection Statistics

Parameter	All Vehicles		Visible Plate #'s: Passenger Cars Only				
	Total	Visible Plate #'s	Plates	OR Plates	WA Plates	Other State Plates	Unknown State Plates
All Plates							
Weekday NB	42,526	35,954	33,602	11,857	19,070	638	2,037
Weekday SB	41,054	32,810	30,384	11,805	15,510	520	2,549
Weekend NB	34,632	30,002	29,297	11,527	16,308	754	708
Weekend SB	35,829	30,335	29,717	11,572	16,946	675	524
Weekday	83,580	68,764	63,986	23,662	34,580	1,158	4,586
Weekend	70,461	60,337	59,014	23,099	33,254	1,429	1,232
Total	154,041	129,101	123,000	46,761	67,834	2,587	5,818
Duplicate Plates Removed							
Weekday	67,573	52,757	48,895	17,556	26,333	950	4,056
Weekend	53,160	43,036	41,927	16,209	23,561	1,180	977
Total	115,915	90,975	86,111	32,182	47,085	2,085	4,759

Notes:

1. Most weekday and weekend plates were collected on Wed Oct 24 and Sun Nov 4, 2012, respectively

2. Weekday plates were collected from around 8:15am to 5:30pm, weekend from 8:00am to 5:00pm

3. The number of vehicles in the "Total" column are based on NDS' counts.

4. Totals in this table compared well to counts from permanent counter stations.

5. The "Total" row under "Duplicate Plates Removed" has additional duplicates removed from between weekdays and weekends. Thus "Weekday" plus "Weekend" does not equal "Total" in this section.

DMV/DOL Query

NDS processed the license plate video collected and the results were used to query the state DMV/DOLs. Note that Oregon called their agency a DMV and Washington State a DOL. A timeline of the Oregon DMV query process is given below:

- Nov 6, 2012: I got Claudia Hirschey working on the Oregon DMV account application. I sent her a pdf copy of the 2009 application made for the previous O-D survey as a template for our application.

- Nov 14, 2012: Carley Francis submitted the account application to the Oregon DMV (Annie Weathers). I also submitted a helpdesk ticket as we needed CDM Smith's "IP address and fully qualified DNS name of Customer site, as presented to DMV" for the Meterskip user request application. This is a separate application from the account application. "Meterskip"

is the name of the interface used to submit and received DMV query requests. I received the necessary information late on Nov 14th.

- Nov 15, 2012: Our account application was approved and set up by Annie. Carley Francis also submitted our Meterskip user request application for approval and setup.

- Nov 21, 2012: I received an email from Susie Hanlon (Oregon DMV) that our Meterskip account was set up.

- Nov 26, 2012: I started trying to work with the Meterskip system. I talked to Susie and others at DMV and received my Meterskip password. They referred me to the meterskip manual and recommended that I talk to my IT department to get the FTP file transfer set up. I also discussed some formatting questions for the plate numbers with Susie.

- Nov 27 to Nov 29, 2012: I discussed more formatting questions with Susie. I started working with Cathy Del Carlo to get the meterskip access set up via FTP but we had several problems. We continued to have problems. Part of the problem was that we couldn't get their recommended FTP file transfer programs because they weren't available on shopping. Even though other FTP programs theoretically should work this proved to be a challenge in troubleshooting with the Oregon DMV IT department

- Nov 30, 2012: A problem with us getting access was identified on the Oregon DMV setup of our account. Susie called Cathy about this and said they were working to fix it.

- Dec 3, 2012: Cathy worked with an Oregon DMV IT person for an hour on the phone but didn't get anywhere. She was able to get into their system but was not able to get to the right file locations.

- Dec 4, 2012: We received notification from Susie that our access was finally implemented. We had some additional confusion with formatting the files as the meterskip manual was not very clear in some situations. We were still having problems.

- Dec 5, 2012: We finally were able to submit a file to the site. In the end Cathy had to get the specific software that their user manual recommended to get it to upload correctly.

- Dec 6 to Dec 7, 2012: We got a file back but it was in a strange format. We communicated again with Susie and found that we had made an incorrect selection in the FTPS downloading. We just had to change a setting and it downloaded in the correct format after that. We ended up getting the data we needed on Dec 7.

A timeline of the Washington State DOL query process is given below:

- Nov 13, 2012: Matt Beaulieu from WSDOT was identified as the contact person for managing the Washington query in an email to me from Terri Slack.

- Nov 19 to Nov 20, 2012: I sent Matt our weekday license plates from WA or unknown state to Matt on Nov 19. I also discussed formatting and turnaround time with Matt over the phone. Matt expected about a two week turnaround time after he started the query process. Matt also said he would take care of the necessary formatting including that Washington distinguishes between zero and "O" in their plates.

- Nov 26, 2012: I sent Matt our weekend license plates from WA or unknown.

- Nov 28, 2012: Terri Slack spoke with Matt and he said that he would try to meet our goal of having the post cards out by December 10. They can send 10,000 plates a day and the DOL usually send the data back within 24 hours.

- Dec 3, 2012: I touched base with Matt a couple times. Initially he was more positive and thought that they would make good progress. The key person that actually does the plate queries was out of the office last week so they couldn't do anything. He thought he was done processing but when he got the first 10,000 batch back later that day he had an unprecedented number of unmatched plates. Matt thought it was tied to the zero and "O" issue. He said that he would re-check his rules and would submit again.

- Dec 5, 2012: I touched base with Matt again and he said that he wouldn't be able to get the addresses by the end of Dec 5 as promised. The zeros and "O"s thing was slowing them up.

- Dec 12, 2012: I touched base with Matt and his new estimate was to have the plate queries done by the end of this week.

- Dec 19, 2012: Terri Slack contacted Matt and Matt said that match rate was low but the data would be sent to CDM Smith in a few days.

- Jan 2 to Jan 4, 2013: Tim Boesch and I tried to get an update from Matt but didn't hear anything back.

- Jan 8, 2013: Todd Merkens talked to Matt and he said that he would deliver the addresses by the end of Jan 8.

- Jan 10, 2013: The final matched address list was delivered by Matt. The match rate was just under 50 percent which was lower than we expected. Matt mentioned that there were "more headaches that he could have imagined" in getting the data but did not elaborate on the reasons.

A general lesson learned from the DMV/DOL query process is that they take much longer than you would think. Both states had significant delays in the process that looking back could not have been avoided from our end. The only think considering future projects I would recommend is to not do them during the holiday season as we ran into issues with key people being on vacation. We didn't have a choice with the timing of these queries though.

Table 5 gives statistics from the query process. Note that the Washington State match rates were much lower than expected. It is unclear why they were so low but it was likely party due to the zero and "O" issue in Washington (the fact mentioned previously that WA distinguishes between these digits on plates). Since the response was so late from Matt we did not have time to investigate or follow up on this.

Table 5: DMV/DOL Query Statistics

Parameter	Known State Queries	Unknown State Queries	Total Queries	Address Match	Total Match Rate	Postcards Mailed
Weekday OR	16,004	4,452	20,456	14,592	71%	14,129
Weekday WA	26,011	4,453	30,464	15,361	50%	15,211
Weekend OR	16,104	1,138	17,242	15,433	90%	14,996
Weekend WA	23,614	1,035	24,649	11,862	48%	10,671
OR	32,108	5,590	37,698	30,025	80%	29,125
WA	49,625	5,488	55,113	27,223	49%	25,882
Total	81,733	11,078	92,811	57,248	62%	55,007

Notes:

1. Most plates from unknown states were queried with both the OR DMV and WA DOL
2. The "Sent to DMV/DOL" numbers are lower than the visible because some reductions were made to the plate data. Nearly all of the reductions were due to duplicate plates.
3. Duplicate plate numbers between weekdays and weekend days were removed from the weekend days because the weekday results were more critical to the study.
4. One survey card was sent to Ron Davis and is not included in this table

Survey Postcard

An online O-D survey was decided to be used for the survey. A post was sent to the addresses from the DMV/DOL query to invite them to respond. Ten $200 Fred Meyer gift cards were used as an incentive for completing the survey. (Fred Meyer is a western store similar to Super Target in the Chicago area.) A timeline of the survey postcard development is given below:

- Nov 2 to Nov 5, 2012: I started working on the postcard design.

- Nov 6, 2012: I sent out a draft postcard for review by Terri Slack and Carley Francis.

- Nov 7, 2012: I sent out a draft postcard to the project team for review from CRC communications department.

- Nov 9, 2012: I requested print quotes for the postcard from Mike at Arbor Printing and Nathan at Fountainhead Graphics

- Nov 16, 2012: I received feedback from CRC Communications.

- Nov 20, 2012: I updated the postcard based on feedback from CRC communications, Inshu Minocha, and Mike at Arbor Printing and sent it back to Carley for another review.

- Nov 27, 2012: We decided to select Arbor Printing for the printing (quoted $2913.87 for Printing and $1840 for Mailing assuming 100 pound cardstock and 75,000 postcards). Fountainhead graphics sent a quote that was significantly lower than Arbor ($1662.5 for Printing and $1500 for Mailing). We followed up with Arbor Printing and Mike was surprised and thought their quote was below cost. In the end we contacted Fountainhead again and they found that they had made a mistake in their quote so it was lower than it should be. This was confirmed in an email on 11/27/12. Because of this we ended up going with Arbor Printing.

- Nov 28, 2012: I heard back from CRC and they didn't have any more suggested edits.

- Jan 14, 2013: I sent Mike at Arbor printing the final postcard design.

- Jan 17, 2013: I sent Mike at Arbor printing the final address list

- Jan 23, 2013: The printed postcards were mailed in the later afternoon (dropped off at the post office by Arbor Printing). We ended up mailing 55,008 postcards. The postage cost was $12,804.30. The cost ended up being a total of $3,772.94 for the printing and mailing.

- Jan 28, 2013: People started receiving the postcards (assumed because people started to respond to the online survey on this day).

Each postcard had a unique password to help prevent duplicate entries. I made the passwords multiples of three to make it more confusing in the event respondents attempted to sabotage the survey (multiples of three from 003 to 999). However I also removed all numbers with zeros to avoid potential confusion with "O"s. This left a total of 243 sets of numbers for each different set of letters. I also did not use "O"s or "Z"s to avoid potential confusion when assigning the letters.

Online Survey Interface

A CDM Smith internally developed online survey interface was used for the first time for the O-D survey. The application concept was developed by Jonathon Hart and Michael Waddell in a 2012 Research and Development grant. The timeline for developing the survey interface is shown below:

- Nov 2, 2012: I attended a conference call with Michael Waddell, Jonathon Hart, and Eugene Ryan to discuss the possibility of doing the survey online using the application concepts developed by Michael and Jonathon in their R&D Project. They originally tried to develop the survey on their own (code it all from scratch) but this proved to be too complicated in their R&D project. In the end (later in summer I believe) they decided to use a survey hosting site that allowed us to design the survey through their system. The site is called Survey Gizmo.

Also on Nov 2 I sent a draft concept of the survey questions and website layout for the online survey.

- Nov 19, 2012: I had a conference call with Michael to discuss the progress he made setting up the survey. I also sent him feedback from myself and from CRC communication on the questions.

- Nov 21, 2012: Michael registered our URLs for the survey, www.mybridgestudy.com (weekday survey version) and www.mybridgesurvey.com (weekend survey version) and also let me know that he had made most of the major edits that I suggested on the 19th. We used two survey URL version because we did not have the ability to tie the weekend/weekday versioning to the password.

- Nov 27 to Nov 28, 2012: I received reviews of the online survey from Eugene Ryan, Tim Boesch, Raghu Kowshik, Inshu Minocha, and Zubair Ghafoor. After receiving all the feedback I compiled it and met with Eugene and Tim to review the survey in detail and see what feedback they would like seen included in the final. I emailed Michael the list of feedback at the end of the day on Nov 28.

- Nov 29, 2012: Michael emailed me that he had made most of the changes suggested and was working on the others.

- Dec 17, 2012: I had a conference call with Michael to review how to export the survey results. Michael set up a generic login so that I could access the Survey Gizmo account for this purpose and also so that I could make small changes to the survey design on my own.

- Dec 28, 2012: Inshu Minocha did another detailed review of the survey with all the latest changes.

- Jan 17, 2013: Tim and Yonnel did another review of the survey in advance of going live.

- Jan 23, 2013: Michael made the survey live and set the survey to run through the end of Feb 18, 2013.

- Jan 28, 2013: Carley Francis emailed me that she was getting a few users calling their office and saying that they couldn't get into the survey correctly.   We figured out that it was because people were trying to go to the website without typing in "www.". Michael made a change that same day so that it didn't matter if "www." was used which lowered the number of calls we received about this.

- Jan 29, 2013: Michael and Carley communicated on a few issues individual people had. Both these issues seemed very isolated unlike the 'www." issue.

- Feb 8, 2013: Carley emailed me about a user who got the "you already completed the survey" message after they started the survey, couldn't complete it, and went back to do it later. This was because of the security we set up to have the survey add a cookie to the respondent's

web browser to prevent them from taking it multiple times unless they delete the cookie or use a different browser.

- Feb 22, 2013: Carley emailed about the survey closing messages not matching up and being missing on one. I looked and couldn't find why. Michael also looked and ended up emailing Survey Gizmo. They found out that Link Settings (in the Distribute tab of the survey) didn't match with the message we wanted. (Click on the little pencil icon next to the "Default Link".

Overall, the online survey seemed to work very well. Michael was very good to work with and was efficient. It also helped after the survey went live that he was able to communicate directly with Carley. It did add a little bit of time to the process since this was the first time using this tool but not too much.

Add response statistics. As of 2/11/13 the survey was still in progress.