

Economic Characteristics of Drayage Drivers at the Port of Seattle

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Abstract

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By increasing the number of days that the survey was distributed, and by soliciting driver feedback to make the survey understandable and relevant to drivers, the 2013 survey was able to gather a larger survey size than previous efforts (290 responses in 2013, compared to 99 responses in 2008 and 167 responses in 2006).

From 2008 to 2013, there was a reduction in the number of drivers working five or more days per week, from 80% in 2008 to 70% in 2013. The percentage of drivers doing work other than port trucking has increased from 8% in 2008 to 37% in 2013. Findings suggest that due to changing conditions at the Port of Seattle, that there is a growing population of drivers that do port trucking as a part-time job in combination with other forms of work, rather than a full-time occupation.

Attempts at modeling driver earnings based on other factors (English as a second language, trip type, doing work other than port trucking, and average hours worked per week) did not discover strong relationships between these factors and earnings. It is recommended that future efforts in this area use higher resolution earnings data than the data available from the 2013 survey.

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Abstract

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1. Introduction

The Port of Seattle, like many other ports in the United States, has periodically conducted surveys of its drayage truck drivers. Early surveys occurred in 2004 and 2008. In 2013, the University of Washington and the Port of Seattle surveyed port truckers at the Port of Seattle again, with the purpose of developing a statistically valid and reproducible method for surveying drayage drivers, providing information about the characteristics of drayage driving at the Port of Seattle, and comparing the results

of the 2013 survey with past surveys of drivers. Like its predecessors, the survey included sections on trip and destination information, employment, economics, truck information, and demographics.

This paper provides information focused on the economic status of drivers, both employees and owner-operators, serving the Port of Seattle, based on a partial selection of the questions from the 2008 and 2013 surveys. Further, this paper examines if certain factors have a relationship to port driver earnings, and explores how reliability and congestion vary for different areas and types of trips that drivers serve.

2. Objectives

This thesis has four main objectives:

- Describe the development of a methodology for a robust, repeatable survey of drayage drivers at the Port of Seattle
- Explore the current economic status of drayage drivers at the Port of Seattle
- Examine how the Port of Seattle drayage driver population has changed since previous surveys were conducted at the Port of Seattle
- Examine the possibility of modeling the port trucking earnings of drivers based on other characteristics

3. Background

In the shipping industry, drayage is the transportation of containerized cargo from ports to rail yards, warehouses, and distribution centers. At the Port of Seattle, drayage drivers are responsible for transporting containers to:

- BSNF Railway and Union Pacific Railroad rail yards for transport via rail (e.g. Chicago and points further east)
- Locations in Seattle, east King County, and the Kent/Green River Valley for:
 - Storage
 - Distribution to local retail locations
 - Repackaging of goods into domestic or mixed containers (trans-loading)
- Port of Seattle terminals for export of agricultural products from both local rail yards and Central Washington to overseas locations.

The movement of containers through marine terminals is a complex component of the supply chain involving many parties. On the waterside, containers are brought to and from the Port by large ships operated by steamship lines. In Seattle, container terminals are owned by the Port of Seattle, but leased and managed by terminal operators. These operators oversee the loading and unloading of ships, and are responsible for loading containers onto drayage trucks and on-dock rail trains. The International Longshore and Warehouse Union (ILWU) is responsible for terminal labor. Licensed Motor Carriers (LMCs) are responsible for moving containers between the Port of Seattle and warehouses, distribution centers, or rail yards. Trucking companies coordinate with the steamship companies, the terminal operator, and truck drivers to arrange for a container to get to its destination. LMCs can directly employ

drivers, or they can contract with owner-operators; drivers who own their own equipment and business. Due to the complexity of these arrangements, it can be difficult to determine the status of the drayage truck industry.

The Port of Seattle first surveyed its drayage driver population in 2006. Another survey was conducted in 2008. The survey this thesis is based on was conducted in March of 2013, and sought to gather more up to date information on the population, as well as achieving a larger sample size than previous survey efforts. The Port of Seattle was specifically interested in achieving the following goals with the 2013 survey:

- Develop a statistically valid and reproducible method for surveying drayage truck drivers;
- Provide information about the characteristics of drayage truck drivers at the Port of Seattle; and
- Compare the results of the 2013 survey to past surveys of drivers serving the Port of Seattle.

In the future, the Port of Seattle intends on surveying drayage drivers every two years. The surveys will contain twenty standardized questions selected from the 2013 survey, so that changes in the population can be easily identified.

One example of why it is important for the Port of Seattle to have knowledge of the characteristics of the truck driver population is the Clean Trucks Program. In recent years, ports and port communities throughout the United States, Seattle included, have become concerned about how Port activities affect the air quality in their region. One target for these concerns is port drayage truck fleets. Ports such as Long Beach, Los Angeles, and Seattle are working with their industry partners to design and implement “Clean Truck” programs. Typically, these programs require drivers to upgrade to a certain model-year truck engine, eliminating trucks with old engines, which cause more pollution than newer models. It is important to understand the economics of truck drayage, and the financial situation of the drivers, to be able to assess how much these requirements will affect the drayage industry. Surveys such as this can help ports design programs that reduce diesel emissions while supporting the economic viability of the drayage trucking industry.

At the Port of Seattle, the first phase of the program, which eliminated trucks with engines older than 1994, was implemented in 2011 in close cooperation with industry partners and the trucking community. The Port is now in the process of working with its partners to develop the approach for the second phase of the program, which will phase out all truck engines older than 2007 by January 1st, 2018.

3.1 Traffic Decline at the Port of Seattle

From 2008 to 2013, the Port of Seattle saw a significant reduction in volume, with some of the decrease due to the move of a major shipping line to the Port of Tacoma. Total traffic at the Port of Seattle declined from 1,704,492 TEUs in 2008 to 1,592,753 TEUs in 2013, a reduction of about seven percent. Near dock intermodal TEUs, which are drayed from the Port’s container terminals to local railyards by

independent owner-operator drivers, saw even more reduction, going from 559,300 TEUs in 2008 to 221,308 in 2013, a reduction of 61%.

The Port of Seattle is in close proximity to the Port of Tacoma, which moved 1.45 million TEUs in 2010 and 1.89 million TEUs in 2013. The Port of Tacoma is a 31 mile drive from the Port of Seattle, and many destinations in the Puget Sound region are approximately equal distance from each port. As a result, many drayage drivers and firms serve both ports – in 2013, 54% of drivers indicated that they worked at both the Port of Seattle and the Port of Tacoma in the last week.

4. Literature Review

This section will review four previous projects that gathered primary data about the drayage trucking population on the west coast of the United States, with two in Seattle. One study, “A Study of Drayage at the Ports of Los Angeles and Long Beach” by Kristen Monaco and Lisa Grobar, surveyed truckers at the Port of Long Beach during April and May of 2004, and attempted to describe the population. This study was a first in the field and was used as a model for many other studies of port drayage at other ports in the United States. Another study, “Incentivizing Truck Retrofitting in Port Drayage: A Study of Drivers at the Ports of Los Angeles and Long Beach”, by Kristen Monaco, conducted at the Port of Long Beach and the Port of Los Angeles, explored the economic conditions of drayage truckers and their willingness and ability to upgrade their trucks, to help inform clean trucks policies at those ports. A 2006 study at the Port of Seattle, “Big Rig, Short Haul”, was carried out by the non-profit Port Jobs. This study gathered data to characterize the Port of Seattle drayage driver population, and was the first survey of drayage drivers at the Port of Seattle. In 2008, the “2008 Truckers Day Survey” was carried out by the Port of Seattle, to expand on the data gathered in 2006 and look for changes over the two years since the last survey had been distributed.

4.1 Previous Study Methods

Monaco and Grobar’s study, “A Study of Drayage at the Ports of Los Angeles and Long Beach,” was conducted by randomly selecting three terminals at the Port of Long Beach. The survey was conducted in April and May of 2004. Self-administered surveys were handed out at two of these terminals (one terminal was determined not to be conducive to handing out surveys). The surveys were handed out to drivers waiting to enter the port between 6am and 7am. Surveys were available in English and Spanish. Surveys were given to truckers waiting in or around their trucks, unless they were sleeping.

The Port Jobs study, “Big Rig, Short Haul”, was based on the Monaco and Grobar study conducted in Long Beach. Truckers were given a self-administered survey on April 27, 2006 at 6 am while waiting to enter terminals. The survey was distributed at terminals 5, 8, and 46. The survey was explained by the facilitators. Surveys were only available in English.

The Monaco and Grobar study, “Incentivizing Truck Retrofitting in Port Drayage: A Study of Drivers at the Ports of Los Angeles and Long Beach”, was conducted by surveying drivers at catering trucks outside

three different terminals at the Ports of Long Beach and Los Angeles. The survey was given by administrators, and drivers were given \$10 to participate. It was conducted during lunch (11:30 am to 1:30 pm) and dinner (4:30 am to 6 pm) on weekdays during two weeks in December. Respondents were given a choice between Spanish and English.

The Port of Seattle Trucker Survey was distributed to 580 truckers with 99 respondents. The survey report did not provide detail on how this survey was conducted. However, the survey distribution approach for the 2013 survey was developed in part based on the 2008 survey in consultation with Port staff. The 2008 survey was handed out along with pre-paid envelopes at the entrances to Port container terminals.

4.2 Relevant Findings:

The table below summarizes the mean annual earnings of port drivers and the percentage of drivers employed as owner-operators (as opposed to employee drivers) found during each study. The Port of Seattle studies found a lower proportion of owner-operators than the Los Angeles/Long Beach studies. Both 2008 studies found similar mean earnings.

Table 1 Previous Studies

	Ports of Los Angeles/Long Beach		Port of Seattle	
	2004	2008	2006	2008
Mean Earnings (all drivers)	\$29,903	\$34,749	\$31,341	\$35,140
Owner-Operator Percentage	86%	78.5%	61%	56%

The 2004 Monaco and Grobar study also created a regression to analyze factors that affected driver earnings. The dependent variable was net earnings, and independent variables included experience, tenure at current firm, and education, race/ethnicity (with white as the reference), and firm size. In the regression, drivers who identified as Hispanic had a significant difference from the reference race (white), earning \$11,128 less per year. Firm size was also found to be significant, with drivers working for firms with 25-99 drivers earning \$6221 less than the reference size (1-25 drivers), and drivers for firms with 100-249 drivers making \$9903 less than the reference. Drivers working for firms of 250 drivers or more were not found to have significantly different earnings from drivers working for firms of 1-25 drivers.

This paper will describe the economic characteristics of drayage drivers at the Port of Seattle. Furthermore, the paper will examine if certain driver characteristics have a significant relationship with driver earnings, so that low earning drivers can be identified.

5. Survey Design

5.1 2013 Port of Seattle Truck Driver Survey

The 2013 Port of Seattle Truck Driver Survey was a 44 question survey designed by the University of Washington research team to obtain information on the trip destinations, work practices, economic situation, equipment, and demographics of truck drivers serving the Port of Seattle. The survey used a combination of categorical response questions and fill-in questions. The 2013 survey instrument was designed in consultation with the Port to ensure it could meet the Port's information needs. Previous Port of Seattle surveys, and surveys used at other Ports, served as models to inform the design of the 2013 survey instrument. The survey was further refined by 1-on-1 interviews with Port of Seattle truck drivers, to make the survey understandable to drivers, and to work to design questions that drivers thought were relevant. Port Jobs, a non-profit that works with the Port of Seattle to help connect workers to port related employment opportunities, also provided input on the survey. A copy of the survey instrument is included in the appendix.

The survey was distributed at the Port of Seattle's international container terminals, shown in blue in Figure 1. Surveys were handed out by workers from Port Jobs. Two workers would stand at each terminal gate, and ask each driver entering the terminal if they had received a survey yet. If a driver had

already received a survey, they were asked if they had returned it, and reminded to return it if they indicated they had not.



Figure 1 Map of Port of Seattle’s international container terminals (Image from www.portseattle.org)

Surveys were distributed from 7 am to 9 am on eight days between March 20th and April 5th, according to the schedule below. In total, 1,251 surveys were distributed. Of these, 290 surveys were returned, for a response rate of 23%. The following table provides the sampling schedule.

Table 2 2013 Port of Seattle trucker survey sampling schedule

Date	Sampling Schedule	
	Terminal	Time
March 20, 2013	18 and 46	7 am to 9 am
March 21, 2013	5, 25/30, and 46	7 am to 9 am
March 25, 2013	5, 18, and 46	7 am to 9 am
March 26, 2013	5, 18, and 46	7 am to 9 am
March 27, 2013	5 and 18	7 am to 9 am
April 3, 2013	5, 18, and 46	7 am to 9 am
April 4, 2013	5 and 46	7 am to 9 am
April 5, 2013	5, 18, and 46	7 am to 9 am

5.2 Previous Studies

Prior surveys of truck drivers serving the Port of Seattle were conducted in 2004 and 2008. These studies surveyed drivers on one rather than multiple days. A comparison of the studies is shown in Table 3.

Table 3 Comparison of previous and current study sample sizes and survey distribution

Survey	Handouts	Responses	Response Rate	Terminals	Days
2004 (PortJobs)*	277	167	60%	5, 18, 46	1
2008 (POS internal)*	580	99	17%	5, 18, 46	1
2013 (UW)	1,251	290	23%	5, 18, 25/30, 46	8

* Note: Terminal 25/30 was not in container use when the prior surveys were conducted.

5.3 Methodology Improvements for 2013

The 2013 drayage driver survey sought to gather a larger sample size than previous surveys at the Port of Seattle. The 2013 survey was designed off the 2006 and 2008 surveys. Improvements were made by soliciting feedback from drivers prior to survey distribution. This feedback was gathered by doing one-on-one interviews with drivers, in which drivers filled out surveys, and then discussed what they thought about the survey with designers. This allowed the survey to be refined to be easily understood by drivers, and allowed the survey to include questions about issues that drivers found important.

The other effort to improve sample size was made at the distribution side. Previous survey efforts have distributed on one day, and in 2013, eight days were selected for survey distribution. Drivers who hadn't gotten a survey were given one upon entry, and drivers entering who indicated that they had already received a survey were reminded to turn the survey in.

Another refinement made to prepare for future surveying efforts at the Port of Seattle was to settle on a set of 20 standard questions to be included in all future surveying efforts. The standardization of a question set will allow for easy comparison of survey results over multiple years. Questions regarding issues at the time of each survey can be added to allow the Port to gather information specific to those issues.

5.4 Validation

To explore how representative the 2013 sampling was of the total Port of Seattle truck driver population, survey data was compared to data gathered from a required RFID transponder that all trucks serving the port must have to enter (as of 4/1/13). The RFID data records the date and time every time a truck enters the port. The survey turns per day distribution was compared to the distribution of the number of times trucks checked into the Port with their RFID transponder.

The shapes of the distributions were similar, although the RFID data had a wider distribution than the survey data. This is consistent with a bias towards the mean that would be expected by asking drivers to indicate their *average* number of turns. The survey question asked drivers about the typical number of turns per day. The phrasing of this question will lead respondents to answer closer to the mid-range, as they will not select their highest or lowest turn days. However, the RFID data will include a full

distribution, including drivers who were able to make unusually large and unusually small numbers of turns.

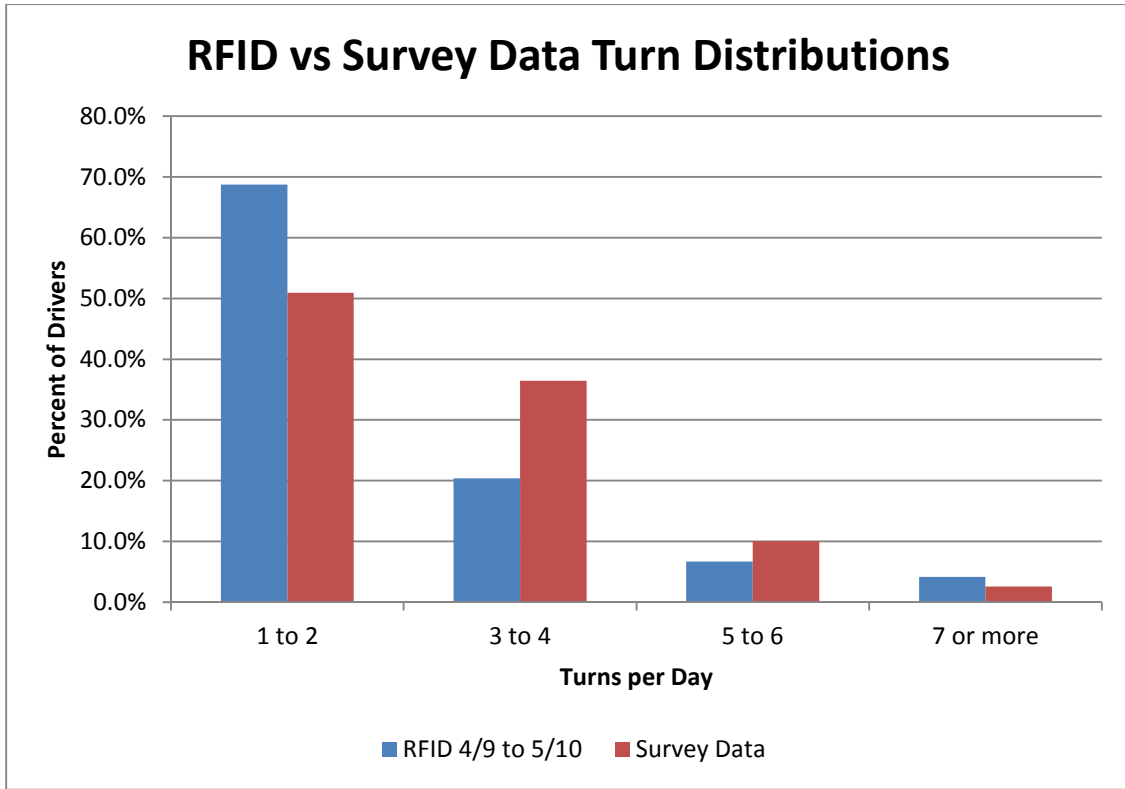


Figure 2 RFID vs Survey Data Turn Distributions

6. Characteristics and Comparisons to Past Surveys

6.1 Changes in Trip Type

At the Port of Seattle, trips of less than 10 miles consist mainly of trips to intermodal rail yards, located in close proximity to port terminals, or near-dock warehouses. Trips of 10 to 40 miles are typically to warehouses or distribution centers located in the Kent Valley, or other areas outside of Seattle. Trips of 40 to 500 miles are often the transport of agricultural products, to or from Central Washington or other Washington agricultural centers.

As can be seen below, the typical trip length drivers make changed sharply from 2008 to 2013. In 2008, 36% of drivers reported their typical trip being less than 10 miles. This declined to 14% in 2013. This decline is also reflected in the 61% reduction in near-dock intermodal TEUs from 2008 to 2013, discussed above. Near dock intermodal trips are almost exclusively the domain of owner operators, while employee drivers serve intermediate or longer distance trips.

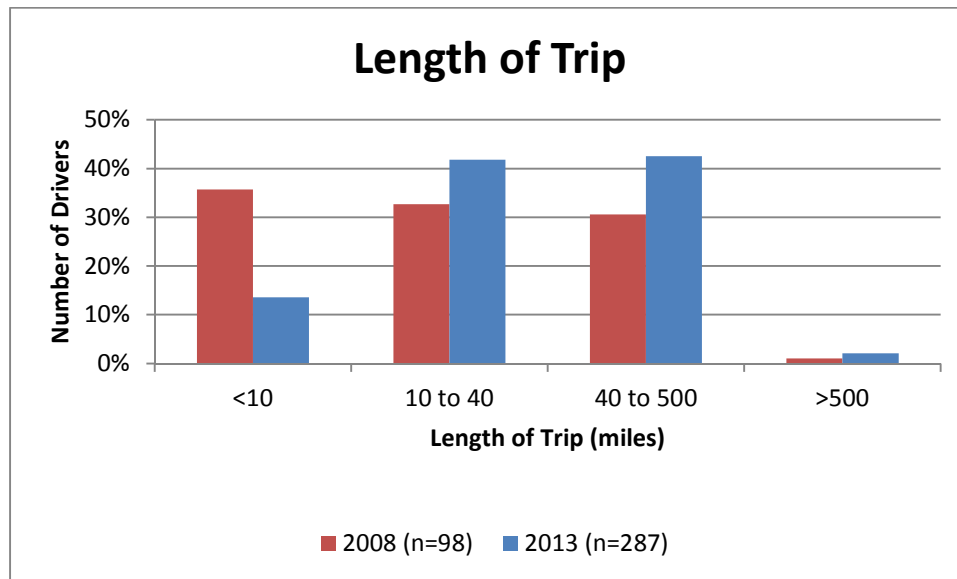


Figure 3 Length of Trip

6.2 Earnings Data

Drivers were asked to give their household income. Household income means all income, and may include more than one earner, and earnings that a truck driver may have gotten from non-trucking work as well as trucking work. The question used to gather information on household income is shown below:

What was your total household income last year?

- Less than \$20,000 \$20,000-\$40,000 \$40,000-\$60,000 \$60,000-\$80,000
 \$80,000-\$100,000 \$100,000-\$120,000 \$120,000-\$140,000 More than \$140,000

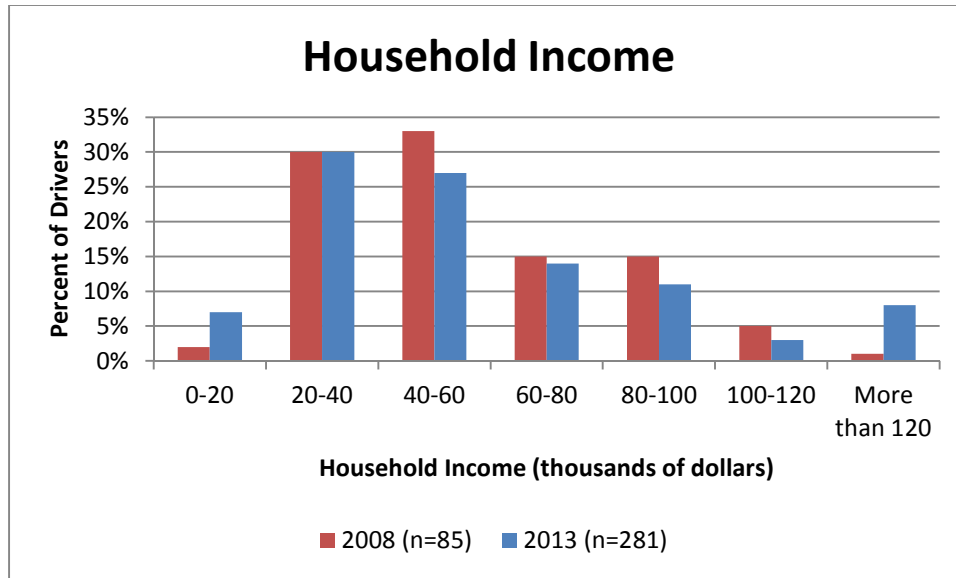


Figure 4 Household income of 2013 survey population

As can be seen in the figure above, 7% of drivers have a household income of less than \$20,000 a year. Further, 30% of drivers fall into the \$20,000-\$40,000 per year category. The distribution of household incomes is similar between 2008 and 2013, with a slight increase in drivers who reported less than \$20,000 per year (2% in 2008 and 7% in 2013), and drivers who reported household incomes of more than \$120,000 a year (1% in 2008 and 8% in 2013).

Drivers are generally employed in one of two ways – as an employee driver, who drives a truck owned by a company, and earning a salary or hourly wage, or as an owner-operator. Owner-operators own their own trucks, and are responsible for paying their trucking costs, such as fuel, maintenance, and repairs. Owner-operators are paid by the load moved rather than by the hour or by salary. Data collected for the 2013 Port of Seattle truck driver survey indicated that 64% of drivers are owner-operators, and 36% of drivers are employees (n=286).

Drivers were asked to indicate their port trucking earnings via a categorical response question, shown below:

- How much money did you earn driving a Port truck last year (before truck expenses like repairs or new tires)?
- | | | | |
|---|--|--|---|
| <input type="checkbox"/> Less than \$10,000 | <input type="checkbox"/> \$10,000-\$20,000 | <input type="checkbox"/> \$20,000-\$30,000 | <input type="checkbox"/> \$30,000-\$40,000 |
| <input type="checkbox"/> \$40,000-\$50,000 | <input type="checkbox"/> \$50,000-\$60,000 | <input type="checkbox"/> \$60,000-\$70,000 | <input type="checkbox"/> More than \$70,000 |

Due to the different earning structures of employees and owner-operators, the earnings of the two groups were plotted on separate graphs. The earnings of employee drivers are shown below:

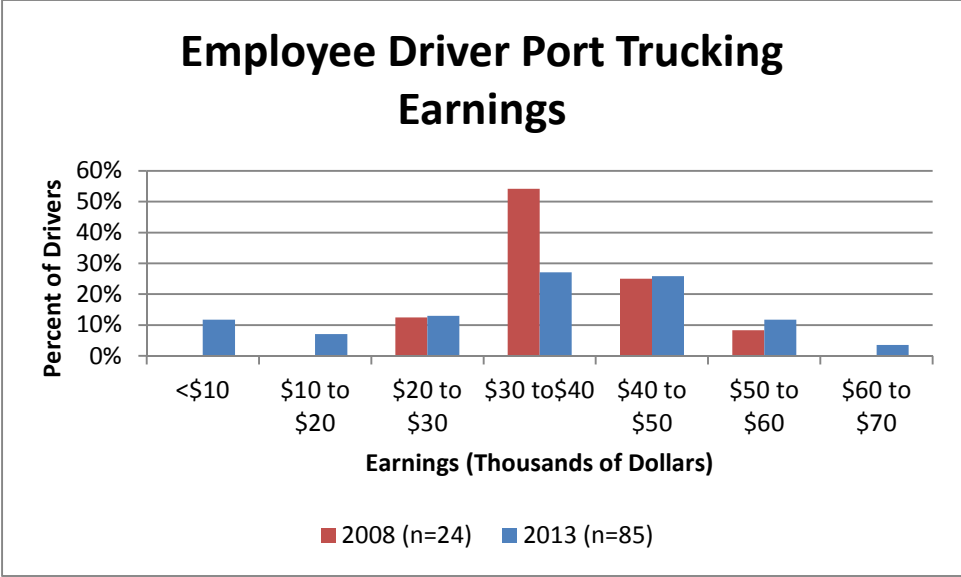


Figure 5 Employee Driver Port Trucking Earnings

Twelve percent of employee drivers indicated that they earned less than \$10,000 driving a port truck in the last year, and another 7% indicated earnings between \$10,000 and \$20,000.

Owner-operators also responded to the question, but were asked to choose their earnings before truck expenses. Because truck expenses can take up a substantial portion of an owner-operator’s earnings, these numbers should not be confused with net income.

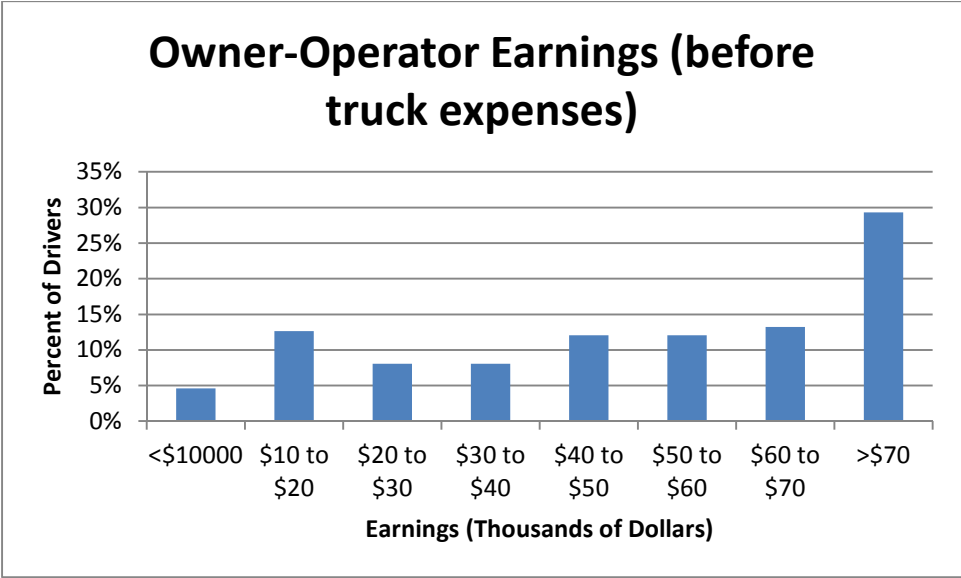


Figure 6 Owner-Operator gross earnings

Owner-operators were also asked to indicate how much money they spent on truck expenses in the last year. Truck expenses include costs such as fuel, repairs, insurance, and registration fees, but does not include the cost of purchasing or financing a truck.

What did you spend on truck expenses last year (repairs, insurance, fuel etc. but **not** including truck payments)?

- None, company pays
 Less than \$5,000
 \$5,000-\$10,000
 \$10,000-\$20,000
 \$20,000-\$30,000
 \$30,000-\$40,000
 \$40,000-\$50,000
 More than \$50,000

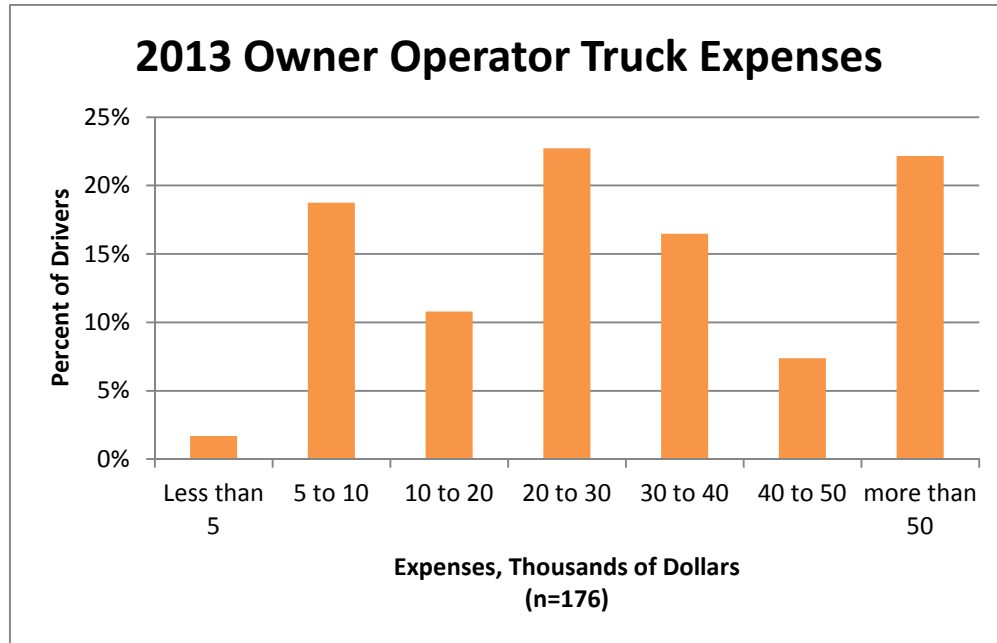


Figure 7 Owner-Operator truck expenses

In the above figures, it can be seen that owner-operator incomes are approximately uniformly distributed, with between 8 and 13 percent of drivers falling into each income category, with the exception of the less than \$10,000 category (5%) and the more than \$70,000 category (29%). In contrast, truck expenses did not follow any recognizable distribution. For this reason, it is hard to determine the net earnings of drivers unless their expenses and income are related to estimate earnings after expenses.

The following figure shows estimated income after expenses for owner-operators. The earnings are mostly distributed around the \$20,000-\$30,000 per year range, but there is an outlier at the less than \$10,000 per year category, which contains 29% of owner-operators.

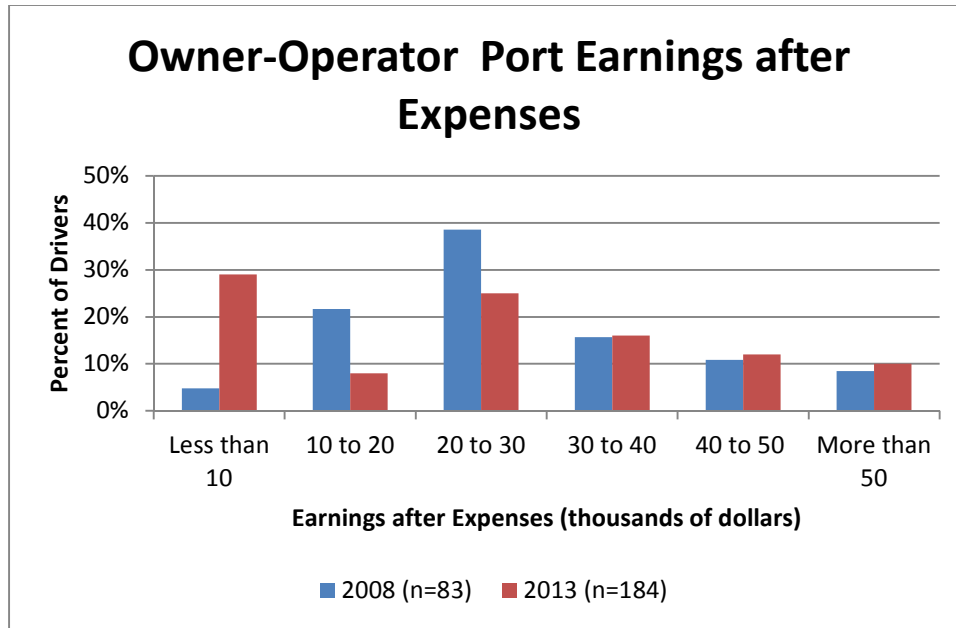


Figure 8 Owner-Operator estimated net income

A closer look at owner-operator earnings and expense data indicated that 26 out of 171 owner-operators indicated that they had expenses equal to or greater than gross earnings. A further 28 drivers indicated that they would be making between 0 and \$20,000 after expenses.

Table 4 Low Earning Owner-Operators

Owner-operators making less than expenses	26	15%
Owner-operators making less than \$20,000/year	28	16%

6.3 Drivers doing other work

Drivers who have low earnings from driving a port truck may have earnings from other sources. In 2008, 8% of drivers reported doing work other than port trucking; in 2013, 37% of drivers reported having done other work. 100% of owner-operators making less than \$20,000/year from Port Trucking indicated doing work other than port trucking in the last year. Sixty-three percent of employee drivers who reported less than \$20,000 of port trucking earnings in the last year reported doing other work. Additionally, drivers may work part-time by choice and/or have other income sources in their household.

6.4 Changes in Days per Week

In both the 2008 and the 2013 surveys, drivers were asked to indicate how many days they had worked per week during their last pay period. The number of days per week for each survey is shown on the chart below:

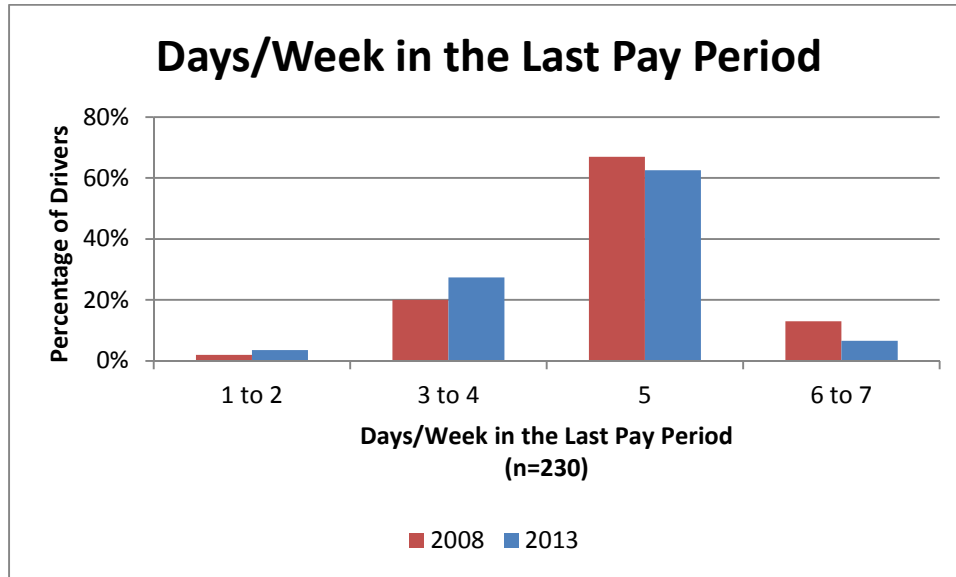


Figure 9 Days per Week in the Last Pay Period

As can be seen on the chart, there has been a shift of drivers working five or more days during the last work week: 67% of drivers reported working five days a week in 2008, and 63% reported working five days a week in 2013. Thirteen percent of drivers reported working 6 or 7 days a week in 2008, and 7% reported working 6 or 7 days in 2013. The proportion of drivers working a full five-day week in drayage trucking declined from 80% to 70%

6.4 Household income of Low Earning Drivers

To better determine the economic situation of drivers that indicated low port trucking earnings in the last year, the household income of drivers that fell into the low earning categories was examined. The below chart shows the household income of employee drivers earning less than \$20,000 a year, owner-operators with expenses exceeding or equaling earnings, owner-operators earning less than \$20,000 a year after expenses, and the complete survey population.

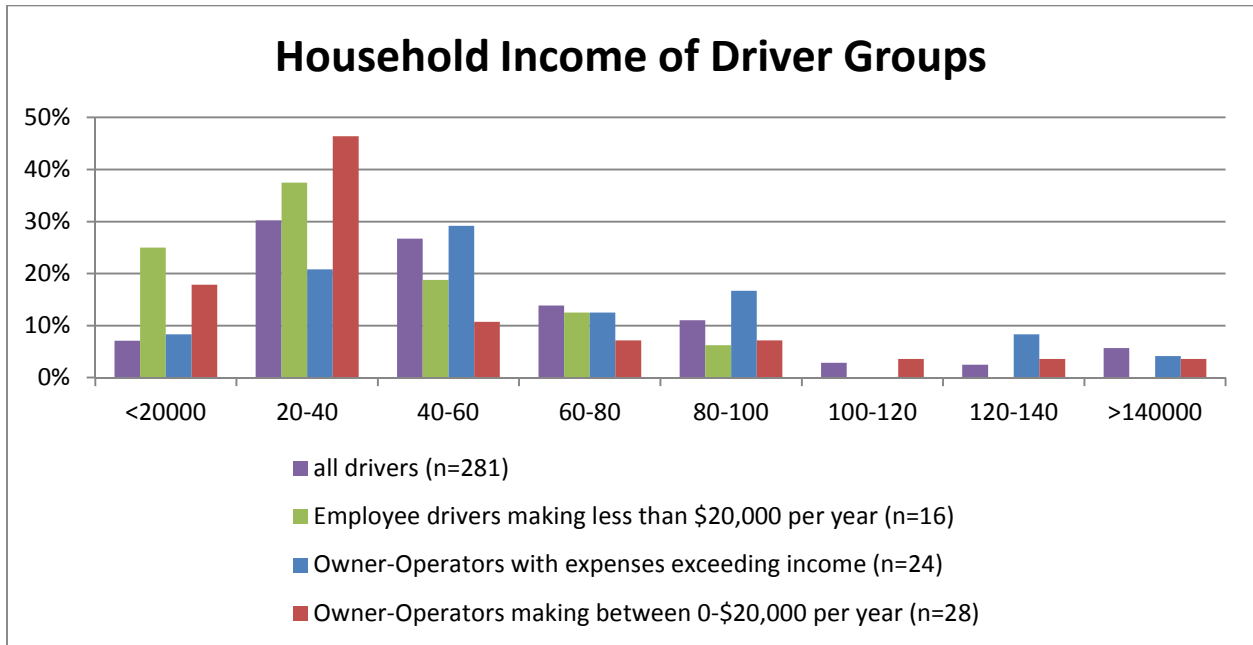


Figure 10 Household income by earnings group

As can be seen above, low earning employee drivers have the highest representation in households making less than \$20,000 a year, at 25% compared to just 7% for the trucking population as a whole. Owner-operators making less than \$20,000 a year are also highly represented in this group, at 18%, and owner-operators who indicated that expenses exceeded income were represented at 8%.

Owner-operators who indicated that their expenses exceeded income were over-represented in the \$80,000-\$100,000 of household income/year bracket, at 16% compared to 11% of the survey population as a whole.

7. Pay Per Mile Regression

To examine the pay structure of owner-operators, a regression was created to attempt to estimate the structure of driver payment.

The data for the regression came from two survey questions. One question asked the origin and destination of the driver's last trip:

What was the origin and destination of that trip?

I started my trip at (name of city or terminal) _____

I ended my trip at (name of city or terminal) _____

The other question asked how much drivers were paid for their last trip:

How much were you paid for that trip (please report the amount you anticipate being paid if you have not been paid yet)? _\$ _____

Employee drivers were removed from the regression because their pay is structured differently than owner-operators. A separate pay regression was created for each driver category based on typical trip length.

The structure of the regression was a linear regression of the following formula:

$$\text{(Pay for last trip)} = \text{(Intercept)} + \text{(miles for last trip)} * \text{(coefficient)}$$

Three regressions were formed, one for each typical trip length indicated by owner-operators responding to the question. The model for drivers doing trips shorter than 10 miles is shown below:

Table 5 Pay regression for drivers making trips of less than 10 miles

	Estimate	Standard Error	t value	P value
Intercept	43.939	15.121	2.906	0.00562
Miles of trip	2.259	2.775	0.814	0.41985
Residual standard error: 23.35 on 46 degrees of freedom				
Multiple R-squared: 0.0142, Adjusted R-squared: -0.007231				

The regression shows that owner-operators doing trips of less than 10 miles are paid a \$43 base fee, with an additional \$2.26 per mile. The regression showed that the intercept was highly significant, and mileage was insignificant, suggesting that drivers of short trips are paid based on a per-trip basis rather than a mileage basis.

Table 6 Pay regression for drivers making trips of 10 to 40 miles

	Estimate	Standard Error	t value	P value
Intercept	12.5684	22.8581	0.55	0.585206
Mileage of Trip	2.8155	0.7831	3.595	0.000814
Residual standard error: 42.61 on 44 degrees of freedom				
Multiple R-squared: 0.2271, Adjusted R-squared: 0.2095				

Drivers making trips of 10 to 39 miles were found to receive a \$12 base fee, and \$2.81 per mile. The intercept (base charge) was found to be insignificant, suggesting that mileage was the significant factor in determining the pay of owner-operators making trips that fell into this distance range.

Another model was made to check to see if there was a different pay structure for drivers doing longer trips. This model was constructed using the same equation, but using only drivers reporting typical trip lengths of 40 to 500 miles.

The results of this regression can be seen below:

Table 7 Pay regression for drivers making trips of 40 to 500 miles

	Estimate	Std. Error	t value	P value
Intercept	51.015	48.225	1.058	0.293
Mileage of Last Trip	2.13	0.288	7.394	5.57E-11
Residual standard error: 313.6 on 95 degrees of freedom				
Multiple R-squared: 0.3653, Adjusted R-squared: 0.3586				

In this regression, the intercept turned out to not be significant at a 95% confidence interval ($P > 0.05$). The mileage of last trip variable was still significant, with a P value close to zero. The coefficient estimate for the mileage of last trip variable was 2.13 for owner-operators indicating trips of 40 to 500 miles, or \$0.69 less per mile than the value obtained for owner-operators making trips of 10 to 40 miles.

8. Earnings Regressions

8.1 Employee Driver Earnings Regression

To determine if there was a relationship between non-earning driver characteristics and driver earnings, a multiple linear regression model was constructed. The model's dependent variable was port trucking earnings, and included five independent variables to determine if they had an effect on potential earnings: trip length of 40 to 500 miles (as compared to other trip lengths) length of time working at current company, English as a second language, if the driver had done work other than port trucking in the last year, and total hours per week.

The tenure at current company variable was programmed to be a five point ordinal variable equivalent to the categorical responses in the survey question, in which 1 = less than one year, 2 = 1-2 years, 3 = 3-5 years, 4 = 6-10 years, and 5 = more than 10 years. The total hours per week category was calculated by multiplying the responses of two questions: typical days per week and typical hours per day.

Table 8 Employee driver earnings regression

	Estimate	Standard Error	t value	P value
Intercept	3707	11184.7	0.331	0.74142
40 to 500 mile typical trip	2344.5	3754.3	0.624	0.53457
Time at current company	4310.3	1313.3	3.282	0.00168
English as first language	2266.9	6552	0.346	0.73051
Other work in the last year	-7981.1	3897.1	-2.048	0.04474
Total hours per week	332.4	148.9	2.232	0.02915
Multiple R-squared: 0.264, Adjusted R-squared: 0.2056				
F-statistic: 4.52 on 5 and 63 DF, p-value: 0.001388				

Out of the categories included in the regression, the following were found to be significant: time at current company, which had an increased earnings estimate of \$4,310 per year for each unit of time at the company, and drivers who did other work in the last year, which had an estimate of \$7981 decrease in earnings per year. The total hours per week variable was also found to be significant, with an increase of \$332 per year for every weekly hour worked.

One finding was that there was not a significant difference in earnings between drivers who spoke English as a first language and drivers who spoke English as a second language. Note that there was not a measure of English competence, but rather just if English was a first language, and that drivers who spoke English as a second language could cover a wide range of English competencies.

8.2 Owner-Operator Earnings Regression

A similar regression was set up for owner-operators to determine factors that affected their earning potential. Because owner-operators have a wide range of expenses, truck expenses were subtracted from gross port trucking earnings to determine net earnings. Because earnings were given as categorical response ranges, the mid-point of each range was used to determine an estimate of expenses, gross earnings, and therefore net earnings: for example, if a driver indicated that they had \$5000-\$10000 of truck expenses, their expenses were estimated at \$7500 for the data for this regression.

Table 9 Owner-operator earnings regression

	Estimate	Standard Error	t value	P value
Intercept	25707.56	6256.54	4.109	6.96E-05
40 to 500 mile typical trip	-9933.61	4541.76	-2.187	0.0305
Other work in the last year	-8175.19	4008.11	-2.04	0.0434
Total hours per week	35.47	134.77	0.263	0.7928
English as a first language	-2188.54	4624.48	-0.473	0.6368
Multiple R-squared: 0.08922, Adjusted R-squared: 0.06141				
F-statistic: 3.208 on 4 and 131 DF, p-value: 0.01503				

In the owner-operator regression, the variables found to be significant was if the driver had done other work in the last year, which was associated with a \$8,829 decrease in annual net port trucking earnings, and making trips of 40 to 500 miles, which was found to have an estimated \$9934 decrease in earnings per year. Similar to the employee driver regression, drivers who spoke English as a second language did not have a significant difference in earnings potential from drivers who were native English speakers (p value of 0.64).

8.3 Model Applications

The goal of modeling driver earnings based on non-earning characteristics was to be able to make the identification of low earning drivers easier, therefore helping inform programs to assist drivers at the Port of Seattle. While some of the variables tested in the regression models showed significance, the low adjusted R squared values of the models (0.2056 for employee drivers and 0.06141 for owner-operators), doesn't show strong predictive power for either of the models, especially for owner-operators.

One possibility for the low predictive power of the two models, especially the owner-operator model, is the need to estimate earnings based on categorical responses. This dilutes the resolution of earnings data. In the case of the owner-operator model, both gross earnings and expenses must be estimated to determine net earnings, further diluting the resolution of the data set. Future studies interested in modeling earnings may want to consider asking about earnings after truck expenses, as well as asking for a numerical response rather than a categorical response, although drivers may feel less comfortable giving a numerical response for earnings information.

9. Trip Speed and Reliability

Owner-operators in the 40 to 500 mile typical trip were found to have a lower rate of per-mile compensation than the per-mile compensation of the entire driver population. With lower per-mile earnings, drivers making long trips would need to have faster and more reliable trips than drivers making shorter trips at higher per-mile rates.

To determine how each region was affected by trip reliability, the distance of each's driver's last trip was calculated. This distance was divided by the time the driver indicated it took to make the trip, to get an average speed for the trip. The coefficient of variation for average speed of the trip was calculated for each regional service grouping. Note that the time given for drivers to make their last trip included waiting time at the Port of Seattle, as well as driving time. This analysis operates based on the assumption that the distribution of waiting times at the Port of Seattle is the same for each regional driver group.

9.1 Results

The table below shows the average speed for each typical trip length. The average speed of the trip increased as the trip length increased – this makes sense because longer trips will have more driving time relative to waiting and loading time at the port and final destination.

Trips of less than 10 miles were the slowest, but were found to be reliably slow, with a lower coefficient of variation than the 10 to 40 mile trips. The 10 to 40 mile trips were in the middle for speed, but had the highest coefficient of variation, indicating the least reliable trips. Trips of 40 to 500 miles were found to be reliably fast, with the highest speed and the lowest coefficient of variation.

Table 10 Trip speed and variability

Typical Trip Length (miles)	Less than 10	10 to 40	40 to 500
Average speed (mph)	5.05	9.52	15.09
Standard Deviation (mph)	4.20	9.72	9.15
Coefficient of Variation	0.83	1.02	0.61

10. Summary

About 31% of the Port of Seattle owner-operator population makes less than \$20,000 per year, and about half of these drivers (15% of total owner-operator population) indicated that their trucking expenses exceeded their income from port trucking. However, only 8% of owner-operators with expenses exceeding income and 17% of owner-operators making less than \$20,000/year in net income reported household incomes of less than \$20,000/year. This implies that for most drivers in these groups, port trucking is not the only income source in the household. Additionally, 100% of drivers with expenses exceeding income reported doing work other than port trucking in the last year.

Nineteen percent of employee drivers reported making less than \$20,000 a year doing port trucking. Twenty-five percent of these employee drivers also had household incomes of less than \$20,000 a year, and a further 37.5% reported household incomes between \$20,000 and \$40,000 a year. Sixty-three percent of these drivers reported having done work other than non-port trucking in the last year.

Regressions formed to explore the structure of pay for owner-operators suggested that owner-operators making trips of less than 10 miles are paid by the trip. Owner-operators making trips of 10 to 40 miles or 40 to 500 miles are paid by the mile, with owner-operators making shorter trips making more per mile than those making longer trips.

Doing work other than port trucking in the last year was an indicator of lower port trucking earning potential, for both employee drivers and owner-operators. The number of employee drivers making less than \$20,000 per year doing work other than port trucking was about double that of all employee

drivers, and the number of owner-operators making less than \$20,000 per year (net income) doing work other than port trucking was approximately triple that of all owner-operators.

11. Conclusions

Since 2008, the number of drivers working full-time has declined, with an increase from 70% to 80% of drivers indicating that they worked less than 5 days per week during the last pay period. Further, the number of drivers reporting having done other work in the last year increased from 8% in 2008 to 38% in 2013. 31% of owner-operators reported having port trucking earnings of under \$20,000 per year, however, only 13% of these owner-operators reported household incomes of under \$20,000 per year, suggesting that these owner-operators have significant other sources of income in their households. Further, 100% of these owner-operators reported having done other work in the last year. This data suggests that while Port of Seattle owner-operators have seen a decline in work at the Port of Seattle, potentially due to loss of traffic, these owner-operators have been able to supplement their work with work outside of the port trucking sector.

Owner-operators who have been able to fill out their earnings with non-port work may be less likely to upgrade their trucks. These drivers would have to make a significant investment in upgrading their vehicle to protect only a portion of their earnings, and they may be inclined to look for more non-port work instead of upgrading. Over one third of owner-operators at the Port of Seattle reported doing other work in the last year, so if these drivers do not upgrade their trucks, the Port of Seattle could see a significant change (and possible reduction) in their drayage population.

One purpose of this thesis was to identify any groups of drivers that were economically disadvantaged relative to the entire population of drivers. Examinations that were performed to look for characteristics that would identify low-earning drivers found few relationships between tested characteristics and earnings. Employee operators showed a relationship between time at current company and hours worked and earnings, other variables tested did not show a relationship. Owner-operator earnings showed a relationship with work in the last year and a typical trip length of 40 to 500 miles both being indicators of lower earnings; however, the R squared value for the model was quite low, suggesting that the relationship is not incredibly strong. Overall, no single non-earning characteristic stood out as being a strong indicator of low port trucking earnings, suggesting that there are no groups of drivers who are at a significant disadvantage compared to the entire driver population.

The hypothesis that drivers doing some trip lengths may be disadvantaged by their pay structure was tested by investigating the pay structure for each trip length and comparing it to the speed and reliability for that trip length. Drivers who make slower or less reliable trips would need to be compensated at a higher per-mile rate to be able to make comparable earnings to drivers making faster or more reliable trips. The findings of this thesis was that there were not any distortions in how drivers of different distances were compensated – drivers making fast and reliable trips were compensated at a lower per-mile rate than drives who were found to be making slower and less reliable trips.

12. Recommendations

The survey methodology used for the 2013 Port of Seattle survey worked well to gather a large data set. By increasing the number of days that surveys were distributed, a larger data set was gathered than in previous survey efforts, allowing for more detailed analyses of drivers. Researchers interested in tracking changes from year to year can improve their ability to compare data to past surveys by standardizing questions across surveys.

The Port of Seattle has expressed a desire in conducting a survey of the Port of Seattle drayage trucking population every two years. This will allow for a larger data set to use for comparisons, and trends affecting the drayage population will be able to be more easily identified as more survey data sets are available.

Earnings that used numerical response data rather than categorical data would improve the ability to construct models of earnings. The models created for this thesis had little predictive power, which could be caused by either choosing variables which did not relate to earnings, or due to insufficient resolution of the earnings data used. Future research done in this area should attempt to get an earnings data set with higher resolution if possible.

The data set gathered in 2013 had a large sample size (290 drivers). Some analyses focusing on sub-groups within the population were still limited by small sample sizes. If future survey efforts are able to achieve larger sample sizes, more detailed analyses could be conducted, and model results could potentially be improved.

13. References

Port Jobs. *Big Rig, Short Haul*. Port Jobs. 2006.

Monaco, Kristen, and Grobar, Lisa. *A Study of Drayage at the Ports of Los Angeles and Long Beach*. Department of Economics, California State University Long Beach. December 15, 2004.

Monaco, Kristen. *Incentivizing Truck Retrofitting in Drayage: A Study of Drivers at the Ports of Los Angeles and Long Beach*. Department of Economics, California State University Long Beach. February 2008.

Port of Seattle. *2008 Trucker Survey*. Port of Seattle. 2008.

Port of Tacoma. *Port's 2008 Cargo Volumes Reflect Global Economic Conditions*. Port of Tacoma. <http://onlinepubs.trb.org/onlinepubs/archive/guidelines/authors.pdf>. Accessed June 30, 2014.

Appendix: Survey Instrument

2013 Trucker Survey

This survey is designed to learn more about truck drivers and their work. Your answers will help the Port of Seattle to make better decisions about truck programs. Do not write your name on the survey. Your information is private and anonymous.

Please mail this survey back in the provided envelope, or seal the survey in the envelope and return the survey to the person who gave it to you.

Please check the boxes that apply, and provide numbers/other information where indicated _____.

Thank you for your help!

I. Trip/ Destination Info

1. Please pick one: How long are **most** trips you drive to or from the Port terminals?
 Less than 10 miles (to rail yards or warehouses in Seattle)
 Between 10 and 40 miles (to warehouses in the Kent/ Auburn Valley or the Eastside, e.g. Issaquah)
 Between 40 and 500 miles (to other locations in Washington, Oregon, Idaho, or West British Columbia)
 Over 500 miles (long haul trips)
2. Last week, how many days did you work at:
 Port of Seattle: _____ Days Port of Tacoma: _____ Days
3. How many turns (round trips) do you usually make in one day? _____ turns
4. How many hours do you work each day (including waiting and other non-driving time)?
_____ Hours/Day

Now think about the last trip you completed to or from the Port of Seattle (not this one).

5. What was the origin and destination of that trip?
I started my trip at (name of city or terminal) _____
I ended my trip at (name of city or terminal) _____
6. How much were you paid for that trip (please report the amount you anticipate being paid if you have not been paid yet)? \$ _____
7. How was the payment for your last trip calculated? per trip mile hour (check one)
8. Were you reimbursed for fuel? (Please fill in the amount you were reimbursed)
_____ Percent _____ Per Mile _____ Per Trip I was not reimbursed for fuel.
9. How many hours did the trip take (please count all driving and non-driving work time, including time spent waiting or stuck in traffic) _____ hours.

II. Employment/ Job Experience

10. Are you an: Owner/Operator Employee driver?
11. How many years have you worked as a truck driver?
 Less than a year 1-2 years 3-5 years 6-10 years Over 10 years
12. How long have you worked for your current employer or company?
 Less than a year 1-2 years 3-5 years
 6-10 years Over 10 years I am an owner-operator
13. Is this a year round, full-time job for you?
Year-round Yes No Full-time Yes No

14. Did you do any other work in the last year? Please check all that apply:
 Non-port trucking Other driving (bus, limo, taxi) Construction
 Agriculture Retail Mechanic Other: _____
15. Are you interested in training for other work?
 Yes No
16. Are you interested in financial assistance for training for other work?
 Yes No

III. Earnings/ Payments *(All information on this survey is anonymous and confidential.)*

17. What was your total household income last year?
 Less than \$20,000 \$20,000-\$40,000 \$40,000-\$60,000 \$60,000-\$80,000
 \$80,000-\$100,000 \$100,000-\$120,000 \$120,000-\$140,000 More than \$140,000
18. How much money did you earn driving a Port truck last year (before truck expenses like repairs or new tires)?
 Less than \$10,000 \$10,000-\$20,000 \$20,000-\$30,000 \$30,000-\$40,000
 \$40,000-\$50,000 \$50,000-\$60,000 \$60,000-\$70,000 More than \$70,000
19. What did you spend on truck expenses last year (repairs, insurance, fuel etc. but **not** including truck payments)?
 None, company pays Less than \$5,000 \$5,000-\$10,000 \$10,000-\$20,000
 \$20,000-\$30,000 \$30,000-\$40,000 \$40,000-\$50,000 More than \$50,000
20. How often do you get paid: Weekly Every other week Monthly
21. How much was your last paycheck after deductions? \$ _____
22. How much did you work during that pay period? _____ Turns/Roundtrips per day
 _____ Days per week

IV. Truck Information

23. Do you own the truck you drive?
 I own it I lease it I drive a company truck
24. If you own or lease your truck, how long have you owned or leased it?
 Less than a year 1-2 years 3-5 years 6-10 years Over 10 years
25. Did you replace or upgrade your truck to meet the Clean Trucks Program requirement that all trucks comply with 1994 federal emissions standards? Yes No
26. If you own your truck, how much did you pay for it? \$ _____
27. If you own your truck, when will it be paid off (what year)? (Please leave blank if you have already paid off your loan.) 20 _____
28. If you own your truck, how much is your monthly truck payment?
 Truck paid off Under \$250 \$250-500 \$500-750 \$750-1,000
 \$1,000-1,250 \$1,250-1,500 \$1,500-1,750 \$1,750-2,000 Over \$2,000
29. What is the **engine year** of your truck? 19 _____ or 20 _____
30. How many miles does your truck have? _____
31. How many miles did you drive your truck last year? _____
32. Do you plan to upgrade your truck to/with a cleaner truck? Yes No When? (year) 20 _____
33. If you were required to upgrade your truck to a cleaner truck, how much would you be able to pay for this upgrade?
 Less than \$10,000 \$10,000-\$25,000 \$25,000-\$50,000 More than \$50,000
34. What type of financial assistance would help you upgrade your truck? (Check all that apply.)
 a low interest loan

- a leasing assistance program
- a grant to cover a portion of the expenses

V. Truck Parking

35. Where do you park your truck when it is not in use?

- off street at home on street at home _____ # nights per week
 - in trucking company's lot _____ #nights per week
 - at Port of Seattle lot on T-25 _____ #nights per week
 - street in Georgetown _____ # nights per week
 - street in South Park _____ #nights per week
 - street lot elsewhere in Seattle _____ # nights per week.
- Where? _____

36. Do you pay for parking?

- No Yes _____ # nights per week
- If Yes, how much is it: \$ _____ / day OR \$ _____ / month

VI. Demographics (Please tell us about yourself.)

37. What is your home zip code? _____

38. How old are you? _____ years

39. Are you Male Female?

40. How many people live in your household? _____ adults _____ Children

41. Do you support children who do not live in your household? No Yes
 _____ Children

If yes, how many children do you support? _____

42. Is English your first language? Yes No

If NO: Where do you come from? (check one)

- Africa
- Asia/Pacific Islands
- Middle East
- Eastern Europe
- South/Central America
- Other (please specify):

AND: What is your first language? (check one)

Africa:

- Amharic
- Oromo
- Punjabi
- Somali
- Swahili
- Tigrinya

South/Central America

- Garifuna
- Spanish

Eastern Europe:

- Russian
- Ukrainian

Middle East:

- Arabic
- Farsi

Other (please specify): _____

Asia/Pacific Islands:

- Korean
- Samoan
- Vietnamese

43. What is the highest grade of education that you completed? (*check one*)

8th grade or less

Some college (no degree)

9th - 12th grade

Associate degree (2-year diploma/degree)

High school diploma/degree

College degree (4-year diploma/degree)

Vocational or technical school

Graduate degree or coursework

44. What else can the Port of Seattle do to help you be successful as a driver? (Possible examples: small business training, driving or safety training, connections to financial resources)

