Southwest Washington Regional
Transportation Council

Clark County Freight Mobility Study

Technical Report 3.B.3.

Characteristics of Truck Movements

Prepared By:
Heffron Transportation, Inc.

Prepared For:
RTC

November 2009

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Table of Contents

List of Figures

List of Tables

Appendix A. Truck Classifications

Appendix B. Detailed Truck Counts

1. Study Purpose

1.1 What Is The Purpose Of This Technical Report?

The purpose of this technical report, *Characteristics of Truck Movements*, is to document existing truck movements throughout the county, define the relationship between truck movements and land uses, and understand the relationship of the global supply chain on truck movement in Clark County. Other reports prepared for this study include information as described below.

- The results of interviews with shippers to understand how Clark County's freight system fits into the global supply chain.
- An understanding of the multi-modal freight and goods system in Clark County,
- An analysis of the existing freight system in terms of freight volume moved throughout Clark County and major generators of freight movement, and
- An analysis of how the freight system relates to and supports the local economy,

Ultimately this and all other study reports will be used to evaluate freight system deficiencies and future needs, and the infrastructure and policy needs to support freight mobility.

1.1.1 How does Clark County's freight system fit into the global supply chain?

As part of the Clark County Freight Mobility Study, Starboard Alliance Company, LLC conducted outreach to shippers, motor carriers, the Ports, and barge operators. The interviews included ten shippers, eight motor carriers, three ports, two railroads, and two barge lines (Starboard Alliance Company, April 2009).

The companies interviewed each employed between 40 to 4,000 full-time employees, and had motor carrier fleets ranging from 35 to about 2,900 trucks. Their fully-loaded operating costs per hour ranged from $24 per hour, including benefits for the driver, to $225 per hour for high-value products. The eight motor carriers interviewed surveyed moved about one million fully-loaded trucks inbound to Clark County in 2008. The shippers inventoried did not provide outbound volumes. Two of the companies interviewed ship small packages, and together they estimated the inbound volume was 17.9 million packages moved by truck in 2008 of which 16.2 million moved by truck to the airport. The outbound volume was about 14.5 million, most of which were by air.

Highlights of information received from this diverse outreach to shippers, and the effect on truck movement, is summarized below. About half of the shippers interviewed intended to make changes to their supply chains in the next two years. Needs for local improvements identified through the interviews have been captured for potential inclusion as study recommendations.

<u>Truck Movements</u>

- Shippers in Clark County use all transport modes and many types of specialty trucks. Trucks utilized by the companies surveyed include fully loaded trucks, less-than-load

(LTL) trucks, dump trucks, cement trucks, flatbed trucks, heavy-haul specialized flatbed trucks, tractor-trailer trucks including triple trailers, dry and liquid build tankers, sweepers, water trucks, stepdeck1 or double drop trailers, and small package trucks.

- Congestion on I-5 over the Columbia River was the primary congestion issue identified in Clark County. Shippers and motor carriers expressed support for the Columbia River Crossing (CRC) project, a multi-year construction project including five miles of freeway reconstruction. Shippers avoid traveling during peak period congestion when travel would slow down transportation through the supply chain.
- Shippers would like assurance that moving freight will be a priority during construction of the Columbia River Bridge.
- The truck routes from the Port of Vancouver to I-5 can be problematic for trucks. There are geometric deficiencies at the Fourth Plain Boulevard/I-5 interchange (i.e., tight loop ramps and super elevation of ramps connecting I-5 and State Route (SR) 14 that can disrupt freight movement. The traffic signals on Boulevard are close together and not timed well for trucks. Adequate arterial access to I-5 is important to the economic vitality of the Port.
- Oversize loads from the Port of Vancouver must make advance preparations to move through downtown Vancouver. Prior to an oversized load passing through, metered parking spaces are purchased to eliminate on-street parking and provide space for the oversize loads to make a turn.
- Other congested locations of concern to trucks were at the SE Mill Plain Boulevard and Chkalov Drive intersection and the SR 14 and SE 164th Avenue intersection.

Rail Transport

- Railcars are delayed in transit between Portland and Vancouver and at the Vancouver rail yard. The Vancouver rail yard, in the vicinity of W 39th Street, is one of the busiest rail yards in the Pacific Northwest. More than 100 trains pass through the Vancouver rail yard every day.
- The Rye Junction, where the Lewis and Clark shortline railway (Chelatchie Prairie rail line) ties into the Burlington Northern Santa Fe (BNSF) Railway mainline, is at capacity. The increased price of fuel has caused shippers to shift freight from truck to rail, thereby increasing the shortline's volume. The Lewis and Clark railway is working with BNSF to identify another location to interchange rail off the rail mainline.
- There were concerns with low clearances in the rail system through tunnels and on bridges. The low clearances limit the products that can be shipped by rail.
- The rail line and spur at the Port of Camas-Washougal is deteriorating and needs improvement.
- There is concern that the rail system is at capacity.

[1] A stepdeck or double drop trailer is used to transport units that are too high for standard flat bed trailer. The flat bed is lower between the axles and can the transport pieces up to 10' high.

Barge Transport

- Navigation, lock maintenance, channel dredging, and seasonally mandated water flow rates must be continuously monitored and managed to support barge transport. In the winter of 2010-2011 the locks on the Columbia River will be closed for four months. Freight transport by barge will have to shift to rail and truck.
- There are times when the availability of break bulk2 vessels is limited. Freight shipments can be stalled waiting for a break bulk vessel.

Shipping Costs

- The rising cost of fuel was identified as the primary issue of concern by shippers.
- The federal regulations governing supply chain security has slowed down transportation through the supply chain, which adds to the supply chain costs.

Anticipated Changes in the Supply Chain

- Shipping companies expect to increase the portion of cargo that moves directly from the foreign supplier to the customer, bypassing the company's distribution center to save transportation and warehousing costs. Under this supply chain model, a container that arrives in the United States (U.S.) port would be placed on a truck and transported directly to a store. This means that the warehouse and distribution function would occur overseas. For example, for shipments to stores in the Midwest, a pre-loaded container would move directly to a train at the U.S. port and then transferred to a truck closer to the final destination.
- Shippers expect growth in shipment by unit trains in an effort to minimize shipping costs. A unit train is a train in which all the cars in a train move from the same origin to the same destination, without being split up or stored en route. This saves time and money associated with assembling and disassembling trains at rail yards. Unit trains typically serve a single commodity.
- The rising cost of fuel, as well as other overseas manufacturing costs, has already caused one company to increase domestic manufacturing to eliminate import costs. If domestic manufacturing increases, then raw materials will be delivered to manufacturing centers, and finished products will be shipped domestically. This will mean a reduction in the import of manufactured goods.
- As changes occur in global transport, local shippers expect to address changes in the transport market by reducing costs, operating more efficiently, capturing the expected increase in oversize loads (wind turbines) from the Port of Vancouver, and diversifying geographically.

[2] Break bulk is a shipping term for any loose material that must be loaded individually, and not in intermodal containers or bulk as with oil or grain.

1.1.2 What are the advantages of Clark County's freight transportation system?

The interviews of shippers and motor carriers included a question asking if there were strengths in Clark County's multimodal transportation system. There were numerous positive comments received that are summarized below:

- Easy access to the interstate system, providing good access to destinations north, south, and east.
- I-5 provides easy access from the Ports of Seattle and Tacoma to distribution centers in the Portland-Vancouver area.
- Jurisdictions have made arterial improvements that increase capacity and improve intersection operations such as SR 500 and Paden Parkway.
- The Port of Vancouver has taken the initiative to upgrade its facility to accommodate the demand for wind turbine parts spurred by the demand for green energy production.
- Access to both the Union Pacific (UP) Railroad Company and the BNSF Railway Company. In Washington State, UP operates via trackage rights over the BNSF mainline between Vancouver (Clark County) and Tacoma.
- There are five deep water ports within one hour of Clark County with good connections to the ports and the interstate. The dispersion of port traffic minimizes traffic and truck congestion.
- Availability of barge facilities.

The advantages of Clark County's multi-modal transportation system mean a financial benefit for shippers, motor carriers, and industry.

1.1.3 How does the Washington State Transportation Plan relate to the global supply chain?

The Washington Transportation Plan (WSDOT, January 2005) recognizes three components of Washington State's freight system:

- Global Gateways – international and national trade flows through Washington
- Made in Washington – regional economies rely on the freight system
- Delivering Goods to You – the retail and wholesale distribution system

All three of the plan components relate directly to Clark County. The Port of Vancouver and the Port of Camas-Washougal are significant global gateways to freight products such as wind turbine parts and grains. Products made in Clark County that are dependent on freight system include lumber and wood products, farm and food products, technology products, transportation equipment and steel. Distribution and wholesale trade businesses are the last link in delivering the goods to the customer.

The Washington State Freight and Goods Transportation System (FGTS) is used to classify Washington State roadways by average annual gross truck tonnage. I-5 is at the highest classification, T-1, with more than 10 million tons per year. Globalization, competitive industry trends, and new technologies have pushed freight volumes up twice as fast as Washington's overall population and traffic growth. From 1980 to 2002, truck trips increased by 94 percent in the I-5 corridor (Washington State University 1993/1994 – 2002).

1.2 Relationship between Freight and the Economy

1.2.1 How much of the County's economy depends on freight moblity?

As part of the Clark County Freight Mobility Study, BST Associates prepared an analysis and report on *Current and Expected Economic Conditions* (BST Associates, November 2009). The report focused on the freight-generating sectors of the economy of Clark County and the economic benefits of freight movement to Clark County.

Most of the freight-related jobs in Clark County are located within five miles of the Columbia River. The area near the river has traditionally been home to the county's manufacturing and transportation industries. The largest concentration of freight-related jobs (nearly 30% of the total) is located in the urbanized area of Clark County in the vicinity of I-5, I-205, and the Columbia River. There are also pockets north and south of this area that are major centers of freight-related employment. Figure 1**Error! Reference source not found.** presents the employment locations for all Standard Industrial Classification (SIC), which clearly shows how industrial employment is distributed throughout the county.

The five most freight-intensive industry sectors, which account for half of the freight moving in the Portland-Vancouver area are:

- petroleum products,
- minerals,
- food and beverages,
- wood products, and
- grain.

These top five commodities also account for more than half of the freight moved by truck. Other key commodities include logs, aggregates, and mixed freight. (BST Associates, 2009).

1.2.2 How much of the freight if moved by truck?

There are six major freight transport modes used in Clark County: airplane, barge, rail (both intermodal, i.e., containers on rail, and freight, i.e., box cars, tankers, etc.), ocean ship, pipeline, and truck. Of these, trucks carry more freight than all other modes combined—55% of the tonnage and about 60% of the value. The percentage of freight moved by truck in Clark County is lower than for the Portland-Vancouver region as a whole because a much higher proportion of freight in Clark County is shipped by rail and barge through the Port of Vancouver. Table 1 summarizes freight tonnage and value by mode of transport for Clark County.

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CLARK COUNTY FREIGHT MOBILITY STUDY

Figure 1

State Industrial Classification by Employment Size

Legend

SIC Category	*# of Employees*	
Agriculture, Forestry, & Fishing	1,000+	20-49
Construction	250-499	10-19
Manufacturing	100-249	5-9
Mining	500-999	1-4
Transportation & Public Utilities	50-99	Uncoded
Wholesale Trade		

N

0 1 2 Miles

Map Source: Clark County GIS
Data Source: Various

File: P:\SSWRT\00000020\060\0NFO\GIS\Arcmap\ClarkCo_EmpSIC+Volumes_WallSize.mxd
Date: 8/31/2009 2:09 PM

Table 1. Clark County 2007 Freight Tonnage and Value by Mode

Transport Mode	Tons (1,000)[1]	% by Ton	Value ($1,000s)	% by Value	$/Ton
Ocean	5,943	18.3%	$4,660,220	17.6%	$784
Barge	2,269	7.0%	$675,383	2.6%	$298
Rail	5,625	17.3%	$4,568,740	17.3%	$812
Truck	17,920	55.2%	$15,818,286	59.9%	$883
Air	42	0.1%	$433,668	1.6%	$10,249
Pipeline	647	2.0%	$252,517	1.0%	$390
Total	32,446	100.0%	$26,408,813	100.0%	$814

Source: BST Associates using 2007 data, analysis performed in 2009

The market for commodities is sensitive to transport time and shipping cost. Rail is more cost effective for large tonnages, but it cannot meet the delivery schedule requirements for many commodities. Thus, the majority of freight within the Portland-Vancouver region will continue to move by truck, and a major focus of the Clark County Freight Study will be a plan for the efficient movement of freight by truck.

1.3 Truck Classifications and Data Sources

This section presents truck volume data and analysis at locations throughout Clark County. Truck volume data were used to determine the magnitude of trucks using various highways and arterials, how these volumes have changed in the past few years, and how they vary by season, day of week, and by time of day. The truck volumes provide a basis for understanding the relationship between truck volumes and land uses, determining potential truck route designations, and the application of design guidelines for truck mobility and safety.

1.3.1 How are trucks classified for analysis?

The Federal Highway Administration (FHWA) has established a vehicle classification system that uses 13 categories distinguished by vehicle type, and by number of axles, and number of trailers for trucks. The classifications were originally established for use in pavement and bridge design. However, when describing trucks for the purpose of transportation planning or traffic operations analysis, the truck classifications are often grouped into three primary categories: light (small), medium, and heavy (large). Appendix A summarizes the 13 vehicle classifications by number, name, the planning terminology, and size of truck and number of axles. The three groupings are defined as follows:

> **Light trucks** are a single unit, have two axles and up to six tires. This size truck performs light commercial activity, and includes small delivery trucks such as those operated by UPS. On highways and arterials the operating characteristics are similar to a passenger car.
>
> **Medium trucks** have three or four axles. A heavy garbage truck or a single dump truck would be categorized as a "medium" truck. The medium trucks carry heavier loads,

require a wider turning radius, and use more capacity on highways and arterials than a passenger car.

Heavy trucks have five or more axles and a "tractor-trailer" configuration. The operating characteristics differ substantially from a passenger car, with slower acceleration speeds, longer stopping distances, different sight lines, and a large turning radius. Their operating characteristics consume approximately double the street capacity as compared to a passenger car.

1.3.2 What are oversize loads?

The truck classifications described above do not include some oversized loads. Technically, oversize loads are those that require a permit because they exceed the maximum thresholds for length, height or weight. The permits are required to make sure that infrastructure along the desired travel route can accommodate the load or dimension. For example, making sure that bridge load restrictions are not exceeded or that vertical clearances are adequate.

Within Clark County there are some unique and strategically important oversize load transport routes. The Port of Vancouver ships over-length and over-height loads of wind turbines and wind turbine parts to eastern Washington and Oregon wind energy farms. These shipments leave the Port of Vancouver on Mill Plain Boulevard, enter I-5 southbound, and exit to SR 14 eastbound. The Columbia Industrial Park ships oversize loads to the Port of Vancouver and to the north and south on I-5. These loads use SR 14 westbound to I-5, access I-5 (northbound or southbound), and exit onto Mill Plain Boulevard.

On most highways and arterials, the primary limiting factor for oversize load route choice is vertical clearance. The standard clearance for an arterial crossing is 16 feet (16.5 feet for a new bridge). Signal mast arms can also be a clearance constraint. Many of the wind turbines are also exceptionally long, and require additional horizontal clearances when making a turning maneuver. When wind turbines are now being moved through downtown Vancouver, temporary parking restrictions are implemented to accommodate turning maneuvers.

1.3.3 What sources of truck data were available?

There were four sources of vehicle classification data in Clark County:

- **Columbia River Crossing (CRC) project** - The CRC data include a comprehensive set of truck volumes on the Interstate-5 mainline segments and all ramps between the Columbia River and SR 500. Most of the CRC data were collected in October 2005, with some additional counts performed in 2009.
- **Portland Freight Data Collection Project (PFDC)** - The PFDC data included truck counts at 15 locations on state highways and arterials in Clark County. These data were collection in May 2006.
- **Washington State Department of Transportation (WSDOT**) - There are five WSDOT permanent traffic recorders in Clark County that provide 24-hour, yearly vehicle

classification data. In addition, the WSDOT had collected 12-hour vehicle classification data at 27 locations on state highways throughout the county.

- **Clark County Freight Mobility Study** – New data were collected at 21 locations.

The full set of count data used for this study reflects counts performed from 2005 to 2009, in many different months. As will be discussed later, the only consistent trend determined from the data is that truck volumes declined between 2005 and 2009, likely as a result of the economic downturn. Also, there are no distinct seasonal variations in volumes except for the typical low volumes between November and January. Therefore, no annual or seasonal adjustments were made to the truck counts. All table, maps, and charts that use the data report both the volume and the date that the count was performed.

1.4 Truck Volumes on Clark County's Three Major Highways

WSDOT maintains Permanent Traffic Recording (PTR) stations on three major highways in Clark County: Interstate 5, Interstate 205, and SR 14. The PTRs provide daily traffic volumes by vehicle type for every day of the year (except when a counter malfunctions due to construction or other damage). This allows the determination of average daily truck volumes for a year, a month, or by day of week to show how truck volumes fluctuate. This section describes these fluctuations on the three major highways.

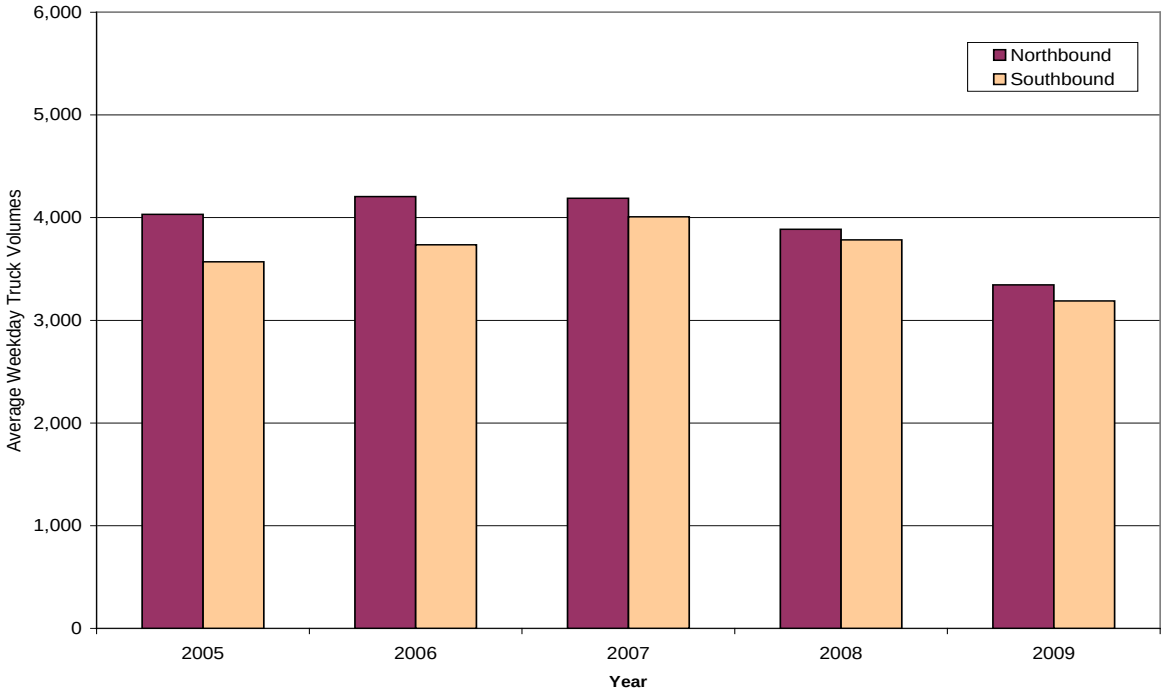
1.4.1 How have average weekday truck volumes changed by year?

Average weekday truck volumes were compiled for the three major highways for the period between January 1, 2005 and December 31, 2008 (year 2005 data were not available for Interstate 205.) Although data for some days throughout these years were missing (due to counter malfunctions), it did not appear to affect the average. The weekday average was used since these are the volumes that coincide with commuting days. Truck volumes by day of week are shown later in this section. The truck volumes include both medium and heavy trucks as defined in Appendix A.

There are two locations on Interstate 5 in Clark County with PTRs: one in downtown Vancouver and another at the Clark-Cowlitz County line. The average daily truck volumes for these locations are shown on Figure 2 and

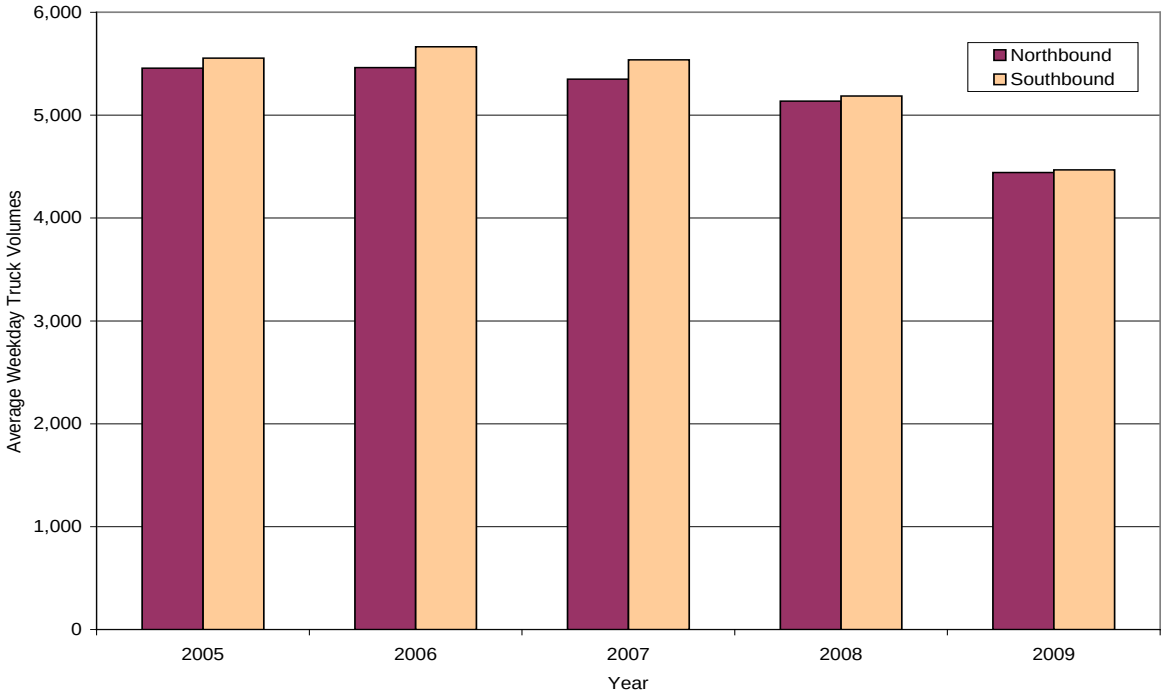
Figure 3, respectively. These figures show that truck volumes increased slightly between 2005 and 2007, and then decreased in 2008. Although not shown, truck volumes in 2009 were below the 2008 levels based on data available from January through April. According to analysis performed for the CRC, medium and heavy truck volumes on I-5 between the Columbia River and SR 500 had grown at a rate of 1.7% per year between 2001 and 2006 (CRC, 2008).

Figure 2. Average Weekday Truck Volumes by Year - Interstate 5 in Downtown Vancouver



Source: WSDOT, PTR I-5 milepost 1.98. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks. Data available in 2009 is from January through April.

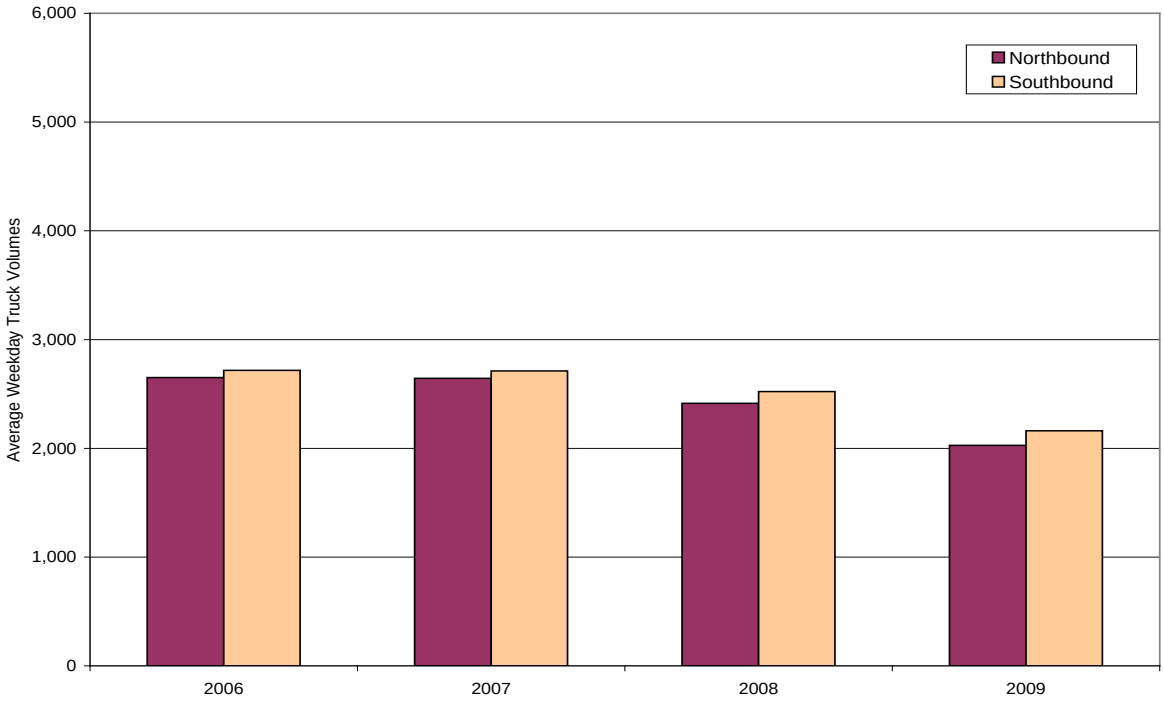
Figure 3. Average Weekday Truck Volumes by Year - Interstate 5 at the Clark/Cowlitz County Line



Source: WSDOT, PTR I-5 milepost 20.14 at the Clark/Cowlitz county line. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks.
Data available in 2009 is from January through April.

Figure 4 presents annual truck volumes on I-205 at milepost 28.84, in the vicinity of E Mill Plain Boulevard. Truck volumes on I-205 are 40% lower at this location than on I-5 in downtown Vancouver. The sum of I-5 in downtown Vancouver and on I-205 is reflected in the higher truck volumes at the Clark/ Cowlitz County line. The average weekday truck volumes were stable in 2006 and 2007 and then decreased slightly in 2008.

Figure 4. Average Weekday Truck Volumes by Year - Interstate 205 at East Mill Plain Boulevard

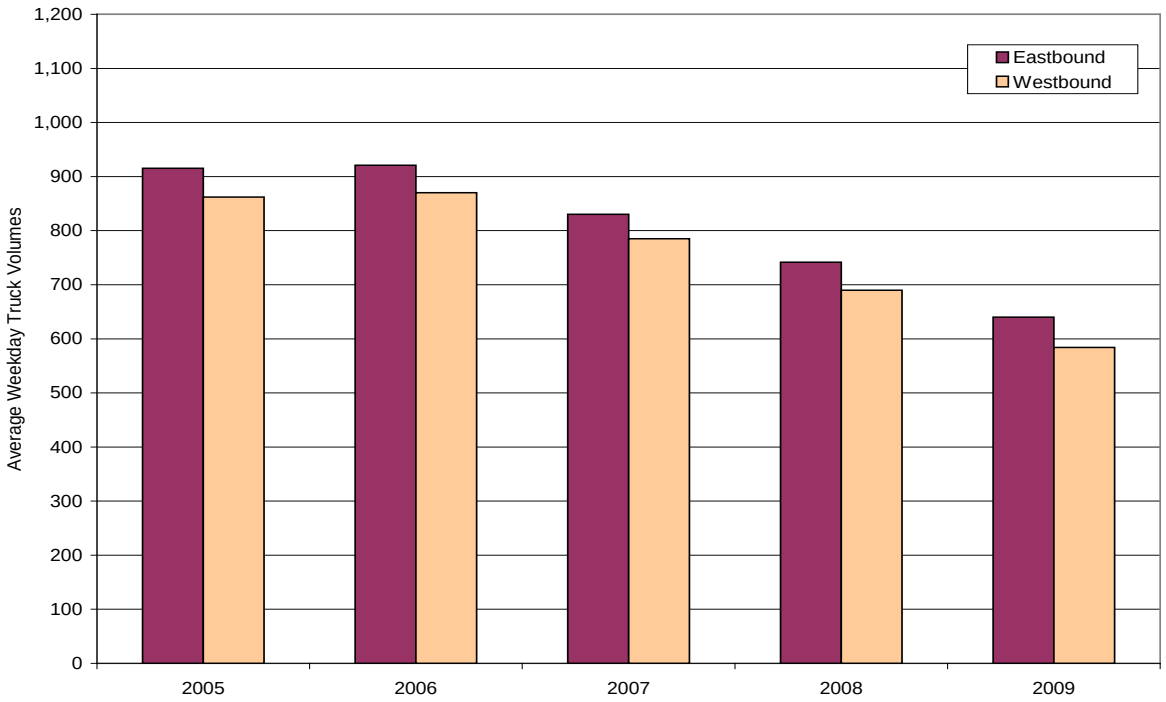


Source: WSDOT, PTR I-205 milepost 28.84. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks. Data available in 2009: northbound in January, and southbound in January, February, and March

Historic annual truck volume data were also evaluated on SR 14, which is a major freight route both for freight generators within Clark County as well as for through freight trips to locations outside of the County. There are two PTRs on SR 14: one in Camas and one in Washougal. Average weekday truck volumes, derived from annual data, are shown on Figure 5 for Camas and Figure 6 for Washougal.

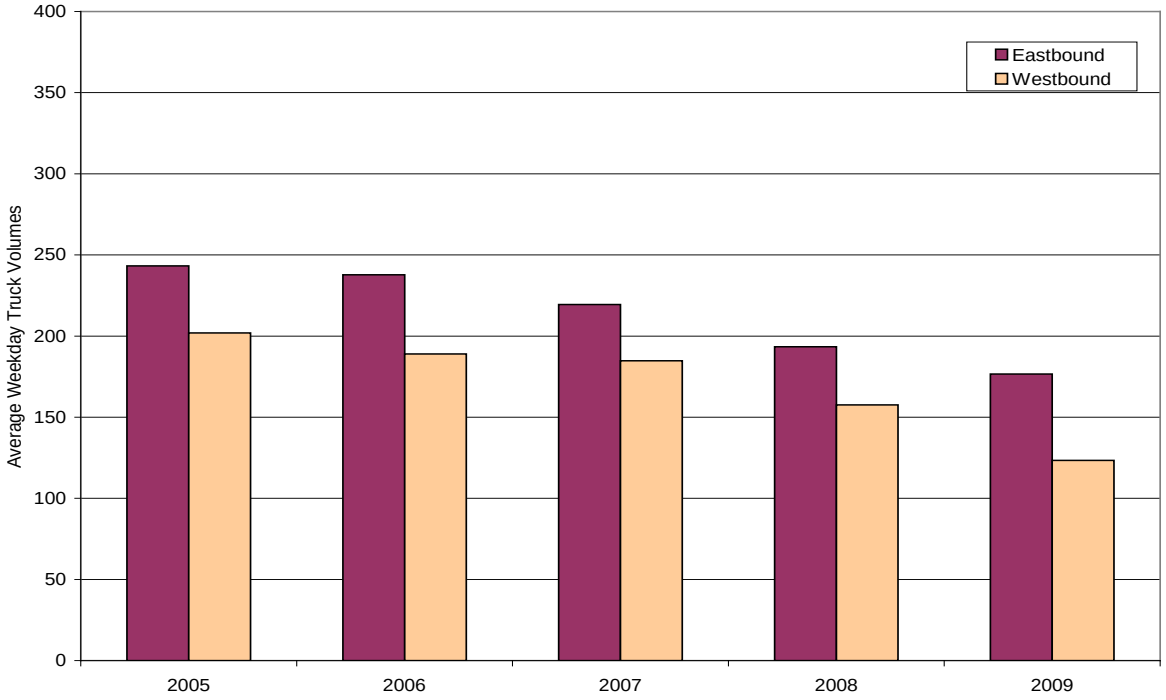
The weekday truck volumes on SR 14 in Camas were approximately 1,800 per day in both directions. This compares to approximately 6,000 on I-205 and 10,000 on I-5. The truck volumes on SR 14 in Washougal were about 400 per day in both directions, or approximately 75% less than the volume in Camas. Both counts show that volumes were relatively stable in 2005 and 2006, decreasing slightly in 2007, and then further in 2008. In Camas, the 2007 volumes were 10% lower than 2006, and the 2008 volumes were 20% lower than 2006. Truck volume data for 2009 were available from January through April. The average weekday truck volumes in 2009 were 32% lower than in 2006 for the months of January through April.

Figure 5. Average Weekday Truck Volumes by Year - SR 14 east of NE 192nd Avenue, Camas



Source: WSDOT, PTR SR 14 milepost 7.6. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks. Data available in 2009 is from January through April.

Figure 6. Average Weekday Truck Volumes by Year - SR 14 near 42nd Street, Washougal



Source: WSDOT, PTR SR 14 milepost 17.7. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks. Data available in 2009 is from January through April.

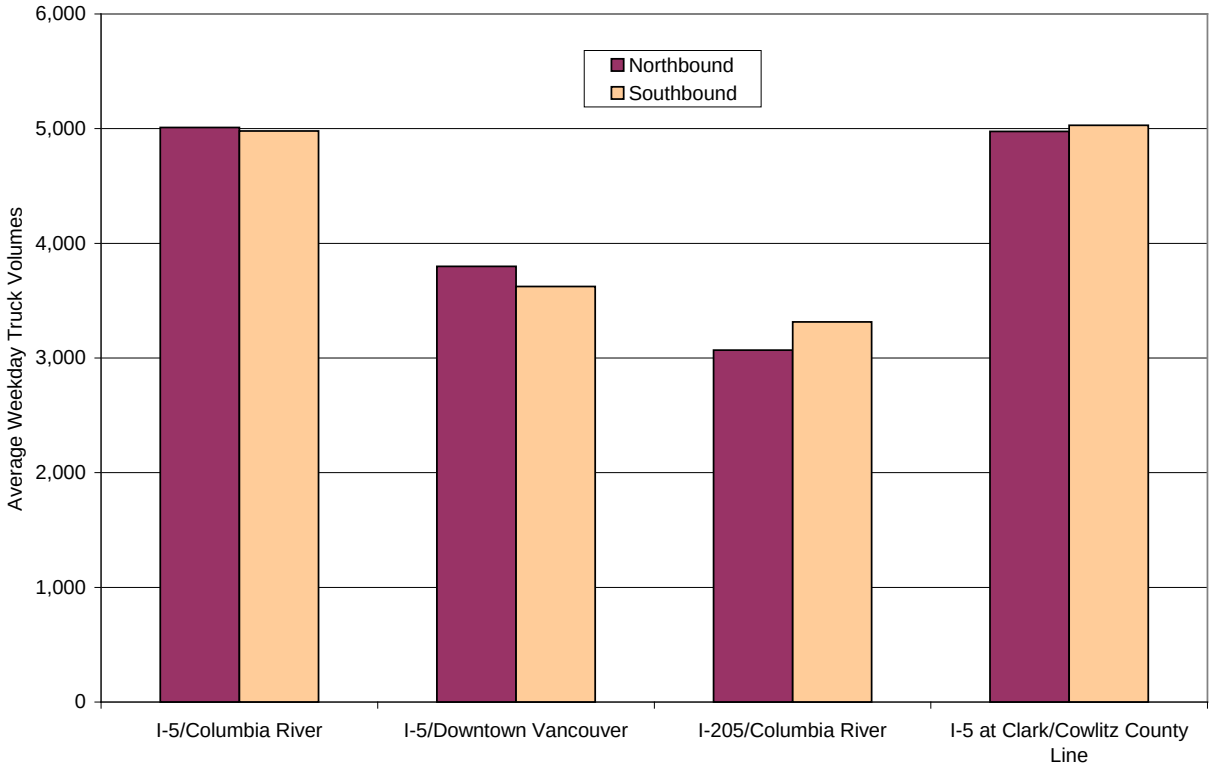
1.4.2 How do truck volumes on I-5 and I-205 compare?

Year 2008 average weekday volumes were compared for three locations on I-5 and I-205. Figure 7 presents the truck volumes on I-5 over the Columbia River Bridge, on I-205 just north of the Columbia River, and on I-5 at the Clark County/Clark County line. This shows that the I-5 bridge is used by approximately 10,000 trucks per day, versus about 6,400 on I-205, a difference of 3,600 trucks, or 56 percent This differential is explained by a number of factors. During uncongested periods, long-distance through truck trips will typically remain on I-5 because it is a shorter and faster route than I-205. The travel distance on I-5 from the south I-205 junction to the north I-205 junction is 19.3 miles. The travel distance between the two junctions on I-205 is 25.5 miles. Distance is a cost factor for a truck trip and includes the cost of truck operations, fuel, and travel time for the driver. Many truck drivers avoid traveling during congested conditions when the trip on I-5 might take longer than I-205.

The medium and heavy truck volumes are approximately equal on I-5 over the Columbia River and on I-5 at the Clark/Cowlitz County line. This can be explained by the proportion of through versus local truck trips. Local truck volumes on I-5 are a mix of truck trips generated by industrial and commercial land uses that access I-5. According to the *Portland Freight Data Collection Phase II* study, approximately 48% of trucks that originate outside the Portland-Vancouver urban area (at external cordon locations) are going to or from a location within the

Portland-Vancouver region. (Cambridge Systematics, July 2006). The remaining 52% of the truck trips from outside the Portland-Vancouver urban area are through trips.

Figure 7. Comparison of Truck Volumes on I-5 and I-205

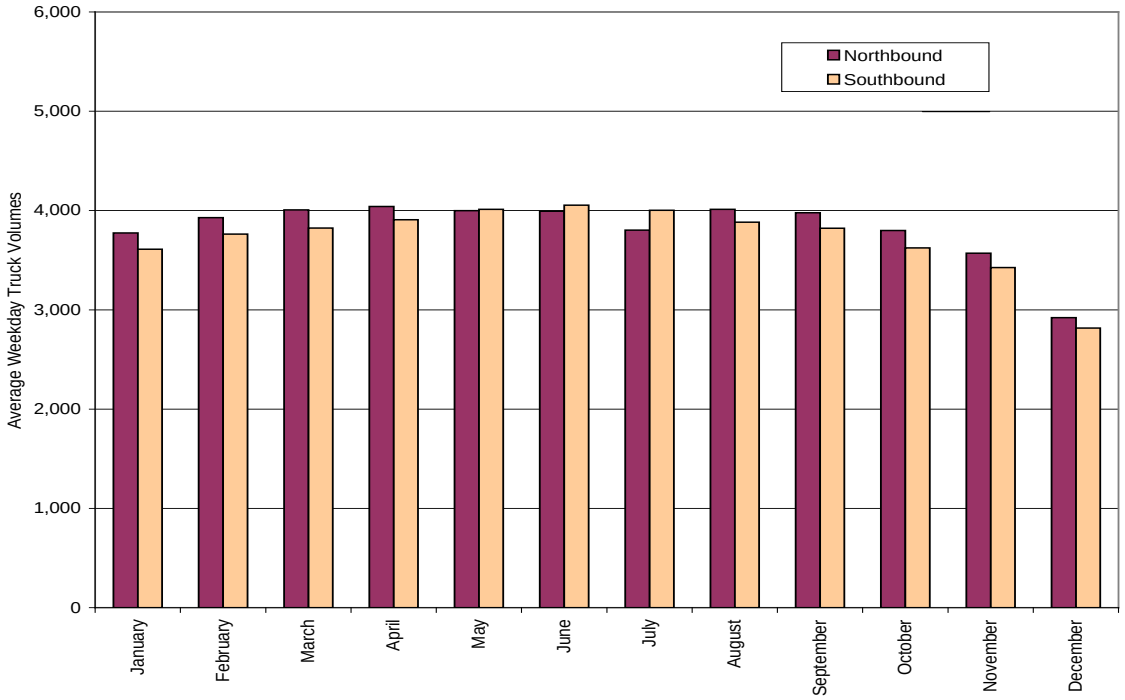


Source: ODOT for the Columbia River Crossing Project; I-5 over the Columbia River, October 2008 Traffic Data
ODOT for the Columbia River Crossing Project; I-205 over the Columbia River, September 2008 Traffic Data
WSODT PTR, MP 1.98 north of Fourth Plain Blvd and south of SR 500 ramps for Downtown Vancouver, October 2008
WSDOT PTR, MP 20.14 for I-5 at Clark/Cowlitz county line, October 2008
Vehicle classifications 6 – 13, medium and heavy trucks.

1.4.3 How do truck volumes vary by month?

Average weekday truck volumes for I-5 through downtown Vancouver were compiled to show how they vary by month of the year. Year 2008 was evaluated because it had no missing data. Figure 8 presents medium and heavy truck volume by month. This shows that I-5 in Clark County does not have notable peak season. As with other regions, the lowest truck volumes occurred in November, December and January. October volumes were very close to the annual average.

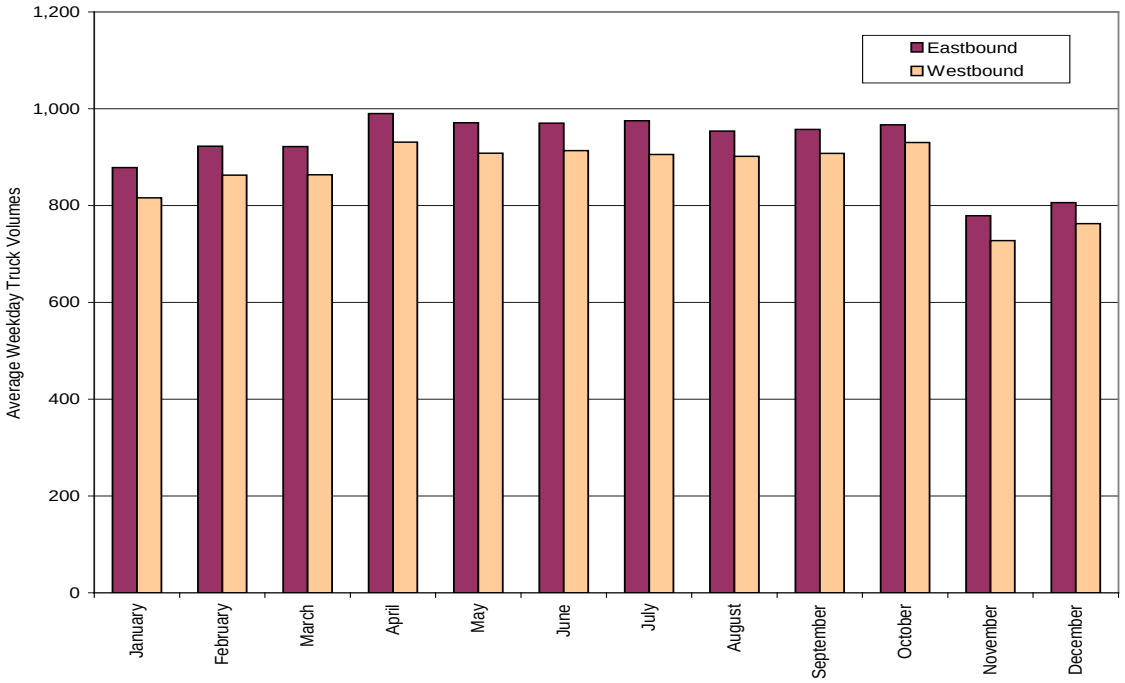
Figure 8. Average Weekday Truck Volumes by Month - I-5 in Downtown Vancouver



Source: WSDOT, PTR I-5 milepost 1.98., 2008. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks.

Figure 9 presents the average weekday daily medium and heavy truck volume on SR 14 in Camas by month. The month of February most closely reflects the average month. Daily volumes are somewhat higher and relatively constant from April through October. The AWDT by month also shows that truck volumes are consistently higher eastbound than westbound. One explanation this is that truck drivers may choose to travel on SR 14 rather than I-84 due to the weight-distance tax in Oregon.

Figure 9. Average Weekday Truck Volumes by Month - SR 14 east of NE 192nd Avenue, Camas



Source: WSDOT, PTR SR 14 at milepost 11.9 in Camas, 2006. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks.

The above data show that truck volumes are relatively constant from February through October. Volumes are lower November through January. For this reason, future truck counts in winter months should be avoided.

1.4.4 What is the relationship between average weekday and annual truck volumes?

The truck volume data from WSDOT permanent traffic recorders (PTRs) were used to quantify the relationship between the annual truck volume and the annual average weekday truck volume. Such a factor provides a tool to use average weekday truck volumes in estimating annual truck volumes, weekend truck volumes, annual freight volumes, and the annual truck factor for pavement design. Two data sources selected for analysis were the PTR on I-5 in Downtown Vancouver and the PTR on SR 14 at mile post 11.9, east of NE 192nd Avenue in 2006.

Table 2 presents the Daily-to-Weekday Conversion Factor. This factor was developed based on truck volume data for 253 working days (260 weekdays less 7 holidays) and 365 days per year. The conversion factor was calculated as:

Daily-to-Weekday Truck Volume Conversion Factor =
Sum of all truck volumes in a year ÷ Sum of all weekday truck volumes in a year

The Annual Truck Factor shown in Table 2 is the factor used in pavement design. It is the equivalent days per year to arrive at annual trucks from an average weekday volume. This factor was calculated as:

Annual Truck Factor =
253 Workdays per Year x Daily-to-Weekday Truck Volume Conversion Factor

The annual factor determined from the I-5 and SR 14 counts ranged from 282 to 299. This is higher than the rule-of-thumb factor of 260 that is often applied when estimating the annual trips for an isolated site. This is because highways often have higher weekend truck volumes than other roadways, which then increases the annual number of trucks.

Table 2. Relationship of Annual Truck Volume to Average Annual Weekday Truck Volume

Location and Direction	Daily-to-Weekday Conversion Factor[1]	Annual Truck Factor
I-5 Northbound [2]	1.18	299
I-5 Southbound	1.16	293
SR 14 Eastbound [3]	1.14	289
SR 14 Southbound	1.12	282

1. Factors developed based on data for 253 working days (260 weekdays less 7 holidays) and 365 days per year.

2. Data source: WSDOT, PTR I-5 milepost 1.98., 2008. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks.

3. Data source: WSDOT, PTR SR 14 at milepost 11.9 in Camas, 2006. Truck volumes reflect vehicle classifications 6 – 13.

The daily-to-weekday truck volume conversion factor can also be used for the following calculations:

Annual Truck Volume =
Average Weekday Truck Volume x Annual Truck Factor

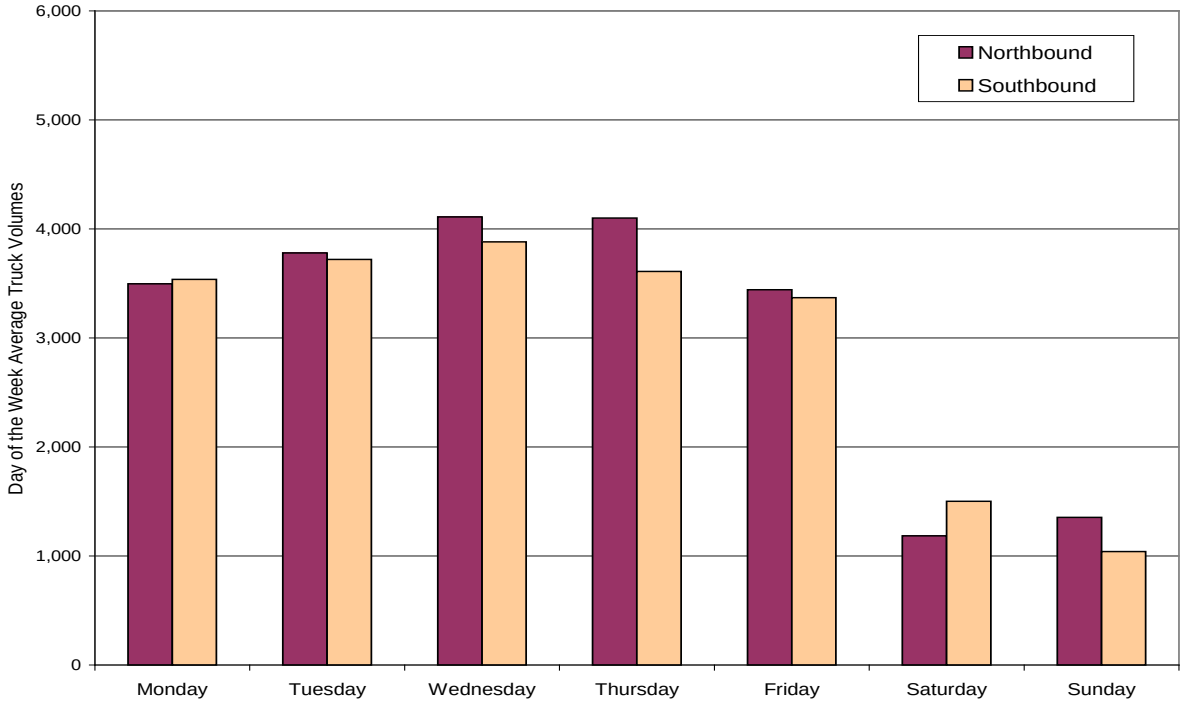
Average Daily Truck Volume (average of a seven-day week) =
Average Weekday Truck Volume ÷ Daily-to-Weekday Conversion Factor

Average Weekend Day Truck Volume =
[(Average Daily Truck Volume x 7) – (Average Weekday Truck Volume x 5)] ÷ 2

1.4.5 How do truck volumes vary by day of week?

The same data used to determine the monthly variations in truck volumes (see above) were used to determine how truck volumes change by day of week. Figure 10 shows the average weekday volumes for I-5 in downtown Vancouver. Medium and heavy truck volumes increase gradually throughout the week until Thursday, and then drop on Friday to a level approximately equal to Monday. Tuesday volumes match the weekday average. The ratio of weekday to weekend volume is 2.92 (average of both directions).

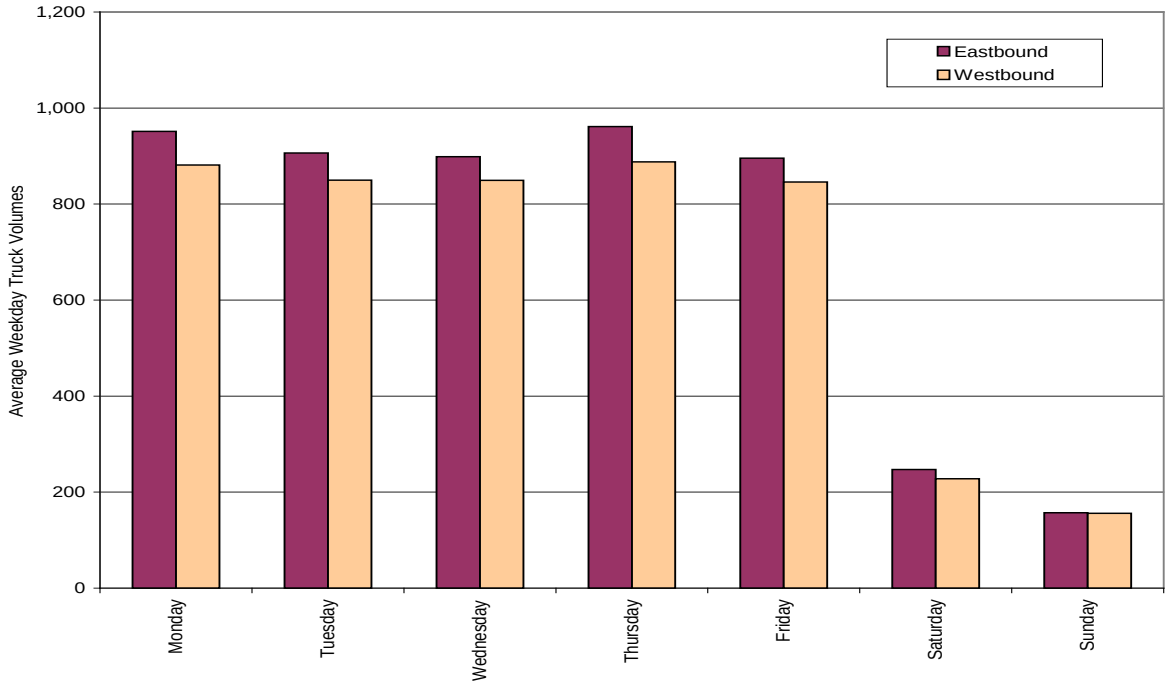
Figure 10. Average Daily Truck Volumes by Day of Week - I-5 in Downtown Vancouver



Source: WSDOT, PTR I-5 milepost 1.98., October 2008. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks.

Figure 11 shows the average daily medium and heavy truck volumes on SR 14 in Camas by day of week. Volumes by day of week are relatively constant, but Tuesday is the day that most closely reflects the average. The ratio of weekday to weekend volume is 4.53 (average of both directions). Weekend truck volumes are substantially lower than weekday volumes on SR 14 compared to I-5.

Figure 11. Average Daily Truck Volumes by Day of Week - SR 14 east of NE 192nd Avenue, Camas



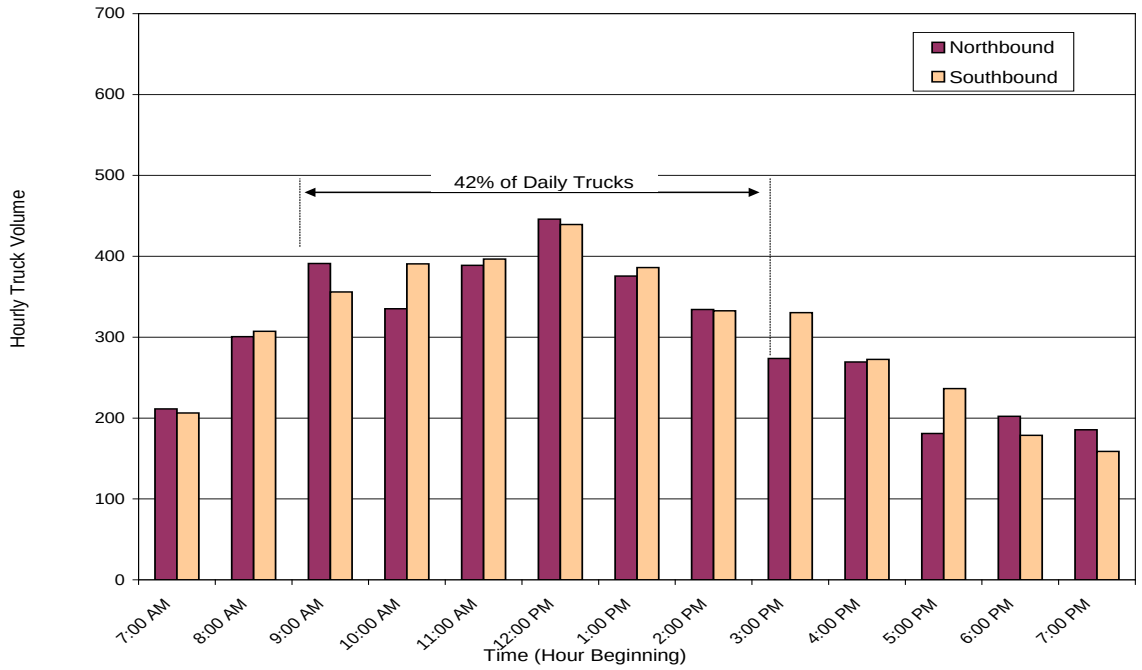
Source: WSDOT, PTR SR 14 at milepost 11.9 in Camas, February 2006. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks.

1.4.6 How do truck volumes vary by time of day?

Detailed traffic operations analyses are typically performed for a peak one-hour period. However, the peak truck volumes seldom overlap with the commuter peak hour volumes. Hourly truck volume data were compiled for the three major highways to show how truck volumes change by time of day.

Figure 12 shows trucks by time of day on I-5 crossing the Columbia River. These reflect the medium and heavy trucks. Most trucks travel during normal business hours, with the peak hour truck volumes from 12:00 to 1:00 P.M. Lower volumes occur during the commuter peak periods (from 7:00 to 9:00 A.M. and from 4:00 to 6:00 P.M.) Because travel times are faster during off-peak times, most truck movements occur during these periods. This is illustrated by the fact that 42% of the daily truck trips occurred between 9:00 A.M. and 3:00 P.M.

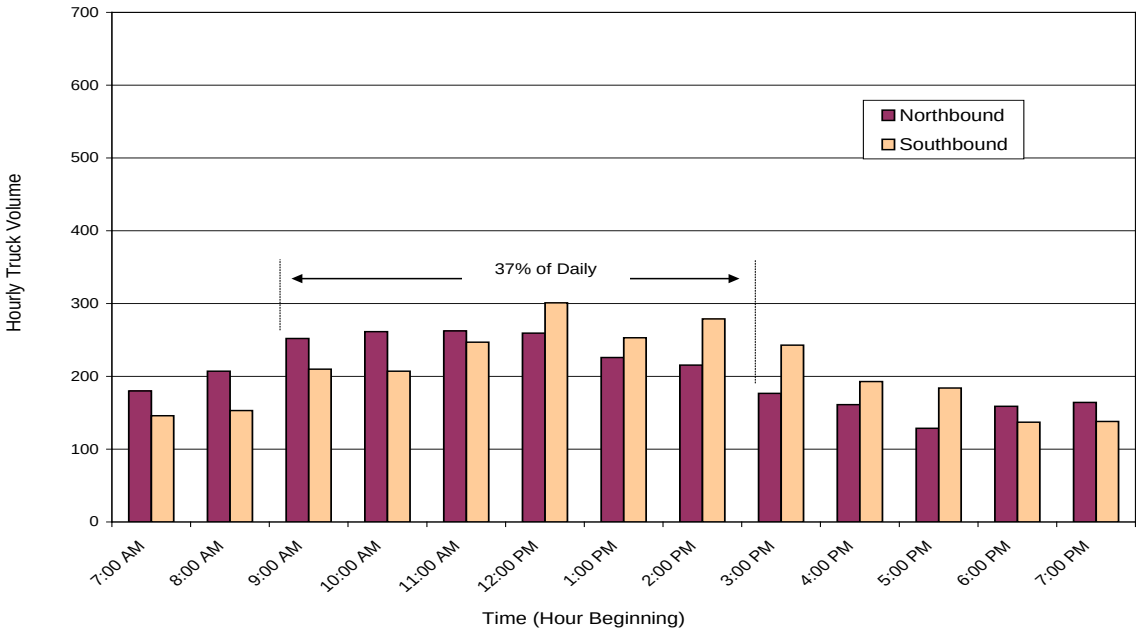
Figure 12. Hourly Truck Volumes - I-5 on the Columbia River Bridge



Source: Columbia River Bridge Project, October 2005 Traffic Data. Vehicle classifications 6 – 13, medium and heavy trucks.

Figure 13 shows the hourly truck counts on I-5 north of 78th Street. This shows similar peaking characteristics as the volumes across the Columbia River. Hourly truck volumes are lower at this location than over the Columbia River Bridge which shows that many truck trips enter or leave I-5 between 78th Street and the river. Another trend revealed by these data is that southbound volumes are noticeably higher than northbound volumes in the afternoon. This is likely due to the fact that many trucks that originate in the Puget Sound region (e.g., the Port of Seattle, Port of Tacoma, or many distribution centers in the Green River Valley) leave those sites in the morning, reaching the Vancouver area in the afternoon.

Figure 13. Hourly Truck Volumes - I-5 between 78th and 99th Streets



Source: Columbia River Crossing Project, October 2005 Traffic Data. Vehicle classifications 6 – 13, medium and heavy trucks.

1.4.7 How do truck peak hours compare to commuter peak hours?

When truck volume data are not available, transportation planners often substitute a truck percentage. This reflects the truck volume as a percent of all traffic, and can change depending on the peak hour condition being evaluated. Hourly traffic data for the three major highways were compiled to show the medium and large trucks as a percentage of all traffic.

All traffic on I-5 over the Columbia River Bridge is shown on Figure 14 (northbound) and Figure 15 (southbound). These show that northbound traffic increases steadily over the day, peaking in the afternoon when commuters are leaving Portland and returning north. During the PM peak hour (4:00 to 5:00 P.M.), trucks represent 5% of the traffic. During the noon hour when truck volumes are highest, they represent 10% of all traffic. In the southbound direction, traffic volumes peak in the morning from 7:00 to 8:00 A.M. when commuters are heading to work. At this time, trucks represent 4% of all traffic. At noon, trucks represent 10% of all traffic. Similar percentages were determined on I-5 north of 78th Street.

Truck volumes by time of day for SR 14 are shown on Figure 16 and Figure 17 for the eastbound and westbound directions, respectively. These figures show that truck represent 1% to 2% of the peak hour, peak directions volumes on this highway, increasing to between 4% and 5% midday.

Figure 14. Hourly Traffic and Truck Volumes - I-5 on the Columbia River Bridge Northbound

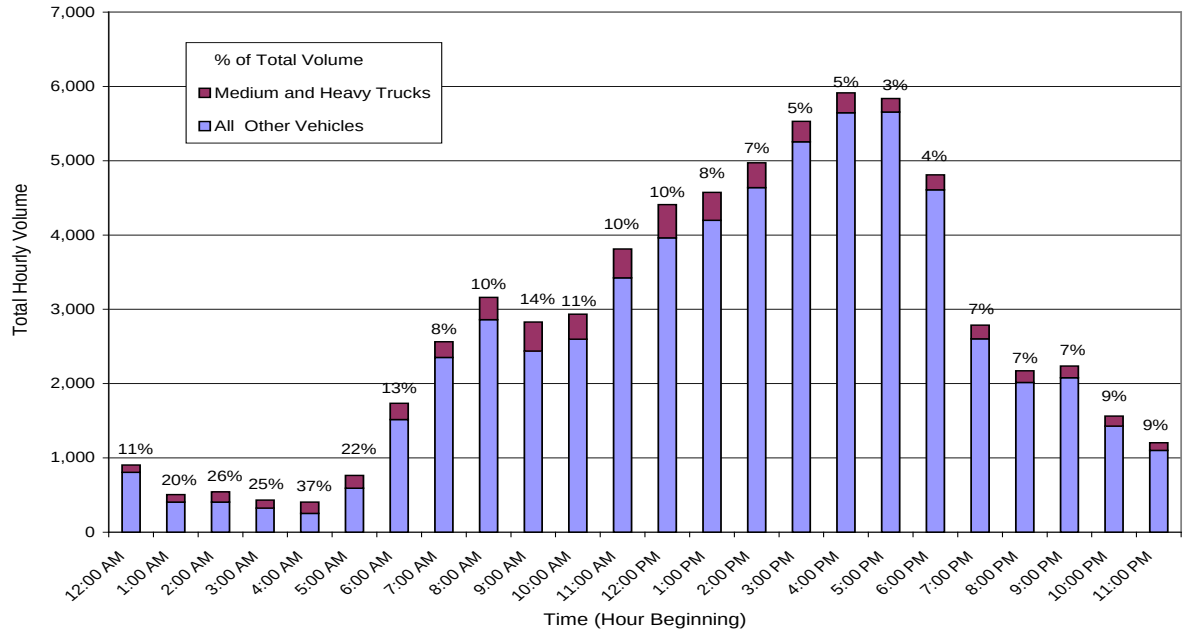
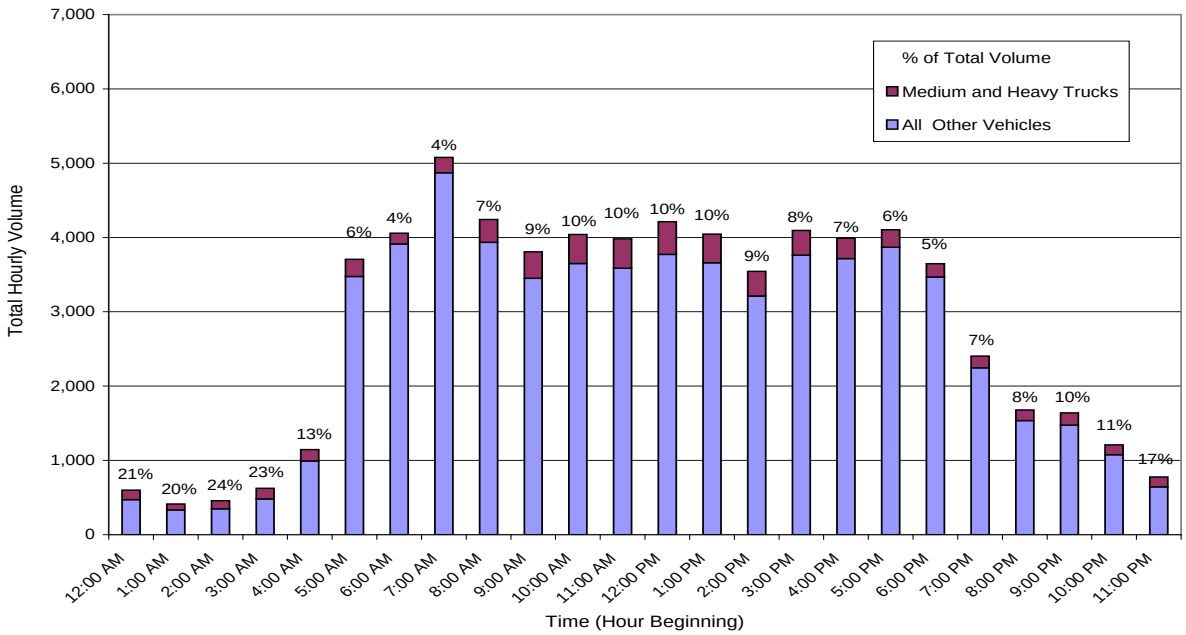


Figure 15. Hourly Traffic and Truck Volumes - I-5 on the Columbia River Bridge Southbound



Source: Columbia River Crossing Project, October 2005 Traffic Data

Figure 16. Hourly Traffic and Truck Volumes - SR 14 West of NE 192nd Avenue Eastbound

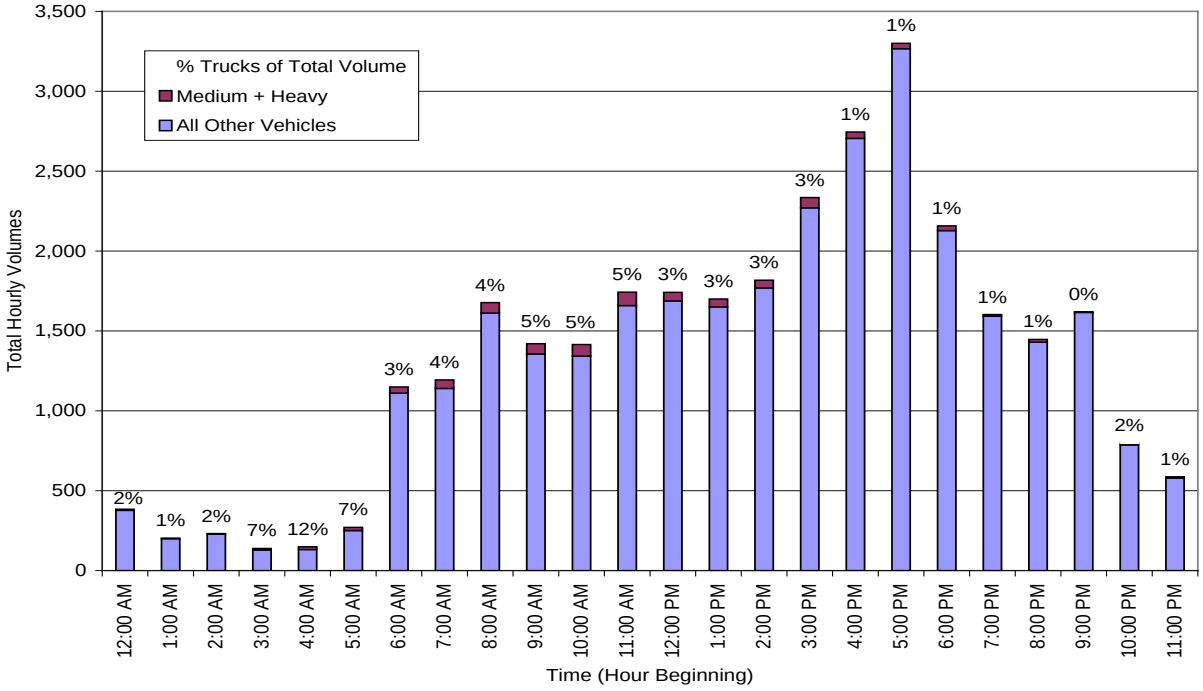
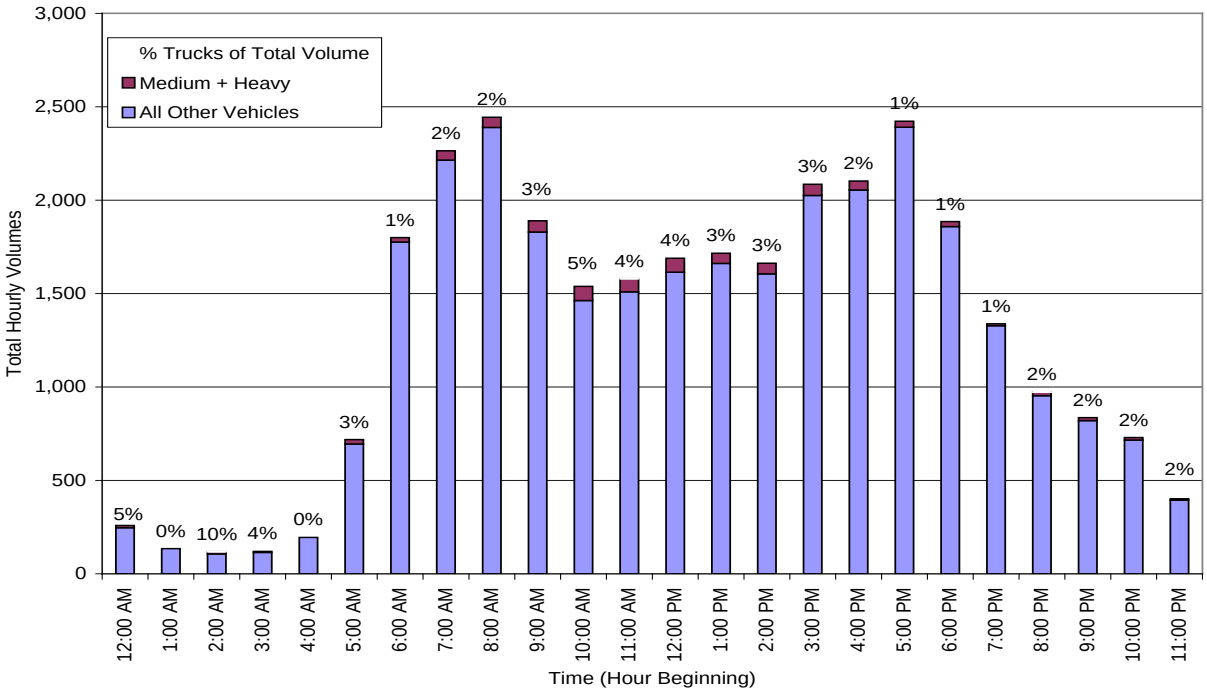


Figure 17. Hourly Traffic and Truck Volumes - SR 14 West of NE 192nd Avenue Westbound



Source: WSDOT, PTR SR 14 at milepost 11.9 in Camas, May 2006. Truck volumes reflect vehicle classifications 6 – 13, medium and heavy trucks.

1.4.8 How many trucks are getting on and off I-5 in Vancouver?

The volume of medium and heavy trucks on each I-5 ramp from the Columbia River to SR 500 was available from the CRC project office. The truck volumes using these ramps are generated from the approximately 30% of the industrial and manufacturing jobs in Clark County that are located in the urban area near downtown Vancouver and along the Columbia River (BST Associates, November 2009). Therefore, these ramp volumes were evaluated to understand the relationship of truck trips in the heart of the county's industrial area to I-5 and the regional freight movement.

The medium and heavy truck trips using the I-5 ramps from the Columbia River to SR 500 are summarized in Table 3. Of all the truck trips using the I-5 ramps between the Columbia River and the SR 500/E 39th Street interchange approximately 33% travel to and from the north and 67% travel to and from the south. During the midday peak period, the proportion north and south is approximately the same, at 35% and 65%. These data show the dependence of these industries to move freight across the Columbia River.

Table 3. Truck Movement to and from Interstate-5, Columbia River to SR 500

Ramp Movement	Peak Truck Movement: 11:00 A.M. to 1:00 P.M. [1]	Proportion by Direction	Daily Truck Movement [2]	Proportion by Direction
Northbound on	180		1,510	
Southbound off	185		800	
Total to/from north	365	35%	2,310	33%
Northbound off	350		2,580	
Southbound on	320		2,150	
Total to/from south	670	65%	4,730	67%
Total	1,035	100%	7,040	100%

2. *Source: Columbia River Crossing Project, 2005 Existing Heavy Freight Volumes, VISUM 9.43-3 (balanced). Adjusted by Heffron Transportation, Inc. to include medium truck volumes (Class 6,7).*
3. *Weekday daily truck volume estimated from CRC VISUM 9.43-3 and I-5 24-hour vehicle classification data.*

1.5 Truck Volumes on Other Highways and Arterials in Clark County

1.5.1 How many trucks use other roads in Clark County?

There are three sources of comprehensive truck volume data collected in 2005 and 2006, and WSDOT data collection on state highways in Clark County in 2005 through 2008. Most of these data were collected in the month of April. Additional data for this study were collected in July 2009. These data are summarized in Appendix B. Consistent with the counts on the three regional highways in Clark County, locations where multiple years of data were available also showed a decline in truck volumes in 2008. There were a few locations where truck volumes increased, which may have been related to a local land use change. Overall, the counts do not reveal a consistent trend by type of facility or location. Therefore, all data are presented as unadjusted volumes along with the year the count was performed. **Error! Reference source not found.** presents average weekday daily truck volumes for medium and heavy trucks throughout Clark County.

1.5.2 What is the proportion of trucks to all traffic volumes?

When truck volume data are not available, transportation planners often substitute a truck percentage. This reflects the truck volume as a percent of all traffic, and usually reflects the peak hour condition being evaluated. The percentage of trucks can vary depending on the location, the prevailing land uses in the area, and the type of roadway (highway or arterial). The available count data were compiled to determine truck percent factors that could be used in future planning studies if no better data are available. This information is summarized in Appendix B, Table B-1 through B-3. These tables present the percent of medium and heavy trucks during the AM peak hour for all traffic, the midday peak hour of truck traffic, and the PM peak hour for all traffic. The range of percent trucks are summarized below.

- AM peak hour of traffic = 3% to 5% trucks
- Midday peak hour of truck traffic = 2% to 12% trucks
- PM peak hour of traffic = 2% to 15% trucks

1.5.3 What is the relationship between truck volumes and jobs?

Figure 19 shows SIC employment sites of greater than 50 employees and the daily truck volumes. The location of major SIC employment sites reflects corridors with higher truck volumes, including I-5, I-205, SR 14, W Fourth Plain Boulevard, SR 501/Mill Plain Boulevard, E Mill Plain Boulevard (east of I-205), SR 503 (east of I-205), NE 78th Street, and SE 164th Avenue. These highways and arterials all carry more than 300 truck trips per day in each direction, or over 600 daily truck trips in both directions.

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CLARK COUNTY FREIGHT MOBILITY STUDY

Figure 16

Existing Weekday Daily Truck Volumes

Legend

Truck Volume Count Locations
(Year of Count and Travel Direction)

WB
SB YEAR NB
EB

N

0 1 2 Miles

Map Source:
Clark County GIS
Data Source:
Various

File: P:\SI\SWRT00000\002\060\NFR\GIS\Arcmap\ClarkCo_BaseYear_Truck_Volumes_WallSize.mxd
Printing Date: Tuesday, August 18, 2009 9:21 AM

SOUTHWEST WASHINGTON REGIONAL TRANSPORTATION COUNCIL
CLARK COUNTY FREIGHT MOBILITY STUDY

Figure 17

State Industrial Classification Employment over 50 and Weekday Truck Volumes

Legend

Truck Volume Count Locations
(Year of Count and Travel Direction)

WB / SB / YEAR / NB / EB

Number of Employees	SIC Category
1,000+	Agriculture, Forestry & Fishing
500-999	Construction
250-499	Manufacturing
100-249	Mining
50-99	Transportation & Public Utilities
	Wholesale Trade

N

0 1 2 Miles

Map Source:
Clark County GIS
Data Source:
BST Associates Employment Data

File: P:\SSWRT0000000\0600INFO\GIS\Arcmap\Clark\Co_BaseYear_Truck_Volumes_WallSize.mxd
Printing Date: Tuesday, August 18, 2009 9:21 AM

1.6 Summary

The existing truck data revealed several trends that can be used to describe Clark County's existing freight system. These are:

- An estimated 55% of Clark County's freight is moved by truck. This exceeds the tonnage of freight moved by all other modes combined.

- There is a strong correlation between industrial employment sectors and truck trip generation. Most of the freight-related jobs in Clark County are located within five miles of the Columbia River. The largest concentration of freight-related jobs (nearly 30% of the total) is located in the urbanized area of Clark County between I-5, I-205, and the Columbia River. There are also pockets north and east that are major centers of freight-related employment.

- The five most freight-intensive industry sectors, which account for half of the freight moving in the Portland-Vancouver area, are: petroleum products, minerals, food and beverages, wood products, and grain. These top five commodities also account for more than half of the freight moved by truck.

- Truck volumes throughout Clark County have declined in recent years. On I-5 in downtown Vancouver, the medium and heavy truck volumes fell by 6% from 2007 to 2008 and then by 15% from 2008 to 2009 (January through April data).

- On SR 14 in Camas, the decline in truck volumes first occurred from 2006 to 2007, decreasing by 10%. Truck volume fell another 11% from 2007 to 2008, and fell another 32% from 2008 to 2009 (January through April data).

- Truck volumes are relatively constant from February through October. Volumes are loweest from November through January. For this reason, future truck counts in winter months should be avoided.

- Truck volumes are highest on Tuesday, Wednesday, and Thursday. Lower volumes occur on Monday and Friday and over the weekend**.**

- The peak hour truck volumes typically occur midday (12:00 to 1:00 P.M.) Lower volumes occur during the commuter peak periods (from 7:00 to 9:00 A.M. and from 4:00 to 6:00 P.M.) because travel times are slower at those times. On I-5 across the Columbia River Bridge, 42% of the daily truck trips occurred between 9:00 A.M. and 3:00 P.M.

- The percentage of trucks varies depending on the location, the prevailing land uses in the area and the type of roadway (highway or arterial). The percentage of trucks in the traffic stream is often higher than expected. At ten locations on state highways and arterials in Clark County, the percentages of trucks are:
    - AM peak hour of all traffic is 3% to 5% trucks
    - Midday peak hour of truck traffic is 2% to 12% trucks, and
    - PM peak hour of all traffic is 2% to 15% trucks.

- There are about 7,000 medium and heavy daily truck trips that use all of I-5's on and off all the ramps between SR 14 and SR 500. Of these trips, 67% are to and from the south which is about 2,400 more trips to and from the south, than to and from the north.

4. References

BST Associates, *Current and Expected Economic Conditions,* Clark County Freight Mobility Study, September 2009.

Cambridge Systematics, Inc., *Portland Freight Data Collection Phase II*, Draft Report, July 18, 2006.

Columbia River Crossing (CRC) Project, Technical Memorandum, *Feasibility of Diverting Truck Freight to Rail in the Columbia River Corridor*, Draft, April 2006.

Oregon Department of Transportation (ODOT) *Regional Economic Effects of the I-5 Corridor/Columbia River Crossing Transportation Choke Points*, prepared for ODOT by Cambridge Systematics, Inc. in association with David Evans and Associates, Inc., April 2003.

Starboard Alliance Company, LLC, *Outreach to Shippers and Documentation of Representative Supply Chains*, Clark County Freight Mobility Study, August 2009.

Washington State University, *Strategic Freight Transportation Analysis (SFTA) Origin-Destination Freight Data* 1993/1994 – 2002.

Washington State Department of Transportation (WSODT), *Annual Traffic Reports*, 2001 through 2006.

Washington State Department of Transportation, *Washington Transportation Plan, Moving Freight, Executive Summary of Freight Report*, Draft, January 2005.

APPENDIX A

TRUCK CLASSIFICATIONS

The Federal Highway Administration (FHWA) has established a vehicle classification system that uses 13 vehicle types distinguished by the number of axles. The classifications were originally established for use in pavement and bridge design. However, when describing trucks for the purpose of transportation planning or traffic operations analysis, the 13 classifications are often grouped into three primary categories: light (small), medium, and heavy (large). Sometimes trucks are grouped as single, double, and triple. Table A-1 shows the FHWA classifications, typical size groupings, and weight classifications.

Examples of different size trucks are shown on Figure 1. Light trucks are a single unit, have two axles and up to six tires. This size truck performs light commercial activity. On highways and arterials, the operating characteristics may be similar to a passenger car. This is the Class 5 example in Figure 1. It is noted that some goods are delivered in passenger vehicle classes such as vans and pick-up trucks. These types of vehicles are not included in the truck classifications. Medium sized trucks have three or four axles, but are a single unit. Today, single unit trucks with three or four axles are fire trucks, dump trucks, and large recreational vehicles. Some delivery trucks may have two rear axles although few are observed in the field. The medium trucks carry heavier loads, require a wider turning radius, and use more capacity on highways and arterials than a passenger car. Heavy trucks have four or more axles and a “tractor-trailer” configuration. The tractor is the vehicle, and the trailer is connected to the tractor to haul freight. The tractor-trailer trucks have operating characteristics that differ significantly from a passenger car, with slower acceleration speeds, longer stopping distances, different sight lines, and a large turning radius. Their operating characteristics consume approximately double the freeway capacity as compared to a passenger car. These are the Class 8, 9, 10, and 13 examples in Figure 1.

Table A-1. Truck Type Nomenclature

Class Number [1]	Name	Truck Group [2]	Other Nomenclature [3]	Size and Typical Weight
1	Cycle			
2	Cars and Trailers			<16,000 lbs
3	2 Axle Long	Pass Veh/Light[4]		<16,000 lbs
4	Buses			
5	2 Axle 6 Tire	Light		<16,000 lbs
6	3 Axle Single	Medium	Single	Single Unit 16 – 52,000 lbs
7	4 Axle Single	Medium	Single	Single Unit 16 – 52,000 lbs
8	<5 Axle Double	Heavy	Double	Tractor Trailer – one trailer >52,000 lbs[5]
9	5 Axle Double	Heavy	Double	Tractor Trailer – one trailer >52,000 lbs
10	>6 Axle Double	Heavy	Double	Tractor Trailer – one trailer >52,000 lbs
11	<6 Axle Multi	Heavy	Triple	Tractor Trailer – two trailers >52,000 lbs
12	6 Axle Multi	Heavy	Triple	Tractor Trailer – two trailers >52,000 lbs
13	>6 Axle Multi	Heavy	Triple	

1. *Federal Highway Administration Classifications.*
2. *Groupings of truck categories for the purpose of a transportation planning study. These categories were originally defined in the Congestion Relief Analysis, PSRC Travel Model Documentation Final Report, Chapter 10.0 Truck Model, August 24, 2006, Cambridge Systematics, Inc.*
3. *Trucks are sometimes grouped by into these categories.*
4. *Category 3 has often been classified as a "Light Truck." However, recent observations have found that this type of vehicle is most often a larger passenger vehicle such as a pick-up truck or a sports utility vehicle built on a large pick-up truck frame (e.g., Chevy Suburban). Category 3 has been excluded from most groupings of truck counts.*
5. *The weight of Class 8 and 9 may exceed the typical weight of 52,000 for extra heavy loads such as a cement truck.*

Figure A-1. Example Truck Classifications

Class 5: Single Unit Delivery Truck Light Truck	
Class 7: Four-Axle Single Truck Medium Truck	
Class 8: Four Axle Tractor Trailer Heavy Truck	
Class 9: 5 Axle Tractor Trailer Heavy Truck	
Class 12: Six Axle Truck (two trailers) Heavy Truck	
Class 13: Eight Axle Tractor Trailer Heavy Truck	

Source : Heffron Transportation, Inc., June 2009. Some of the photos are from WSDOT's training website at: http://training.ce.washington.edu/wsdot/Modules/04_design_parameters/trucks_buses.htm

APPENDIX B

PEAK HOUR TRUCK VOLUME DATA

Project: Clark County Freight Data

Truck Percentage of Total Volume During AM Peak Hour, 8:00 to 9:00 AM

		% Trucks[3]			Total Volumes		
Location	**Date of Counts**	**NB or EB**	**SB or WB**	**Both dirs.**	**NB or EB**	**SB or WB**	**Both dirs.**
SR-14 east of I-205	9-May-06	4%	2%	3%	2,036	3,788	5,824
SR-14 west of N Lieser Road	9-May-06	5%	3%	4%	1,596	2,156	3,752
SR-500 east of I-205	9-May-06	3%	2%	4%	936	2,792	2,252
SE 164th Avenue north of SR-14	16-Jul-09	3%	3%	3%	1,113	1,270	2,383
NE Padden Parkway east of NE 72nd	24-May-06	5%	3%	4%	1,244	1,264	2,508
SR-503 north of NE Padden Pkwy	11-May-06	5%	4%	4%	908	1,176	2,084
SE Mill Plain Boulevard west of I-5	10-May-06	3%	7%	5%	1,488	872	2,360
NE 78th Street west of I-5	7-Jul-09	5%	5%	5%	446	628	1,074
NE Fourth Plain Road west of I-5	9-May-06	3%	12%	8%	356	448	804
SE Columbia Way east of SE Col. Shores Blvd.	8-Jul-09	10%	26%	15%	433	189	622

Footnotes:

2006 Data Source: Portland Freight Data Collection Project

2009 Data Source: Clark County Freight Study, Quality Counts, LLC

[3] Medium and Heavy Trucks. FHWA Vehicle Classifications, 6-13

Project: Clark County Freight Data

Truck Percentage of Total Volume During Mid-day, 12:00 to 1:00 PM

		% Trucks[4]			Total Volumes		
Location	**Date of Counts**	**NB or EB**	**SB or WB**	**Both dirs.**	**NB or EB**	**SB or WB**	**Both dirs.**
SR-14 east of I-205	9-May-06	4%	4%	4%	2,224	2,252	4,476
SR-14 west of N Lieser Road	9-May-06	3%	4%	3%	1,556	1,600	3,156
SR-500 east of I-205	9-May-06	4%	3%	3%	1,264	2,000	3,264
SE 164th Avenue north of SR-14	16-Jul-09	1%	2%	2%	1,197	1,091	2,288
NE Padden Parkway east of NE 72nd	24-May-06	4%	5%	5%	1,100	1,240	2,340
SR-503 north of NE Padden Pkwy	11-May-06	3%	4%	3%	1,108	1,360	2,468
SE Mill Plain Boulevard west of I-5	10-May-06	10%	5%	7%	1,056	1,584	2,640
NE 78th Street west of I-5	7-Jul-09	5%	5%	5%	783	820	1,603
NE Fourth Plain Road west of I-5	9-May-06	6%	9%	8%	728	816	1,544
SE Columbia Way east of SE Col. Shores Blvd.	8-Jul-09	12%	11%	12%	341	325	666

Footnotes:

2006 Data Source: Portland Freight Data Collection Project

2009 Data Source: Clark County Freight Study, Quality Counts, LLC

[4] Medium and Heavy Trucks. FHWA Vehicle Classifications, 6-13

Project: Clark County Freight Data

Truck Percentage of Total Volume During PM Peak Hour, 4:00 to 5:00 PM

		% Trucks[5]			Total Volumes		
Location	**Date of Counts**	**NB or EB**	**SB or WB**	**Both dirs.**	**NB or EB**	**SB or WB**	**Both dirs.**
SR-14 east of I-205	9-May-06	2%	3%	2%	3,492	2,712	6,204
SR-14 west of N Lieser Road	9-May-06	1%	2%	2%	2,892	2,408	5,300
SR-500 east of I-205	9-May-06	2%	2%	2%	2,280	2,268	4,548
SE 164th Avenue north of SR-14	16-Jul-09	2%	3%	2%	1,802	1,713	3,515
NE Padden Parkway east of NE 72nd	24-May-06	1%	4%	3%	1,560	1,676	3,236
SR-503 north of NE Padden Pkwy	11-May-06	3%	3%	3%	1,748	1,420	3,168
SE Mill Plain Boulevard west of I-5	10-May-06	4%	2%	3%	1,016	1,808	2,824
NE 78th Street west of I-5	7-Jul-09	5%	3%	4%	908	867	1,775
NE Fourth Plain Road west of I-5	9-May-06	3%	4%	3%	896	788	1,684
SE Columbia Way east of SE Col. Shores Blvd.	8-Jul-09	22%	11%	15%	162	344	506

Footnotes:

2006 Data Source: Portland Freight Data Collection Project

2009 Data Source: Clark County Freight Study, Quality Counts, LLC

[5] Medium and Heavy Trucks. FHWA Vehicle Classifications, 6-13