

TECHNICAL MEMORANDUM

Project: Truck Needs Assessment for City of Seattle
Subject: Truck Volume and Classification Data Base
Date: September 20, 2007
Author: Marni C. Heffron, P.E. P.T.O.E.
Claudia S. Hirschey, P.E.

This technical memorandum documents and submits the results of a study Heffron Transportation, Inc. conducted on behalf of the Washington State Department of Transportation (WSDOT). The study was designed to analyze and document the characteristics of truck movements within one of the state's major urban areas, the City of Seattle. Truck and supply chain activities transcend jurisdictional boundaries and require the use of facilities that may be owned and managed by state, local, and/ or private entities. While there are some data documenting truck movements on pieces of the state highway system, there is little comprehensive truck volume information off the state and interstate system. On both systems, limitations in existing data may not provide adequate information to understand truck characteristics, trends, and needs. For example, estimations of truck percentages are often used when comprehensive truck counts are not collected and counts may only be collected during peak commute periods. The information from this study will help state and local planners better understand truck movements, including operational characteristics related to different economic activities, and test current assumptions used in estimating truck volumes.

The purpose of this study, developed by WSDOT, the Seattle Department of Transportation, the Manufacturing Industrial Council, and Heffron Transportation, Inc. was to:

- Document truck volumes, routes, and operational characteristics related to different economic activities in the City of Seattle.
- Show the key corridors used by trucks and the relative volume of trucks using them.
- Test the use of truck classification counts as a means to supplement existing data gaps in describing and understanding truck activity in an urban area.
- Provide additional data on truck volumes and operational characteristics in the City of Seattle.
- Identify truck volume trends associated with different economic activities (land uses) in a metro city—such as peak travel periods—and describe why they are important to local, regional and state economies.

1. Data Collection Methodology

The WSDOT, City of Seattle, Manufacturing Industrial Council, and Heffron Transportation, Inc. worked together to identify and prioritize a list of up to twenty locations for truck classification

counts. A variety of locations were selected to provide a comparison of freight characteristics on different types of streets and in different economic activity centers (e.g., commercial versus industrial areas). This study was not intended to provide a comprehensive data base of all arterials in the City of Seattle, and the number of counts performed was limited both by the physical characteristics of the street as well as the project's budget. This initial count set is intended to be the first sample of data, and additional counts should be added over time. Table 1 lists the truck count locations.

Table 1. City of Seattle Truck Count Locations¹

Street	Cardinal Location	Cross Street	Route Type ²	Economic Activity ³
4th Avenue	North of	James Street	Arterial	Downtown
Stewart Street	South of	Denny Way	Arterial	Downtown
Lake City Way NE	East of	15th Avenue NE	Major Truck Street	Commercial/Residential
23rd Avenue S	North of	S Jackson Street	Arterial	Commercial/Residential
N 45th Street	East of	Eastern Avenue N	Arterial	Commercial/Residential
Aurora Avenue N	North of	N 50th Street	Major Truck Street, Seaport Highway Connector	Commercial/Residential
S Dearborn Street	West of	I-5 ramps	Major Truck Street	Manufacturing Center ³
S Michigan Street	West of	Corson Avenue S	Major Truck Street	Manufacturing Center
Fauntleroy Way SW	North of	SW Graham Street	Major Truck Street	Commercial/Residential
1st Avenue S	South of	S Lucille Street	Major Truck Street	Manufacturing Center
1st Avenue S	South of	S Lander Street	Major Truck Street	Manufacturing Center
6th Avenue S	South of	S Lander Street	Major Truck Street	Manufacturing Center
Airport Way S	South of	S Lander Street	Major Truck Street	Manufacturing Center
E Marginal Way	North of	S Hanford St	Major Truck Street	Manufacturing Center
Boren Avenue S	North of	12th Avenue S	Arterial	Office/Hospitals
Montlake Blvd NE	North of	Entrance to Montlake Parking Lot	Arterial	University/Residential
Northgate Way NE	East of	1st Avenue NE	Arterial	Commercial
W Nickerson Street	East of	6th Avenue W	Major Truck Street	Industrial/Residential
Edgar Martinez Drive S	East of	1st Avenue S	Major Truck Street	Manufacturing Center
S Lander Street	East of	Occidental Avenue S	Major Truck Street	Manufacturing Center

1) Locations identified by WSDOT, City of Seattle, and Heffron Transportation, Inc. May 2007.

2) FMSAP Route types: Major Truck Street, Seaport Highway Connectors, Seaport Intermodal Connectors. Arterial = all other streets as shown in the FMSAP.

3) Freight Mobility Strategic Action Plan (FMSAP), June 2005, Seattle Manufacturing Centers

As discussed above, the physical characteristics of some streets are not conducive to machine counting methods. Arterials with more than two lanes in each direction should not be counted with machines. This is because an accurate count requires one counting machine per lane so that vehicles in another lane do not create false reads in the lane being counted. It is not possible to isolate more than two lanes along an arterial. For this reason, future counts using camera, induction loops, or manual data collection methods should be performed along wide arterials such as East Marginal Way S, surface Spokane Street, and Rainier Avenue S. Also, some of the locations where counts are desired were affected by construction in Spring 2007 including portions of the Rainier Valley (due to ongoing LINK construction) and areas near Fremont due to freight restrictions on the Fremont Bridge.

Truck volume and classification counts were collected on mid-week days in May and June 2007. A full 24 hours of data were collected at each location. Traffic Count Consultants, Inc., the firm commissioned to perform the counts, placed the tubes and counters in the field and provided traffic data in tables and an excel spreadsheet for each location. Vehicle classifications are the current Federal Highway Administration (FHWA) standard of 13 vehicle classifications. Table 3 presents a summary of vehicle classifications.

Table 3. FHWA Truck Classifications

Class Number	Name	Category	Size
1	Bikes	Passenger Vehicle	
2	Cars and Trailers	Passenger Vehicle	<16,000 lb
3	2-Axle Long	Passenger Vehicle	<16,000 lb
4	Buses	Bus	
5	2-Axle 6 Tire	Light Truck	<16,000 lb
6	3-Axle Single	Medium Truck	Single Unit 16 – 52,000 lb
7	4-Axle Single	Medium Truck	Single Unit 16 – 52,000 lb
8	<5-Axle Double	Heavy Truck	Tractor Trailer– one trailer >52,000 lb
9	5-Axle Double	Heavy Truck	Tractor Trailer– one trailer >52,000 lb
10	>6-Axle Double	Heavy Truck	Tractor Trailer– one trailer >52,000 lb
11	<6-Axle Multi	Heavy Truck	Tractor Trailer– two trailers >52,000 lb
12	6-Axle Multi	Heavy Truck	Tractor Trailer– two trailers >52,000 lb
13	>6-Axle Multi	Heavy Truck	Tractor Trailer– two trailers >52,000 lb

Source: Federal Highway Administration and WSDOT

2. Truck Classification Data

The study team created a truck volume database from the truck counts. In addition, some analysis was performed to verify that the machine counts were accurately classifying vehicles. The verification process and the database are described below.

2.1. Truck Classification Verification

To evaluate the accuracy of the machine counts in classifying different types of trucks, a manual truck classification count was performed on Dearborn Street, east of the I-5 ramps while the machines were on the street. Trucks were noted by type and number of axles. Pick-ups, vans, and SUVs were excluded from the truck counts. The Class 3, single-unit, long-axle trucks were the most challenging to visually classify. This class can include light-duty trucks that have a commercial purpose such as contractor pick-up trucks. However, the machines cannot distinguish those with commercial purposes from trucks, vans and SUVs that were for personal use. It was observed that most of the single unit trucks used for commercial and freight delivery with two axles were 6-tire trucks (rear duals), which are Class 5 vehicles. The vehicle classification verification data are shown in Table 3.

The data for Class 3 and Class 5 trucks clearly show that the machines are counting more than commercial and freight vehicles. Analysis of the Class 3 and Class 5 data show that it is likely that Class 3 includes pick-ups, vans, and SUVs. Class 5 data most closely matches the manual field count for light trucks. This finding reflects a change in how various agencies have classified "Light Trucks." In the past, that grouping has included Class 3 vehicles. However, based on our observations, the vast majority of the vehicles in Class 3 are now for personal-use, and reflects the increasing size of passenger vehicles and SUVs in recent years. For this study (and recommended for subsequent studies), Class 3 has been excluded from Light Trucks.

The data also show that Classes 6 and 7, or medium trucks with more than two axles are a relatively small proportion of the total truck traffic volume. Observations indicate that the medium trucks are primarily garbage collection trucks, cement trucks, and dump trucks without trailers. Historically, medium trucks were three axle trucks that carried heavy deliveries such as beverage trucks. However, it is now rare to observe this type of truck. These data may indicate that heavy deliveries carried by single unit trucks have shifted from 3-axle trucks to two-axle, 6-tire trucks.

The dump trucks may add irregularities to the truck classification data because single-unit dump trucks were observed with up to 7 axles, or greater than the number of axles identified for Class 6 and 7. In addition, Dump trucks with one trailer were observed with up to eight axles or greater than the number of axles for Class 8 to 10, tractor-trailer trucks with one trailer.

Table 3. Truck Classification Field and Machine Count Comparison – Dearborn Street¹

	Westbound		Eastbound	
	One-Hour Manual Count ¹	One-Hour Machine Count ²	One-Hour Manual Count ¹	One-Hour Machine Count ²
Class 3, Light Trucks, Long 2 Axle, Single Unit	Pick-ups, vans, and SUVs excluded from manual count			
Total	Not Counted	100	Not Counted	118
Class 5, Light Trucks, 6 Tire, Single Unit	24 single unit 1 single unit with light trailer 1 dump truck, 2 axle 3 school bus (small)		27 single unit	
Total	29	32	27	35
Class 6, 7, Medium, 3-4 Axles, Single Unit	3 dump truck, 3-7 axle 3 single unit, 3-4 axle 1 fire truck		2 dump truck, 3-7 axle 2 single unit, 3 axle	
Total	7	7	4	6
Class 8-10, Heavy 5-6 Axles, 1 Trailer	4 dump trucks, 6-8 axle 12 tractor-trailers, 3-8 axles 2 oversize loads, 6 axle 1 articulated bus, 4 axle		7 dump trucks, 6-7 axle 13 tractor-trailer, 3-5 axle	
Total	19	10	20	16
Class 11-13 Heavy 6+ Axle, 2 Trailers			1 tractor+2 trailers, 5 axle	
Total	0	7	1	3
Sub-total Medium / +Heavy Trucks	25	24	25	25

1) Machine Count set by Traffic Count Consultants, Inc., Thursday, May 31, 2007, east of I-5 ramps

2) Manual Count performed by Heffron Transportation, Inc., Thursday, May 31, 2007, 9:00 to 10:00 A.M.

2.2. Truck Volume Data Base

Attachment A presents the data base, which is also provided in an electronic file. The data base includes the truck classification data by truck type, and by peak hour of truck traffic and PM peak hour of street traffic. For each location, an excel spreadsheet is available with the original traffic counts and the formulas that summarize the vehicle classification data.

The spreadsheet, from left to right, has three types of information. On the left are the street name, location, and identification of the “Route Type” and “Economic Activity” based on City of Seattle’s *Freight Mobility Strategic Action Plan* (FMSAP), June 2005. The route types include: Major Truck Streets, Seaport Connectors, and arterials.

Next, in the center of the spreadsheet, truck classification data are presented for both daily and the peak hour of the street. It should be noted that the peak hour of the street can change by direction with a morning peak for flows into the city and an afternoon peak in the opposite direction. Data for detailed operations analysis should be extracted from the individual counts. The count data are presented in the categories:

- Light trucks = Single Unit trucks of Class 5 with 6-tires (rear duals)
- Medium trucks = Single Unit trucks of Class 6 with 3 axles and Class 7 with 4 axles
- Heavy trucks = Tractor with one trailer, Classes 8-10 with 3 or more axles
- Heavy trucks = Tractor with two trailers, Classes 11-13 with 5 or more axles

Normally, heavy trucks are combined in one category, but because few tractors with two trailers were observed within the data, the tractor with two trailers was maintained separately to disclose this information. For each of the above four categories, the peak hour of the truck volume is reported.

3. Summary of Seattle Truck Movements

A summary of the truck classification data is shown in Table 1. These counts include the total volumes in both directions (except the two one-way streets that were counted) as well as the total volume of trucks per day. These have been sorted by the total truck volume.

The truck count data revealed some unexpected findings:

- The highest volume of trucks was recorded on Aurora Avenue N north of N 50th Street (near the Woodland Park Zoo). There were over 5,500 trucks per day on Aurora, or about 15% of the total traffic. The percentage of trucks increased during the peak hours to over 18% of the total traffic. While this is a major highway serving Seattle, it is not often perceived as a highly used truck route, but it is. Over 60% of the trucks on this route were heavy trucks.
- Boren Avenue S north of 12th Avenue S had a relatively high volume of truck traffic with 1,570 trucks per day or about 13.6% of the traffic on this street. Anecdotal information from trucking firms have suggested that this route is being used as a bypass around downtown Seattle's truck prohibitions. The data confirms this.
- 23rd Avenue S north of S Jackson Street in Seattle's Central District also has a relatively high volume of trucks with 1,220 per day, or about 9.2% of the traffic on this street. About 60% of these are large trucks. This arterial may also be used as a north-south route that bypasses downtown.
- Truck percentages outside of the industrial areas are higher than are usually assumed. The default truck percentage in a standard traffic operations model such as Synchro is 2% trucks. However, the actual percentage of trucks during the peak hour of the street (see attached database) ranged from 3% up to 24%. High percentages of trucks can have a profound effect on traffic operations at urban intersections because of their slow acceleration rates and the longer space they occupy when queued. Therefore, it is critically important to collect actual truck data for all areas of the City for the purposes of traffic operations analysis.

Table 1. Daily Trucks Volumes at Count Locations – 2007 ^a

Location Information			Daily Volumes						
Street	Cardinal Location	Cross Street	All Traffic Total	All Trucks Total	Light Trucks	Medium Trucks	Heavy Trucks 1 trailer	Heavy Trucks 2 trailers	% Trucks per Day
Aurora Avenue N	North of	N 50th Street	37,450	5,510	1,870	210	2,830	600	14.7%
1st Avenue S	South of	S Lander Street	28,380	3,660	1,450	260	1,480	470	12.9%
S Michigan Street	West of	Corson Avenue S	32,270	3,340	1,900	370	890	180	10.4%
1st Avenue S	South of	S Lucille Street	12,240	2,080	1,040	170	670	200	17.0%
Airport Way S	South of	S Lander Street	16,030	1,680	1,060	170	370	80	10.5%
4th Avenue	North of	James Street	14,680	1,630	520	80	770	260	11.1%
Boren Avenue S	North of	12th Avenue S	11,540	1,570	240	110	780	440	13.6%
Edgar Martinez Drive ^b	East of	1st Avenue S	15,970	1,500	510	190	610	190	9.4%
S Dearborn Street	East of	I-5 ramps	19,720	1,460	770	150	420	120	7.4%
6th Avenue S	South of	S Lander Street	9,860	1,410	650	120	540	100	14.2%
E Marginal Way ^c	North of	S Hanford St	6,990	1,320	300	210	570	240	19.0%
Lake City Way NE	East of	15th Avenue NE	27,870	1,260	730	130	280	120	4.5%
Montlake Blvd	North of	Entrance to Montlake Parking Lot	41,590	1,240	910	80	190	60	3.0%
23rd Avenue S	North of	S Jackson Street	13,180	1,220	370	120	540	190	9.2%
W Nickerson Street	East of	6th Avenue W	22,400	1,130	690	80	330	30	5.0%
Fauntleroy Way SW	North of	SW Graham Street	12,770	1,080	490	80	450	60	8.5%
NE Northgate Way	East of	1st Avenue NE	25,430	1,060	630	50	270	110	4.2%
N 45th Street	East of	Eastern Avenue N	18,910	980	600	60	270	50	5.1%
Stewart Street	South of	Denny Way	13,270	810	290	120	340	60	6.1%
S Lander Street	East of	Occidental Ave S	5,960	440	320	30	70	20	7.4%

a. All counts were performed in May or June 2007 except as noted. The volumes have been sorted from highest to lowest total truck volume.

b. Count performed May 31, 2006.

c. Count performed April 26, 2006.

Table 2. Truck Peak Hour Volumes at Count Locations – 2007 ^a

Location Information			Hourly Volumes during Truck Peak Hour						
Street	Cardinal Location	Cross Street	Truck Peak Hour	All Traffic Total	All Trucks Total	Light Trucks	Medium Trucks	Heavy Trucks	% Trucks
Aurora Avenue N	North of	N 50th Street	4:00 PM	3,240	604	106	12	486	18.6%
S Michigan Street	West of	Corson Avenue S	11:00 AM	2,030	343	196	41	106	16.9%
1st Avenue S	South of	S Lander Street	8:00 AM	2,130	341	121	26	194	16.0%
Airport Way S	South of	S Lander Street	8:00 AM	1,560	217	151	12	54	13.9%
East Marginal Way S ^c	North of	S Hanford St	1:00 PM	460	190	24	18	148	41.3%
1st Avenue S	South of	S Lucille Street	8:00 AM	970	189	109	15	65	19.5%
4th Avenue	North of	James Street	8:00 AM	1,030	167	53	12	102	16.2%
Edgar Martinez Drive S ^b	East of	1st Avenue S	8:00 AM	1,250	158	44	16	98	12.6%
Boren Avenue S	North of	12th Avenue S	8:00 AM	820	155	16	11	128	18.9%
Dearborn Street	East of	I-5 ramps	11:00 AM	1,120	140	80	18	42	12.5%
6th Avenue S	South of	S Lander Street	10:00 AM	670	139	64	4	71	20.7%
Fauntleroy Way SW	North of	SW Graham Street	7:00 AM	900	124	49	13	62	13.8%
W Nickerson Street	East of	6th Avenue W	12:00 PM	1,430	122	71	19	32	8.5%
Montlake Blvd	North of	Entrance to Montlake Parking Lot	10:00 AM	2,510	119	89	15	15	4.7%
23rd Avenue S	North of	S Jackson Street	3:00 PM	950	119	31	8	80	12.5%
Lake City Way NE	East of	15th Avenue NE	3:00 PM	1,820	104	58	7	39	5.7%
Stewart Street	South of	Denny Way	7:00 AM	1,120	102	41	5	56	9.1%
Northgate Way NE	East of	1st Avenue NE	9:00 AM	1,430	97	62	4	31	6.8%
N 45th Street	East of	Eastern Avenue N	12:00 PM	1,090	90	52	3	35	8.3%
S Lander Street	East of	Occidental Ave S	1:00 PM	500	45	32	1	12	9.0%

a. All counts were performed in May or June 2007 except as noted. The volumes have been sorted from highest to lowest total truck volume.

b. Count performed May 31, 2006.

c. Count performed April 26, 2006.

3.1. Truck Volume Trends Associated with Different Economic Activities

The truck volumes were evaluated to determine if there were any trends associated with the economic activity of the area's neighborhood. The different types of economic activity centers were defined as: manufacturing, downtown, commercial/residential and office/hospital. Neither the volume of daily trips nor the peak hour trips showed any correlation to the type of area. The volumes are more likely related to the route and whether it provided truck access either to or through the neighborhood. There was some correlation related to the profile of truck volumes by time of day. Charts showing volumes by time of day are a part of the attached truck database.

The volumes by time of day charts show that truck volumes in the manufacturing and commercial areas outside of downtown tend to peak during the midday hours. Some streets, such as those near the port terminals or rail yards, exhibit a steep reduction in truck volumes during the lunch hour. In contrast, truck volumes in downtown and in the office/hospital area (Boren Avenue) tend to peak about the same time as the traditional commuter peak hours. It should be noted that the counts in the downtown core (Stewart Street and 4th Avenue) were checked to make sure that buses were not being counted as trucks. Both counts showed a very high volume of buses (FHWA Classification 4) that are not included as trucks in these time-of-day profiles.

This confirms that detailed truck data collection should be performed for areas outside of the traditional manufacturing areas.

4. Recommendations for Future Studies

Based on our experience with the data collection process and the efforts performed to verify and compile data, we recommend the following for future studies:

Use of Data

- Vehicle Class 3 should not be included in the category for "Light Trucks." The verification performed for this study found that only a small fraction of Class 3 vehicles, which includes pick-up trucks, vans, and SUVs, are commercial vehicles. Further data analysis (where manual or camera counts are performed at the same time as the machine counts) should be performed to confirm this recommendation.

Additional Data Collection

- More vehicle classification studies should be performed on arterials outside of the traditional industrial areas in Seattle. The counts that have been performed revealed that truck volumes are higher, sometimes much higher, than typically assumed. The truck percentages should be incorporated into traffic operations analysis performed in these areas.

- Additional equipment may be needed to collect accurate vehicle-classification data on arterials with more than two lanes in each direction. This could include induction loops or camera equipment.

Operational Studies

- The operational effect of trucks at intersections is evaluated using assumptions and characteristics that are now decades old. There have been substantial changes in both truck size and distribution of truck types in recent years. For example, the use of light trucks for deliveries has increased. Trucks at the larger end, both semis and construction trucks, have gotten bigger. Additional studies related to the effect that these different types of trucks have on the capacity of urban intersections should be performed. This could include saturation flow studies combined with detailed truck counts at intersections. Saturation flow is the primary input assumption used to determine the lane capacity of an intersection.

CSH/MCH

Attachments: Detailed truck count data

WSDOT Freight Study 2007: Truck Classification Counts In Seattle

Truck Counts Performed in May & June 2007

Counts performed by Traffic Count Consultants, Inc.
Compiled by Heffron Transportation, Inc.

Location Information							Daily Volumes						
Location Reference Number ¹	Street	Cardinal Location	Cross Street	Travel Direction	Route Type ²	Area's Economic Activity	All Traffic Total	All Trucks Total	Light Trucks	Medium Trucks	Heavy Trucks Single	Heavy Trucks Double	% Trucks per Day
1	4th Avenue	North of	James Street	NB	Arterial	Downtown	14,679	1,627	515	82	766	264	11.1%
2	Stewart Street	South of	Denny Way	SB	Arterial	Downtown	13,271	814	293	115	343	63	6.1%
3	Lake City Way	East of	15th Avenue NE	WB (b-up) ³	Major Truck Street	Commercial/Residential	11,823	623	274	70	167	112	5.3%
3	Lake City Way	East of	15th Avenue NE	EB	Major Truck Street	Commercial/Residential	16,044	628	455	56	110	7	3.9%
4	23rd Avenue S	North of	S Jackson Street	NB	Arterial	Commercial/Residential	6,677	517	182	51	229	55	7.7%
4	23rd Avenue S	North of	S Jackson Street	SB	Arterial	Commercial/Residential	6,498	691	184	64	311	132	10.6%
5	N 45th Street	East of	Eastern Avenue N	WB	Arterial	Commercial/Residential	9,875	508	312	32	136	28	5.1%
5	N 45th Street	East of	Eastern Avenue N	EB	Arterial	Commercial/Residential	9,057	459	286	24	129	20	5.1%
6	Aurora Avenue N	North of	N 50th Street	NB	Major Truck Street, Seaport Connector	Commercial	19,422	3,308	1,403	80	1,585	240	17.0%
6	Aurora Avenue N	North of	N 50th Street	SB	Major Truck Street, Seaport Connector	Commercial	18,026	2,203	467	129	1,244	363	12.2%
9	Dearborn Street	East of	I-5 ramps	WB	Major Truck Street	Commercial	10,545	775	387	78	229	81	7.3%
9	Dearborn Street	East of	I-5 ramps	EB	Major Truck Street	Commercial	9,175	681	385	67	190	39	7.4%
12	Michigan Street	West of	Corson Avenue S	WB	Major Truck Street	Industrial	16,842	1,821	1,138	216	394	73	10.8%
12	Michigan Street	West of	Corson Avenue S	EB	Major Truck Street	Industrial	15,426	1,523	766	153	494	110	9.9%
13	Fauntleroy Way SW	North of	SW Graham Street	NB	Arterial	Commercial/Residential	6,341	613	274	39	263	37	9.7%
13	Fauntleroy Way SW	North of	SW Graham Street	SB	Arterial	Commercial/Residential	6,429	468	218	37	190	23	7.3%
14	1st Avenue S	South of	Lacille Street	NB (park) ⁵	Major Truck Street	Industrial	5,242	815	303	78	307	127	15.5%
14	1st Avenue S	South of	Lacille Street	SB (park) ⁵	Major Truck Street	Industrial	6,993	1,260	735	91	363	71	18.0%
15	1st Avenue S	South of	Lander Street	NB	Major Truck Street	Industrial	14,966	2,070	756	149	890	275	13.8%
15	1st Avenue S	South of	Lander Street	SB	Major Truck Street	Industrial	13,413	1,575	690	107	588	190	11.7%
16	6th Avenue S	South of	Lander Street	NB (park) ⁶	Major Truck Street	Industrial	5,064	669	289	52	267	61	13.2%
16	6th Avenue S	South of	Lander Street	SB (park) ⁶	Major Truck Street	Industrial	4,798	732	358	63	277	34	15.3%
17	Airport Way	South of	Lander Street	NB	Major Truck Street	Industrial	7,292	776	500	67	178	31	10.6%
17	Airport Way	South of	Lander Street	SB	Major Truck Street	Industrial	8,742	901	559	104	188	50	10.3%
Heffron ^A	E Marginal Way	North of	S Hanford St	NB	Major Truck Street	Industrial	2,961	505	134	121	123	127	17.1%
Heffron ^A	E Marginal Way	North of	S Hanford St	SB	Major Truck Street	Industrial	4,028	820	169	88	450	113	20.4%
24	Boren Avenue S	North of	12th Avenue	NB	Arterial	Office / Hospitals	6,158	999	131	65	539	264	16.2%
24	Boren Avenue S	North of	12th Avenue	SB	Arterial	Office / Hospitals	5,377	568	108	48	241	171	10.6%
33	Montlake Blvd	North of	Entrance to Montlake Parking Lot	NB	Arterial	University / Residential	22,704	629	501	38	79	11	2.8%
33	Montlake Blvd	North of	Entrance to Montlake Parking Lot	SB	Arterial	University / Residential	18,890	609	408	44	112	45	3.2%
35	Northgate Way	East of	1st Avenue NE	WB	Arterial	Commercial	12,396	557	332	34	144	47	4.5%
35	Northgate Way	East of	1st Avenue NE	EB	Arterial	Commercial	13,035	503	293	20	128	62	3.9%
Heffron ^A	W Nickerson Street	East of	6th Avenue W	WB	Major Truck Street	Industrial / Residential	12,004	543	314	57	156	16	4.5%
Heffron ^A	W Nickerson Street	East of	6th Avenue W	EB	Major Truck Street	Industrial / Residential	10,392	587	378	27	169	13	5.6%
Heffron ^A	Edgar Martinez Drive	East of	1st Avenue S	WB	Major Truck Street	Industrial	4,294	483	155	105	168	55	11.2%
Heffron ^A	Edgar Martinez Drive	East of	1st Avenue S	EB	Major Truck Street	Industrial	11,675	1,015	353	86	444	132	8.7%
Heffron ^A	Lander Street	East of	Ocidental Ave S	WB	Major Truck Street	Industrial	3,443	268	190	15	46	17	7.8%
Heffron ^A	Lander Street	East of	Ocidental Ave S	EB	Major Truck Street	Industrial	2,521	171	129	13	27	2	6.8%

Notes:

1. Location Number based on initial target list for vehicle classification counts. This number is for project purposes only.
- 1A. Locations without number are from other studies
2. Source: Freight Mobility Strategic Action Plan (FMSAP), June 2005
- FMSAP Route types: Major Truck Street, Seaport Highway Connectors, Seaport Intermodal Connectors
- Arterial = all other streets as shown in the FMSAP
3. Source: Freight Mobility Strategic Action Plan (FMSAP), June 2005, Seattle Manufacturing Centers
4. Back-up queues may have affected counts at this location, in this direction
5. Possible parked car pinching tube at 12:00 p.m. Volume is very low for one hour.
6. Possible parked car pinching tube at 1:00 p.m. Volume is very low for one hour.

WSDOT Freight Study 2007: Truck Classification Counts In Seattle

Truck Counts Performed in May & June 2007

Counts performed by Traffic Count Consultants, Inc.
Compiled by Heffron Transportation, Inc.

Location Information		Peak Hour of Street									
Location Reference Number ¹	Street	Cardinal Location	Cross Street	Travel Direction	Hour	All Traffic	Truck Total	Light Trucks	Medium Trucks	Heavy Trucks	% Trucks During Peak Hour
1	4th Avenue	North of	James Street	NB	5:00 PM	1,210	118	10	6	102	9.8%
2	Stewart Street	South of	Denny Way	SB	8:00 AM	1,179	89	34	9	46	7.5%
3	Lake City Way	East of	15th Avenue NE	WB (b-up) ²	7:00 AM	1,465	76	30	3	43	5.2%
3	Lake City Way	East of	15th Avenue NE	EB	5:00 PM	1,588	40	25	1	14	2.5%
4	23rd Avenue S	North of	S Jackson Street	NB	8:00 AM	548	67	20	7	40	12.2%
4	23rd Avenue S	North of	S Jackson Street	SB	5:00 PM	496	73	4	7	62	14.7%
5	N 45th Street	East of	Eastern Avenue N	WB	3:00 PM	645	22	15	1	6	3.4%
5	N 45th Street	East of	Eastern Avenue N	EB	2:00 PM	620	49	30	0	19	7.9%
6	Aurora Avenue N	North of	N 50th Street	NB	5:00 PM	1,922	417	75	6	336	21.7%
6	Aurora Avenue N	North of	N 50th Street	SB	4:00 PM	1,316	187	31	6	150	14.2%
9	Dearborn Street	East of	I-5 ramps	WB	4:00 PM	749	37	23	4	10	4.9%
9	Dearborn Street	East of	I-5 ramps	EB	4:00 PM	693	44	26	1	17	6.3%
12	Michigan Street	West of	Corson Avenue S	WB	10:00 AM	1,247	181	105	25	51	14.5%
12	Michigan Street	West of	Corson Avenue S	EB	2:00 PM	1,087	105	53	9	43	9.7%
13	Fauntleroy Way SW	North of	SW Graham Street	NB	7:00 AM	688	89	29	6	54	12.9%
13	Fauntleroy Way SW	North of	SW Graham Street	SB	5:00 PM	703	49	9	1	39	7.0%
14	1st Avenue S	South of	Lacille Street	NB (park) ³	4:00 PM	654	110	23	8	79	16.8%
14	1st Avenue S	South of	Lacille Street	SB (park) ³	7:00 AM	805	137	70	4	63	17.0%
15	1st Avenue S	South of	Lander Street	NB	7:00 AM	1,425	213	73	18	122	14.9%
15	1st Avenue S	South of	Lander Street	SB	5:00 PM	1,504	138	39	5	94	9.2%
16	6th Avenue S	South of	Lander Street	NB (park) ⁶	8:00 AM	497	70	32	6	32	14.1%
16	6th Avenue S	South of	Lander Street	SB (park) ⁶	4:00 PM	573	64	28	5	31	11.2%
17	Airport Way	South of	Lander Street	NB	8:00 AM	1,165	159	123	5	31	13.6%
17	Airport Way	South of	Lander Street	SB	5:00 PM	1,212	97	82	5	10	8.0%
Heffron ^A	E Marginal Way	North of	S Hanford St	NB	7:00 AM	345	83	19	13	51	24.1%
Heffron ^A	E Marginal Way	North of	S Hanford St	SB	5:00 PM	512	32	15	1	16	6.3%
24	Boren Avenue S	North of	12th Avenue	NB	8:00 AM	520	125	7	8	110	24.0%
24	Boren Avenue S	North of	12th Avenue	SB	4:00 PM	449	71	11	7	53	15.8%
33	Montlake Blvd	North of	Entrance to Montlake Parking Lot	NB	5:00 PM	2,131	30	23	3	4	1.4%
33	Montlake Blvd	North of	Entrance to Montlake Parking Lot	SB	1:00 PM	1,447	61	50	7	4	4.2%
35	Northgate Way	East of	1st Avenue NE	WB	6:00 PM	848	22	14	0	8	2.6%
35	Northgate Way	East of	1st Avenue NE	EB	3:00 PM	936	35	25	1	9	3.7%
Heffron ^A	W Nickerson Street	East of	6th Avenue W	WB	8:00 AM	1,031	42	21	4	17	4.1%
Heffron ^A	W Nickerson Street	East of	6th Avenue W	EB	5:00 PM	845	29	16	0	13	3.4%
Heffron ^A	Edgar Martinez Drive	East of	1st Avenue S	WB	8:00 AM	378	44	17	9	18	11.6%
Heffron ^A	Edgar Martinez Drive	East of	1st Avenue S	EB	5:00 PM	993	62	20	10	32	6.2%
Heffron ^A	Lander Street	East of	Occidental Ave S	WB	8:00 AM	302	29	24	1	4	9.6%
Heffron ^A	Lander Street	East of	Occidental Ave S	EB	4:00 PM	252	13	10	3	0	5.2%

Notes:

1. Location Number based on initial target list for vehicle classification counts. This number is for project purposes only.
- 1A. Locations without number are from other studies.
2. Source: Freight Mobility Strategic Action Plan (FMSAP), June 2005
3. FMSAP Route types: Major Truck Street, Seaport Highway Connectors, Seaport Intermodal Connectors
- Arterial = all other streets as shown in the FMSAP
3. Source: Freight Mobility Strategic Action Plan (FMSAP), June 2005, Seattle Manufacturing Centers
4. Back-up queues may have affected counts at this location, in this direction
5. Possible parked car pinching tube at 12:00 p.m. Volume is very low for one hour.
6. Possible parked car pinching tube at 1:00 p.m. Volume is very low for one hour.

WSDOT Freight Study 2007: Truck Classification Counts In Seattle

Truck Counts Performed in May & June 2007

Counts performed by Traffic Count Consultants, Inc.
Compiled by Heffron Transportation, Inc.

Location Information		Truck Peak Hour									
Location Reference Number ¹	Street	Cardinal Location	Cross Street	Travel Direction	Hour	All Traffic	Truck Total	Light Trucks	Medium Trucks	Heavy Trucks	% Trucks During Peak Hour
1	4th Avenue	North of	James Street	NB	8:00 AM	1,031	167	53	12	102	16.2%
2	Stewart Street	South of	Denny Way	SB	7:00 AM	1,121	102	41	5	56	9.1%
3	Lake City Way	East of	15th Avenue NE	WB (b-up) ²	3:00 AM	443	45	11	2	32	10.2%
3	Lake City Way	East of	15th Avenue NE	EB	3:00 AM	1,375	59	47	5	7	4.3%
4	23rd Avenue S	North of	S Jackson Street	NB	3:00 AM	473	44	18	3	23	9.3%
4	23rd Avenue S	North of	S Jackson Street	SB	3:00 AM	477	75	13	5	57	15.7%
5	N 45th Street	East of	Eastern Avenue N	WB	12:00 PM	560	47	27	1	19	8.4%
5	N 45th Street	East of	Eastern Avenue N	EB	12:00 PM	531	43	25	2	16	8.1%
6	Aurora Avenue N	North of	N 50th Street	NB	4:00 PM	1,922	417	75	6	336	21.7%
6	Aurora Avenue N	North of	N 50th Street	SB	4:00 PM	1,316	187	31	6	150	14.2%
9	Dearborn Street	East of	I-5 ramps	WB	11:00 AM	615	75	42	14	19	12.2%
9	Dearborn Street	East of	I-5 ramps	EB	11:00 AM	508	65	38	4	23	12.8%
12	Michigan Street	West of	Corson Avenue S	WB	11:00 AM	1,093	191	117	27	47	17.3%
12	Michigan Street	West of	Corson Avenue S	EB	11:00 AM	935	152	79	14	59	16.3%
13	Fauntleroy Way SW	North of	SW Graham Street	NB	7:00 AM	688	89	29	6	54	12.9%
13	Fauntleroy Way SW	North of	SW Graham Street	SB	7:00 AM	214	35	20	7	8	16.4%
14	1st Avenue S	South of	Lacille Street	NB (park) ³	8:00 AM	222	48	22	8	18	21.6%
14	1st Avenue S	South of	Lacille Street	SB (park) ³	8:00 AM	744	141	87	7	47	19.0%
15	1st Avenue S	South of	Lander Street	NB	8:00 AM	1,421	219	54	14	151	15.4%
15	1st Avenue S	South of	Lander Street	SB	8:00 AM	705	122	67	12	43	17.3%
16	6th Avenue S	South of	Lander Street	NB (park) ⁶	10:00 AM	394	75	33	2	40	19.0%
16	6th Avenue S	South of	Lander Street	SB (park) ⁶	10:00 AM	272	64	31	2	31	23.5%
17	Airport Way	South of	Lander Street	NB	8:00 AM	1,165	159	123	5	31	13.6%
17	Airport Way	South of	Lander Street	SB	8:00 AM	394	58	28	7	23	14.7%
Heffron ⁴	E Marginal Way	North of	S Hanford St	NB	1:00 PM	189	99	14	11	74	52.4%
Heffron ⁴	E Marginal Way	North of	S Hanford St	SB	1:00 PM	268	91	10	7	74	34.0%
24	Boren Avenue S	North of	12th Avenue	NB	8:00 AM	520	125	7	8	110	24.0%
24	Boren Avenue S	North of	12th Avenue	SB	8:00 AM	302	30	9	3	18	9.9%
33	Montlake Blvd	North of	Entrance to Montlake Parking Lot	NB	10:00 AM	1,257	56	41	6	9	4.5%
33	Montlake Blvd	North of	Entrance to Montlake Parking Lot	SB	10:00 AM	1,253	63	48	9	6	5.0%
35	Northgate Way	East of	1st Avenue NE	WB	9:00 AM	670	56	36	3	17	8.4%
35	Northgate Way	East of	1st Avenue NE	EB	9:00 AM	757	41	26	1	14	5.4%
Heffron ⁴	W Nickerson Street	East of	6th Avenue W	WB	12:00 PM	772	70	37	13	20	9.1%
Heffron ⁴	W Nickerson Street	East of	6th Avenue W	EB	12:00 PM	654	52	34	6	12	8.0%
Heffron ⁴	Edgar Martinez Drive	East of	1st Avenue S	WB	8:00 AM	378	44	17	9	18	11.6%
Heffron ⁴	Edgar Martinez Drive	East of	1st Avenue S	EB	8:00 AM	870	114	27	7	80	13.1%
Heffron ⁴	Lander Street	East of	Occidental Ave S	WB	1:00 PM	263	24	16	0	8	9.1%
Heffron ⁴	Lander Street	East of	Occidental Ave S	EB	1:00 PM	233	21	16	1	4	9.0%

Notes:

1. Location Number based on initial target list for vehicle classification counts. This number is for project purposes only.
- 1A. Locations without number are from other studies.
2. Source: Freight Mobility Strategic Action Plan (FMSAP), June 2005
- FMSAP Route types: Major Truck Street, Seaport Highway Connectors, Seaport Intermodal Connectors
- Arterial = all other streets as shown in the FMSAP
3. Source: Freight Mobility Strategic Action Plan (FMSAP), June 2005, Seattle Manufacturing Centers
4. Back-up queues may have affected counts at this location, in this direction
5. Possible parked car pinching tube at 12:00 p.m. Volume is very low for one hour.
6. Possible parked car pinching tube at 1:00 p.m. Volume is very low for one hour.

WSDOT Freight Study 2007: Freight and Googs Transportation System (FGTS)

Truck Counts Performed in May & June 2007

Counts performed by Traffic Count Consultants, Inc.

Compiled by Heffron Transportation, Inc.

Location Reference Number ¹	Street	Cardinal Location	Cross Street	Route Type ²	Direction	Daily Number Trucks by Type ¹			Yearly Totals (Assume 250 Days/Year)		
						Single Unit Trucks (7 tons)	Double Unit Trucks (27 tons)	Trains-Tactor with two trailers (42 tons)	Tons per Year	Tons per Year, 2-way	FGTS Class
1	4th Avenue	North of	James Street	Arterial	NB	597	766	264	8,987,250	8,987,250	T-2
2	Stewart Street	South of	Denny Way	Arterial	SB	408	343	63	3,690,750	3,690,750	T-3
3	Lake City Way	East of	15th Avenue NE	Major Truck Street	WB	344	167	112	2,905,250	4,615,500	T-2
3	Lake City Way	East of	15th Avenue NE	Major Truck Street	EB	511	110	7	1,710,250		
4	23rd Avenue S	North of	S Jackson Street	Arterial	NB	233	229	55	2,531,000	6,450,250	T-2
4	23rd Avenue S	North of	S Jackson Street	Arterial	SB	248	311	132	3,919,250		
5	N 45th Street	East of	Eastern Avenue N	Arterial	WB	344	136	28	1,814,000	3,437,250	T-3
5	N 45th Street	East of	Eastern Avenue N	Arterial	EB	310	129	20	1,623,250		
6	Aurora Avenue N	North of	N 50th Street	Major Truck Street, Seaport Connector	NB	1,483	1,585	240	15,814,000	29,065,500	T-1
6	Aurora Avenue N	North of	N 50th Street	Major Truck Street, Seaport Connector	SB	596	1,244	363	13,251,500		
9	Dearborn Street	West of	I-5 ramps	Major Truck Street	WB	465	229	81	3,210,000	5,693,000	T-2
9	Dearborn Street	West of	I-5 ramps	Major Truck Street	EB	452	190	39	2,483,000		
12	Michigan Street	West of	Corson Avenue S	Major Truck Street	WB	1,354	394	73	5,795,500	11,893,250	T-1
12	Michigan Street	West of	Corson Avenue S	Major Truck Street	EB	919	494	110	6,097,750		
13	Fauntleroy Way SW	North of	SW Graham Street	Arterial	NB	313	263	37	2,711,500	4,681,750	T-2
13	Fauntleroy Way SW	North of	SW Graham Street	Arterial	SB	255	190	23	1,970,250		
14	1st Avenue S	South of	Lucille Street	Major Truck Street	NB	381	307	127	4,072,500	8,713,750	T-2
14	1st Avenue S	South of	Lucille Street	Major Truck Street	SB	826	363	71	4,641,250		
15	1st Avenue S	South of	Lander Street	Major Truck Street	NB	905	890	275	10,478,750	17,837,500	T-1

WSDOT Freight Study 2007: Freight and Googs Transportation System (FGTS)

Truck Counts Performed in May & June 2007

Counts performed by Traffic Count Consultants, Inc.

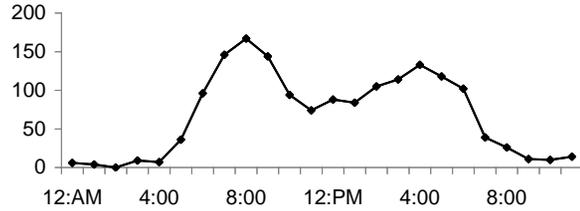
Compiled by Heffron Transportation, Inc.

Location Reference Number ¹	Street	Cardinal Location	Cross Street	Route Type ²	Direction	Daily Number Trucks by Type ¹			Yearly Totals (Assume 250 Days/Year)		
						Single Unit Trucks (7 tons)	Double Unit Trucks (27 tons)	Trains-Tactor with two trailers (42 tons)	Tons per Year	Tons per Year, 2-way	FGTS Class
15	1st Avenue S	South of	Lander Street	Major Truck Street	SB	797	588	190	7,358,750		
16	6th Avenue S	South of	Lander Street	Major Truck Street	NB	341	267	61	3,039,500	6,003,000	T-2
16	6th Avenue S	South of	Lander Street	Major Truck Street	SB	421	277	34	2,963,500		
17	Airport Way	South of	Lander Street	Major Truck Street	NB	567	178	31	2,519,250	5,473,500	T-2
17	Airport Way	South of	Lander Street	Major Truck Street	SB	663	188	50	2,954,250		
Heffron1A	E Marginal Way	North of	S Hanford St	Major Truck Street	NB	255	123	127	2,610,000	7,283,750	T-2
Heffron1A	E Marginal Way	North of	S Hanford St	Major Truck Street	SB	257	450	113	4,673,750		
24	Boren Avenue S	North of	12th Avenue	Arterial	NB	196	539	264	6,753,250	10,448,500	T-1
24	Boren Avenue S	North of	12th Avenue	Arterial	SB	156	241	171	3,695,250		
33	Montlake Blvd	North of	Entrance to Montlake Parking Lot	Arterial	NB	539	79	11	1,592,000	3,611,500	T-3
33	Montlake Blvd	North of	Entrance to Montlake Parking Lot	Arterial	SB	452	112	45	2,019,500		
35	Northgate Way	East of	1st Avenue NE	Arterial	WB	366	144	47	2,106,000	4,168,750	T-2
35	Northgate Way	East of	1st Avenue NE	Arterial	EB	313	128	62	2,062,750		
Heffron ^{1A}	W Nickerson Street	East of	6th Avenue W	Major Truck Street	WB	371	156	16	1,870,250	3,856,250	T-3
Heffron ^{1A}	W Nickerson Street	East of	6th Avenue W	Major Truck Street	EB	405	169	13	1,986,000		
Heffron ^{1A}	Edgar Martinez Drive	East of	1st Avenue S	Major Truck Street	WB	260	168	55	2,166,500	7,317,750	T-2
Heffron ^{1A}	Edgar Martinez Drive	East of	1st Avenue S	Major Truck Street	EB	439	444	132	5,151,250		
Heffron ^{1A}	Lander Street	East of	Occidental Ave S	Major Truck Street	WB	205	46	17	847,750	1,299,500	T-3
Heffron ^{1A}	Lander Street	East of	Occidental Ave S	Major Truck Street	EB	142	27	2	451,750		

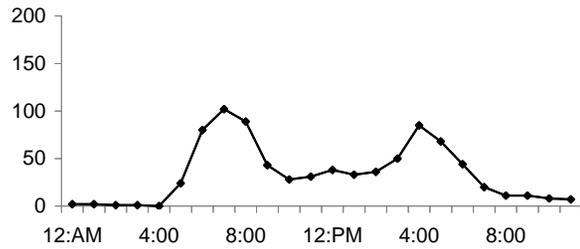
Truck Volumes by Time of Day - 2007

Downtown

Hourly Volume of Trucks on 4th Avenue at North of James Street
May, 2007

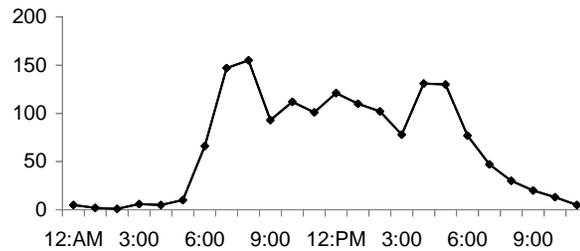


Hourly Volume of Trucks on Stewart Street at South of Denny Way
May, 2007



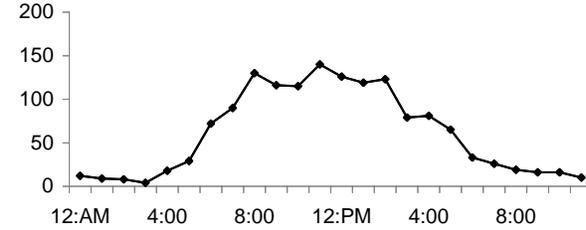
Office/ Hospital

Hourly Volume of Trucks on Boren Avenue S at North of 12th Avenue S (Both Directions)
May, 2007

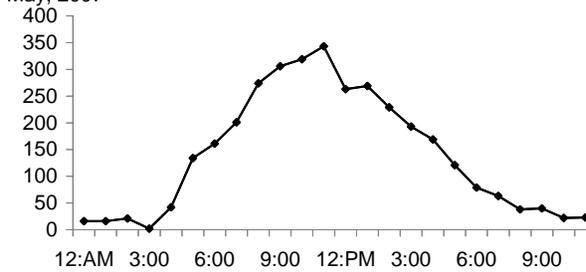


Manufacturing Center

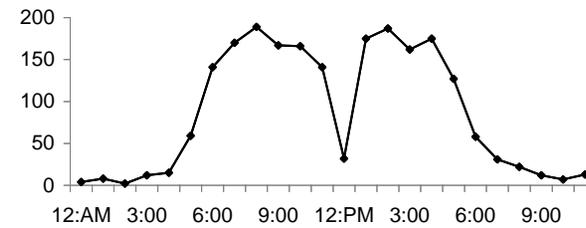
Hourly Volume of Trucks on S Dearborn Street at West of Interstate 5 Onramps (Both Directions)
May, 2007



Hourly Volume of Trucks on S Michigan Street at West of Corson Avenue S (Both Directions)
May, 2007



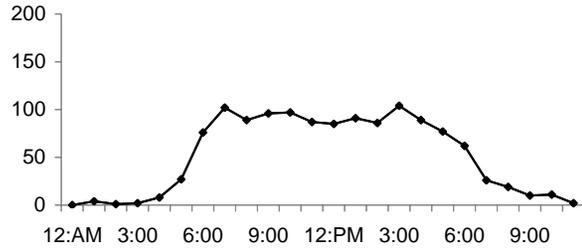
Hourly Volume of Trucks on 1st Avenue S at South of S Lucille Street (Both Directions)
May, 2007



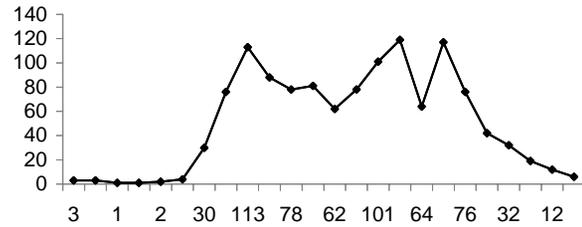
Truck Volumes by Time of Day - 2007

Commercial/ Residential

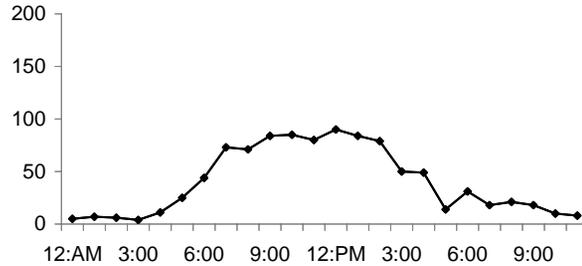
Hourly Volume of Trucks on Lake Lake City Way at East of 15th Ave NE (Both Directions)
May, 2007



Hourly Volume of Trucks on 23rd Avenue S at North of S Jackson Street (Both Directions)
May, 2007

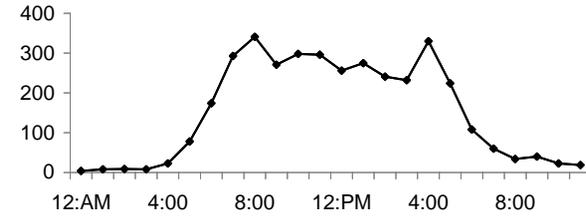


Hourly Volume of Trucks on N 45th Street at East of Eastern Avenue N (Both Directions)
May, 2007

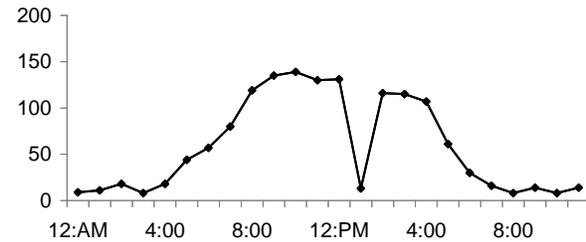


Manufacturing Center

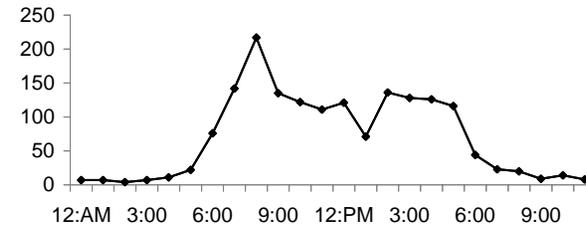
Hourly Volume of Trucks on 1st Avenue S at South of S Lander Street (Both Directions)
May, 2007



Hourly Volume of Trucks on 6th Avenue S at South of S Lander Street (Both Directions)
May, 2007



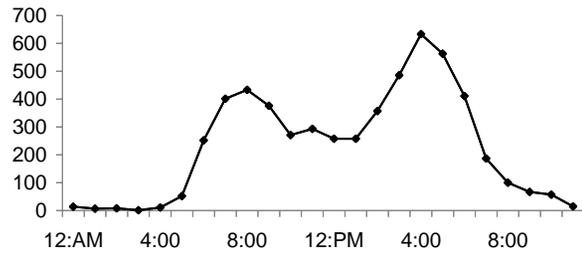
Hourly Volume of Trucks on Airport Way S at South of S Lander Street (Both Directions)
May, 2007



Truck Volumes by Time of Day - 2007

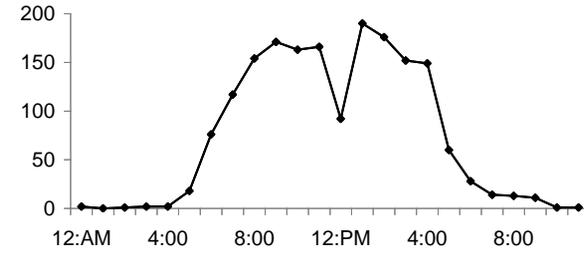
Commercial/ Residential

Hourly Volume of Trucks on Aurora Avenue N at North of N 50th Street (Both Directions)
May, 2007

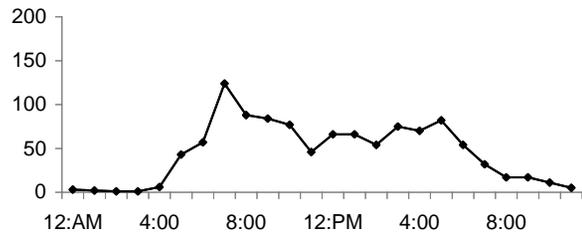


Manufacturing Center

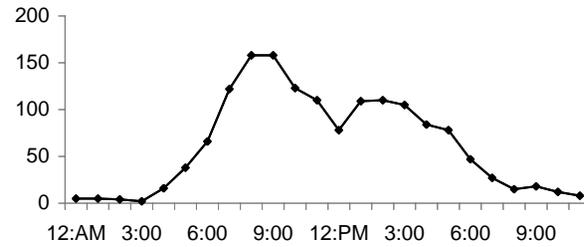
Hourly Volume of Trucks on E Marginal Way at North of S Hanford St (Both Directions)
May, 2007



Hourly Volume of Trucks on Fauntleroy Way SW at North of SW Graham Street (Both Directions)
May, 2007



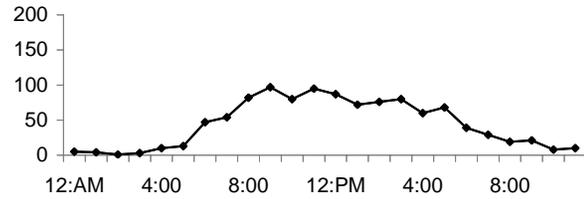
Hourly Volume of Trucks on Edgar Martinez Drive S at East of 1st Avenue S (Both Directions)
May, 2007



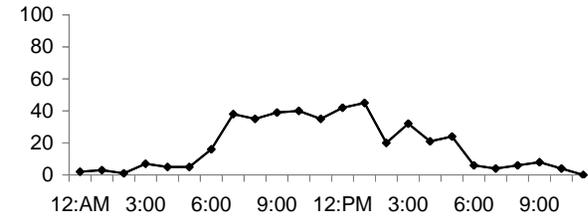
Truck Volumes by Time of Day - 2007

Commercial

Hourly Volume of Trucks on Northgate Way NE at East of 1st Avenue NE (Both Directions)
May, 2007

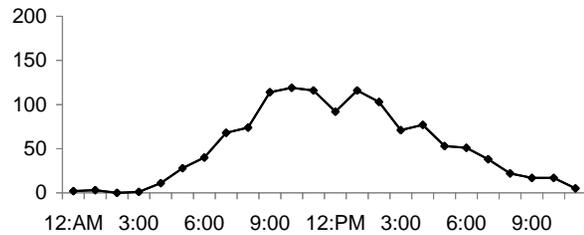


Hourly Volume of Trucks on S Lander Street at East of Occidental Avenue S (Both Directions)
May, 2007



University/ Residential

Hourly Volume of Trucks on Montlake Blvd NE at North of Entrance to Montlake Parking Lot (Both Directions)
May, 2007



Industrial/ Residential

Hourly Volume of Trucks on W Nickerson Street at East of 6th Avenue W (Both Directions)
May, 2007

