HEAVY VEHICLES VS. URBAN PAVEMENTS

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16. ABSTRACT

An analysis was conducted of the impact that overweight vehicles have and will have on the life of the pavements in the Seattle metropolitan area. The study focuses on major Metro bus routes with both rigid and flexible pavements.

Recommendations are made to mitigate the impact of the higher loads from the bus fleet. These recommendations include route modifications to avoid streets with thinner, underdesigned pavements, increasing pavement thickness for rebuild or overlaid streets, and the purchase of vehicles which meet legal axle loads.

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FINAL REPORT
for
HEAVY VEHICLES Vs URBAN PAVEMENTS

By

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Submitted to:

Transit, Research and Intermodal Planning Division
Washington State Department of Transportation

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HEAVY VEHICLE Vs URBAN PAVEMENTS

FINAL REPORT

SUMMARY

The damage to a pavement structure is directly related to the magnitude and frequency of the load applied. Pavement performance (and design) is governed by environmental conditions as well as truck, buses and other heavy vehicles to the exclusion of light, passenger vehicles.[1] The heavier a vehicle utilizing a pavement, the more extensive the damage induced. In pavement design, all axle loads are commonly converted to equivalent single axle loads (ESAL's) representing the standard 18,000 pound single axle design load to simplify analysis. Results of the AASHO Road Test[2] concluded that the ratio of damage induced by an axle load is proportional of that axle load to a standard 18,000 pound single axle load raised to the fourth power. Therefore, a fully loaded METRO Breda bus (which exceeds legal axle loads) would induce nearly four times as much damage as a similar bus meeting legal axle loads.

It was originally anticipated that the overweight vehicles in the METRO bus fleet would have a much more significant impact than the study discovered. There was a marginal increase in pavement life for most of the streets evaluated if the METRO bus fleet could be immediately modified to meet legal axle loads. Reductions in the typical Seattle portland cement concrete (PCC) pavement life created by the METRO buses because they were over legal axle loads ranged from 5 to 25 percent versus that which would be expected if they met legal axle loads. For many of the streets evaluated which had already been in place for 30 or more years, the reduction in pavement life induced by the overweight buses is negligible because they are close to or past their design life.

Most of the asphalt concrete (AC) pavements included within the study were relatively thin, especially in relationship to the PCC pavements. These pavements were less capable of sustaining heavy vehicles of any kind, and the METRO buses constituted 55 to 97 percent of all heavy vehicles using these streets. Despite these conditions, reductions in pavement life were similar to those noted for the PCC pavements. The design of future pavements in the urban system should consider the overweight vehicles. Pavements can be designed to accommodate these vehicles, and if this is done, the entire life cycle cost of the street system will be minimized.

CONCLUSIONS AND RECOMMENDATIONS

The following recommendations have been formulated to assist in contending with the increased use of overweight buses on urban streets:

1. Bus system routing should recognize that some of the thinner asphalt concrete streets in the urban areas are less capable of sustaining the heavy loading induced by overweight vehicles. Routes should be developed to avoid these streets if at all possible. If the street cannot be avoided, the routes utilizing the street should be using the lighter vehicles in the bus fleet, or consideration should be made for rebuilding the street to sustain the increased loadings.

2. Future street designs should accommodate the overweight vehicles such as buses, fire trucks and waste vehicles which utilize them. During the course of the study it was found that the loads induced by the City of Seattle fire trucks are the greatest of any vehicle considered (although because these loads are generally infrequent, their contribution to pavement deterioration is usually not significant). Pavements

can be designed to accommodate the heavier loads of the bus fleet and other overweight vehicles. The increased initial cost of the slightly thicker pavement sections which might be required would be a more effective means of dealing with overweight vehicles rather than frequent, disruptive rehabilitation.

3. As new vehicles are added to the bus and other fleets, every effort should be made to ensure they will meet legal axle loads. While future pavements can be designed to meet heavier axle loads, many local streets are composed of relatively thin asphalt concrete pavements which were not initially designed to accommodate heavy loads. By subjecting these pavements to heavier loads, their service life is shortened, thereby requiring expenditure of rehabilitation funds which are in short supply.

4. Additional work that could benefit this study would be an aggressive program of collecting truck counts on a regular basis throughout key arterials of the City. This data, when combined with weigh-in-motion information being collected by the WDSOT, would provide a more accurate picture of pavement response to the Seattle urban conditions.

INTRODUCTION

Problem Statement

Metro buses have been exceeding the legal load limit permitted under loaded conditions for at least the last several years. The recently acquired dual mode tunnel buses (henceforth referred to as the BREDA bus) further exacerbates the problem by exceeding the legal load limits on one of its three axles even when empty. When fully loaded (defined as 150% of the seated capacity or a total of 94 passengers) the BREDA exceeds legal axle loads on two of its three axles. These overweight conditions accelerate damages within the pavement system. Most of the pavements within the METRO bus routes were not designed to accommodate the loadings now being inflicted upon them.

Project Background

A preliminary analysis conducted by the Seattle Engineering Department in March and April of 1989 anticipated approximately $8 million in additional pavement damage during the subsequent 15 years due to the overweight METRO buses utilizing the City street system. The earlier study focused on five streets considered representative of the streets in the Metro routing plan for Breda buses. The rate of pavement deteriation for the five streets was modeled using the AASHTO pavement design equations. The results of the limited analysis indicated a net loss of pavement life of 2.5 years during the expected 15 year life span of the Breda buses. This information was then extrapolated out to the entire Seattle roadway system to approximate the cost impacts of the Breda vehicles utilizing City streets.

Objectives

The objective of this project was to evaluate the impact of heavy axle bus loads on urban street systems, in particular the METRO Breda dual-mode bus, using the Seattle local street system as a prototype. If it was determined that the magnitude of impact was significant, alternative solutions to mitigating the heavy axle loads to achieve as closely as possible the same impact as legal load limits were to be explored.

Review of Previous Work

A literature search was conducted to determine the methods by which other agencies are dealing with heavy weight vehicles and their impact on pavements. A key source of information regarding the relationships between heavy vehicles and pavements is the AASHO Road Test and the subsequent AASHTO Design Pavement Design Guides that were developed from the Road Test. The information in the 1986 "AASHTO Guide for Design of Pavement Structures" is the most comprehensive source of pavement design and rehabilitation information currently available (Note that an updated 1993 version was recently released).

The United States Forest Service (USFS) has been investigating the potential benefits of variable tire pressures on thin asphalt concrete pavements to increase pavement life with promising results.[3] The USFS research conducted to date has focused principally on asphalt concrete pavements three inches and less in thickness and was not applicable to this study. No other studies were located which focused on reducing the impacts of heavy weight vehicles on urban pavements.

DATA ACQUISITION

In order to determine the impacts that heavy vehicles are having on local streets, a number of important elements required research. These elements helped define the rate of pavement deteriation and the vehicles principally responsible. The information necessary to make these evaluations are outlined below and explained as follows:

- Routes utilized by the Breda buses.
- Pavement structural sections and the year of construction for each of the Breda routes.
- Traffic Equivalent Single Axle Loads (ESAL's) on each route since the year of construction.
- Existing bus loadings for each route.
- Approximate soil conditions for each route.
- Existing pavement conditions.

Breda Bus Routes

The study focused on the city streets were the Breda buses where identified as running in early 1992. Information regarding the Breda bus routes was established by observing the bus routes utilizing the Downtown Seattle Bus Tunnel. The City streets which the tunnel buses were utilizing was then determined by using the Metro route map[4]. The routes were then confirmed by METRO as carrying the BREDA buses when the evaluation of existing bus loading conditions was performed. The streets considered are outlined in Table 1.

TABLE 1 - STUDY ROADWAYS

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit
1	Renton Ave S	S 115th St	S Bangor St
2	Renton Ave S	S Bangor St	51st Ave S
3	51st Ave S	Renton Ave S	S Barton Pl
4	Ranier Ave S	S Barton Pl	S Othello St
5	S Othello & Myrtle St	Beacon Ave S	Rainer Ave
6	Swift Ave S	I-5	Beacon Ave S
7	Spokane St	6th Ave S	I-5
8	Spokane St	4th Ave S	6th Ave S
9	6th Ave S	Spokane St	Airport Way S
10	Airport Way S	6th Ave S	4th Ave S
11	4th Ave S	Spokane St	Airport Way S
12	Fairview Ave N	Denny Way	Valley St
13	Fairview Ave N	Valley St	Eastlake Ave E
14	Eastlake Ave E	Fairview Ave N	University Bridge
15	Roosevelt Way NE	University Bridge	NE Campus Parkway
16	NE Campus Parkway	Roosevelt Way NE	University Way NE
17	University Way NE	NE Campus Parkway	15th Ave NE
18	15th Ave NE	University Way NE	NE 65th St
19	15th Ave NE	NE 65th St	NE 80th St
20	15th Ave NE	NE 80th St	NE 125th St
21	15th Ave NE	NE 125th St	NE 145th St
22	NE 145th St	15th Ave NE	20th Ave NE
23	20th Ave NE	NE 145th St	NE 135th St
24	NE 135th St	20th Ave NE	17th Ave NE
25	17th Ave NE	NE 135th St	NE 137th St
26	NE 137th St	17th Ave NE	20th Ave NE
27	NE 80th St	15th Ave NE	Ravenna Ave NE
28	Ravenna Ave NE	NE 80th St	Lake City Way NE
29	Lake City Way NE	Ravenna Ave NE	NE 125th St
30	Lake City Way NE	NE 125th St	NE 145th St
31	30th Ave NE	NE 125th St	NE 145th St
32	NE 145th St	30th Ave NE	32nd Ave NE
33	32nd Ave NE	145th Ave NE	NE 137th St
34	NE 137th St	32nd Ave NE	30th Ave NE
35	NE 125th St	5th Ave NE	Lake City Way
36	5th Ave NE	NE 125th St	NE 130th St
37	Roosevelt Way NE	5th Ave NE	NE 125th St

Pavement structural sections and year of construction

Once the city streets had been identified were the Breda buses where operating, it was necessary to establish their pavement structural sections and the year of construction. The pavement structural section was necessary to assist in the evaluation of the impacts that heavy vehicles of all types were having on the street. The year of construction was important in order to ascertain the volume of ESAL's that the street had supported in order to determine its ability to support further loadings (an "ESAL" represents the load a particular axle imparts to a pavement strucutre expressed in an equivalant 18,000 pound

single axle load). The City of Seattle Records Vault was researched to acquire all available paving plans in order to determine the required information regarding each roadway's existing structural section. Additional verification was obtained for some of the streets by conducting pavement coring. The results of that research are documented in Table 2. Figure 1 below helps illustrate the "surface" identified in Table 2.

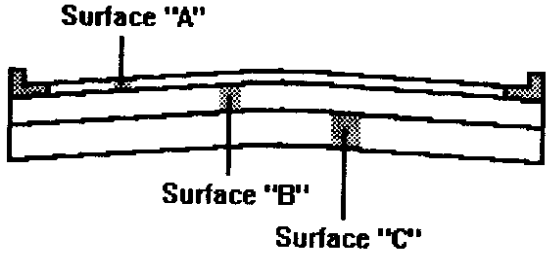

FIGURE 1 - ROADWAY SECTION

TABLE 2 - EXISTING ROADWAY STRUCTURAL SECTIONS

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	Surface "A" Thickness	Surface "B" Thickness	Base Course Thickness	Constr. Year
1	Renton Ave S	S Hazel St	S Bangor St	7" PCC			1927
1	Renton Ave S	S Hazel St	S Bangor St	2" AC	7" PCC		1963
2	Renton Ave S	S Bangor St	51st Ave S	7" PCC			1927
2	Rentonr Ave S	S Bangor St	51st Ave S	2" ACP	7" PCC		1963
3	51st Ave S	Renton Ave S	S Barton Pl	7" PCC			1916
3	51st Ave S	Renton Ave S	S Barton Pl	2" ACP	7" PCC		1963
4	Rainer Ave S	S Barton St	S Thistle St	Brick	1" Sand Layer	6" PCC	1916
4	Rainer Ave S	Rainer Pl	S Othello St	2-3/4" Brick Block	5" PCC		1918
4	Rainer Ave S	S Barton Pl	S Othello St	4" Brick Block	6" PCC		1924
4	Rainer Ave S	S Barton Pl	S Othello St	8" PCC			1938
4	Rainer Ave S	S Barton Pl	S Othello St				1978
5	S Othello & Myrtle	Beacon Ave S	Ranier Ave S	7" PCC			1932
5	S. Othello & Myrtle	Beacon Ave S	37th Ave S	7" RPCC			1937
5	S Othello & Myrtle	Beacon Ave S	Martin Luther King Way	2" ACP	7" PCC		1961
5	S Othello & Myrtle	Martin Luther King Way	Rainer Ave S	8" PCC		6" CSBC	1987
5	S Othello & Myrtle	Beacon Ave S	Martin Luther King Way	1.5" AC Class B	Nonwoven Fabric	.5" AC Class G	1990
6	Swift Ave S	I-5	Beacon Ave S	2" AC	7" PCC		1954
6	Swift Ave S	I-5	Beacon Ave S	1.5" ACP Class B	.5" ACP Class G		1990
7	Spokane St	6th Ave S	I-5	8" PCC			1920
7	Spokane St	6th Ave S	I-5	8" PCC			1926
8	Spokane St	6th Ave S	I-5	8" PCC			1920
8	Spokane St	6th Ave S	I-5	8" PCC			1926
9	6th Ave S	Holgate	Airport Way S	8" PCC			1920
9	6th Ave S	S Forest St	Lander St S	8" PCC			1931
9	6th Ave S	Spokane St	S Lander St	2" ACP Class B	8" PCC	24" Ballast	1970
9	6th Ave S	S Massachusetts St	S Atlantic St	10" PCC		8" CSTC/CSBC	1987
9	6th Ave S	S Massachusetts St	St Atlantic St	11" PCC/ 3" AC		6" CSTC/CSBC	1987
9	6th Ave S	Spokane St	S Lander St	8" PCC			?
10	Airport Way S	5th Ave S	6th Ave S	Brick	6" PCC		1914
11	4th Ave S	Lander St S	Holgate St S	Brick	1" Sand	6" PCC	1920
11	4th Ave S	Spokane St	Holgate St	Brick	1" Sand	6" PCC	1920
11	4th Ave S	Spokane St	Atlantic St	2" AC			1925
11	4th Ave S	Spokane St	Airport Way	8" PCC			1927
11	4th Ave S	Atlantic St	Airport Way S	8" PCC			1930
11	4th Ave S	Spokane St	Airport Way S	8" PCC			1936
12	Fairview Ave N	Denny Way	?	2" AC	1" Binder	5" PCC	1914
12	Fairview Ave N	Denny Way	Valley St	8" PCC			1929
13	Fairview Ave N	Valley St	Eastlake	Wood Plank			1913
13	Fairview Ave N	Valley St	Eastlake	4" Wood Plank			1913
13	Fairview Ave N	Valley St	Eastlake	Wood Plank			1915
13	Fairview Ave N	Valley St	Eastlake	Wood Plank			1915
13	Fairview Ave N	Valley St	Eastlake	4" Wood Planking			1924
13	Fairview Ave N	Valley St	Prospect St				1938
13	Fairview Ave N	Prospect St	Eastlake	8" PCC			1938
13	Fairview Ave N	Prospect St	Nelson Pl	3" AC	1.5" CSTC	4.5" CSBC	1988
13	Fairview Ave N	Yale St	Yale St	3" AC CLass B	2" CSTC	4" CSBC	1991
14	Eastlake	Fairview Ave N	University Bridge	8" PCC			1938
15	Eastlake	Fairview Ave N	E Boston St	Brick	1" Sand	6" PCC	1908
15	Eastlake	E Boston St	University Bridge	2" AC	1" Binder	6" PCC	1908
15	Eastlake	Fairview Ave N	E. Boston St	5" PCC			1940
15	Eastlake	E Boston St	University Bridge	1" AC			1940
15	Eastlake	E Martin St	University Bridge	8" PCC			1946
15	Eastlake	E Hamlin St	E Martin St	2" AC Class B			1982
15	Eastlake	E Lynn St	E Hamlin St	2" AC Class B			1988
16	Roosevelt Way NE	University Bridge	NE Campus Parkway	8" PCC			1920

TABLE 2 - EXISTING ROADWAY STRUCTURAL SECTIONS (cont)

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	Surface "A" Thickness	Surface "B" Thickness	Base Course Thickness	Constr. Year
17	NE Campus Parkway	Roosevelt Way NE	University Way NE	8" PCC			1949
18	University Way NE	NE Campus Parkway	50th Ave NE	3" AC	5" PCC		1908
18	University Way NE	50th Ave NE	Ravenna	2" AC	6" PCC		1912
18	University Way NE	50th Ave NE	Ravenna	7" PCC			1931
18	University Way NE	NE Campus Parkway	50th Ave NE				1940
18	University Way NE	NE 41st St	NE 52nd St	2" AC Class B			1985
19	15th Ave NE	NE 55th	Cowen Place	6" PCC			1920
19	15th Ave NE	NE 63rd	NE 65th	7" PCC			1925
19	15th Ave NE	NE 62nd	NE 65th	6" PCC			1943
20	15th Ave Ne	NE 65th	NE 68th	7" PCC			1925
20	15th Ave NE	NE 65th	NE 68th	6" PCC			1943
20	15th Ave NE	NE 78th	NE 80th	7" PCC			
21	15th Ave NE	NE 80nd St	NE 82nd	7" PCC			
22	15th Ave NE	NE 82nd	NE 85th	9" PCC		6" CSTC	1988
22	15th Ave NE	NE 82nd	NE 85th	7" PCC			
23	15th Ave NE	NE 107th	NE 113th				1968
23	15th Ave NE	NE 116th	NE 117th	10" PCC		6" CSTC	1987
23	15th Ave NE	NE 85th	NE 91st	9" PCC		6" CSTC	1988
25	15th Ave NE	NE 125th	NE 130th	2" AC	6" PCC		1968
26	NE 145 St	15th Ave NE	20th Ave NE	2" AC	6" PCC		1964
26	NE 145th St	15th Ave NE	20th Ave NE				1980
27	20th Ave NE	NE 135th St	NE 145th St	Gravel			
28	NE 135th St	17th Ave NE	20th Ave NE	6" Gravel			1939
31	NE 80th St	15th Ave NE	20th Ave NE	7" PCC			1930
31	NE 80th St	20th Ave NE	Ravenna	6" PCC			1957
32	Ravenna Ave NE	25th Ave NE	NE 82nd	8" PCC			1957
32	Ravenna Ave NE	NE 75th St	25th Ave NE	6" PCC			1957
32	Ravenna Ave NE	NE 82nd St	NE 92nd St	2" AC Class B			1979
33	Lake City Way NE	NE 123rd St	Ne 125th St				1937
33	Lake City Way NE	Ravenna Ave NE	NE 125th St	7" PCC			1938
33	Lake City Way NE	NE 117th St	NE 117th St				1953
33	Lake City Way NE	NE 123rd	NE 127th				1979
34	Lake City Way NE	NE 125th St	NE 145th St	7" PCC			1938
34	Lake City Way NE	NE 125th St	NE 127th St				1979
35	30th Ave NE	NE 125th St	NE 145th St				1967
36	NE 145th St	30th Ave NE	32nd Ave NE	2" AC	6" PCC		1964
36	NE 145th St	30th Ave NE	32nd Ave NE				1981
36	NE 145th St	30th Ave NE	32nd Ave NE				1984
37	32nd Ave NE	NE 137th St	NE 137th St	3" ACP	6" CSTC		1982
37	32nd Ave NE	NE 137th St	NE 140th St	3" AC Class B		6" CSTC	1989
37	32nd Ave NE	NE 143rd St	NE 143rd St	3" ACP	6" CSTC		1990
37	32nd Ave NE			3" AC Class B		6" CSTC	1991
38	NE 137th St	32nd Ave NE	32nd Ave NE	3" ACP		6" CSTC	1982
38	NE 137th St	30th Ave NE	30th Ave NE	3" ACP		6" CSTC	1988
39	NE 125th St	28th Ave NE	28th Ave NE	3" ACP		7" CSTC	1964
39	NE 125th St	30th Ave NE	28th Ave NE	3" ACP		7" CSTC	1967
39	NE 125th St	Roosevelt Way NE	25th Ave NE	2" ACP	7" PCC		1968
39	NE 125th St	25th Ave NE	Lake City Way NE	2" ACP	6" PCC		1968
39	NE 125th St	5th Ave NE	10th Ave NE	10" PCC		6" CSTC	1985
40	5th Ave NE	NE 125th St	NE 130th St	2" ACP	6" PCC		1968
41	Roosevelt Way NE	5th Ave NE	NE 125th St	2" ACP	6" PCC		1968

Traffic ESAL's on each route since the year of construction

Determination of the ESAL's each street had supported was one of the most difficult elements of the project. While the City of Seattle has good records for general traffic volumes on the arterial street system dating back to the late 1920's, there is very little available information regarding specific truck volumes on any street until the mid-1960's. Detailed truck volumes were not available on many of the lower volume arterials at all. As part of this study, detailed truck counts were taken on some of the arterials to further supplement the available data.

The first step in determining the total ESAL's for each street was to attempt to ascertain the percentage of trucks, and what type of truck, each street experienced for each year. In cases where this information was available from count records, it was utilized. When a specific truck count was not available, the truck percentage that had been determined as a function of the average daily traffic (ADT) volumes for that particular street in another year were utilized. If the street had not been counted specifically for trucks, the percentage of trucks on a similar street in the area was utilized to establish truck volumes for the street in question, again based on ADT volumes. It should be noted that specific truck type and volume data was not available for the entire pavement life for many of the streets within the study. This required the methodology cited above for determining ESAL's.

Once the number of trucks had been determined or assumed for each street, and each year, the ESAL's where determined on the basis of the WSDOT W-4 tables. Professor Joe Mahoney of the University of Washington compiled an evaluation of ESAL's for the many different trucks using the WSDOT weigh stations from 1960 to 1983[5]. Prior to 1960,

information that Professor Mahoney has accumulated, but not published, indicates that ESAL's for trucks did not vary greatly. In order to utilize the W-4 tables, all trucks were converted to either single unit (SU) or combination unit (CU) vehicles. This conversion assumed that all trucks with three or more axles were CU vehicles while trucks with 2 axles were classified as SU vehicles. Utilizing these guidelines, the general truck ESAL's could then be determined.

In addition to determining the general truck volumes for each of the arterial streets, it was considered necessary to also gather information specifically related to school buses, fire engines and garbage trucks as these heavy vehicles typically follow a specific route on a relatively common basis. Information was therefore solicited from the Seattle School District for school buses, the Seattle Solid Waste Utility for waste vehicles, and the Seattle Fire Department for fire engines to determine both typical routing and loading. This information, along with the general truck traffic ESAL data outlined above, is summarized in Table 3. Additional detail regarding how the general truck traffic ESAL data was calculated is contained in Table A-1 of Appendix A..

TABLE 3 - STREET ESAL'S

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	1992 Truck ESAL	1991 Truck ESAL	1989 Truck ESAL	1987 Truck ESAL	1985 Truck ESAL	1983 Truck ESAL	1980 Truck ESAL	1976 Truck ESAL	1971 Truck ESAL	1965 Truck ESAL	1960 Truck ESAL	1955 Truck ESAL	1950 Truck ESAL	1944 Truck ESAL
1	Renton Ave S	S 115th St	S Bangor St	29,100	30,900	32,900	28,400	19,700	19,500	23,400	16,400	14,600	11,000	6,300	5,000	2,900	2,500
2	Renton Ave S	S Bangor St	51st Ave S	18,400	23,200	21,200	19,900	14,500	14,500	17,900	16,400	9,000	10,400	7,600	5,000	2,900	2,500
3	51st Ave S	Renton Ave S	S Barton Pl	11,200	11,700	12,000	10,500	8,000	7,200	9,000	7,700	6,000	4,100	3,800	3,800	3,800	2,500
4	Ranier Ave S	S Barton Pl	S Othello St	39,800	39,600	40,000	39,800	32,000	29,000	31,500	24,900	16,900	14,300	14,200	10,000	9,700	8,400
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	24,700	24,700	23,500	23,500	15,500	15,300	20,000	15,900	10,100	7,600	7,200	4,300	3,300	2,900
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	31,200	31,800	30,300	34,700	27,100	25,300	28,800	28,800	20,200	20,300	13,700	8,600	9,100	4,300
7	Swift Ave S	I-5	Beacon Ave S	24,700	20,300	22,900	20,300	17,500	21,600	27,000	28,800	12,400	15,600	14,400	11,500	8,200	5,800
8	Spokane St	6th Ave S	I-5	571,300	568,600	558,200	533,500	364,100	356,900	480,800	366,100	326,600	300,300	272,500	353,500	206,200	191,500
9	Spokane St	4th Ave S	6th Ave S	555,800	563,800	518,600	473,400	341,000	341,000	380,300	295,300	110,700	165,900	279,900	441,900	206,200	191,500
10	6th Ave S	Spokane St	Lander St	544,300	616,800	693,000	638,600	410,200	410,200	225,000	382,600	202,800	159,400	101,000	151,400	144,000	135,300
11	6th Ave S	Lander St	Airport Way S	227,500	337,500	308,400	144,400	152,200	100,600	222,100	176,200	180,900	164,300	147,800	184,700	174,900	165,000
12	Airport Way S	6th Ave S	4th Ave S	152,900	147,200	138,200	259,200	194,200	72,400	91,500	67,800	189,400	162,900	117,000	114,600	112,100	109,700
13	4th Ave S	Spokane St	Airport Way S	195,700	147,700	125,900	109,900	250,700	228,500	324,000	331,000	318,100	340,300	302,200	325,900	394,600	225,200
14	Fairview Ave N	Denny Way	Valley St	106,200	122,200	119,300	104,000	79,000	78,100	92,400	59,600	186,700	218,300	189,600	142,200	170,600	94,800
15	Fairview Ave N	Valley St	Eastlake Ave E	61,700	51,600	59,900	52,300	36,100	40,400	47,300	35,100	25,200	28,100	43,900	38,400	34,800	25,600
16	55th Ave NE	NE 70th St	NE 68th St	4,900	4,900	4,800	4,600	3,300	3,200	4,100	3,100	2,800	2,300	1,400	1,300	1,200	1,100
17	Eastlake Ave E	Fairview Ave N	University Bridge	56,600	57,400	58,800	59,500	47,300	43,800	58,100	35,100	32,600	20,100	51,200	43,900	43,900	23,800
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	108,600	110,800	111,100	111,100	86,500	79,900	97,900	69,800	54,800	41,200	27,500	32,900	71,600	36,600
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	6,200	6,100	6,800	7,000	5,700	5,300	6,100	5,700	4,300	2,900	4,700	2,300	9,600	9,000
20	University Way NE	NE Campus Parkway	15th Ave NE	21,400	21,200	24,000	23,700	19,500	19,300	20,600	16,900	21,900	9,200	9,800	7,400	7,400	7,400
21	15th Ave NE	University Way NE	NE 65th St	20,000	19,600	19,400	21,700	17,700	58,500	84,700	110,900	55,200	67,200	67,600	97,000	29,400	17,600
22	15th Ave NE	NE 65th St	NE 80th St	19,800	20,400	21,700	21,100	19,100	63,200	84,700	60,600	49,100	40,300	64,700	64,700	70,600	17,600
23	15th Ave NE	NE 80th St	NE 125th St	16,500	16,500	17,500	18,300	14,300	47,700	75,600	50,300	115,700	33,600	64,700	50,000	55,900	52,600
24	15th Ave NE	NE 125th St	NE 145th St	33,400	33,800	35,700	35,900	32,600	107,500	160,300	116,500	115,700	47,000	61,700	58,800	29,400	27,700
25	NE 145th St	15th Ave NE	20th Ave NE	70,100	50,900	71,900	67,900	57,900	44,600	50,400	45,300	31,700	16,100	12,600	9,600	9,100	8,600
26	20th Ave NE	NE 145th St	NE 135th St	2,200	2,600	3,300	4,100	2,700	2,900	4,100	2,400	1,900	1,600	1,400	1,300	1,300	1,200
27	NE 135th St	20th Ave NE	17th Ave NE	2,800	2,800	2,700	2,700	2,000	2,000	2,500	1,900	1,500	1,300	1,100	1,000	1,000	900
28	17th Ave NE	NE 135th St	NE 137th St	800	800	800	800	600	600	700	500	400	400	300	300	300	300
29	NE 137th St	17th Ave NE	20th Ave NE	3,300	3,200	3,200	3,100	2,300	2,300	2,900	2,200	1,700	1,500	1,200	1,200	1,100	1,100
30	NE 80th St	15th Ave NE	Ravenna Ave NE	13,300	13,300	13,000	12,400	10,000	9,900	11,200	8,600	5,700	5,000	4,400	4,200	4,000	3,800
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	130,200	128,800	128,800	122,600	80,900	76,600	100,600	69,800	52,200	105,000	72,000	61,700	58,700	55,200
32	Lake City Way NE	Ravenna Ave NE	Northgate	116,300	118,300	123,500	122,900	89,800	86,700	103,100	73,100	53,200	41,600	42,800	35,100	24,600	12,000
33	Lake City Way NE	Northgate	NE 125th St	131,700	128,800	132,700	131,700	96,200	94,100	87,400	78,000	59,600	43,500	42,800	3,800	3,700	3,400
34	Lake City Way NE	NE 125th St	NE 145th St	123,800	126,100	131,700	125,800	90,300	86,700	108,400	73,900	62,100	47,300	46,200	41,000	39,000	36,600
35	30th Ave NE	NE 125th St	NE 145th St	23,400	23,400	24,200	23,000	18,500	18,200	18,700	12,100	5,500	6,300	5,600	5,300	5,000	4,700
36	NE 145th St	30th Ave NE	32nd Ave NE	76,200	73,400	71,900	67,900	57,900	44,600	50,400	36,900	31,700	16,100	12,600	9,600	9,100	8,600
37	32nd Ave NE	145th Ave NE	NE 137th St	3,300	3,300	3,300	3,200	2,400	2,300	3,000	2,300	1,700	1,500	1,300	1,200	1,100	1,100
38	NE 137th St	32nd Ave NE	30th Ave NE	3,600	3,500	3,400	3,400	2,500	2,500	3,200	2,400	1,900	1,600	1,400	1,300	1,200	1,100
39	NE 125th St	Roosevelt	15th Ave NE	44,700	43,500	43,700	40,500	26,600	26,600	31,300	25,100	18,400	7,900	5,300	7,000	6,700	6,300
40	NE 125th St	15th Ave NE	Lake City Way	34,300	39,300	39,100	38,200	24,600	24,600	31,300	22,300	11,800	11,900	9,900	9,400	8,900	8,400
41	5th Ave NE	NE 125th St	NE 130th St	46,900	49,000	49,000	43,900	33,500	33,500	34,700	23,500	25,700	16,500	18,900	16,200	15,400	14,500
42	Roosevelt Way NE	5th Ave NE	NE 125th St	98,700	95,900	96,400	89,500	69,300	69,300	77,900	14,400	11,100	2,300	5,600	4,600	4,400	4,100

For additional detail, see Table A-1 in Appendix A.

TABLE 3 - STREET ESAL'S

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	1941 Truck ESAL	1937 Truck ESAL	1930 Truck ESAL	1928 Truck ESAL	'50-'92 Truck ESAL	Const-'50 Truck ESAL	Const. Year	TOTAL TRUCK ESAL	ONE-WAY TRUCK ESAL	TOTAL OTHER Trucks	TOTAL BUS ESAL	TOTAL ESAL
1	Renton Ave S	S 115th St	S Bangor St	5,000	1,700	1,300	1,300	661,900	54,000	1927	715,900	358,000	40,400	528,900	927,300
2	Renton Ave S	S Bangor St	51st Ave S	5,000	1,700	1,300	1,300	525,700	54,000	1927	579,700	289,900	56,900	501,900	848,700
3	51st Ave S	Renton Ave S	S Barton Pl	2,400	2,300	2,200	2,100	282,800	55,700	1916	363,700	181,900	8,000	369,700	559,600
4	Ranier Ave S	S Barton Pl	S Othello St	6,300	2,700	5,800	4,800	954,300	134,700	1924	1,146,600	573,300	43,700	1,730,100	2,347,100
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	5,800	600	600	600	542,000	49,900	1987	144,600	72,300	47,200	1,033,100	1,152,600
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	4,300	1,100	1,000	1,000	929,700	69,200	1932	998,900	499,500	82,900	1,033,100	1,615,500
7	Swift Ave S	I-5	Beacon Ave S	2,900	2,800	2,600	2,500	768,800	90,500	1954	729,400	364,700		1,037,800	1,402,500
8	Spokane St	6th Ave S	I-5	184,100	92,800	92,800	76,800	15,936,100	3,129,500	1926	19,219,200	9,609,600	52,100	478,800	10,140,500
9	Spokane St	4th Ave S	6th Ave S	184,100	134,000	92,800	76,800	13,507,600	3,356,100	1926	17,017,300	8,508,700	52,100	1,243,600	9,804,400
10	6th Ave S	Spokane St	Lander St	131,200	126,200	117,700	115,300	12,410,300	2,484,200	1931	14,894,500	7,447,300		813,500	8,260,800
11	6th Ave S	Lander St	Airport Way S	160,100	153,900	143,600	140,600	7,932,600	3,460,800	1920	12,518,200	6,259,100		813,500	7,072,600
12	Airport Way S	6th Ave S	4th Ave S	107,300	158,800	70,200	83,300	5,812,800	2,478,100	1914	9,457,100	4,728,600		2,425,200	7,153,800
13	4th Ave S	Spokane St	Airport Way S	397,000	281,900	201,200	162,800	12,407,100	6,205,400	1927	18,775,300	9,387,700		4,061,500	13,449,200
14	Fairview Ave N	Denny Way	Valley St	154,100	135,300	59,100	35,600	6,055,100	2,523,500	1929	8,543,000	4,271,500		869,400	5,140,900
15	Fairview Ave N	Valley St	Eastlake Ave E	30,200	20,100	29,300	39,300	1,677,700	340,400	1938	2,018,100	1,009,100		883,100	1,892,200
16	55th Ave NE	NE 70th St	NE 68th St	1,100	1,100	1,000	1,000	121,000	24,000		145,000	72,500			72,500
17	Eastlake Ave E	Fairview Ave N	University Bridge	35,700	28,200	37,200	34,700	1,848,500	388,200	1938	2,236,700	1,118,400		3,113,800	4,232,200
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	56,700	54,500	46,300	40,000	2,813,100	1,446,100	1920	4,259,200	2,129,600		3,691,300	5,820,900
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	8,700	8,400	7,800	7,700	216,300	9,300	1949	225,600	112,800		4,320,400	4,433,200
20	University Way NE	NE Campus Parkway	15th Ave NE	6,200	6,200	7,300	7,700	670,200	275,100	1912	945,300	472,700		3,551,000	4,023,700
21	15th Ave NE	University Way NE	NE 65th St	23,500	22,600	21,100	20,600	2,688,300	551,300	1925	3,239,600	1,619,800		3,312,600	4,932,400
22	15th Ave NE	NE 65th St	NE 80th St	17,600	16,900	15,800	15,500	2,226,800	578,700	1925	2,805,500	1,402,800		1,662,200	3,065,000
23	15th Ave NE	NE 80th St	NE 125th St	51,100	49,100	46,400	45,500	1,273,100		1968	1,273,100	636,600		1,012,600	1,649,200
24	15th Ave NE	NE 125th St	NE 145th St	26,900	25,800	24,000	23,600	2,196,800		1968	2,196,800	1,098,400		598,300	1,696,700
25	NE 145th St	15th Ave NE	20th Ave NE	8,300	8,000	7,500	7,300	1,296,100		1964	1,296,100	648,100		1,497,100	2,145,200
26	20th Ave NE	NE 145th St	NE 135th St	1,100	1,100	1,000	1,000	96,000	24,700		120,700	60,400	10,400	643,000	713,800
27	NE 135th St	20th Ave NE	17th Ave NE	900	800	800	800	73,900	19,000		92,900	46,500		614,400	660,900
28	17th Ave NE	NE 135th St	NE 137th St	300	200	200	200	21,200	5,500		26,700	13,400		614,400	627,800
29	NE 137th St	17th Ave NE	20th Ave NE	1,000	1,000	900	900	85,100	22,200		107,300	53,700		321,400	375,100
30	NE 80th St	15th Ave NE	Ravenna Ave NE	3,700	3,500	3,300	3,200	325,200	72,900	1930	398,100	199,100		900,500	1,099,600
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	53,500	51,500	48,000	47,000	3,155,300		1957	3,155,300	1,577,700		756,600	2,334,300
32	Lake City Way NE	Ravenna Ave NE	Northgate	11,600	11,200	10,400	10,200	2,904,300	179,400	1938	3,083,700	1,541,900	84,600	645,100	2,271,600
33	Lake City Way NE	Northgate	NE 125th St	3,300	3,200	3,000	2,900	2,812,000	41,100	1938	2,853,100	1,426,600	84,600	645,100	2,156,300
34	Lake City Way NE	NE 125th St	NE 145th St	35,600	34,200	31,900	31,200	3,135,500	439,800	1938	3,575,300	1,787,700	84,600	1,328,900	3,201,200
35	30th Ave NE	NE 125th St	NE 145th St	4,600	4,400	4,100	4,000	498,900	98,900		597,800	298,900	14,600	673,200	986,700
36	NE 145th St	30th Ave NE	32nd Ave NE	8,300	8,000	7,500	7,300	1,352,400		1961	1,352,400	676,200		744,100	1,420,300
37	32nd Ave NE	145th Ave NE	NE 137th St	1,100	1,000	900	900	32,700		1982	32,700	16,400		315,300	331,700
38	NE 137th St	32nd Ave NE	30th Ave NE	1,100	1,100	1,000	1,000	34,600		1982	34,600	17,300		314,400	331,700
39	NE 125th St	Roosevelt	15th Ave NE	6,100	5,900	5,500	5,300	865,200	132,300		997,500	498,800	74,100	971,400	1,544,300
40	NE 125th St	15th Ave NE	Lake City Way	8,100	7,800	7,300	7,100	837,200	175,700		1,012,900	506,500	74,100	971,400	1,552,000
41	5th Ave NE	NE 125th St	NE 130th St	14,000	13,500	12,600	12,300	836,200		1968	836,200	418,100		230,600	648,700
42	Roosevelt Way NE	5th Ave NE	NE 125th St	4,000	3,800	3,600	3,500	1,359,500		1968	1,359,500	679,800		23,100	702,900

For additional detail, see Table A-1 in Appendix A.

Existing Bus Loadings

Metro provided information regarding the individual axle weights for each of the vehicles in their fleet. From this information, bus loading charts were prepared documenting axle loads for each type of bus in the Metro fleet, based on the passenger loading (the bus loading charts are included in Appendix B). Metro also provided information regarding average passenger loadings, the number of buses on an average day, and the type of bus for all the streets in the study. This information was based on bus ridership in the spring of 1992. From this data, the total ESAL's that the buses generated was determined for each of the streets under consideration.

Once the existing bus ESAL's were determined for each street, it was necessary to try and project the data back to the original date of construction. This was done by making several assumptions. These assumptions are: From 1980 to the present, the ESAL loading has remained constant for each year, from 1960 to 1980 it was assumed that the ESAL loading was 60% of the 1992 loading, from 1950 to 1960 it was assumed that the ESAL loading was 20% of the 1992 loading, and prior to 1950, it was assumed that the ESAL loading was insignificant. These assumptions are based on very general knowledge of the past history of the transit system and its ridership volumes. Additional data on these assumptions would be desirable to further refine the analysis.

Approximate Soil Conditions

Approximate soil conditions were determined for each street by reviewing soil boring information from the City of Seattle Records Vault. California Bearing Ratio's (CBR's) were determined based on the boring information and this information was used to determine k-values for the rigid pavements and M_r values for the flexible pavements.

While rigid pavements are not generally very sensitive to subgrade k-values, the response of flexible pavements to heavy traffic axle loadings can be influenced by the M_r value. Past experience with estimating subgrade values from soil borings provides some assurance that the assumptions made herein are reasonable.

Existing Pavement Conditions

Existing pavement conditions were determined by accessing the City of Seattle Pavement Management System (PMS) and utilizing the information contained therein for each street to determine the existing conditions. The Seattle PMS assigns values of between 0 to 100 for each street, rough correlations to the AASHTO system of pavement serviceability indexes necessary to utilize the 1986 AASHTO design equations are as follows:

PCR=100	P_t=4.5
PCR=75	P_t=3.5
PCR=50	P_t=2.5
PCR=25	P_t=1.5

These correlations are important in determining how well the theoretical AASHTO design equations are predicting field performance of the Seattle urban pavements. It was assumed for the purposes of this study that a P_t of 2.5 would represent the point where pavement rehabilitation is desirable.

PAVEMENT ANALYSIS

Once the data identified above was compiled, it was necessary to conduct the analysis and determine the magnitude of damage that the individual categories of vehicles were inducing. The pavement analysis attempted to compare the theoretical maximum allowable ESAL's the pavement could withstand based on the 1986 AASHTO Guide for Design of Pavement Structures versus the calculated number of ESAL's the roadway had already accumulated. The PCC pavement analysis results are included in Table 4.

TABLE 4

RIGID PAVEMENT DESIGN EVALUATION (Based on '86 AASHTO methodology)

Link #	Street Name	k (pci)	Ec (psi)	S'c (psi)	J	Cd	So	R (%)	Zr	Po	Pt	Delta P	PAVEMENT DEPTH (in)	ALLOWABLE ESAL's	ACTUAL TOTAL ESAL'S
1	Renton Ave S	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,534,673	927,300
2	Renton Ave S	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,534,673	848,700
3	51st Ave S	180	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,691,529	559,600
4	Rainier Ave S	125	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,233,453	2,347,100
5	S Othello & Myrtle St	200	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,786,078	1,152,600
6	S Othello & Myrtle St	200	5,650,000	650	3.2	1	0.34	85	-1.037	4.5	2.5	2	7	3,180,068	1,615,500
7	Swift Ave S	180	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,691,529	1,402,500
8	Spokane St	125	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,233,453	10,140,500
9	Spokane St	125	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,233,453	9,804,400
10	6th Ave S	125	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,233,453	8,260,800
11	6th Ave S	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,351,058	7,072,600
12	Airport Way S	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,351,058	7,153,800
13	4th Ave S	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,351,058	13,449,200
14	Fairview Ave N	180	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,646,155	5,140,900
15	Fairview Ave N	180	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,646,155	1,892,200
17	Eastlake Ave E	250	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	4,120,332	4,232,200
18	Roosevelt Way NE	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,351,058	5,820,900
19	NE Campus Parkway	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,351,058	4,433,200
20	University Way NE	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	5	250,539	4,023,700
21	15th Ave NE	140	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	6	661,828	4,932,400
22	15th Ave NE	200	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,766,808	3,065,000
23	15th Ave NE	200	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,766,808	1,649,200
24	15th Ave NE	200	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	6	782,607	1,696,700
25	NE 145th St	180	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	6	742,984	2,145,200
30	NE 80th St	180	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,691,529	1,099,600
30	NE 80th St	180	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	6	742,984	1,099,600
31	Ravenna Ave NE	180	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	8	3,646,155	2,334,300
32	Lake City Way NE	290	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	2,090,332	2,271,600
33	Lake City Way NE	290	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	2,090,332	2,156,300
34	Lake City Way NE	250	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,948,918	3,201,200
36	NE 145th St	250	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	6	880,214	1,420,300
39	NE 125th St	250	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,948,918	1,544,300
40	NE125th St	250	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	7	1,948,918	1,552,000
40	NE 125th St	290	5,650,000	650	3.8	1	0.34	85	-1.037	4.5	2.5	2	6	513,318	1,552,000
41	5th Ave NE	180	5,650,000	650	3.2	1	0.34	85	-1.037	4.5	2.5	2	6	716,795	648,700
42	Roosevelt Way NE	230	5,650,000	650	3.2	1	0.34	85	-1.037	4.5	2.5	2	6	811,688	702,900

When conducting the PCC pavement analysis documented in Table 4, several assumptions were made. The assumptions not discussed elsewhere consist of the following:

- E_C, or the Modulus of Elasticity, for the portland cement concrete (PCC) pavements was assumed to be 5,650,000 psi based on information from the SED Materials Laboratory.

- S'_C, or the Modulus of Rupture, for the PCC pavements was assumed to be 650 psi based on information from the SED Materials Laboratory.

- J, or the Load Transfer Coefficient, was assumed to be 3.8 for the non-doweled PCC pavements and 3.2 for the doweled PCC pavements, based on recommendations in the 1986 AASHTO Guide for Design of Pavement Structures.
- C_d, or the Drainage Coefficient, was assumed to be 1.00 because of the generally silty soils that most of the streets were based upon as well as the assumption that significant moisture is present at least 25% of the time.
- S_O, or the Overall Standard Deviation, was assumed to be .34 for rigid pavements and .44 for flexible pavements, based on recommendations in the 1986 AASHTO Guide for Design of Pavement Structures.
- R, or the Reliability Level, was assumed to be 85% based on past experience and recommendations in the 1986 AASHTO Guide for Design of Pavement Structures.

Analysis for the few asphalt concrete streets in the study was also conducted using the AASHTO Design Equations. The evaluation for the AC pavements is included in Table 5.

TABLE 5
FLEXIBLE PAVEMENT EVALUATION (Based on '86 AASHTO methodology)

Link #	Street Name	Mr (psi)	a1	D1	a2	D2	m2	a3	D3	m3	SN	Po	Pt	Delta P	ALLOWABLE ESAL's	ACTUAL TOTAL ESAL'S	
26	20th Ave NE	12,000	0.39	3.5	0.13	4	1		0		1.885	4.2	2.5	1.7	288,043	713,800	
27	NE 135th St	12,000	0.39	1	0.13	6	1		0		1.17	4.2	2.5	1.7	21,524	660,900	
28	17th Ave NE	12,000	0.39	1	0.13	6	1		0		1.17	4.2	2.5	1.7	21,524	627,800	Note 1
29	NE 137th St	12,000	0.39	2	0.13	4	1		0		1.3	4.2	2.5	1.7	36,813	375,100	
35	30th Ave NE	30,000	0.39	5	0.13	0	1		0		1.95	4.2	2.5	1.7	2,942,098	986,700	
37	32nd Ave NE	30,000	0.39	3	0.13	4	1		0		1.69	4.2	2.5	1.7	1,288,283	331,700	
38	NE 137th St	30,000	0.39	3	0.13	6	1		0		1.95	4.2	2.5	1.7	2,942,098	331,700	

Where: Note 1: Estimate regarding pavement section, based on other streets in the area.

When conducting the AC pavement analysis documented in Table 5, several assumptions were made. Those assumptions are briefly outlined below:

- Mr, or subgrade resilient modulus, was based on the available boring information and/or NDT testing.
- a1, represents the first layer's structural layer coeffiecent. The City of Seattle typically uses a value of 0.39 for asphalt concrete.
- D1 is the thickness, in inches of the first structural layer.
- a2, represents the second layer's structural coefficient. This material is often a crushed rock material which for which the City of Seattle utulizes a structural coefficient of 0.13. In some instances this material is asphalt treated base for which the City of Seattle estimates a structural coefficient of 0.27.
- D2 is the thickness, in inches, of the second structural layer.
- M2 is the drainage coefficient of the third pavement section layer.
- a3, D3, and M3 are repetitions of a2, D2, and M2.
- M3 is the drainage coefficient of the third pavement section layer.
- SN is the pavement sections structural number based on the equation:

SN=a1*D1+a2*D2*M2+a3*D3*M3

- Po is the initial serviceablitiy index at completion of original construction (assumed to be 4.2, based on Seattle experience).
- Pt is the terminal serviceability index where the pavement would require reconstruction or major maintenance (Seattle typically assumes this to occur at a rating of about 1.7).
- Delta P is the total change in serviceablity index determined as follows:

  Delta P=Po-Pt
- Allowable ESAL's is the calculated allowable ESAL's for the street in question based on the AASHTO equation shown on page I-5 of the guide.

Results of Pavement Evaluations

The focus of the pavement evaluations consisted of evaluating the effects that overweight buses were having on the City streets. To do this, each street was evaluated using the AASHTO Design Equations and the remaining ESAL's was used to help determine the approximate number of years of remaining life for the pavement before reconstruction or rehabilitation was necessary. The remaining life analysis was conducted using several different future scenarios consisting of the following:

- Both truck and bus loadings continuing at their present pace.
- Both truck and bus loadings increasing at 1 percent per year (consistent with general traffic growth in the Seattle area).
- Elimination of buses in their entirety, but truck loadings continuing at their present pace.
- Lastly, bus loadings being reduced to meet the legal axle load limits and truck loadings continuing at their present pace.

For each scenario, the difference between the theoretical maximum allowable ESAL's versus the calculated number of ESAL's the roadway had experienced was divided by the ESAL's per year for each assumed scenario to approximate the remaining life. The results of this evaluation are included in Table 6 for the PCC pavements and Table 7 for the AC pavements. As is illustrated in the tables, reducing the buses to the legal axle loading rates would generally have a marginal impact on the rate of pavement deteriation.

TABLE 6

RIGID PAVEMENT REMAINING LIFE EVALUATION (Based on '86 AASHTO methodology)

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	Allowable ESAL's	Actual Total ESAL'S	Remaining ESAL's	'92 Truck ESAL's	'92 Bus ESAL's	Bus @ Legal Axle Load (ESAL's)	#1	#2	#3
1	Renton Ave S	S 115th St	S Bangor St	1,534,673	927,300	607,373	29,133	20,342	16,906	12	11	13
2	Renton Ave S	S Bangor St	51st Ave S	1,534,673	848,700	685,973	18,426	19,302	15,870	18	15	20
3	51st Ave S	Renton Ave S	S Barton Pl	1,691,529	559,600	1,131,929	11,205	32,586	28,834	26	21	28
4	Rainier Ave S	S Barton Pl	S Othello St	3,233,453	2,347,100	886,353	39,831	66,542	58,310	8	7	9
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	3,786,078	1,152,600	2,633,478	24,696	39,736	31,946	41	30	46
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	3,180,068	1,615,500	1,564,568	31,164	39,736	31,946	22	18	25
7	Swift Ave S	I-5	Beacon Ave S	1,691,529	1,402,500	289,029	24,696	39,915	31,907	4	4	5
8	Spokane St	4th Ave S	I-5	8,149,394	10,140,500	-1,991,106	571,261	18,416	17,540	0	0	0
9	Spokane St	4th Ave S	6th Ave S	8,149,394	9,804,400	-1,655,006	555,836	47,829	46,015	0	0	0
10	6th Ave S	Spokane St	Lander St	3,233,453	8,260,800	-5,027,347	544,275	31,287	31,287	0	0	0
11	6th Ave S	Lander St	Airport Way S	3,351,058	7,072,600	-3,721,542	227,507	31,287	31,287	0	0	0
12	Airport Way S	6th Ave S	4th Ave S	3,351,058	7,153,800	-3,802,742	152,929	88,269	89,625	0	0	0
13	4th Ave S	Spokane St	Airport Way S	3,351,058	13,449,200	-10,098,142	195,696	156,210	153,335	0	0	0
14	Fairview Ave N	Denny Way	Valley St	3,646,155	5,140,900	-1,494,745	106,215	33,439	25,839	0	0	0
15	Fairview Ave N	Valley St	Eastlake Ave E	3,646,155	1,892,200	1,753,955	61,662	33,966	31,598	18	15	19
17	Eastlake Ave E	Fairview Ave N	University Bridge	4,120,332	4,232,200	-111,868	56,643	119,762	101,894	0	0	0
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	3,351,058	5,820,900	-2,469,842	108,626	141,937	111,402	0	0	0
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	3,351,058	4,433,200	-1,082,142	6,176	166,169	139,090	0	0	0
20	University Way NE	NE Campus Parkway	15th Ave NE	250,539	4,023,700	-3,773,161	21,414	136,575	105,105	0	0	0
21	15th Ave NE	University Way NE	NE 65th St	661,828	4,932,400	-4,270,572	20,016	127,408	108,677	0	0	0
22	15th Ave NE	NE 65th St	NE 80th St	1,766,808	3,065,000	-1,298,192	19,808	63,933	54,220	0	0	0
23	15th Ave NE	NE 80th St	NE 125th St	3,180,068	1,649,200	1,530,868	16,472	36,224	33,533	28	32	31
24	15th Ave NE	NE 125th St	NE 145th St	782,607	1,696,700	-914,093	33,360	31,173	28,140	0	0	0
25	NE 145th St	15th Ave NE	20th Ave NE	742,984	2,145,200	-1,402,216	70,140	60,367	53,765	0	0	0
30	NE 80th St	15th Ave NE	20th Ave NE	1,691,529	1,099,600	591,929	13,325	34,635	30,025	12	11	14
30	NE 80th St	20th Ave NE	Ravenna Ave NE	742,984	1,099,600	-356,616	13,325	34,635	30,025	0	0	0
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	3,646,155	2,334,300	1,311,855	130,209	30,757	25,771	8	7	8
32	Lake City Way NE	Ravenna Ave NE	Northgate	2,090,332	2,271,600	-181,268	116,289	25,392	19,321	0	0	0
33	Lake City Way NE	Northgate	NE 125th St	2,090,332	2,156,300	-65,968	131,729	25,392	19,321	0	0	0
34	Lake City Way NE	NE 125th St	NE 145th St	1,948,918	3,201,200	-1,252,282	123,845	51,108	40,672	0	0	0
36	NE 145th St	30th Ave NE	32nd Ave NE	880,214	1,420,300	-540,086	76,152	34,455	31,101	0	0	0
39	NE 125th St	Roosevelt	15th Ave NE	1,948,918	1,544,300	404,618	44,730	50,594	43,768	4	3	5
40	NE125th St	NE 15th Ave	25th Ave NE	1,948,918	1,552,000	396,918	34,304	50,594	43,768	5	4	5
40	NE 125th St	25th Ave NE	Lake City Way	513,318	1,552,000	-1,038,682	34,304	50,594	43,768	0	0	0
41	5th Ave NE	NE 125th St	NE 130th St	396,243	646,700	-250,457	46,920	12,011	11,508	0	0	0
42	Roosevelt Way NE	5th Ave NE	NE 125th St	450,964	702,900	-251,936	98,726	1,211	1,152	0	0	0

#1. Life Remainging at '92 Rates = (Remaining ESAL's)/('92 Truck ESAL's + '92 Bus ESAL's)

#2. Life Remaing at 1% per year growth = (Remaining ESAL's)/('92 Truck ESAL's + '92 Bus ESAL's, both increasing at 1

#3. Life Remaining if Buses met Legal Axle Loads = (Remaining ESAL's)/('92 Truck ESAL's + Bus at Legal Axle Load)

TABLE 7

FLEXIBLE PAVEMENT REMAINING LIFE EVALUATION (Based on '86 AASHTO methodology)

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	Allowable ESAL's	Actual Total ESAL'S	Remaining ESAL's	'92 Truck ESAL's	'92 Bus ESAL's	Bus @ Legal Axle Load (ESAL's)	#1	#2	#3
26	20th Ave NE	NE 145th St	NE 135th St	288,043	713,800	-425,757	2,206	26,792	23,390	0	0	0
27	NE 135th St	20th Ave NE	17th Ave NE	21,524	660,900	-639,376	2,805	25,601	22,251	0	0	0
28	17th Ave NE	NE 135th St	NE 137th St	21,524	627,800	-606,276	816	25,601	22,251	0	0	0
29	NE 137th St	17th Ave NE	20th Ave NE	36,813	375,100	-338,287	3,264	26,787	23,400	0	0	0
35	30th Ave NE	NE 129th St	NE 145th St	2,942,098	986,700	1,955,398	23,400	28,050	23,442	38	88	42
37	32nd Ave NE	145th Ave NE	NE 137th St	1,288,283	331,700	956,583	3,315	26,273	22,584	32	25	37
38	NE 137th St	32nd Ave NE	30th Ave NE	2,942,098	331,700	2,610,398	3,557	26,197	22,646	88	48	100

#1. Life Remainging at '92 Rates = (Remaining ESAL's)/('92 Truck ESAL's + '92 Bus ESAL's)

#2. Life Remaing at 1% per year growth = (Remaining ESAL's)/('92 Truck ESAL's + '92 Bus ESAL's, both increasin

#3. Life Remaining if Buses met Legal Axle Loads = (Remaining ESAL's)/('92 Truck ESAL's + Bus at Legal Axle Lo

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[3] "Effects of Variable Tire Pressure on Road Surfacings" and "Truck Operation at Constant Reduced Tire Pressure", Number 1291, Volume 2, Transportation Research Board, Washington, D.C., 1991.

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APPENDIX A
ESAL DEVELOPMENT

ESAL EVALUATION

The methodology utilized in determining the general truck ESAL's has been outlined in the body of the text. The following Table A-1 provides additional detail regarding the truck volumes utilized in the analysis of each roadway, the split between SU and CU vehicles used, and the ESAL value which was applied to each truck classification. Those streets for which manual counts were available are identified with shading in the cell, all other values are based on either interpolating or extrapolating from available counts in other years. When a particular street had no available truck counts, the percentage of trucks on a similar street in the area was utilized to establish truck volumes for the street of interest.

TABLE A-1

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	1992	%SU	%CU	SU Equiv	CU Equiv	Total '92 ESAL	1991	%SU	%CU	SU Equiv	CU Equiv	Total '91 ESAL	1989	%SU	%CU	SU Equiv	CU Equiv	Total '89 ESAL
1	Renton Ave S	S 115th St	S Bangor St	11,700	1.4	0.4	0.25	1.2	29,133	12,400	1.4	0.4	0.25	1.2	30,876	13,200	1.4	0.4	0.25	1.2	32,868
2	Renton Ave S	S Bangor St	51st Ave S	7,400	1.4	0.4	0.25	1.2	18,426	9,300	1.4	0.4	0.25	1.2	23,157	8,500	1.4	0.4	0.25	1.2	21,165
3	51st Ave S	Renton Ave S	S Barton Pl	4,500	1.4	0.4	0.25	1.2	11,205	4,700	1.4	0.4	0.25	1.2	11,703	4,800	1.4	0.4	0.25	1.2	11,952
4	Ranier Ave S	S Barton Pl	S Othello St	18,700	1.4	0.3	0.25	1.2	39,831	18,600	1.4	0.3	0.25	1.2	39,618	18,800	1.4	0.3	0.25	1.2	40,044
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	8,400	2	0.4	0.25	1.2	24,696	8,400	2	0.4	0.25	1.2	24,696	8,000	2	0.4	0.25	1.2	23,520
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	10,600	2	0.4	0.25	1.2	31,164	10,300	2	0.44	0.25	1.2	31,765	10,300	2	0.4	0.25	1.2	30,282
7	Swift Ave S	I-5	Beacon Ave S	8,400	2	0.4	0.25	1.2	24,696	6,900	2	0.4	0.25	1.2	20,286	7,800	2	0.4	0.25	1.2	22,932
8	Spokane St	6th Ave S	I-5	21,480	5.7	6.2	0.25	1.2	571,261	21,380	5.7	6.2	0.25	1.2	568,601	20,990	5.7	6.2	0.25	1.2	558,229
9	Spokane St	4th Ave S	6th Ave S	20,900	5.7	6.2	0.25	1.2	555,836	21,200	5.7	6.2	0.25	1.2	563,814	19,500	5.7	6.2	0.25	1.2	518,603
10	6th Ave S	Spokane St	Lander St	15,000	7.1	8.6	0.25	1.2	544,275	17,000	7.1	8.6	0.25	1.2	616,845	19,100	7.1	8.6	0.25	1.2	693,044
11	6th Ave S	Lander St	Airport Way S	6,270	7.1	8.6	0.25	1.2	227,507	9,300	7.1	8.6	0.25	1.2	337,451	8,500	7.1	8.6	0.25	1.2	308,423
12	Airport Way S	6th Ave S	4th Ave S	5,090	19.9	4.2	0.25	1.2	152,929	4,900	19.9	4.2	0.25	1.2	147,221	4,600	19.9	4.2	0.25	1.2	138,207
13	4th Ave S	Spokane St	Airport Way S	26,900	4.9	1	0.25	1.2	195,698	20,300	4.9	1	0.25	1.2	147,683	17,300	4.9	1	0.25	1.2	125,858
14	Fairview Ave N	Denny Way	Valley St	14,600	4.9	1	0.25	1.2	106,215	16,800	4.9	1	0.25	1.2	122,220	16,400	4.9	1	0.25	1.2	119,310
15	Fairview Ave N	Valley St	Eastlake Ave E	17,200	1.9	0.6	0.25	1.2	61,662	14,400	1.9	0.6	0.25	1.2	51,624	16,700	1.9	0.6	0.25	1.2	59,870
16	55th Ave NE	NE 70th St	NE 68th St	1,930	1	0.5	0.25	1.2	4,922	1,920	1	0.5	0.25	1.2	4,896	1,890	1	0.5	0.25	1.2	4,820
17	Eastlake Ave E	Fairview Ave N	University Bridge	15,800	1.9	0.6	0.25	1.2	56,643	16,000	1.9	0.6	0.25	1.2	57,360	16,400	1.9	0.6	0.25	1.2	58,794
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	30,300	1.9	0.6	0.25	1.2	108,626	30,900	1.9	0.6	0.25	1.2	110,777	31,000	1.9	0.6	0.25	1.2	111,135
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	7,625	0.6	0.1	0.25	1.2	6,176	7,550	0.6	0.1	0.25	1.2	6,116	8,400	0.6	0.1	0.25	1.2	6,804
20	University Way NE	NE Campus Parkway	15th Ave NE	8,300	2	0.3	0.25	1.2	21,414	8,200	2	0.3	0.25	1.2	21,156	9,300	2	0.3	0.25	1.2	23,994
21	15th Ave NE	University Way NE	NE 65th St	9,600	2.3	0.1	0.25	1.2	20,016	9,400	2.3	0.1	0.25	1.2	19,599	9,300	2.3	0.1	0.25	1.2	19,391
22	15th Ave NE	NE 65th St	NE 80th St	9,500	2.3	0.1	0.25	1.2	19,808	9,800	2.3	0.1	0.25	1.2	20,433	10,400	2.3	0.1	0.25	1.2	21,684
23	15th Ave NE	NE 80th St	NE 125th St	7,900	2.3	0.1	0.25	1.2	16,472	7,900	2.3	0.1	0.25	1.2	16,472	8,400	2.3	0.1	0.25	1.2	17,514
24	15th Ave NE	NE 125th St	NE 145th St	16,000	2.3	0.1	0.25	1.2	33,360	16,200	2.3	0.1	0.25	1.2	33,777	17,100	2.3	0.1	0.25	1.2	35,654
25	NE 145th St	15th Ave NE	20th Ave NE	28,000	1.9	0.3	0.25	1.2	70,140	20,300	1.9	0.3	0.25	1.2	50,852	28,700	1.9	0.3	0.25	1.2	71,894
26	20th Ave NE	NE 145th St	NE 135th St	865	1	0.5	0.25	1.2	2,206	1,010	1	0.5	0.25	1.2	2,576	1,300	1	0.5	0.25	1.2	3,315
27	NE 135th St	20th Ave NE	17th Ave NE	1,100	1	0.5	0.25	1.2	2,805	1,090	1	0.5	0.25	1.2	2,780	1,070	1	0.5	0.25	1.2	2,729
28	17th Ave NE	NE 135th St	NE 137th St	320	1	0.5	0.25	1.2	816	320	1	0.5	0.25	1.2	816	310	1	0.5	0.25	1.2	791
29	NE 137th St	17th Ave NE	20th Ave NE	1,280	1	0.5	0.25	1.2	3,264	1,270	1	0.5	0.25	1.2	3,239	1,240	1	0.5	0.25	1.2	3,162
30	NE 80th St	15th Ave NE	Ravenna Ave NE	2,350	4.2	0.7	0.25	1.2	13,325	2,340	4.2	0.7	0.25	1.2	13,268	2,300	4.2	0.7	0.25	1.2	13,041
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	7,180	2.1	4.6	0.25	1.2	130,209	7,100	2.1	4.6	0.25	1.2	128,759	7,100	2.1	4.6	0.25	1.2	128,759
32	Lake City Way NE	Ravenna Ave NE	Northgate	35,400	1.5	0.6	0.25	1.2	116,289	36,000	1.5	0.6	0.25	1.2	118,260	37,600	1.5	0.6	0.25	1.2	123,516
33	Lake City Way NE	Northgate	NE 125th St	40,100	1.5	0.6	0.25	1.2	131,729	39,200	1.5	0.6	0.25	1.2	128,772	40,400	1.5	0.6	0.25	1.2	132,714
34	Lake City Way NE	NE 125th St	NE 145th St	37,700	1.5	0.6	0.25	1.2	123,845	38,400	1.5	0.6	0.25	1.2	126,144	40,100	1.5	0.6	0.25	1.2	131,729
35	30th Ave NE	NE 125th St	NE 145th St	6,000	2.8	0.5	0.25	1.2	23,400	6,000	2.8	0.5	0.25	1.2	23,400	6,200	2.8	0.5	0.25	1.2	24,180
36	NE 145th St	30th Ave NE	32nd Ave NE	30,400	1.9	0.3	0.25	1.2	76,152	29,300	1.9	0.3	0.25	1.2	73,397	28,700	1.9	0.3	0.25	1.2	71,894
37	32nd Ave NE	145th Ave NE	NE 137th St	1,300	1	0.5	0.25	1.2	3,315	1,290	1	0.5	0.25	1.2	3,290	1,290	1	0.5	0.25	1.2	3,290
38	NE 137th St	32nd Ave NE	30th Ave NE	1,395	1	0.5	0.25	1.2	3,557	1,380	1	0.5	0.25	1.2	3,519	1,350	1	0.5	0.25	1.2	3,443
39	NE 125th St	Roosevelt	15th Ave NE	21,300	0.4	0.5	0.25	1.2	44,730	20,700	0.4	0.5	0.25	1.2	43,470	20,800	0.4	0.5	0.25	1.2	43,680
40	NE 125th St	15th Ave NE	Lake City Way	18,900	0.5	0.4	0.25	1.2	34,304	18,700	0.4	0.5	0.25	1.2	39,270	18,600	0.4	0.5	0.25	1.2	39,060
41	5th Ave NE	NE 125th St	NE 130th St	9,200	2	1	0.25	1.2	46,920	9,600	2	1	0.25	1.2	48,960	9,600	2	1	0.25	1.2	48,960
42	Roosevelt Way NE	5th Ave NE	NE 125th St	21,300	3.3	0.6	0.25	1.2	98,726	20,700	3.3	0.6	0.25	1.2	95,945	20,800	3.3	0.6	0.25	1.2	96,408

- Based on manual count

SU & CU equaivalents based on WSDOT W-4 Table information provided by Professor Joe Mahoney.

Total ESAL's based on the following formula: [(AWDT x %SU x SU Equiv)+(AWDT x %CU x CU Equiv)] x 300 days = Total ESAL's

TABLE A-1

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	1987	%SU	%CU	SU Equiv	CU Equiv	Total '87 ESAL	1985	%SU	%CU	SU Equiv	CU Equiv	Total '85 ESAL	1983	%SU	%CU	SU Equiv	CU Equiv	Total '83 ESAL
1	Renton Ave S	S 115th St	S Bangor St	11,400	1.4	0.4	0.25	1.2	28,386	9,800	1.4	0.4	0.25	0.8	19,698	9,700	1.4	0.4	0.25	0.8	19,497
2	Renton Ave S	S Bangor St	51st Ave S	8,000	1.4	0.4	0.25	1.2	19,920	7,200	1.4	0.4	0.25	0.8	14,472	7,200	1.4	0.4	0.25	0.8	14,472
3	51st Ave S	Renton Ave S	S Barton Pl	4,200	1.4	0.4	0.25	1.2	10,458	4,000	1.4	0.4	0.25	0.8	8,040	3,600	1.4	0.4	0.25	0.8	7,236
4	Ranier Ave S	S Barton Pl	S Othello St	18,700	1.4	0.3	0.25	1.2	39,831	18,100	1.4	0.3	0.25	0.8	32,037	16,400	1.4	0.3	0.25	0.8	29,028
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	8,000	2	0.4	0.25	1.2	23,520	6,300	2	0.4	0.25	0.8	15,498	6,200	2	0.4	0.25	0.8	15,252
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	11,800	2	0.4	0.25	1.2	34,692	11,000	2	0.4	0.25	0.8	27,060	10,300	2	0.4	0.25	0.8	25,338
7	Swift Ave S	I-5	Beacon Ave S	6,900	2	0.4	0.25	1.2	20,286	7,100	2	0.4	0.25	0.8	17,466	8,800	2	0.4	0.25	0.8	21,648
8	Spokane St	6th Ave S	I-5	20,060	5.7	6.2	0.25	1.2	533,496	19,010	5.7	6.2	0.25	0.8	364,137	18,630	5.7	6.2	0.25	0.8	356,858
9	Spokane St	4th Ave S	6th Ave S	17,800	5.7	6.2	0.25	1.2	473,391	17,800	5.7	6.2	0.25	0.8	340,959	17,800	5.7	6.2	0.25	0.8	340,959
10	6th Ave S	Spokane St	Lander St	17,600	7.1	8.6	0.25	1.2	638,616	15,800	7.1	8.6	0.25	0.8	410,247	15,800	7.1	8.6	0.25	0.8	410,247
11	6th Ave S	Lander St	Airport Way S	3,900	10	8.2	0.25	1.2	144,378	5,600	10	8.2	0.25	0.8	152,208	3,700	10	8.2	0.25	0.8	100,566
12	Airport Way S	6th Ave S	4th Ave S	4,300	19.9	12.6	0.25	1.2	259,226	4,300	19.9	12.6	0.25	0.8	194,210	4,300	11.9	3.3	0.25	0.8	72,434
13	4th Ave S	Spokane St	Airport Way S	15,100	4.9	1	0.25	1.2	109,853	12,400	16.4	3.3	0.25	0.8	250,728	11,300	16.4	3.3	0.25	0.8	228,486
14	Fairview Ave N	Denny Way	Valley St	14,300	4.9	1	0.25	1.2	104,033	13,000	4.9	1	0.25	0.8	78,975	12,850	4.9	1	0.25	0.8	78,064
15	Fairview Ave N	Valley St	Eastlake Ave E	14,600	1.9	0.6	0.25	1.2	52,341	12,600	1.9	0.6	0.25	0.8	36,099	14,100	1.9	0.6	0.25	0.8	40,397
16	55th Ave NE	NE 70th St	NE 68th St	1,800	1	0.5	0.25	1.2	4,590	1,700	1	0.5	0.25	0.8	3,315	1,660	1	0.5	0.25	0.8	3,237
17	Eastlake Ave E	Fairview Ave N	University Bridge	16,600	1.9	0.6	0.25	1.2	59,511	16,500	1.9	0.6	0.25	0.8	47,273	15,300	1.9	0.6	0.25	0.8	43,835
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	31,000	1.9	0.6	0.25	1.2	111,135	30,200	1.9	0.6	0.25	0.8	86,523	27,900	1.9	0.6	0.25	0.8	79,934
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	8,700	0.6	0.1	0.25	1.2	7,047	8,200	0.6	0.1	0.25	0.8	5,658	7,700	0.6	0.1	0.25	0.8	5,313
20	University Way NE	NE Campus Parkway	15th Ave NE	9,200	2	0.3	0.25	1.2	23,736	8,800	2	0.3	0.25	0.8	19,536	8,700	2	0.3	0.25	0.8	19,314
21	15th Ave NE	University Way NE	NE 65th St	10,400	2.3	0.1	0.25	1.2	21,684	9,000	2.3	0.1	0.25	0.8	17,685	8,700	0	2.8	0.25	0.8	58,464
22	15th Ave NE	NE 65th St	NE 80th St	10,100	2.3	0.1	0.25	1.2	21,059	9,700	2.3	0.1	0.25	0.8	19,061	9,400	0	2.8	0.25	0.8	63,168
23	15th Ave NE	NE 80th St	NE 125th St	8,800	2.3	0.1	0.25	1.2	18,348	7,300	2.3	0.1	0.25	0.8	14,345	7,100	0	2.8	0.25	0.8	47,712
24	15th Ave NE	NE 125th St	NE 145th St	17,200	2.3	0.1	0.25	1.2	35,862	16,600	2.3	0.1	0.25	0.8	32,619	16,000	0	2.8	0.25	0.8	107,520
25	NE 145th St	15th Ave NE	20th Ave NE	27,100	1.9	0.3	0.25	1.2	67,886	27,000	1.9	0.3	0.25	0.8	57,915	20,800	1.9	0.3	0.25	0.8	44,616
26	20th Ave NE	NE 145th St	NE 135th St	1,600	1	0.5	0.25	1.2	4,080	1,400	1	0.5	0.25	0.8	2,730	1,500	1	0.5	0.25	0.8	2,925
27	NE 135th St	20th Ave NE	17th Ave NE	1,050	1	0.5	0.25	1.2	2,678	1,030	1	0.5	0.25	0.8	2,009	1,010	1	0.5	0.25	0.8	1,970
28	17th Ave NE	NE 135th St	NE 137th St	300	1	0.5	0.25	1.2	765	300	1	0.5	0.25	0.8	585	290	1	0.5	0.25	0.8	566
29	NE 137th St	17th Ave NE	20th Ave NE	1,220	1	0.5	0.25	1.2	3,111	1,190	1	0.5	0.25	0.8	2,321	1,170	1	0.5	0.25	0.8	2,282
30	NE 80th St	15th Ave NE	Ravenna Ave NE	2,190	4.2	0.7	0.25	1.2	12,417	2,080	4.2	0.7	0.25	0.8	10,046	2,040	4.2	0.7	0.25	0.8	9,853
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	6,760	2.1	4.6	0.25	1.2	122,593	6,410	2.1	4.6	0.25	0.8	80,862	6,070	2.1	4.6	0.25	0.8	76,573
32	Lake City Way NE	Ravenna Ave NE	Northgate	37,400	1.5	0.6	0.25	1.2	122,859	35,000	1.5	0.6	0.25	0.8	89,775	33,800	1.5	0.6	0.25	0.8	86,697
33	Lake City Way NE	Northgate	NE 125th St	40,100	1.5	0.6	0.25	1.2	131,729	37,500	1.5	0.6	0.25	0.8	96,188	36,700	1.5	0.6	0.25	0.8	94,136
34	Lake City Way NE	NE 125th St	NE 145th St	38,300	1.5	0.6	0.25	1.2	125,816	35,200	1.5	0.6	0.25	0.8	90,288	33,800	1.5	0.6	0.25	0.8	86,697
35	30th Ave NE	NE 125th St	NE 145th St	5,900	2.8	0.5	0.25	1.2	23,010	5,600	2.8	0.5	0.25	0.8	18,480	5,500	2.8	0.5	0.25	0.8	18,150
36	NE 145th St	30th Ave NE	32nd Ave NE	27,100	1.9	0.3	0.25	1.2	67,886	27,000	1.9	0.3	0.25	0.8	57,915	20,800	1.9	0.3	0.25	0.8	44,616
37	32nd Ave NE	145th Ave NE	NE 137th St	1,250	1	0.5	0.25	1.2	3,188	1,220	1	0.5	0.25	0.8	2,379	1,200	1	0.5	0.25	0.8	2,340
38	NE 137th St	32nd Ave NE	30th Ave NE	1,330	1	0.5	0.25	1.2	3,392	1,300	1	0.5	0.25	0.8	2,535	1,270	1	0.5	0.25	0.8	2,477
39	NE 125th St	Roosevelt	15th Ave NE	19,300	0.4	0.5	0.25	1.2	40,530	17,700	0.4	0.5	0.25	0.8	26,550	17,700	0.4	0.5	0.25	0.8	26,550
40	NE 125th St	15th Ave NE	Lake City Way	18,200	0.4	0.5	0.25	1.2	38,220	16,400	0.4	0.5	0.25	0.8	24,600	16,400	0.4	0.5	0.25	0.8	24,600
41	5th Ave NE	NE 125th St	NE 130th St	8,600	2	1	0.25	1.2	43,860	8,600	2	1	0.25	0.8	33,540	8,600	2	1	0.25	0.8	33,540
42	Roosevelt Way NE	5th Ave NE	NE 125th St	19,300	3.3	0.6	0.25	1.2	89,456	17,700	3.3	0.6	0.25	0.8	69,296	17,700	3.3	0.6	0.25	0.8	69,296

- Based on manual count

SU & CU equaivalents based on WSDOT W-4 Table information provided by

Total ESAL's based on the following formula: [(AWDT x %SU x SU Equiv)+

TABLE A-1

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	1980	%SU	%CU	SU Equiv	CU Equiv	Total '80 ESAL	1976	%SU	%CU	SU Equiv	CU Equiv	Total '76 ESAL	AWDT 1971	%SU	%CU	SU Equiv	CU Equiv	Total '71 ESAL
1	Renton Ave S	S 115th St	S Bangor St	9,400	1.4	0.4	0.25	1.2	23,406	8,300	1.4	0.4	0.2	0.95	16,434	9,700	1.4	0.4	0.1	0.9	14,550
2	Renton Ave S	S Bangor St	51st Ave S	7,200	1.4	0.4	0.25	1.2	17,928	8,300	1.4	0.4	0.2	0.95	16,434	6,000	1.4	0.4	0.1	0.9	9,000
3	51st Ave S	Renton Ave S	S Barton Pl	3,600	1.4	0.4	0.25	1.2	8,964	3,900	1.4	0.4	0.2	0.95	7,722	4,000	1.4	0.4	0.1	0.9	6,000
4	Rainer Ave S	S Barton Pl	S Othello St	14,800	1.4	0.3	0.25	1.2	31,524	14,700	1.4	0.3	0.2	0.95	24,917	13,700	1.4	0.3	0.1	0.9	16,851
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	6,800	2	0.4	0.25	1.2	19,992	6,800	2	0.4	0.2	0.95	15,912	6,000	2	0.4	0.1	0.9	10,080
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	9,800	2	0.4	0.25	1.2	28,812	12,300	2	0.4	0.2	0.95	28,782	12,000	2	0.4	0.1	0.9	20,160
7	Swift Ave S	I-5	Beacon Ave S	9,200	2	0.4	0.25	1.2	27,048	12,300	2	0.4	0.2	0.95	28,782	7,400	2	0.4	0.1	0.9	12,432
8	Spokane St	6th Ave S	I-5	18,080	5.7	6.2	0.25	1.2	480,838	17,360	5.7	6.2	0.2	0.95	366,122	17,700	5.7	6.2	0.1	0.9	326,565
9	Spokane St	4th Ave S	6th Ave S	14,300	5.7	6.2	0.25	1.2	380,309	14,000	5.7	6.2	0.2	0.95	295,260	6,000	5.7	6.2	0.1	0.9	110,700
10	6th Ave S	Spokane St	Lander St	6,200	7.1	8.6	0.25	1.2	224,967	13,300	7.1	8.6	0.2	0.95	382,641	8,000	7.1	8.6	0.1	0.9	202,800
11	6th Ave S	Lander St	Airport Way S	6,000	10	8.2	0.25	1.2	222,120	6,000	10	8.2	0.2	0.95	176,220	6,000	17.7	9.2	0.1	0.9	180,900
12	Airport Way S	6th Ave S	4th Ave S	4,400	11.9	3.3	0.25	1.2	91,542	4,100	11.9	3.3	0.2	0.95	67,835	6,000	28.7	8.5	0.1	0.9	189,360
13	4th Ave S	Spokane St	Airport Way S	13,400	16.4	3.3	0.25	1.2	324,012	17,200	16.4	3.3	0.2	0.95	331,014	23,000	16.4	3.3	0.1	0.9	318,090
14	Fairview Ave N	Denny Way	Valley St	12,700	4.9	1	0.25	1.2	92,393	10,300	4.9	1	0.2	0.95	59,637	13,500	16.4	3.3	0.1	0.9	186,705
15	Fairview Ave N	Valley St	Eastlake Ave E	13,200	1.9	0.6	0.25	1.2	47,322	12,300	1.9	0.6	0.2	0.95	35,055	11,500	1.9	0.6	0.1	0.9	25,185
16	55th Ave NE	NE 70th St	NE 68th St	1,620	1	0.5	0.25	1.2	4,131	1,550	1	0.5	0.2	0.95	3,139	1,700	1	0.5	0.1	0.9	2,805
17	Eastlake Ave E	Fairview Ave N	University Bridge	16,200	1.9	0.6	0.25	1.2	58,077	12,300	1.9	0.6	0.2	0.95	35,055	14,900	1.9	0.6	0.1	0.9	32,631
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	27,300	1.9	0.6	0.25	1.2	97,871	24,500	1.9	0.6	0.2	0.95	69,825	25,000	1.9	0.6	0.1	0.9	54,750
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	7,500	0.6	0.1	0.25	1.2	6,075	8,900	0.6	0.1	0.2	0.95	5,741	9,500	0.6	0.1	0.1	0.9	4,275
20	University Way NE	NE Campus Parkway	15th Ave NE	8,000	2	0.3	0.25	1.2	20,640	8,200	2	0.3	0.2	0.95	16,851	15,500	2	0.3	0.1	0.9	21,855
21	15th Ave NE	University Way NE	NE 65th St	8,400	0	2.8	0.25	1.2	84,672	13,900	0	2.8	0.2	0.95	110,922	7,300	0	2.8	0.1	0.9	55,188
22	15th Ave NE	NE 65th St	NE 80th St	8,400	0	2.8	0.25	1.2	84,672	7,600	0	2.8	0.2	0.95	60,648	6,500	0	2.8	0.1	0.9	49,140
23	15th Ave NE	NE 80th St	NE 125th St	7,500	0	2.8	0.25	1.2	75,600	6,300	0	2.8	0.2	0.95	50,274	15,300	0	2.8	0.1	0.9	115,668
24	15th Ave NE	NE 125th St	NE 145th St	15,900	0	2.8	0.25	1.2	160,272	14,600	0	2.8	0.2	0.95	116,508	15,300	0	2.8	0.1	0.9	115,668
25	NE 145th St	15th Ave NE	20th Ave NE	20,100	1.9	0.3	0.25	1.2	50,351	22,700	1.9	0.3	0.2	0.95	45,287	23,000	1.9	0.3	0.1	0.9	31,740
26	20th Ave NE	NE 145th St	NE 135th St	1,600	1	0.5	0.25	1.2	4,080	1,200	1	0.5	0.2	0.95	2,430	1,140	1	0.5	0.1	0.9	1,881
27	NE 135th St	20th Ave NE	17th Ave NE	980	1	0.5	0.25	1.2	2,499	940	1	0.5	0.2	0.95	1,904	890	1	0.5	0.1	0.9	1,469
28	17th Ave NE	NE 135th St	NE 137th St	280	1	0.5	0.25	1.2	714	270	1	0.5	0.2	0.95	547	260	1	0.5	0.1	0.9	429
29	NE 137th St	17th Ave NE	20th Ave NE	1,130	1	0.5	0.25	1.2	2,882	1,090	1	0.5	0.2	0.95	2,207	1,030	1	0.5	0.1	0.9	1,700
30	NE 80th St	15th Ave NE	Ravenna Ave NE	1,980	4.2	0.7	0.25	1.2	11,227	1,900	4.2	0.7	0.2	0.95	8,579	1,800	4.2	0.7	0.1	0.9	5,670
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	5,550	2.1	4.6	0.25	1.2	100,649	4,860	2.1	4.6	0.2	0.95	69,838	4,000	2.1	4.6	0.1	0.9	52,200
32	Lake City Way NE	Ravenna Ave NE	Northgate	31,400	1.5	0.6	0.25	1.2	103,149	28,000	1.5	0.6	0.2	0.95	73,080	25,700	1.5	0.6	0.1	0.9	53,199
33	Lake City Way NE	Northgate	NE 125th St	26,600	1.5	0.6	0.25	1.2	87,381	29,900	1.5	0.6	0.2	0.95	78,039	28,800	1.5	0.6	0.1	0.9	59,616
34	Lake City Way NE	NE 125th St	NE 145th St	33,000	1.5	0.6	0.25	1.2	108,405	28,300	1.5	0.6	0.2	0.95	73,863	30,000	1.5	0.6	0.1	0.9	62,100
35	30th Ave NE	NE 125th St	NE 145th St	4,800	2.8	0.5	0.25	1.2	18,720	3,900	2.8	0.5	0.2	0.95	12,110	2,500	2.8	0.5	0.1	0.9	5,475
36	NE 145th St	30th Ave NE	32nd Ave NE	20,100	1.9	0.3	0.25	1.2	50,351	18,500	1.9	0.3	0.2	0.95	36,908	23,000	1.9	0.3	0.1	0.9	31,740
37	32nd Ave NE	145th Ave NE	NE 137th St	1,160	1	0.5	0.25	1.2	2,958	1,120	1	0.5	0.2	0.95	2,268	1,060	1	0.5	0.1	0.9	1,749
38	NE 137th St	32nd Ave NE	30th Ave NE	1,240	1	0.5	0.25	1.2	3,162	1,190	1	0.5	0.2	0.95	2,410	1,130	1	0.5	0.1	0.9	1,865
39	NE 125th St	Roosevelt	15th Ave NE	14,900	0.4	0.5	0.25	1.2	31,290	15,100	0.4	0.5	0.2	0.95	25,142	12,500	0.4	0.5	0.1	0.9	18,375
40	NE 125th St	15th Ave NE	Lake City Way	14,900	0.4	0.5	0.25	1.2	31,290	13,400	0.4	0.5	0.2	0.95	22,311	8,000	0.4	0.5	0.1	0.9	11,760
41	5th Ave NE	NE 125th St	NE 130th St	6,800	2	1	0.25	1.2	34,680	5,800	2	1	0.2	0.95	23,490	7,800	2	1	0.1	0.9	25,740
42	Roosevelt Way NE	5th Ave NE	NE 125th St	16,800	3.3	0.6	0.25	1.2	77,868	13,400	0.6	0.25	0.2	0.95	14,372	13,000	0.6	0.25	0.1	0.9	11,115

- Based on manual count

SU & CU equivalents based on WSDOT W-4 Table information provided by

Total ESAL's based on the following formula: [(AWDT x %SU x SU Equiv)+

TABLE A-1

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	1965	%SU	%CU	SU Equiv	CU Equiv	Total '65 ESAL	1960	%SU	%CU	SU Equiv	CU Equiv	Total '60 ESAL	1955	%SU	%CU	SU Equiv	CU Equiv	Total '55 ESAL
1	Renton Ave S	S 115th St	S Bangor St	8,000	1.4	0.4	0.1	0.8	11,040	5,000	1.4	0.4	0.1	0.7	6,300	4,000	1.4	0.4	0.1	0.7	5,040
2	Renton Ave S	S Bangor St	51st Ave S	7,500	1.4	0.4	0.1	0.8	10,350	6,000	1.4	0.4	0.1	0.7	7,560	4,000	1.4	0.4	0.1	0.7	5,040
3	51st Ave S	Renton Ave S	S Barton Pl	3,000	1.4	0.4	0.1	0.8	4,140	3,000	1.4	0.4	0.1	0.7	3,780	3,000	1.4	0.4	0.1	0.7	3,780
4	Ranier Ave S	S Barton Pl	S Othello St	12,500	1.4	0.3	0.1	0.8	14,250	13,500	1.4	0.3	0.1	0.7	14,175	9,500	1.4	0.3	0.1	0.7	9,975
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	4,900	2	0.4	0.1	0.8	7,644	5,000	2	0.4	0.1	0.7	7,200	3,000	2	0.4	0.1	0.7	4,320
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	13,000	2	0.4	0.1	0.8	20,280	9,500	2	0.4	0.1	0.7	13,680	6,000	2	0.4	0.1	0.7	8,640
7	Swift Ave S	I-5	Beacon Ave S	10,000	2	0.4	0.1	0.8	15,600	10,000	2	0.4	0.1	0.7	14,400	8,000	2	0.4	0.1	0.7	11,520
8	Spokane St	6th Ave S	I-5	18,100	5.7	6.2	0.1	0.8	300,279	18,500	5.7	6.2	0.1	0.7	272,505	24,000	5.7	6.2	0.1	0.7	353,520
9	Spokane St	4th Ave S	6th Ave S	10,000	5.7	6.2	0.1	0.8	165,900	19,000	5.7	6.2	0.1	0.7	279,870	30,000	5.7	6.2	0.1	0.7	441,900
10	6th Ave S	Spokane St	Lander St	7,000	7.1	8.6	0.1	0.8	159,390	5,000	7.1	8.6	0.1	0.7	100,950	7,500	7.1	8.6	0.1	0.7	151,425
11	6th Ave S	Lander St	Airport Way S	6,000	17.7	9.2	0.1	0.8	164,340	6,000	17.7	9.2	0.1	0.7	147,780	7,500	17.7	9.2	0.1	0.7	184,725
12	Airport Way S	6th Ave S	4th Ave S	15,000	6.6	3.7	0.1	0.8	162,900	12,000	6.6	3.7	0.1	0.7	117,000	11,750	6.6	3.7	0.1	0.7	114,563
13	4th Ave S	Spokane St	Airport Way S	26,500	16.4	3.3	0.1	0.8	340,260	25,500	16.4	3.3	0.1	0.7	302,175	27,500	16.4	3.3	0.1	0.7	325,875
14	Fairview Ave N	Denny Way	Valley St	17,000	16.4	3.3	0.1	0.8	218,280	16,000	16.4	3.3	0.1	0.7	189,600	12,000	16.4	3.3	0.1	0.7	142,200
15	Fairview Ave N	Valley St	Eastlake Ave E	14,000	1.9	0.6	0.1	0.8	28,140	24,000	1.9	0.6	0.1	0.7	43,920	21,000	1.9	0.6	0.1	0.7	38,430
16	55th Ave NE	NE 70th St	NE 68th St	1,500	1	0.5	0.1	0.8	2,250	1,000	1	0.5	0.1	0.7	1,350	950	1	0.5	0.1	0.7	1,283
17	Eastlake Ave E	Fairview Ave N	University Bridge	10,000	1.9	0.6	0.1	0.8	20,100	28,000	1.9	0.6	0.1	0.7	51,240	24,000	1.9	0.6	0.1	0.7	43,920
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	20,500	1.9	0.6	0.1	0.8	41,205	15,000	1.9	0.6	0.1	0.7	27,450	18,000	1.9	0.6	0.1	0.7	32,940
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	7,000	0.6	0.1	0.1	0.8	2,940	12,000	0.6	0.1	0.1	0.7	4,680	6,000	0.6	0.1	0.1	0.7	2,340
20	University Way NE	NE Campus Parkway	15th Ave NE	7,000	2	0.3	0.1	0.8	9,240	8,000	2	0.3	0.1	0.7	9,840	6,000	2	0.3	0.1	0.7	7,380
21	15th Ave NE	University Way NE	NE 65th St	10,000	0	2.8	0.1	0.8	67,200	11,500	0	2.8	0.1	0.7	67,620	16,500	0	2.8	0.1	0.7	97,020
22	15th Ave NE	NE 65th St	NE 80th St	6,000	0	2.8	0.1	0.8	40,320	11,000	0	2.8	0.1	0.7	64,680	11,000	0	2.8	0.1	0.7	64,680
23	15th Ave NE	NE 80th St	NE 125th St	5,000	0	2.8	0.1	0.8	33,600	11,000	0	2.8	0.1	0.7	64,680	8,500	0	2.8	0.1	0.7	49,980
24	15th Ave NE	NE 125th St	NE 145th St	7,000	0	2.8	0.1	0.8	47,040	10,500	0	2.8	0.1	0.7	61,740	10,000	0	2.8	0.1	0.7	58,800
25	NE 145th St	15th Ave NE	20th Ave NE	12,500	1.9	0.3	0.1	0.8	16,125	10,500	1.9	0.3	0.1	0.7	12,600	8,000	1.9	0.3	0.1	0.7	9,600
26	20th Ave NE	NE 145th St	NE 135th St	1,070	1	0.5	0.1	0.8	1,605	1,020	1	0.5	0.1	0.7	1,377	970	1	0.5	0.1	0.7	1,310
27	NE 135th St	20th Ave NE	17th Ave NE	835	1	0.5	0.1	0.8	1,253	800	1	0.5	0.1	0.7	1,080	760	1	0.5	0.1	0.7	1,026
28	17th Ave NE	NE 135th St	NE 137th St	240	1	0.5	0.1	0.8	360	230	1	0.5	0.1	0.7	311	220	1	0.5	0.1	0.7	297
29	NE 137th St	17th Ave NE	20th Ave NE	970	1	0.5	0.1	0.8	1,455	920	1	0.5	0.1	0.7	1,242	880	1	0.5	0.1	0.7	1,188
30	NE 80th St	15th Ave NE	Ravenna Ave NE	1,700	4.2	0.7	0.1	0.8	4,998	1,630	4.2	0.7	0.1	0.7	4,450	1,550	4.2	0.7	0.1	0.7	4,232
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	9,000	2.1	4.6	0.1	0.8	105,030	7,000	2.1	4.6	0.1	0.7	72,030	6,000	2.1	4.6	0.1	0.7	61,740
32	Lake City Way NE	Ravenna Ave NE	Northgate	22,000	1.5	0.6	0.1	0.8	41,580	25,000	1.5	0.6	0.1	0.7	42,750	20,500	1.5	0.6	0.1	0.7	35,055
33	Lake City Way NE	Northgate	NE 125th St	23,000	1.5	0.6	0.1	0.8	43,470	25,000	1.5	0.6	0.1	0.7	42,750	2,250	1.5	0.6	0.1	0.7	3,848
34	Lake City Way NE	NE 125th St	NE 145th St	25,000	1.5	0.6	0.1	0.8	47,250	27,000	1.5	0.6	0.1	0.7	46,170	24,000	1.5	0.6	0.1	0.7	41,040
35	30th Ave NE	NE 125th St	NE 145th St	3,100	2.8	0.5	0.1	0.8	6,324	2,950	2.8	0.5	0.1	0.7	5,576	2,800	2.8	0.5	0.1	0.7	5,292
36	NE 145th St	30th Ave NE	32nd Ave NE	12,500	1.9	0.3	0.1	0.8	16,125	10,500	1.9	0.3	0.1	0.7	12,600	8,000	1.9	0.3	0.1	0.7	9,600
37	32nd Ave NE	145th Ave NE	NE 137th St	1,000	1	0.5	0.1	0.8	1,500	950	1	0.5	0.1	0.7	1,283	900	1	0.5	0.1	0.7	1,215
38	NE 137th St	32nd Ave NE	30th Ave NE	1,060	1	0.5	0.1	0.8	1,590	1,010	1	0.5	0.1	0.7	1,364	960	1	0.5	0.1	0.7	1,296
39	NE 125th St	Roosevelt	15th Ave NE	6,000	0.4	0.5	0.1	0.8	7,920	4,500	0.4	0.5	0.1	0.7	5,265	6,000	0.4	0.5	0.1	0.7	7,020
40	NE 125th St	15th Ave NE	Lake City Way	9,000	0.4	0.5	0.1	0.8	11,880	8,500	0.4	0.5	0.1	0.7	9,945	8,000	0.4	0.5	0.1	0.7	9,360
41	5th Ave NE	NE 125th St	NE 130th St	5,500	2	1	0.1	0.8	16,500	7,000	2	1	0.1	0.7	18,900	6,000	2	1	0.1	0.7	16,200
42	Roosevelt Way NE	5th Ave NE	NE 125th St	3,000	0.6	0.25	0.1	0.8	2,340	8,000	0.6	0.25	0.1	0.7	5,640	6,500	0.6	0.25	0.1	0.7	4,583

- Based on manual count

SU & CU equaivalents based on WSDOT W-4 Table information provided by

Total ESAL's based on the following formula: [(AWDT x %SU x SU Equiv)+

TABLE A-1

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit				SU Equiv	CU Equiv	Total '50 ESAL	VDT - 15 HR			SU Equiv	CU Equiv	Total '44 ESAL	VDT - 15 HR			SU Equiv	CU Equiv	Total '41 ESAL
				1950	%SU	%CU				1944	%SU	%CU				1941	%SU	%CU			
1	Renton Ave S	S 115th St	S Bangor St	2,300	1.4	0.4	0.1	0.7	2,898	2,000	1.4	0.4	0.1	0.7	2,520	4,000	1.4	0.4	0.1	0.7	5,040
2	Renton Ave S	S Bangor St	51st Ave S	2,300	1.4	0.4	0.1	0.7	2,898	2,000	1.4	0.4	0.1	0.7	2,520	4,000	1.4	0.4	0.1	0.7	5,040
3	51st Ave S	Renton Ave S	S Barton Pl	3,000	1.4	0.4	0.1	0.7	3,780	2,000	1.4	0.4	0.1	0.7	2,520	1,940	1.4	0.4	0.1	0.7	2,444
4	Rainer Ave S	S Barton Pl	S Othello St	9,200	1.4	0.3	0.1	0.7	9,660	8,000	1.4	0.3	0.1	0.7	8,400	6,000	1.4	0.3	0.1	0.7	6,300
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	2,300	2	0.4	0.1	0.7	3,312	2,000	2	0.4	0.1	0.7	2,880	4,000	2	0.4	0.1	0.7	5,760
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	6,300	2	0.4	0.1	0.7	9,072	3,000	2	0.4	0.1	0.7	4,320	3,000	2	0.4	0.1	0.7	4,320
7	Swift Ave S	I-5	Beacon Ave S	5,700	2	0.4	0.1	0.7	8,208	4,000	2	0.4	0.1	0.7	5,760	2,000	2	0.4	0.1	0.7	2,880
8	Spokane St	6th Ave S	I-5	14,000	5.7	6.2	0.1	0.7	206,220	13,000	5.7	6.2	0.1	0.7	191,490	12,500	5.7	6.2	0.1	0.7	184,125
9	Spokane St	4th Ave S	6th Ave S	14,000	5.7	6.2	0.1	0.7	206,220	13,000	5.7	6.2	0.1	0.7	191,490	12,500	5.7	6.2	0.1	0.7	184,125
10	6th Ave S	Spokane St	Lander St	7,130	7.1	8.6	0.1	0.7	143,955	6,700	7.1	8.6	0.1	0.7	135,273	6,500	7.1	8.6	0.1	0.7	131,235
11	6th Ave S	Lander St	Airport Way S	7,103	17.7	9.2	0.1	0.7	174,947	6,700	17.7	9.2	0.1	0.7	165,021	6,500	17.7	9.2	0.1	0.7	160,095
12	Airport Way S	6th Ave S	4th Ave S	11,500	6.6	3.7	0.1	0.7	112,125	11,250	6.6	3.7	0.1	0.7	109,688	11,000	6.6	3.7	0.1	0.7	107,250
13	4th Ave S	Spokane St	Airport Way S	33,300	16.4	3.3	0.1	0.7	394,605	19,000	16.4	3.3	0.1	0.7	225,150	33,500	16.4	3.3	0.1	0.7	396,975
14	Fairview Ave N	Denny Way	Valley St	14,400	16.4	3.3	0.1	0.7	170,640	8,000	16.4	3.3	0.1	0.7	94,800	13,000	16.4	3.3	0.1	0.7	154,050
15	Fairview Ave N	Valley St	Eastlake Ave E	19,000	1.9	0.6	0.1	0.7	34,770	14,000	1.9	0.6	0.1	0.7	25,620	16,500	1.9	0.6	0.1	0.7	30,195
16	55th Ave NE	NE 70th St	NE 68th St	900	1	0.5	0.1	0.7	1,215	850	1	0.5	0.1	0.7	1,148	820	1	0.5	0.1	0.7	1,107
17	Eastlake Ave E	Fairview Ave N	University Bridge	24,000	1.9	0.6	0.1	0.7	43,920	13,000	1.9	0.6	0.1	0.7	23,790	19,500	1.9	0.6	0.1	0.7	35,685
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	39,100	1.9	0.6	0.1	0.7	71,553	20,000	1.9	0.6	0.1	0.7	36,600	31,000	1.9	0.6	0.1	0.7	56,730
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	24,500	0.6	0.1	0.1	0.7	9,555	23,080	0.6	0.1	0.1	0.7	9,001	22,400	0.6	0.1	0.1	0.7	8,736
20	University Way NE	NE Campus Parkway	15th Ave NE	6,000	2	0.3	0.1	0.7	7,380	6,000	2	0.3	0.1	0.7	7,380	5,000	2	0.3	0.1	0.7	6,150
21	15th Ave NE	University Way NE	NE 65th St	5,000	0	2.8	0.1	0.7	29,400	3,000	0	2.8	0.1	0.7	17,640	4,000	0	2.8	0.1	0.7	23,520
22	15th Ave NE	NE 65th St	NE 80th St	12,000	0	2.8	0.1	0.7	70,560	3,000	0	2.8	0.1	0.7	17,640	3,000	0	2.8	0.1	0.7	17,640
23	15th Ave NE	NE 80th St	NE 125th St	9,500	0	2.8	0.1	0.7	55,860	8,950	0	2.8	0.1	0.7	52,626	8,690	0	2.8	0.1	0.7	51,097
24	15th Ave NE	NE 125th St	NE 145th St	5,000	0	2.8	0.1	0.7	29,400	4,710	0	2.8	0.1	0.7	27,695	4,570	0	2.8	0.1	0.7	26,872
25	NE 145th St	15th Ave NE	20th Ave NE	7,600	1.9	0.3	0.1	0.7	9,120	7,140	1.9	0.3	0.1	0.7	8,568	6,930	1.9	0.3	0.1	0.7	8,316
26	20th Ave NE	NE 145th St	NE 135th St	930	1	0.5	0.1	0.7	1,256	860	1	0.5	0.1	0.7	1,161	840	1	0.5	0.1	0.7	1,134
27	NE 135th St	20th Ave NE	17th Ave NE	720	1	0.5	0.1	0.7	972	670	1	0.5	0.1	0.7	905	650	1	0.5	0.1	0.7	878
28	17th Ave NE	NE 135th St	NE 137th St	210	1	0.5	0.1	0.7	284	200	1	0.5	0.1	0.7	270	190	1	0.5	0.1	0.7	257
29	NE 137th St	17th Ave NE	20th Ave NE	830	1	0.5	0.1	0.7	1,121	780	1	0.5	0.1	0.7	1,053	760	1	0.5	0.1	0.7	1,026
30	NE 80th St	15th Ave NE	Ravenna Ave NE	1,480	4.2	0.7	0.1	0.7	4,040	1,390	4.2	0.7	0.1	0.7	3,795	1,350	4.2	0.7	0.1	0.7	3,686
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	5,700	2.1	4.6	0.1	0.7	58,653	5,360	2.1	4.6	0.1	0.7	55,154	5,200	2.1	4.6	0.1	0.7	53,508
32	Lake City Way NE	Ravenna Ave NE	Northgate	14,360	1.5	0.6	0.1	0.7	24,556	7,000	1.5	0.6	0.1	0.7	11,970	6,800	1.5	0.6	0.1	0.7	11,628
33	Lake City Way NE	Northgate	NE 125th St	2,140	1.5	0.6	0.1	0.7	3,659	2,010	1.5	0.6	0.1	0.7	3,437	1,950	1.5	0.6	0.1	0.7	3,335
34	Lake City Way NE	NE 125th St	NE 145th St	22,800	1.5	0.6	0.1	0.7	38,988	21,430	1.5	0.6	0.1	0.7	36,645	20,790	1.5	0.6	0.1	0.7	35,551
35	30th Ave NE	NE 125th St	NE 145th St	2,660	2.8	0.5	0.1	0.7	5,027	2,500	2.8	0.5	0.1	0.7	4,725	2,420	2.8	0.5	0.1	0.7	4,574
36	NE 145th St	30th Ave NE	32nd Ave NE	7,600	1.9	0.3	0.1	0.7	9,120	7,140	1.9	0.3	0.1	0.7	8,568	6,930	1.9	0.3	0.1	0.7	8,316
37	32nd Ave NE	145th Ave NE	NE 137th St	850	1	0.5	0.1	0.7	1,148	800	1	0.5	0.1	0.7	1,080	780	1	0.5	0.1	0.7	1,053
38	NE 137th St	32nd Ave NE	30th Ave NE	910	1	0.5	0.1	0.7	1,229	850	1	0.5	0.1	0.7	1,148	830	1	0.5	0.1	0.7	1,121
39	NE 125th St	Roosevelt	15th Ave NE	5,700	0.4	0.5	0.1	0.7	6,669	5,360	0.4	0.5	0.1	0.7	6,271	5,200	0.4	0.5	0.1	0.7	6,084
40	NE 125th St	15th Ave NE	Lake City Way	7,600	0.4	0.5	0.1	0.7	8,892	7,140	0.4	0.5	0.1	0.7	8,354	6,930	0.4	0.5	0.1	0.7	8,108
41	5th Ave NE	NE 125th St	NE 130th St	5,700	2	1	0.1	0.7	15,390	5,360	2	1	0.1	0.7	14,472	5,200	2	1	0.1	0.7	14,040
42	Roosevelt Way NE	5th Ave NE	NE 125th St	6,180	0.6	0.25	0.1	0.7	4,357	5,800	0.6	0.25	0.1	0.7	4,089	5,630	0.6	0.25	0.1	0.7	3,969

- Based on manual count

SU & CU equaivalents based on WSDOT W-4 Table information provided by

Total ESAL's based on the following formula: [(AWDT x %SU x SU Equiv)+

TABLE A-1

Link #	Street Name	Southern or Western Limit	Northern or Eastern Limit	15 HR 1937	%SU	%CU	SU Equiv	CU Equiv	Total '37 ESAL	15HR 1930	%SU	%CU	SU Equiv	CU Equiv	Total '30 ESAL	15 HR 1928	%SU	%CU	SU Equiv	CU Equiv	Total '28 ESAL
1	Renton Ave S	S 115th St	S Bangor St	1,365	1.4	0.4	0.1	0.7	1,720	1,042	1.4	0.4	0.1	0.7	1,313	1,000	1.4	0.4	0.1	0.7	1,260
2	Renton Ave S	S Bangor St	51st Ave S	1,365	1.4	0.4	0.1	0.7	1,720	1,042	1.4	0.4	0.1	0.7	1,313	1,000	1.4	0.4	0.1	0.7	1,260
3	51st Ave S	Renton Ave S	S Barton Pl	1,860	1.4	0.4	0.1	0.7	2,344	1,730	1.4	0.4	0.1	0.7	2,180	1,690	1.4	0.4	0.1	0.7	2,129
4	Rainier Ave S	S Barton Pl	S Othello St	2,598	1.4	0.3	0.1	0.7	2,728	5,546	1.4	0.3	0.1	0.7	5,823	4,583	1.4	0.3	0.1	0.7	4,812
5	S Othello & Myrtle St	Martin Luther King	Rainer Ave S	444	2	0.4	0.1	0.7	639	410	2	0.4	0.1	0.7	590	400	2	0.4	0.1	0.7	576
6	S Othello & Myrtle St	Beacon Ave S	Martin Luther King	750	2	0.4	0.1	0.7	1,080	700	2	0.4	0.1	0.7	1,008	680	2	0.4	0.1	0.7	979
7	Swift Ave S	I-5	Beacon Ave S	1,920	2	0.4	0.1	0.7	2,765	1,790	2	0.4	0.1	0.7	2,578	1,750	2	0.4	0.1	0.7	2,520
8	Spokane St	6th Ave S	I-5	6,300	5.7	6.2	0.1	0.7	92,799	6,300	5.7	6.2	0.1	0.7	92,799	5,213	5.7	6.2	0.1	0.7	76,787
9	Spokane St	4th Ave S	6th Ave S	9,100	5.7	6.2	0.1	0.7	134,043	6,300	5.7	6.2	0.1	0.7	92,799	5,213	5.7	6.2	0.1	0.7	76,787
10	6th Ave S	Spokane St	Lander St	6,250	7.1	8.6	0.1	0.7	126,188	5,830	7.1	8.6	0.1	0.7	117,708	5,710	7.1	8.6	0.1	0.7	115,285
11	6th Ave S	Lander St	Airport Way S	6,250	17.7	9.2	0.1	0.7	153,938	5,830	17.7	9.2	0.1	0.7	143,593	5,710	17.7	9.2	0.1	0.7	140,637
12	Airport Way S	6th Ave S	4th Ave S	16,285	6.6	3.7	0.1	0.7	158,779	7,198	6.6	3.7	0.1	0.7	70,181	8,539	6.6	3.7	0.1	0.7	83,255
13	4th Ave S	Spokane St	Airport Way S	23,793	16.4	3.3	0.1	0.7	281,947	16,980	16.4	3.3	0.1	0.7	201,213	13,736	16.4	3.3	0.1	0.7	162,772
14	Fairview Ave N	Denny Way	Valley St	11,420	16.4	3.3	0.1	0.7	135,327	4,991	16.4	3.3	0.1	0.7	59,143	3,000	16.4	3.3	0.1	0.7	35,550
15	Fairview Ave N	Valley St	Eastlake Ave E	11,000	1.9	0.6	0.1	0.7	20,130	16,000	1.9	0.6	0.1	0.7	29,280	21,483	1.9	0.6	0.1	0.7	39,314
16	55th Ave NE	NE 70th St	NE 68th St	790	1	0.5	0.1	0.7	1,067	740	1	0.5	0.1	0.7	999	720	1	0.5	0.1	0.7	972
17	Eastlake Ave E	Fairview Ave N	University Bridge	15,388	1.9	0.6	0.1	0.7	28,160	20,351	1.9	0.6	0.1	0.7	37,242	18,967	1.9	0.6	0.1	0.7	34,710
18	Roosevelt Way NE	University Bridge	NE Campus Parkway	29,790	1.9	0.6	0.1	0.7	54,516	25,292	1.9	0.6	0.1	0.7	46,284	21,835	1.9	0.6	0.1	0.7	39,958
19	NE Campus Parkway	Roosevelt Way NE	University Way NE	21,520	0.6	0.1	0.1	0.7	8,393	20,070	0.6	0.1	0.1	0.7	7,827	19,670	0.6	0.1	0.1	0.7	7,671
20	University Way NE	NE Campus Parkway	15th Ave NE	5,000	2	0.3	0.1	0.7	6,150	5,898	2	0.3	0.1	0.7	7,255	6,221	2	0.3	0.1	0.7	7,652
21	15th Ave NE	University Way NE	NE 65th St	3,840	0	2.8	0.1	0.7	22,579	3,580	0	2.8	0.1	0.7	21,050	3,510	0	2.8	0.1	0.7	20,639
22	15th Ave NE	NE 65th St	NE 80th St	2,880	0	2.8	0.1	0.7	16,934	2,690	0	2.8	0.1	0.7	15,817	2,640	0	2.8	0.1	0.7	15,523
23	15th Ave NE	NE 80th St	NE 125th St	8,350	0	2.8	0.1	0.7	49,098	7,890	0	2.8	0.1	0.7	46,393	7,730	0	2.8	0.1	0.7	45,452
24	15th Ave NE	NE 125th St	NE 145th St	4,390	0	2.8	0.1	0.7	25,813	4,090	0	2.8	0.1	0.7	24,049	4,010	0	2.8	0.1	0.7	23,579
25	NE 145th St	15th Ave NE	20th Ave NE	6,660	1.9	0.3	0.1	0.7	7,992	6,210	1.9	0.3	0.1	0.7	7,452	6,090	1.9	0.3	0.1	0.7	7,308
26	20th Ave NE	NE 145th St	NE 135th St	800	1	0.5	0.1	0.7	1,080	750	1	0.5	0.1	0.7	1,013	730	1	0.5	0.1	0.7	986
27	NE 135th St	20th Ave NE	17th Ave NE	620	1	0.5	0.1	0.7	837	580	1	0.5	0.1	0.7	783	570	1	0.5	0.1	0.7	770
28	17th Ave NE	NE 135th St	NE 137th St	180	1	0.5	0.1	0.7	243	170	1	0.5	0.1	0.7	230	160	1	0.5	0.1	0.7	216
29	NE 137th St	17th Ave NE	20th Ave NE	730	1	0.5	0.1	0.7	986	680	1	0.5	0.1	0.7	918	670	1	0.5	0.1	0.7	905
30	NE 80th St	15th Ave NE	Ravenna Ave NE	1,300	4.2	0.7	0.1	0.7	3,549	1,210	4.2	0.7	0.1	0.7	3,303	1,190	4.2	0.7	0.1	0.7	3,249
31	Ravenna Ave NE	NE 80th St	Lake City Way NE	5,000	2.1	4.6	0.1	0.7	51,450	4,660	2.1	4.6	0.1	0.7	47,951	4,570	2.1	4.6	0.1	0.7	47,025
32	Lake City Way NE	Ravenna Ave NE	Northgate	6,530	1.5	0.6	0.1	0.7	11,166	6,090	1.5	0.6	0.1	0.7	10,414	5,970	1.5	0.6	0.1	0.7	10,209
33	Lake City Way NE	Northgate	NE 125th St	1,870	1.5	0.6	0.1	0.7	3,198	1,740	1.5	0.6	0.1	0.7	2,975	1,700	1.5	0.6	0.1	0.7	2,907
34	Lake City Way NE	NE 125th St	NE 145th St	19,980	1.5	0.6	0.1	0.7	34,166	18,630	1.5	0.6	0.1	0.7	31,857	18,260	1.5	0.6	0.1	0.7	31,225
35	30th Ave NE	NE 125th St	NE 145th St	2,320	2.8	0.5	0.1	0.7	4,385	2,160	2.8	0.5	0.1	0.7	4,082	2,120	2.8	0.5	0.1	0.7	4,007
36	NE 145th St	30th Ave NE	32nd Ave NE	6,660	1.9	0.3	0.1	0.7	7,992	6,210	1.9	0.3	0.1	0.7	7,452	6,090	1.9	0.3	0.1	0.7	7,308
37	32nd Ave NE	145th Ave NE	NE 137th St	750	1	0.5	0.1	0.7	1,013	700	1	0.5	0.1	0.7	945	690	1	0.5	0.1	0.7	932
38	NE 137th St	32nd Ave NE	30th Ave NE	800	1	0.5	0.1	0.7	1,080	750	1	0.5	0.1	0.7	1,013	730	1	0.5	0.1	0.7	986
39	NE 125th St	Roosevelt	15th Ave NE	5,000	0.4	0.5	0.1	0.7	5,850	4,660	0.4	0.5	0.1	0.7	5,452	4,570	0.4	0.5	0.1	0.7	5,347
40	NE 125th St	15th Ave NE	Lake City Way	6,660	0.4	0.5	0.1	0.7	7,792	6,210	0.4	0.5	0.1	0.7	7,266	6,090	0.4	0.5	0.1	0.7	7,125
41	5th Ave NE	NE 125th St	NE 130th St	5,000	2	1	0.1	0.7	13,500	4,660	2	1	0.1	0.7	12,582	4,570	2	1	0.1	0.7	12,339
42	Roosevelt Way NE	5th Ave NE	NE 125th St	5,410	0.6	0.25	0.1	0.7	3,814	5,050	0.6	0.25	0.1	0.7	3,560	4,950	0.6	0.25	0.1	0.7	3,490

- Based on manual count

SU & CU equaivalents based on WSDOT W-4 Table information provided by

Total ESAL's based on the following formula: [(AWDT x %SU x SU Equiv)+

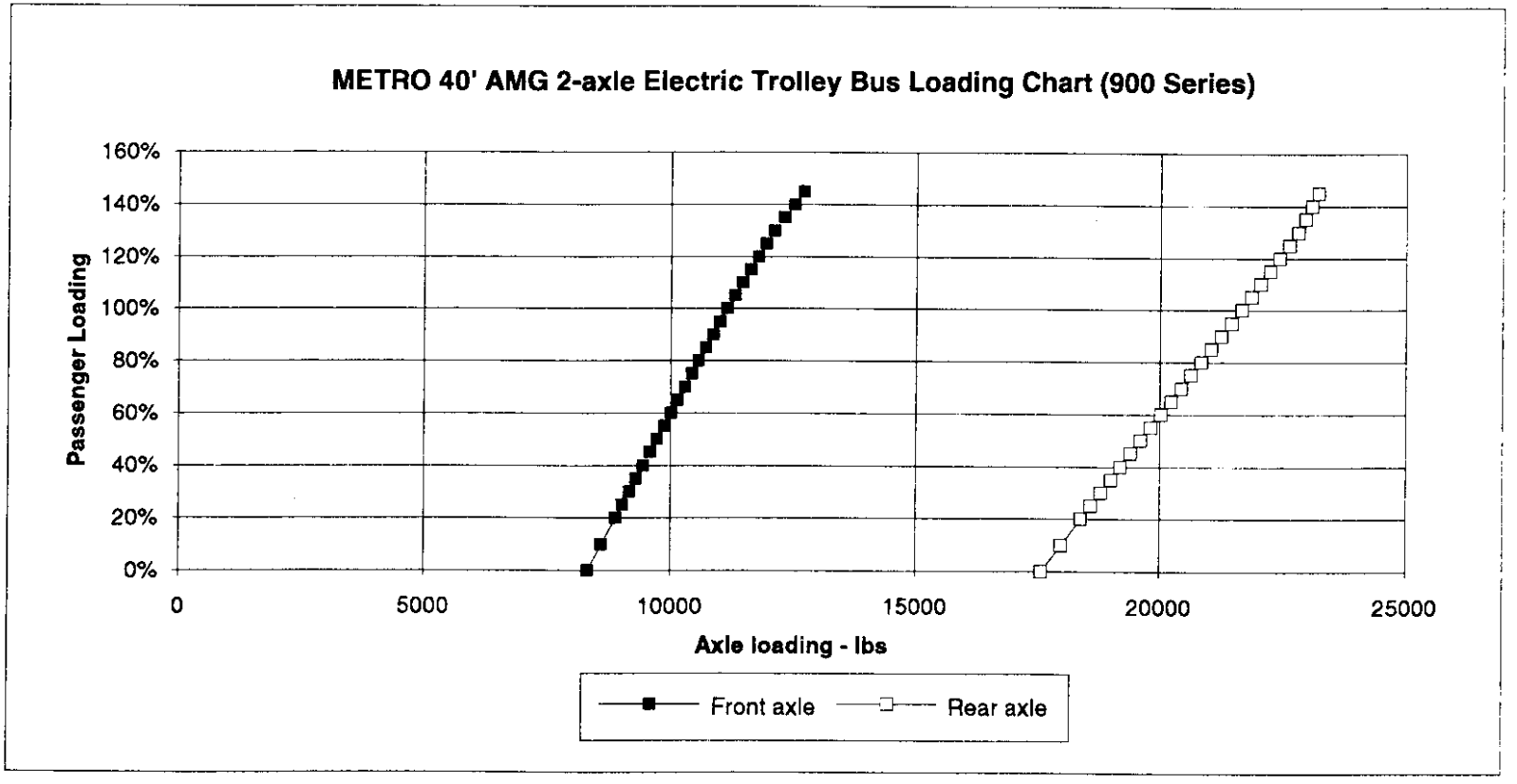
APPENDIX B
BUS LOADING CHARTS

METRO Bus loading Chart
Peter De Boldt - June 26, 1992

40' AMG Trolley Series 900 2-axle Electric

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	8320	8602	8884	9025	9166	9307	9448	9589	9730	9871	10012	10153	10294	10435	10576	10717	10858	10999	11140	11298	11457	11615	11773	11932	12090	12293	12495	12698	12900
Rear Axle	17580	17988	18396	18600	18804	19008	19212	19416	19620	19824	20028	20232	20436	20640	20844	21048	21252	21456	21660	21852	22043	22235	22427	22618	22810	22945	23080	23215	23350

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.

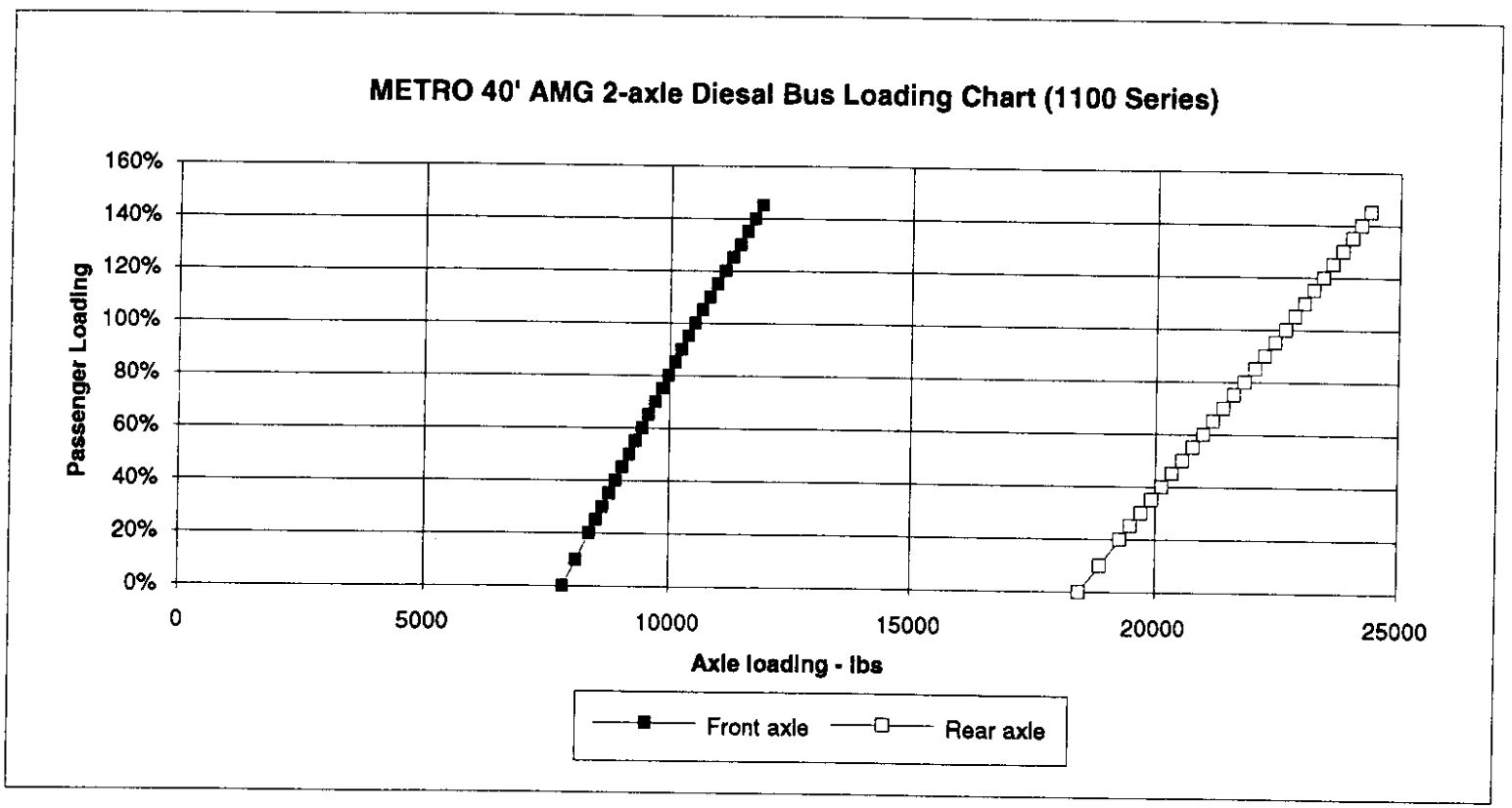


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

40' AMG Series 1100 2-axle Diesel Bus

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	7840	8107	8374	8508	8641	8775	8908	9042	9175	9309	9442	9576	9709	9843	9976	10110	10243	10377	10510	10665	10820	10975	11130	11285	11440	11590	11740	11890	12040
Rear Axle	18440	18863	19286	19498	19709	19921	20132	20344	20555	20767	20978	21190	21401	21613	21824	22036	22247	22459	22670	22865	23060	23255	23450	23645	23840	24028	24215	24403	24590

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.

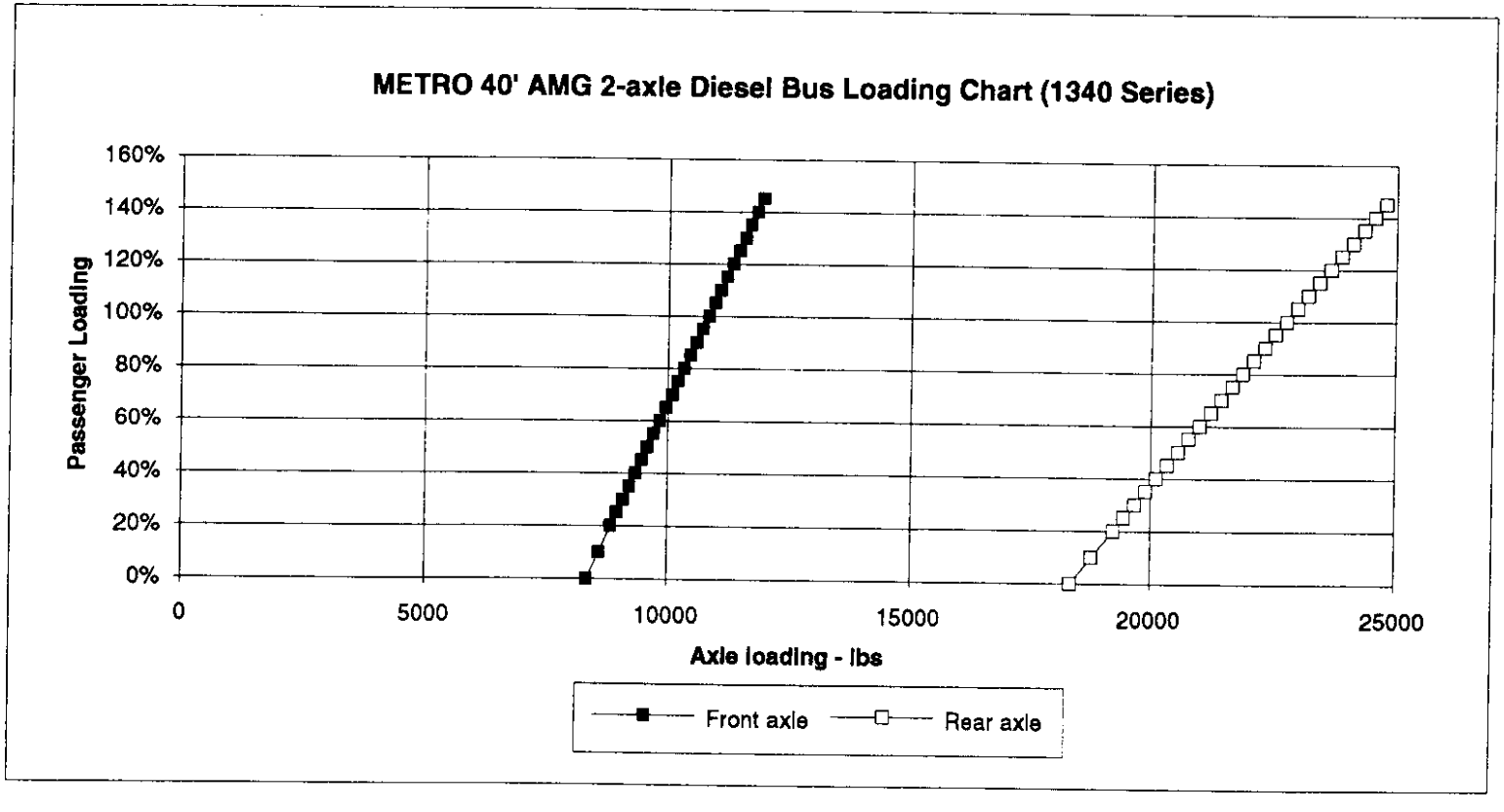


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

40' AMG Series 1340 2-axle Diesel Bus

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	8350	8598	8845	8969	9093	9216	9340	9464	9588	9711	9835	9959	10083	10206	10330	10454	10578	10701	10825	10949	11073	11198	11322	11446	11570	11694	11818	11941	12065
Rear Axle	18340	18785	19229	19451	19674	19896	20118	20340	20563	20785	21007	21229	21452	21674	21896	22118	22341	22563	22785	23008	23230	23453	23675	23898	24120	24343	24565	24788	25010

Information based on METRO supplied data outlining fleet specifications as of 8/4/87.

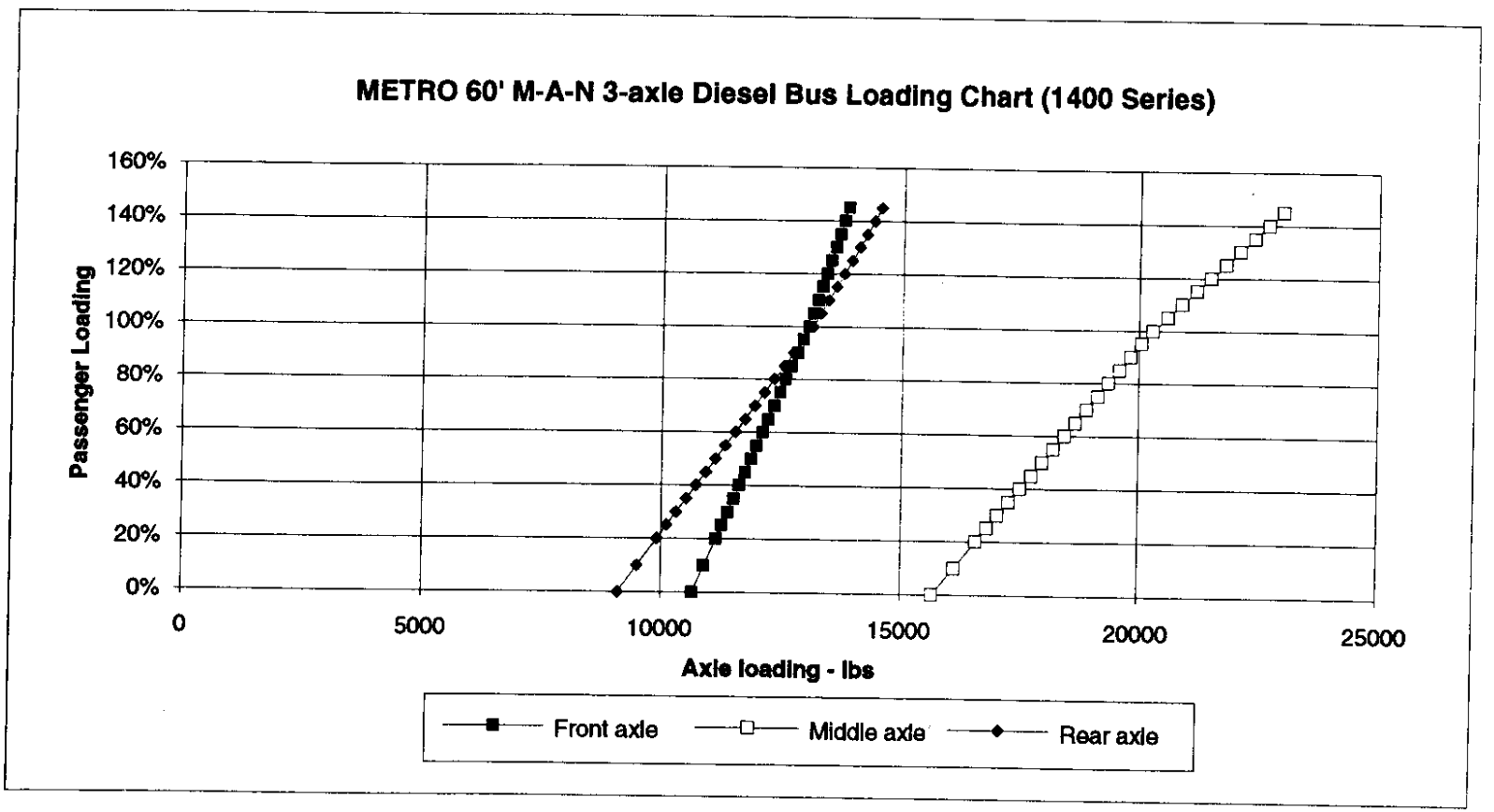


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

60' MAN Series 1400 3-axle Diesel

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	10680	10897	11134	11253	11371	11490	11608	11727	11845	11964	12082	12201	12319	12438	12556	12675	12793	12912	13030	13120	13210	13300	13390	13480	13570	13658	13745	13833	13920
Middle Axle	15680	16140	16600	16830	17060	17290	17520	17750	17980	18210	18440	18670	18900	19130	19360	19590	19820	20050	20280	20582	20883	21185	21487	21788	22090	22390	22690	22990	23290
Rear Axle	9120	9519	9918	10118	10317	10517	10716	10916	11115	11315	11514	11714	11913	12113	12312	12512	12711	12911	13110	13268	13427	13585	13743	13902	14060	14215	14370	14525	14680

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.

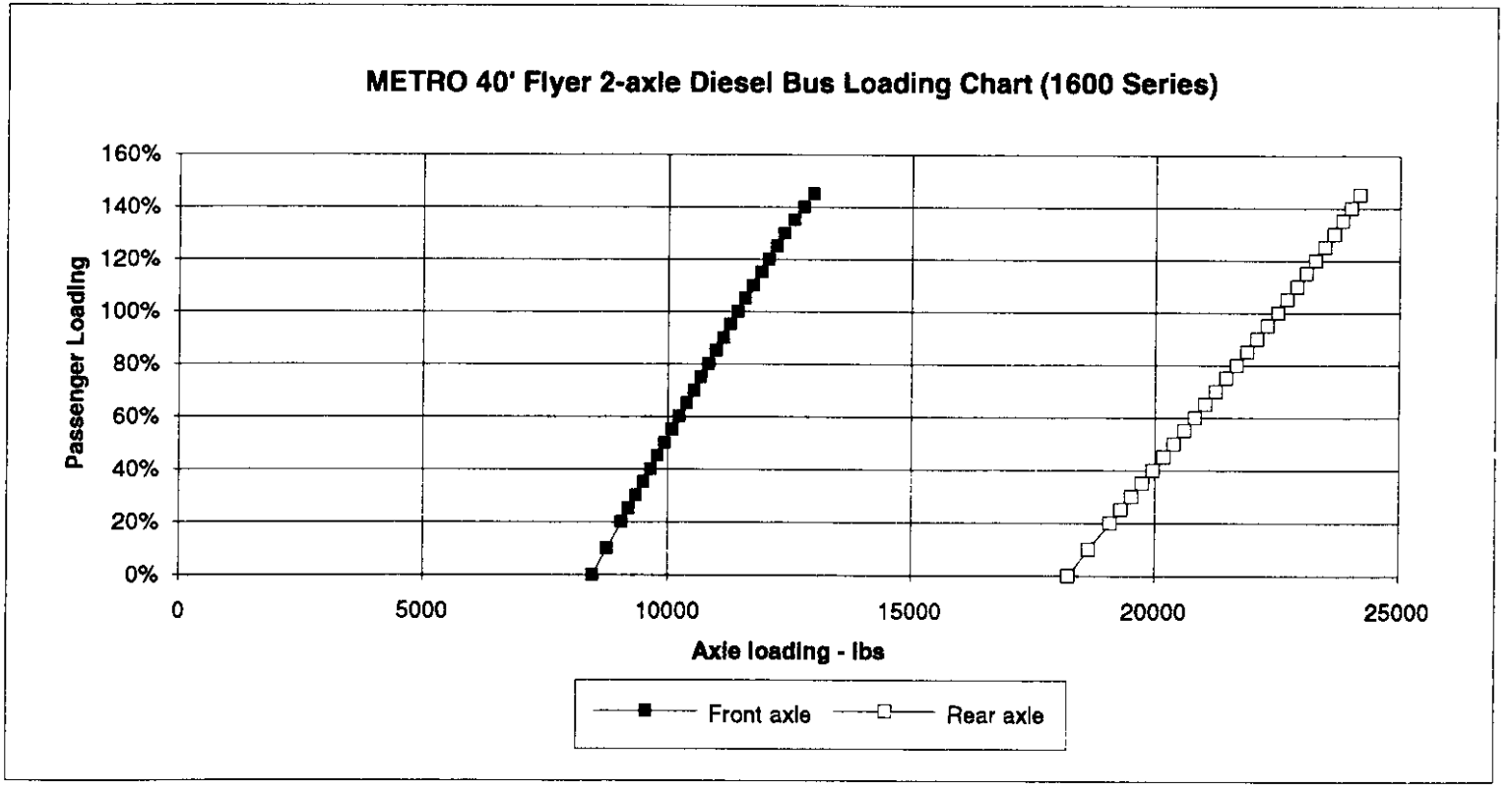


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

40' Flyer Series 1600 2-axle Diesel Bus

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	9480	9755	9050	9198	9345	9493	9640	9788	9935	10083	10230	10378	10525	10673	10820	10968	11115	11263	11410	11558	11727	11885	12043	12202	12360	12560	12760	12960	13160
Rear Axle	18260	18685	19110	19323	19535	19748	19960	20173	20385	20598	20810	21023	21235	21448	21660	21873	22085	22298	22510	22702	22894	23086	23277	23469	23661	23833	24006	24178	24350

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.

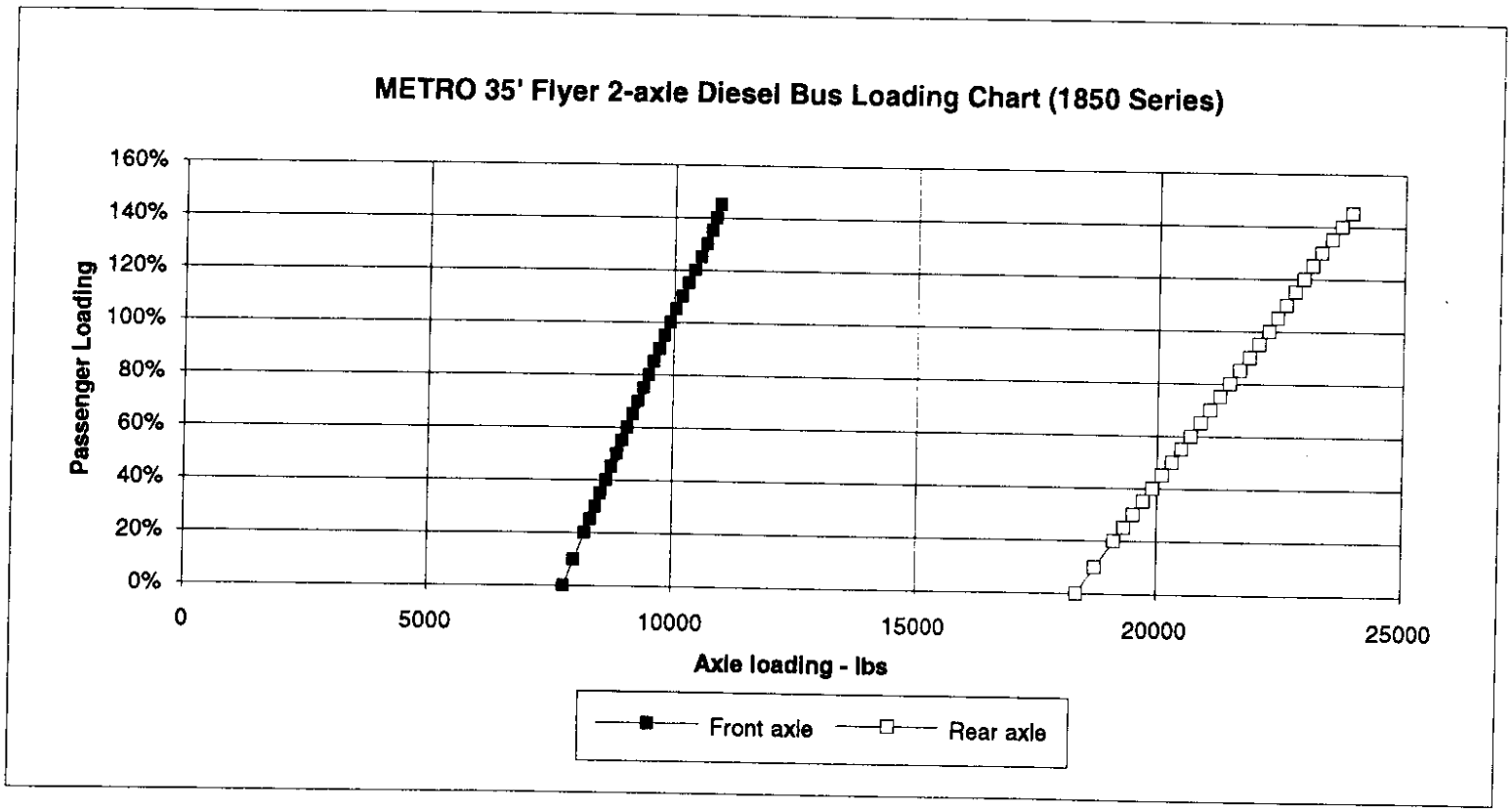


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

35' Flyer Series 1850 2-axle Diesel Bus

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	7800	8012	8224	8330	8436	8542	8648	8754	8860	8966	9072	9178	9284	9390	9496	9602	9708	9814	9920	10043	10167	10290	10413	10537	10660	10750	10840	10930	11020
Rear Axle	18360	18748	19136	19330	19524	19718	19912	20106	20300	20494	20688	20882	21076	21270	21464	21658	21852	22046	22240	22417	22593	22770	22947	23123	23300	23510	23720	23930	24140

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.

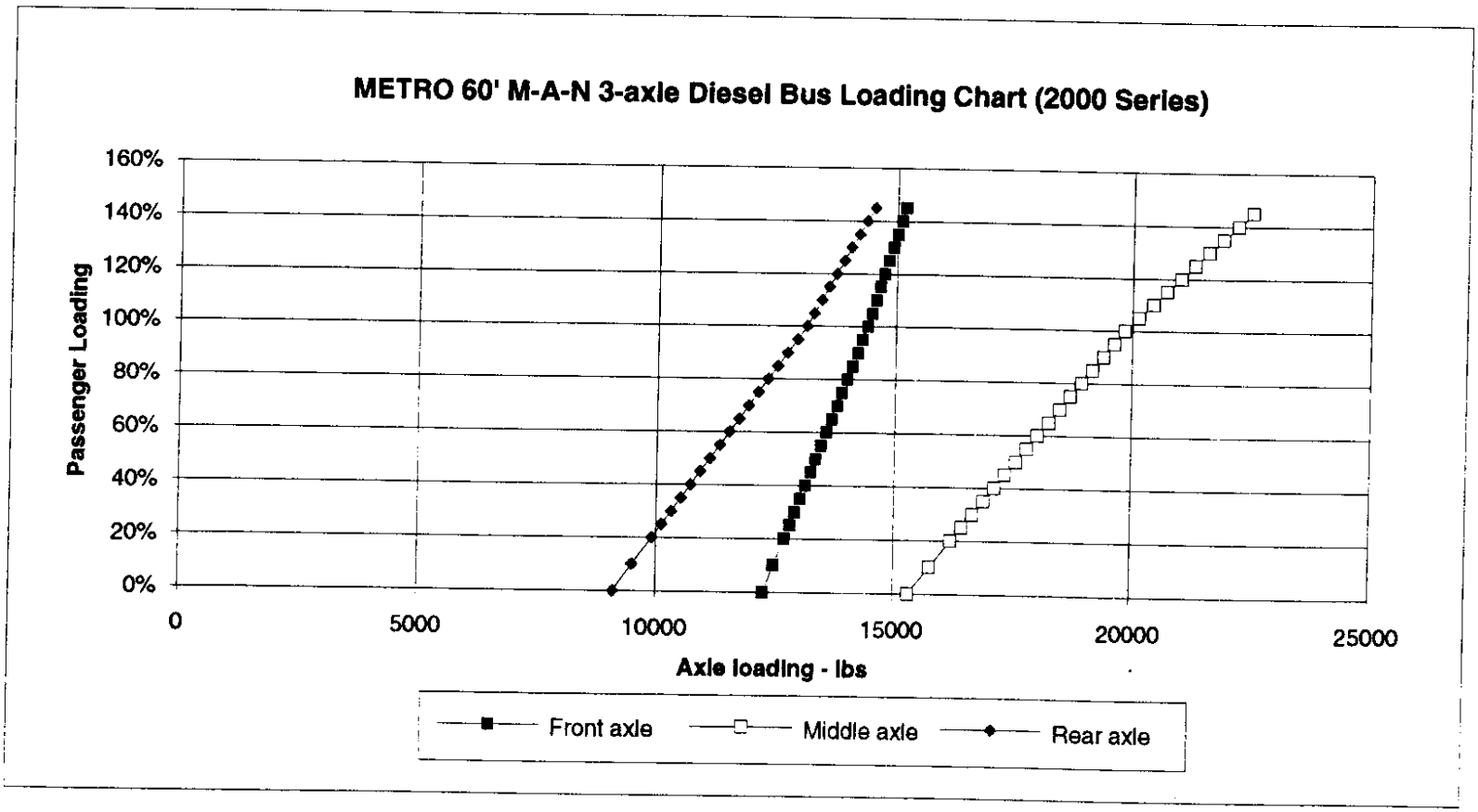


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

60' MAN Series 2000 3-axle Diesel

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	12240	12456	12672	12780	12888	12996	13104	13212	13320	13428	13536	13644	13752	13860	13968	14076	14184	14292	14400	14487	14573	14660	14747	14833	14920	15010	15100	15190	15280
Middle Axle	16320	15772	16224	16450	16676	16902	17128	17354	17580	17806	18032	18258	18484	18710	18936	19162	19388	19614	19840	20130	20420	20710	21000	21290	21580	21883	22185	22488	22790
Rear Axle	9120	9517	9914	10113	10311	10510	10708	10907	11105	11304	11502	11701	11899	12098	12296	12495	12693	12892	13090	13245	13400	13555	13710	13865	14020	14185	14350	14515	14680

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.

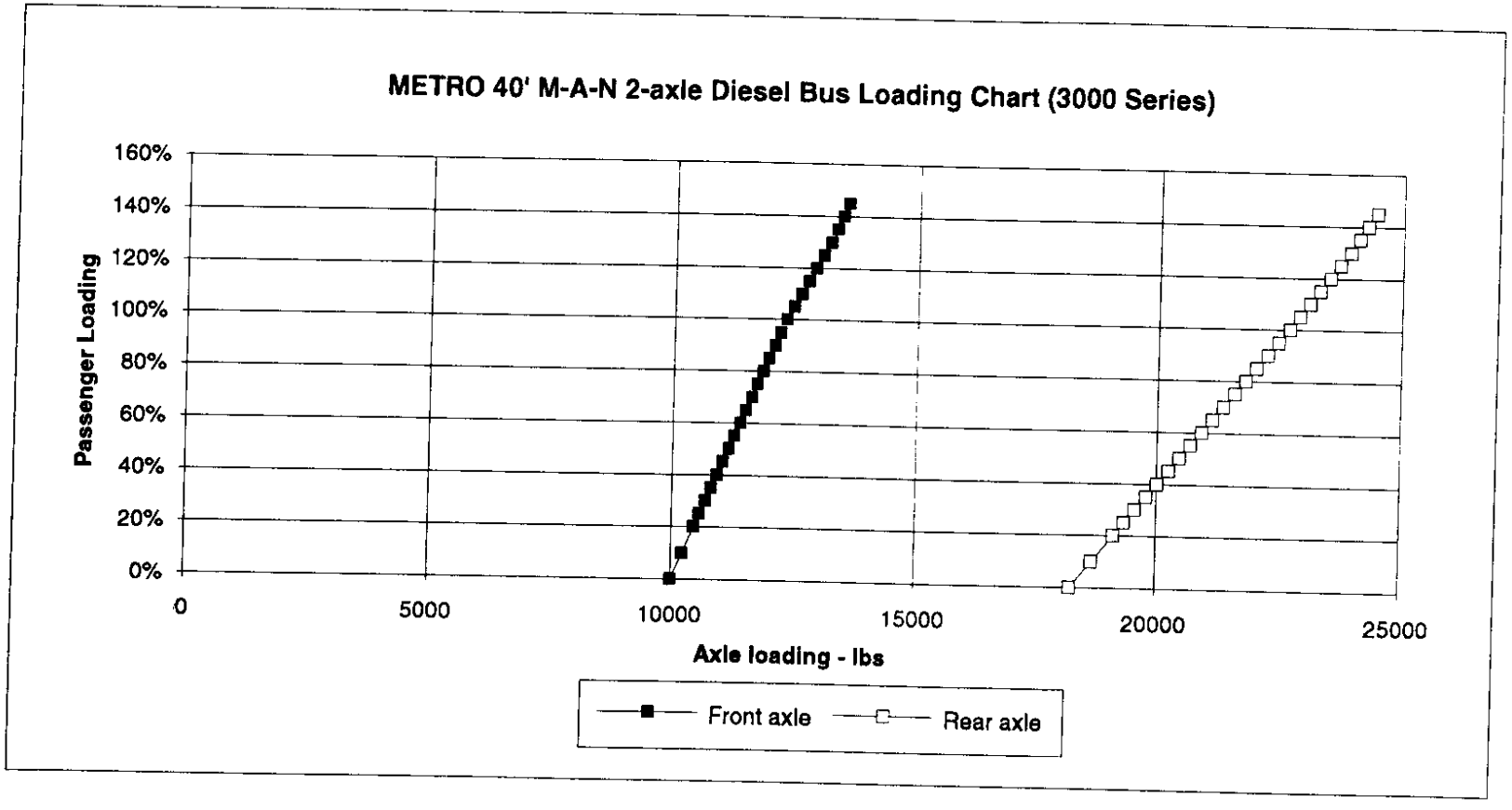


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

40' MAN Series 3000 2-axle Diesel

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	10000	10230	10460	10575	10690	10805	10920	11035	11150	11265	11380	11495	11610	11725	11840	11955	12070	12185	12300	12447	12593	12740	12887	13033	13180	13298	13415	13533	13650
Rear Axle	18240	18685	19130	19353	19575	19798	20020	20243	20465	20688	20910	21133	21355	21578	21800	22023	22245	22468	22690	22897	23103	23310	23517	23723	23930	24108	24285	24463	24640

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.

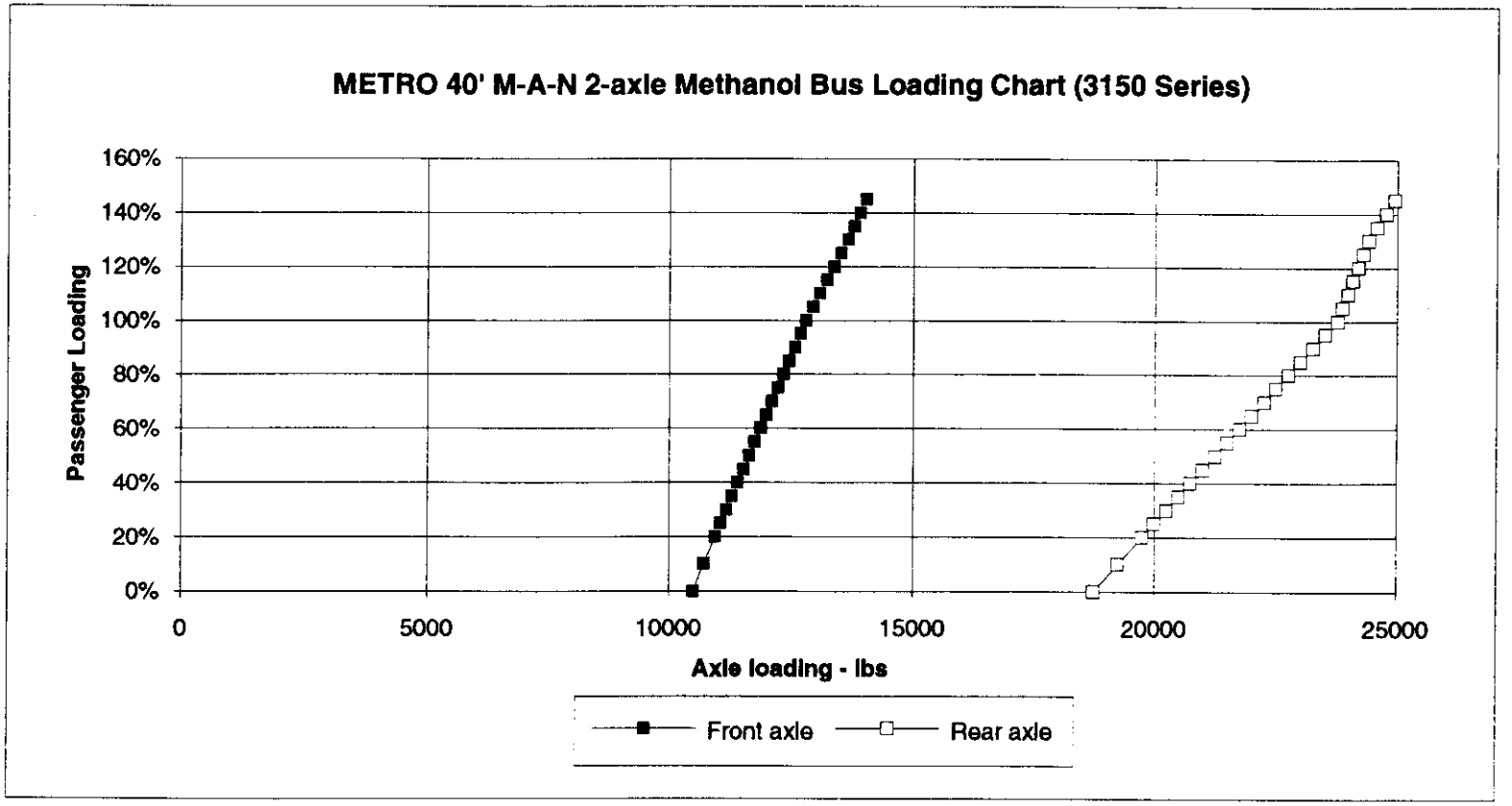


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

40' MAN Series 3150 2-axle Methanol

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	10469	10719	10949	11064	11179	11294	11409	11524	11639	11754	11869	11984	12099	12214	12329	12444	12559	12674	12789	12932	13076	13219	13362	13506	13649	13772	13894	14017	14139
Rear Axle	18729	19235	19741	19994	20247	20500	20753	21006	21259	21512	21765	22018	22271	22524	22777	23030	23283	23536	23789	23894	23999	24104	24209	24314	24419	24597	24774	24952	25129

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.

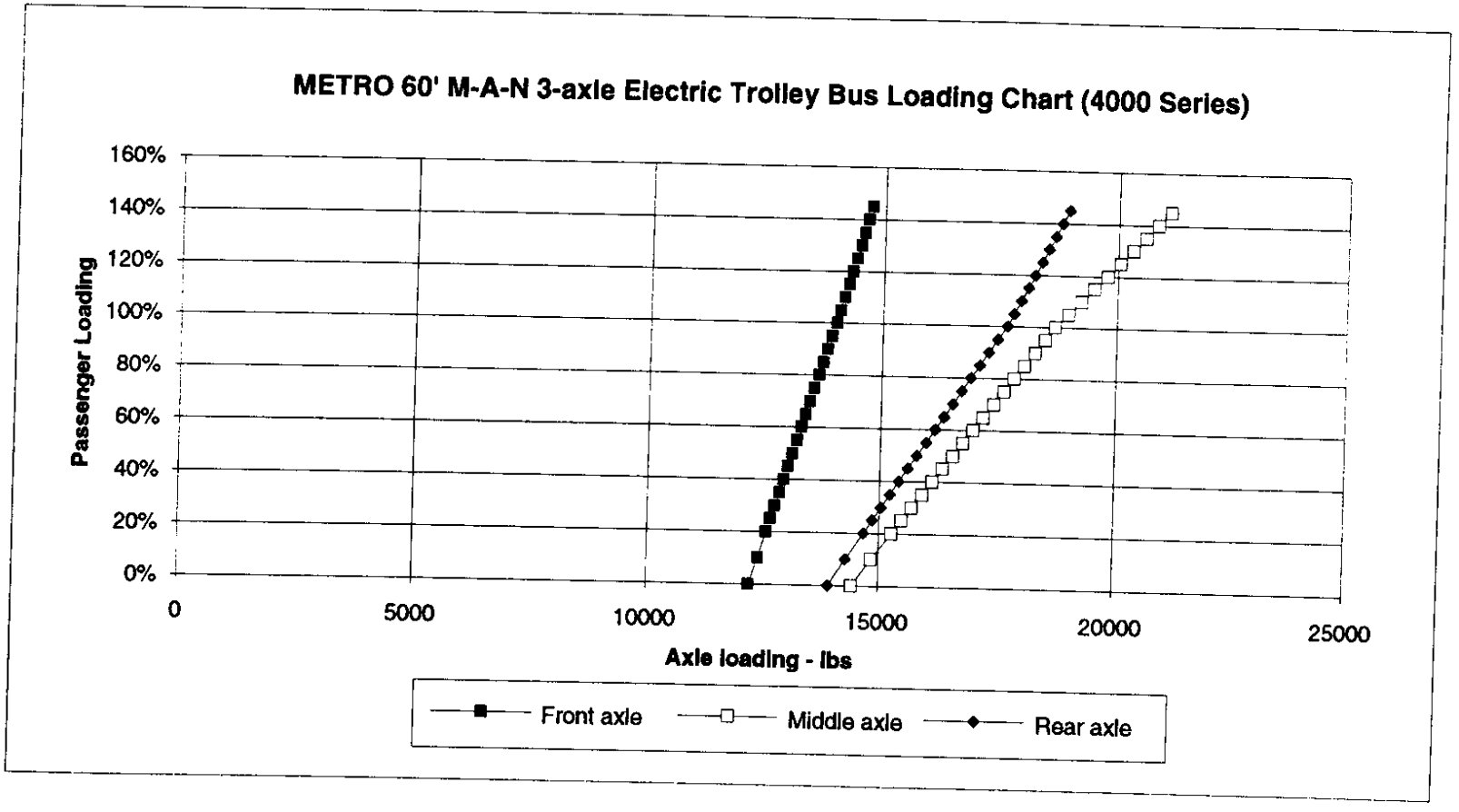


METRO Bus loading Chart
Peter De Boldt - June 26, 1992

60' MAN Series 4000 3-axle Electric Trolley

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	12220	12398	12576	12665	12754	12843	12932	13021	13110	13199	13288	13377	13466	13555	13644	13733	13822	13911	14000	14082	14163	14245	14327	14408	14490	14570	14650	14730	14810
Middle Axle	14420	14845	15270	15483	15695	15908	16120	16333	16545	16758	16970	17183	17395	17608	17820	18033	18245	18458	18670	18945	19220	19495	19770	20045	20320	20585	20850	21115	21380
Rear Axle	13926	14292	14664	14850	15036	15222	15408	15594	15780	15966	16152	16338	16524	16710	16896	17082	17268	17454	17640	17783	17927	18070	18213	18357	18500	18640	18780	18920	19060

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.



METRO Bus loading Chart
Peter De Boldt - June 26, 1992

60' Articulated Breda Series 5000 3-axle Diesel/Electric

	0% (Empty)	10% loaded	20% loaded	25% loaded	30% loaded	35% loaded	40% loaded	45% loaded	50% loaded	55% loaded	60% loaded	65% loaded	70% loaded	75% loaded	80% loaded	85% loaded	90% loaded	95% loaded	100% loaded	105% loaded	110% loaded	115% loaded	120% loaded	125% loaded	130% loaded	135% loaded	140% loaded	145% loaded	150% (Worst Case)
Front Axle	13267	13466	13664	13764	13863	13962	14061	14161	14260	14359	14459	14558	14657	14757	14856	14955	15054	15154	15253	15340	15426	15513	15600	15686	15773	15861	15948	16036	16123
Middle Axle	15546	15936	16326	16521	16715	16910	17105	17300	17495	17690	17885	18080	18275	18470	18664	18859	19054	19249	19444	19677	19911	20144	20377	20611	20844	21102	21359	21617	21874
Rear Axle	20527	20889	21251	21432	21613	21794	21975	22156	22338	22519	22700	22881	23062	23243	23424	23605	23786	23967	24148	24296	24445	24593	24741	24890	25038	25191	25343	25496	25648

Information based on METRO supplied data (Nov. 8, 1990) from certified scales.