

## FINAL

# Revised Aurora Avenue North Transit, Pedestrian, and Safety Improvement Project

## Transportation Analysis Technical Memorandum

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File  
DATE: February 6, 2008  
PROJECT NUMBER: 324876

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### Introduction

Aurora Avenue North is classified as a statewide urban principal arterial that serves regional and local traffic north of downtown Seattle. It is designated a Highway of Statewide Significance (HSS) and a T-2 statewide freight route by WSDOT and is often used as an alternate route to Interstate 5 because it runs parallel to and west of the interstate.

This technical memorandum summarizes the traffic analysis performed in support of the Revised Aurora Avenue North - Transit, Pedestrian and Safety Improvement Project. This revised project will widen Aurora Avenue North to a seven (7) lane roadway section comprised of northbound and southbound business access and transit (BAT) lanes, two general purpose lanes in each direction, a left-turn lane/landscaped center median, new left-turn lanes at signalized intersections, eight-and-a-half foot wide sidewalk with curb-and-gutter and landscaping. The sidewalk area will require consolidation of some business access points and provide new driveways where before there was continuous shoulder access. Additional improvements include street lighting, enhanced transit areas, traffic signal modifications, relocation of utility poles, and storm drainage improvements (if necessary).

The BAT lanes, turn restrictions resulting from the raised center median, and sidewalk improvements can be expected to provide improvements and benefits to intersection operations, transit reliability and pedestrian usage, while reducing the angle and driveway type accidents.

This technical memorandum contains the AM and PM peak hour intersection operations analysis for the existing (2005) year and the Build scenario for the year of opening (2010). The existing year (2005) represents when traffic count data was collected, the base conditions selected, and when project work began. The existing traffic counts are still valid because the physical conditions of the roadway, adjacent land uses, and access characteristics have not changed considerably. Also, there is variability inherent in

collecting a small sample size of data and there is little chance that new traffic counts would be substantially high enough to change the forecasted traffic volumes. Therefore, the results and conclusions of the future operational analysis would not change and are still valid. The operational analyses for both the No Build and Build scenarios in the design (2030) year are also presented. This memorandum also includes a safety analysis, traffic volume forecasting, and the methods and assumptions used to complete the operational analysis.

## Project Description

The Revised Aurora Avenue North project is located within the City of Seattle in King County, Washington. Aurora Avenue North is a major north/south urban highway that serves both local and regional traffic within the City of Seattle. Aurora Avenue North, as named within the City of Seattle, is a portion of signed State Route 99 (SR 99) that extends from north Pierce County to north Snohomish County and serves as a regional link between cities within the Puget Sound Region. Within the project limits, Aurora Avenue serves as a major traffic artery for the City of Seattle, with links to I-5 through connections at North 130th Street and North 145th Street.

The City of Seattle, in cooperation with the Washington Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA), proposes to make improvements to Aurora Avenue North between North 110th Street and North 145th Street (approximately 1.6 miles; see Figure 1). The revised project improvements are described in greater detail on page 18. These improvements are consistent (except for widening existing lanes) with the Route Development Plan (RDP) (WSDOT 2003) prepared by WSDOT for Aurora Avenue North between the north end of the Battery Street Tunnel and North 145th Street in the City of Seattle, Washington (milepost 32.44 to milepost 40.47). The RDP is a 25-year plan intended to assist WSDOT, the City of Seattle, and King County Metro in making informed decisions on future improvements to the SR 99 corridor.

The RDP listed the following six long-term improvement recommendations for what was referred to as the North Focus Area, from North 110th Street to North 145th Street (see Figure 2):

- Widen existing lanes
- Add a southbound business access and transit (BAT) lane
- Add a raised median with controlled access points
- Construct a continuous amenity zone on both sides of SR 99
- Improve pedestrian crossings
- Driveway consolidation at logical locations

This project has been designed with the intent of fulfilling those recommendations with the exception of widening existing lanes. The revised project will match the existing lane widths.

## Existing Conditions

### Physical Characteristics

The study area for this project extends along Aurora Avenue North from N. 110<sup>th</sup> Street to N. 145<sup>th</sup> Street within the City of Seattle (see Figure 1). The study area includes eleven (11) study intersections. The unsignalized intersection at N. 127<sup>th</sup> Street was not chosen to be a study intersection. Seven intersections are currently signalized, while four of them are unsignalized (stop-controlled on the minor street approaches to Aurora Avenue North). These study intersections are located on Aurora Avenue North at:

- North 112<sup>th</sup> Street (signalized)
- North 115<sup>th</sup> Street (signalized)
- North 117<sup>th</sup> Street (signalized)
- North 125<sup>th</sup> Street (signalized)
- North 128<sup>th</sup> Street (unsignalized)
- North 130<sup>th</sup> Street (signalized)
- North 135<sup>th</sup> Street (signalized)
- North 137<sup>th</sup> Street (unsignalized)
- North 140<sup>th</sup> Street (unsignalized)
- North 143<sup>rd</sup> Street (unsignalized)
- North 145<sup>th</sup> Street (signalized)

Within the project limits, Aurora Avenue North is a six-lane roadway. Travel lanes through the study area are typically 10 to 12-foot wide. In the northbound direction, there are two general purpose lanes and business access and transit (BAT) lanes. The northbound BAT lane begins north of N. 112<sup>th</sup> Street and is restricted to transit vehicles, vehicles accessing business driveways, and right-turning vehicles exiting Aurora Avenue North. In the southbound direction, there are two general purpose lanes only. A center two-way left-turn lane (TWLTL) separates north and southbound traffic and provides full access to businesses and cross streets throughout the length of the project. Additional exclusive left-turn pockets occur at many of the study intersections described below.

Aurora Avenue North currently lacks adequate access management. Freestanding commercial buildings with individual driveways or continuous shoulder access are dominant along the roadway throughout the study area, resulting in a large number of individual access points. Much of the existing business parking along the corridor is directly adjacent to the roadway shoulders and is angled or perpendicular to the street.

Aurora Avenue North is also deficient for non-motorized travel. Numerous driveways, limited curbs and sidewalks, and erratic parking all contribute to a general lack of safe passage for pedestrians, wheelchairs, and bicyclists. Sidewalks are limited on either side of the roadway and generally occur only in front of recently developed establishments. When there are no sidewalks, there is shoulder width available for pedestrians and bus riders.

The roadway speed limit is posted at 35 miles per hour (mph) for the segment of Aurora Avenue North between North 110<sup>th</sup> Street and North 115<sup>th</sup> Street. Between North 115<sup>th</sup> Street and North 145<sup>th</sup> Street, the posted speed limit increases to 40 mph.

The following paragraphs describe the characteristics of the study intersections along Aurora Avenue North. Figure 3 shows the current lane channelization and intersection control.

#### **Aurora Avenue North and North 112<sup>th</sup> Street**

The Aurora Avenue North and North 112<sup>th</sup> Street intersection is a 4-leg, 2-phase signalized intersection with permitted left-turn phasing on all approach legs. North 112<sup>th</sup> Street is the access point to the Washelli Cemetery and intersects Aurora Avenue North at approximately a 90-degree angle on both approaches. The southbound approach consists of an exclusive left-turn pocket (approximately 200 feet long), two through lanes, and a shared through/right-turn lane. The northbound approach consists of an exclusive left-turn pocket (approximately 250 feet long), two through lanes, and a shared through/right-turn lane. The eastbound approach on North 112<sup>th</sup> Street consists of an exclusive left-turn pocket (approximately 50 feet long) and a shared through/right-turn lane. The westbound approach on North 112<sup>th</sup> Street consists of an exclusive left-turn pocket (approximately 65 feet long) and a shared through/right-turn lane. Marked crosswalks are provided on the north, east, and west legs of the intersection.

#### **Aurora Avenue North and North 115<sup>th</sup> Street**

The Aurora Avenue North and North 115<sup>th</sup> Street intersection is a 3-leg, 3-phase signalized intersection with protected/permitted (flashing yellow) left-turn phasing on southbound Aurora Avenue North. North 115<sup>th</sup> Street intersects Aurora Avenue North at approximately a 90-degree angle from the east. The southbound approach consists of an exclusive left-turn pocket (approximately 120 feet long) and two through lanes. The northbound approach consists of two through lanes and a BAT lane (exclusive to transit and right-turning vehicles). The westbound approach on North 115<sup>th</sup> Street consists of a single shared left/right-turn lane. A marked crosswalk is provided on the north leg of the intersection.

#### **Aurora Avenue North and North 117<sup>th</sup> Street**

The Aurora Avenue North and North 117<sup>th</sup> Street intersection is a 3-leg, 3-phase signalized intersection with protected/permitted (flashing yellow) left-turn phasing on southbound Aurora Avenue North. North 117<sup>th</sup> Street approaches Aurora Avenue North from the west at a 90-degree angle. The southbound approach consists of an exclusive left-turn pocket (approximately 120 feet long) and two through lanes. The northbound approach consists of two through lanes and a BAT lane (exclusive to transit and right-turning vehicles). The westbound approach on North 117<sup>th</sup> Street consists of exclusive left (approximately 240 feet long) and right-turn lanes. A marked crosswalk is provided on the north leg of the intersection.

#### **Aurora Avenue North and North 125<sup>th</sup> Street**

The intersection at Aurora Avenue North and North 125<sup>th</sup> Street is a 4-leg signalized intersection with protected left-turn phasing on all approaches. North 125<sup>th</sup> Street intersects Aurora Avenue North at a 90-degree angle. The southbound approach consists of an exclusive left-turn pocket (approximately 100 feet long), a through lane and a shared through/right-turn lane. The northbound approach consists of an exclusive left-turn pocket (approximately 140 feet long), two through lanes, and a BAT lane. The cross street approaches on North 125<sup>th</sup> Street include left-turn pockets (westbound pocket is 150 feet

long, eastbound pocket is 120 feet long) and one shared through/right-turn lane. Crosswalks and pedestrian push-buttons are provided on all the intersection legs.

#### **Aurora Avenue North and North 128<sup>th</sup> Street**

At the intersection of Aurora Avenue North and North 128<sup>th</sup> Street, there are four approaches, which generally meet at 90 degree angles. This intersection is unsignalized. The approaches on North 128<sup>th</sup> Street are stop-controlled and consist of a single shared lane approach in each direction. Traffic on Aurora Avenue North operates as the free movement. The southbound approach to this intersection consists of a through lane, a shared through/right-turn lane, and an exclusive left-turn pocket (approximately 130 feet long). Similarly, the northbound approach consists of two through lanes, a BAT lane, and an exclusive left-turn pocket (290 feet long). North and southbound left-turning traffic must yield to opposing through traffic. Crosswalks are not provided at this intersection.

#### **Aurora Avenue North and North 130<sup>th</sup> Street**

The Aurora Avenue North and North 130<sup>th</sup> Street intersection is a 4-leg signalized intersection with protected left-turn phasing on all approaches. The northbound approach includes a left-turn pocket (150 feet long), two through lanes, and a BAT lane. The southbound approach includes a left-turn pocket (320 feet long), a through lane, and a shared through/right-turn lane. The eastbound and westbound approaches each consist of a left-turn pocket (westbound pocket is 190 feet, eastbound pocket is 210 feet long), a through lane, and a shared through/right-turn lane. Crosswalks and pedestrian push-buttons are provided on all legs except across the north leg, where a pedestrian overpass bridge is provided.

#### **Aurora Avenue North and North 135<sup>th</sup> Street**

The intersection at Aurora Avenue North and North 135<sup>th</sup> Street is a 4-leg, 3-phase signalized intersection. The northbound and southbound left turns have separate pockets (each is 140 feet long) and protected phasing. The remaining northbound approach lanes include two through lanes and a BAT lane, while the southbound approach consists of a through lane and a shared through/right-turn lane. The eastbound approach is a single, shared turn lane. The westbound approach includes a separate left-turn pocket (120 feet long) and one shared through/right lane. Eastbound and westbound traffic share the same phase with permitted left turns. Crosswalks and pedestrian push-buttons are provided on all of the intersection legs.

#### **Aurora Avenue North and North 137<sup>th</sup> Street**

At the unsignalized intersection of Aurora Avenue North and North 137<sup>th</sup> Street, the northbound and southbound approaches include two through lanes in each direction (with a northbound BAT lane). The north and southbound movements are free and are divided by a center two-way left turn lane that provides storage for left turning vehicles. There are no exclusive turn pockets marked at this intersection. The storage distance northbound is approximately 300 feet, while the storage distance southbound is approximately 660 feet and extends upstream to North 140<sup>th</sup> Street.

The eastbound and westbound approaches on North 137<sup>th</sup> Street are stop-controlled and each consists of a single, shared left/through/right-turn lane. Crosswalks are not provided at this intersection.

### **Aurora Avenue North and North 140<sup>th</sup> Street**

The Aurora Avenue North and North 140<sup>th</sup> Street intersection is a 3-leg, unsignalized intersection. North 140<sup>th</sup> Street intersects Aurora Avenue North at approximately a 90-degree angle from the east. This westbound approach consists of a single, stop-controlled, shared left/through/right-turn lane. The southbound approach consists of two through lanes and the northbound approach consists of two through lanes and a BAT lane (exclusive to transit and right-turning vehicles). The northbound and southbound movements are free and divided by a center two-way left-turn lane. This center lane provides separated storage length for left-turning vehicles, which must yield to oncoming traffic. There are no exclusive turn pockets marked at this intersection. A marked crosswalk is provided on the south side of the intersection.

### **Aurora Avenue North and North 143<sup>rd</sup> Street**

The intersection at Aurora Avenue North and North 143<sup>rd</sup> Street is a 4-leg unsignalized intersection. Through movements are free along Aurora Avenue North, which includes two through lanes in the southbound direction and two through lanes and a BAT lane in the northbound direction. The directions are separated by a center two-way left turn lane, which provides storage for north and southbound left-turning vehicles. The cross street approaches on North 143<sup>rd</sup> Street are stop-controlled and each include one shared left/through/right-turn lane. Crosswalks are not provided at this intersection.

### **Aurora Avenue North and North 145<sup>th</sup> Street**

At the intersection of Aurora Avenue North and North 145<sup>th</sup> Street, the northbound and southbound approaches include two through lanes in each direction (with an additional BAT lane northbound). The north and southbound directions also include left-turn storage pockets, each of which is approximately 250 feet long. The eastbound approach on North 145<sup>th</sup> Street includes a through lane, a shared through/right-turn lane, and an exclusive left-turn pocket approximately 120 feet long. The westbound approach also includes two through lanes and exclusive left-turn (approximately 165 feet long) and right-turn (approximately 300 feet long) pockets. This intersection is controlled by a 4-phase signal, which provides protected left-turn phases. Crosswalks and pedestrian push-buttons are provided on all of the intersection legs.

## **Traffic Volumes**

Within the study area, average daily traffic volumes along Aurora Avenue North vary between 35,000 vehicles per day (vpd) and 39,000 vpd. Daily traffic volumes are evenly split between northbound and southbound travel.

Morning and afternoon peak period traffic counts were conducted at the eleven study intersections in March and June of 2005 by the City of Seattle. The 2-hour counts occurred between 7 AM and 9 AM in the morning and 4 PM and 6 PM in the afternoon. The traffic counts showed that northbound travel is the dominant movement in the afternoon peak hour while southbound travel is heaviest in the morning. The AM peak traffic volumes in the study area are approximately 75 percent of the PM peak traffic volumes. The existing year (2005) represents when traffic count data was collected, the base conditions selected for the traffic analysis, and when project work began. The existing traffic counts are still valid because the physical conditions of the roadway, adjacent land uses, and access characteristics have not changed considerably. Also, there is variability inherent in

collecting a small sample size of data and there is little chance that new traffic counts would be substantially high enough to change the forecasted traffic volumes. Therefore, the results and conclusions of the future operational analysis would not change and are still valid.

The 2005 peak period traffic counts had large volume differences between adjacent study intersections that could not be fully explained by business driveway activity. Historical traffic counts from 2002 and 2003 were used as part of the volume balancing effort to reduce these volume differences. Figure 4 provides a summary of the adjusted existing AM and PM peak hour study intersection turning movement volumes used in the intersection operational analysis.

## Pedestrian Volumes

Pedestrian volumes at intersection crosswalks were also collected with the traffic counts in March and June of 2005. These counts showed pedestrian activity as high as 59 crossings per intersection during the morning peak hour and 125 per intersection during the afternoon peak hour. The lowest pedestrian counts were collected at the south end of the study area near N. 117th Street and the highest at N. 135th Street and N. 145th Street. See Appendix A for the original traffic count data collected in the study area.

## Transit Service

Transit service is provided in the study area by King County Metro. Route number 358 serves Aurora Avenue North in both directions, with many transit stops between North 110<sup>th</sup> Street and North 145<sup>th</sup> Street. Route number 345 provides service on North 130<sup>th</sup> Street, which crosses Aurora Avenue North at a major transfer point. Similarly, route number 304 provides east/west service across Aurora Avenue North along North 145<sup>th</sup> Street. Table 1 (next page) shows the King County Metro route number, description, service days, service times and directions, and typical headways of each route.

TABLE 1  
King County Metro Routes within Study Area

No.	Route Description	Service Days	Service Times <sup>1</sup> (Direction)	Typical Headways
358	Downtown Seattle to Aurora Village	Weekdays	4:25 AM to 1:00 AM (to Seattle)	6 to 7 minutes (between 6:30 AM and 8:00 AM to Downtown Seattle, 4:30 PM and 6:00 PM to Aurora Village)
			5:35 AM to 2:00 AM (to Aurora Village)	
				15 minutes (all other times of day)
345	Northgate to Shoreline Community College	Weekdays	5:05 AM to 1:00 AM (to Seattle)	15 to 20 minutes
			6:10 AM to 2:00 AM (to Aurora Village)	
304	Downtown Seattle to Richmond Beach	Weekdays	6:00 AM to 11:00 PM (to Northgate)	30 minutes
			6:20 AM to 12:00 AM (to Shoreline CC)	
304	Downtown Seattle to Richmond Beach	Weekdays	6:30 AM to 10:00 PM (to Northgate)	30 minutes (Saturdays) 60 minutes (Sundays)
			6:30 AM to 10:30 PM (to Shoreline CC)	
304	Downtown Seattle to Richmond Beach	Weekdays	6:10 AM to 8:25 AM (to Seattle)	20 minutes (AM to Seattle) 30 minutes (PM to Richmond Beach)
			3:35 PM to 6:40 PM (to Richmond Beach)	

<sup>1</sup> Service times are approximate.

Source: <http://transit.metrokc.gov>

There are no Park-and-Ride lots located in the vicinity of the project area. Sound Transit does not provide any transit service (ST Express) to the area. Transit zones (bus stops) are not well defined, are often marked by a single pole-mounted sign, and lack safe access for people with disabilities.

### Current Ridership

Ridership data was collected for Metro routes 304, 345, and 358. The average weekday (Monday - Friday) and weekend (Saturday, Sunday) boardings and deboardings at stops within the study area are summarized in Table 2 (next page). Ridership data is provided in Appendix B.

TABLE 2  
King County Metro Ridership Data  
February to June 2006

Bus Route	Direction	Average Daily Boardings	Average Daily Deboardings	Average Daily Total
<b>Weekdays</b>				
358 <sup>1</sup>	Northbound	345	894	1,239
	Southbound	936	372	1,308
345 <sup>2</sup>	Eastbound	39	25	64
	Westbound	30	41	71
304 <sup>3</sup>	Eastbound	4	0	4
	Westbound	0	5	5
<b>Weekends</b>				
358 <sup>1</sup>	Northbound	193	456	649
	Southbound	673	312	985
345 <sup>2</sup>	Eastbound	20	10	30
	Westbound	18	42	60

1 – Stops providing data located along Aurora Avenue N. near the Washelli Cemetery Entrance, N. 115th Street, N. 125th Street, N. 130th Street, N. 135th Street, and N. 145th Street intersections.

2 – Stops providing data located near the intersection of Aurora Avenue N. and N. 130th Street.

3 – Stops providing data located near the intersection of Aurora Avenue N. and N. 145th Street.

Source: Seattle Metro APC System.

Table 2 shows that average daily riders in the study area total approximately 2,700 on weekdays and approximately 1,700 on weekend days.

## Accident History

The most current accident data, at the time project work began in 2005 and data requested, was provided by WSDOT for the period from January 1, 2002 to December 31, 2004. The trends and patterns revealed in the accident analysis remain valid because the physical conditions of the roadway, access characteristics, adjacent land uses, and traffic volumes have not changed considerably. Without substantial changes to these factors, it is unlikely that a more recent three-year period of accident data would change the results and conclusions. The following discussion will reveal the accident rates and the important patterns that emerged from the analysis. The accident data is categorized by intersection and roadway segment. A total of 544 accidents were reported for the 3-year period along the study section of Aurora Avenue North. Of the total, 277 resulted in property damage only, 265 accidents resulted in an injury, and 2 fatal crashes were reported.

The predominant accident type along Aurora Avenue North in the past three years has been rear-end accidents (34.9%). The rear-end accident is the most common type in a congested corridor with stop-and-go conditions and long queues. The next most frequent accident type was entering driveway (19.1%), common for a corridor with unmanaged access and numerous business driveways. Combining the entering driveway (19.1%), angle (15.1%), entering at angle (8.1%), and leaving driveway (6.1%) accidents gives a total of 48.4 percent angle-type accidents in the study area. Table 3 summarizes the type and frequency of the accident.

TABLE 3

Aurora Avenue North Accident Type Summary (January 1, 2002 to December 31, 2004)

*N. 110<sup>th</sup> Street to N. 145<sup>th</sup> Street*

<b>Accident Type</b>	<b>Number of Accidents</b>	<b>Percentage</b>
Rear-end	190	34.9%
Entering driveway	104	19.1%
Angle	82	15.1%
Entering at angle	44	8.1%
Sideswipe, same direction	37	6.8%
Leaving driveway	33	6.1%
Pedestrian	16	2.9%
Object	15	2.7%
Other	12	2.2%
Parked	7	1.3%
Bicycle	2	0.4%
Sideswipe, opposite direction	2	0.4%
Total	544	100%

Sources: WSDOT Collision Data Office.

An analysis was performed of the number of accidents occurring in the left-turn lane or median and those involving at least one vehicle making a left-turn movement at an unsignalized location. These are also accidents common for a corridor with unmanaged access. In the three-year period, there were 177 (32%) accidents that involved one of the vehicles in the crash turning left or the location of the impact being in the left-turn lane or TWLTL median at an unsignalized location. This reveals that nearly one-third of the accidents could be prevented by implementing the turn restrictions with the raised median.

During the three-year period along the study section an average of 181 accidents occurred per year. The greatest number of accidents, 190, occurred in 2004. The fewest number of accidents, 174, occurred in 2002. There were at least 89 and no greater than 95 accidents that resulted in property damage only and between 85 and 95 accidents that resulted in injury each of the three years. Two fatal crashes occurred in the three-year study, both in 2004, and alcohol was not involved in either crash. One fatal crash occurred at the N. 115th Street intersection, where a pedestrian (crossing against the signal) was struck and killed by a vehicle traveling in the southbound direction. The second fatal crash occurred at the N. 128th Street intersection, where a southbound motorcycle (exceeding the speed limit) struck a northbound vehicle turning left. Table 4 (next page) summarizes the yearly accidents.

TABLE 4

Aurora Avenue North Accident Yearly Summary (January 1, 2002 to December 31, 2004)  
*N. 110<sup>th</sup> Street to N. 145<sup>th</sup> Street*

Year	Total Accidents	PDO	Injury	Fatality	Under Influence of Alcohol or Drugs
2002	174	89	85	0	2
2003	180	95	85	0	6
2004	190	93	95	2	7
<b>Total</b>	<b>544</b>	<b>277</b>	<b>265</b>	<b>2</b>	<b>15</b>

Sources: WSDOT Collision Data Office.

During the three-year study period, 393 of the 544 accidents occurred during daylight hours. One-hundred and twelve accidents occurred during dark hours with street lights on. This accounts for 93 percent of all accidents along Aurora Avenue North. The lighting conditions of 11 accidents were unknown.

The surface condition during accidents was dry during 388 of the 544, or 71.3 percent. Wet surface conditions accounted for 145 of the 544, or 26.6 percent. Snow/Slush or ice accounted for only three total accidents. The surface conditions of seven accidents were unknown. Table 5 summarizes the lighting and surface conditions during the 544 accidents.

TABLE 5

Aurora Avenue North Accident Conditions Summary (January 1, 2002 to December 31, 2004)  
*N. 110<sup>th</sup> Street to N. 145<sup>th</sup> Street*

Lighting Condition	Surface Condition						Total
	Wet	Dry	Oil	Snow/Slush	Ice	Unknown	
Dark – Street Lights On	50	60	0	1	0	1	<b>112</b>
Dark – Street Lights Off	1	1	0	0	0	0	<b>2</b>
Dawn	5	0	0	0	0	0	<b>5</b>
Daylight	78	312	1	1	0	1	<b>393</b>
Dusk	10	10	0	0	1	0	<b>21</b>
Unknown	1	5	0	0	0	5	<b>11</b>
<b>Total</b>	<b>145</b>	<b>388</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>7</b>	<b>544</b>

Sources: WSDOT Collision Data Office.

## Accident Rates

Roadway segment accident rates, expressed in “accidents per million vehicle-miles traveled,” are used to compare the accident experience of one roadway segment to another. Intersection accident rates, expressed in “accidents per million entering vehicles,” are used to compare the accident experience of one intersection to another. These rates allow a comparison to state and national rates for similar roads. The City of Seattle prioritizes high accident intersections using the number of crashes occurring per year. The threshold for signalized intersections is 10 accidents per year and the threshold for unsignalized intersections is 5 accidents per year.

The study section of Aurora Avenue North was divided into segments between study intersections in order to quantify the accident rate. The accident rate was computed for each intersection and segment based on reported accidents between 2002 and 2004, as shown in Table 6.

**TABLE 6**  
Intersection and Segment Accident Rates (January 1, 2002 to December 31, 2004)

Description	Length (miles)	ADT (vpd)	Number of Accidents				Average Annual Accident Rate <sup>1</sup>
			PDO	Injury	Fatal	Total	
<b>Aurora Avenue North Intersections</b>							
N. 112 <sup>th</sup> Street	0.05	30,200	4	1	0	5	0.15
N. 115 <sup>th</sup> Street	0.05	31,800	14	13	1	28	0.80
N. 117 <sup>th</sup> Street	0.05	33,600	6	13	0	19	0.52
N. 125 <sup>th</sup> Street	0.05	39,600	20	22	0	42	0.97
N. 128 <sup>th</sup> Street	0.05	31,450	22	23	1	46	1.34
N. 130 <sup>th</sup> Street	0.05	43,450	20	18	0	38	0.80
N. 135 <sup>th</sup> Street	0.05	33,950	11	13	0	24	0.65
N. 137 <sup>th</sup> Street	0.05	31,950	6	6	0	12	0.34
N. 140 <sup>th</sup> Street	0.05	31,450	5	13	0	18	0.52
N. 143 <sup>rd</sup> Street	0.05	31,200	27	19	0	46	1.35
N. 145 <sup>th</sup> Street	0.02	45,200	32	16	0	48	0.97
<b>Aurora Avenue North Segments</b>							
N. 110 <sup>th</sup> Street to N. 112 <sup>th</sup> Street	0.09	38,130	3	1	0	4	0.10
N. 112 <sup>th</sup> Street to N. 115 <sup>th</sup> Street	0.11	38,130	3	6	0	9	0.22
N. 115 <sup>th</sup> Street to N. 117 <sup>th</sup> Street	0.12	38,100	8	4	0	12	0.29
N. 117 <sup>th</sup> Street to N. 125 <sup>th</sup> Street	0.27	38,100	22	28	0	50	1.20
N. 125 <sup>th</sup> Street to N. 128 <sup>th</sup> Street	0.15	38,190	25	30	0	55	1.32
N. 130 <sup>th</sup> Street to N. 135 <sup>th</sup> Street	0.23	38,790	23	15	0	38	0.89
N. 135 <sup>th</sup> Street to N. 137 <sup>th</sup> Street	0.05	38,710	6	2	0	8	0.19
N. 137 <sup>th</sup> Street to N. 140 <sup>th</sup> Street	0.08	38,710	3	3	0	6	0.14
N. 140 <sup>th</sup> Street to N. 143 <sup>rd</sup> Street	0.07	38,710	6	5	0	11	0.26
N. 143 <sup>rd</sup> Street to N. 145 <sup>th</sup> Street	0.08	38,710	11	14	0	25	0.59
<b>Totals for Aurora Avenue North</b>	<b>1.77</b>	<b>38,400</b>	<b>277</b>	<b>265</b>	<b>2</b>	<b>544</b>	<b>7.31</b>

Notes:

PDO: property-damage only accident

Segments less than one-mile in length are considered as a one-mile segment to compute the accident rate.

<sup>1</sup> Units for intersection accident rates are accidents per million entering vehicles. Units for roadway segment accident rates are accidents per million vehicle-miles.

The study intersections along Aurora Avenue North had approximately 60 percent (326 of 544) of all accidents in the study area between N. 110th Street and N. 145th Street. These accidents occurred within 100 feet of a controlled intersection and the highest number of accidents (48 of 280) occurred at N. 145th Street. Intersection accident rates ranged from 0.15

accidents per million entering vehicles at N. 112<sup>th</sup> Street to 1.35 accidents per million entering vehicles at N 143<sup>rd</sup> Street.

### *SDOT High Accident Intersections*

The City of Seattle Department of Transportation prioritizes high accident intersections using the number of crashes occurring per year. The threshold for signalized intersections is 10 accidents per year and the threshold for unsignalized intersections is 5 accidents per year. The signalized intersections that had 10 or more accidents in a year were N. 115<sup>th</sup> Street (2002 and 2004), N. 125<sup>th</sup> Street (2002, 2003, and 2004), N. 130<sup>th</sup> Street (2003 and 2004), N. 135<sup>th</sup> Street (2004), and N. 145<sup>th</sup> Street (2002, 2003, and 2004). The unsignalized intersections that had 5 or more accidents in a year were N. 128<sup>th</sup> Street (2002, 2003, and 2004), N. 137<sup>th</sup> Street (2003), N. 140<sup>th</sup> Street (2002, 2003, and 2004), and N. 143<sup>rd</sup> Street (2002, 2003, and 2004). The unsignalized intersections at N. 128<sup>th</sup> Street and N. 143<sup>rd</sup> Street have the second highest three-year accident totals and two of the lowest traffic volumes among all intersections. Together they had approximately 17 percent of all accidents in the study area over the last 3 years. Congestion and nearby business access contributed to the types of crashes experienced at these two intersections.

### *WSDOT High Accident Locations*

The segments along Aurora Avenue North between study intersections had approximately 40 percent (218 of 544) of all accidents in the study area. The section of Aurora Avenue North, between N. 125<sup>th</sup> Street and N. 128<sup>th</sup> Street, had the highest incidence of accidents in the last three years when compared to the entire length. A contributing factor to this total is the unsignalized intersection at N. 127<sup>th</sup> Street that was not considered a study intersection. Roadway segment accident rates ranged from 0.10 accidents per million vehicle-miles between N. 110<sup>th</sup> Street and N. 112<sup>th</sup> Street to 1.32 accidents per million vehicle-miles between N. 125<sup>th</sup> Street and N. 128<sup>th</sup> Street. Statewide accident data from 2003 (latest information available) indicates an overall average accident rate of 2.41 accidents per million vehicle-miles for statewide urban principal arterials. Individual segment accident rates are much less than the statewide average, but the accident rate for the study area (7.31 accidents per million vehicle-miles) is much greater than the statewide average because it includes intersection-related accidents.

The WSDOT Collision Data Office recognized two locations in the study area as High Accident Locations (HALs) for the 2004-2006 Biennium listing. The two HALs were from south of N. 125<sup>th</sup> Street to south of N. 135<sup>th</sup> Street and from N. 135<sup>th</sup> Street to N. 145<sup>th</sup> Street. This is consistent with the intersection and segment accident rates summarized above.

## Intersection Operational Analysis

### Methods and Assumptions

A Synchro traffic operations model from the Route Development Plan<sup>1</sup> was modified for the study area based on traffic counts and field observations. The model includes traffic volume

<sup>1</sup> Washington State Department of Transportation, Northwest Region, Planning and Policy Office. [Route Development Plan, State Route 99/Aurora Avenue North, From the North End of the Battery Street Tunnel \(MP 32.44\) to N. 145th Street \(MP 40.47\)](#). March 2003.

parameters, such as peak hour factors, truck percentages, pedestrians, and bicyclists that were derived from the hourly turning movement counts.

Synchro software uses methodology defined in the 2000 Highway Capacity Manual (HCM 2000) to analyze both signalized and stop-controlled intersections. The model computes the level-of-service, delay, and queue to quantify traffic operations at the study intersections and determine whether the intersections meet the level-of-service goal set in the Methods and Assumptions technical memorandum (see Appendix C).

Refer to Appendix C (Methods and Assumption technical memorandum) for the assumptions and data inputs used in the Synchro model.

Based on existing turn movement counts, forecasted traffic volumes, and the assumptions presented above, an operational analysis was prepared for the existing year (2005), year of opening (2010), and design year (2030). The operational analysis evaluated intersection LOS, intersection delay, and 95th percentile queue lengths. To uphold the LOS goal, LOS E must be maintained for the Build analysis.

### **Intersection Level-of-Service**

The Synchro software program, which incorporates the 2000 Highway Capacity Manual (HCM) methodologies, was used to estimate level-of-service (LOS), a qualitative description of traffic flow characteristics. The highest level (LOS A) describes free-flow conditions in which vehicles experience minimal delay. The lowest level (LOS F) describes stop-and-go conditions in which long delays are experienced by most vehicles in the traffic stream.

The LOS for stop-controlled intersections is defined by the control delay at the minor stop-controlled approach. Control delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position.

LOS defines the overall operations at a signalized intersection based on average control delay. Control delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the deceleration and acceleration delay, the stopped delay, and the amount of green time available to a street. Table 7 (next page) describes the LOS and delay parameters.

TABLE 7  
 HCM LOS and Delay Parameters  
*Unsignalized and Signalized Intersections*

LOS	Delay <sup>1</sup>	
	Unsignalized Intersections	Signalized Intersections
A	≤ 10	≤ 10
B	> 10 and ≤ 15	> 10 and ≤ 20
C	> 15 and ≤ 25	> 20 and ≤ 35
D	> 25 and ≤ 35	> 35 and ≤ 55
E	> 35 and ≤ 50	> 55 and ≤ 80
F	>50	>80

<sup>1</sup> Delay is measured in units of average seconds per vehicle.

### 95th Percentile Queue

The 95th percentile queue length is the accepted measurement in the transportation industry for determining the necessary storage length at signalized intersections. This term is made up of two concepts that can be explained separately. First, the queue length refers to the distance from the front bumper of the first stopped vehicle to the rear bumper of the last stopped vehicle. And second, the 95th percentile refers to the amount of time out of the peak hour of travel that the line of cars will be that distance or less. In other words, the line of cars will be less than the distance indicated 95 percent of the time. It is possible that the line of cars will be longer, but only 5 percent of the time. Designing to the 95th percentile queue length will minimize the occurrence of vehicles extending beyond the turn lane and blocking through lanes, possibly into upstream intersections.

### Existing Conditions and Deficiencies

The signalized intersections on Aurora Avenue North and the stop-controlled streets intersecting it currently operate at LOS E or better during both AM and PM peak hours, with three exceptions. The stop-controlled westbound approaches at N. 137th Street, N. 140th Street, and N. 143rd Street all operate at LOS F during the PM peak hour. The turning movement volumes at these approaches are small, but the conflicting volume along Aurora Avenue North is so high that few gaps exist. This effectively reduces the capacity of the movement. Table 8 (next page) summarizes the existing peak hour levels-of-service at study intersections along Aurora Avenue North.

TABLE 8  
Existing (2005) Intersection LOS Results

Intersection	AM Peak Hour		PM Peak Hour	
	LOS	Delay <sup>2</sup>	LOS	Delay <sup>2</sup>
Aurora Avenue North & N. 112 <sup>th</sup> Street	A	3	A	4
Aurora Avenue North & N. 115 <sup>th</sup> Street	A	9	B	13
Aurora Avenue North & N. 117 <sup>th</sup> Street	A	5	B	16
Aurora Avenue North & N. 125 <sup>th</sup> Street	C	34	D	55
Aurora Avenue North & N. 128 <sup>th</sup> Street <sup>1</sup>	E	37	C	19
Aurora Avenue North & N. 130 <sup>th</sup> Street	E	67	E	76
Aurora Avenue North & N. 135 <sup>th</sup> Street	B	13	B	19
Aurora Avenue North & N. 137 <sup>th</sup> Street <sup>1</sup>	D	33	<b>F</b>	<b>&gt;150</b>
Aurora Avenue North & N. 140 <sup>th</sup> Street <sup>1</sup>	C	17	<b>F</b>	<b>69</b>
Aurora Avenue North & N. 143 <sup>rd</sup> Street <sup>1</sup>	D	34	<b>F</b>	<b>77</b>
Aurora Avenue North & N. 145 <sup>th</sup> Street	D	49	E	69

**Bold** text indicates operations exceed goal of LOS E.

<sup>1</sup> Unsignalized intersection. Reported delay is for the highest minor street approach delay.

<sup>2</sup> Delay is reported in units of average seconds per vehicle.

While many intersections may meet the LOS goal for acceptable operations, there are areas of excessive queuing that exceed the available storage length of turn lanes or extend into an upstream study intersection. These queues block other vehicles and prohibit the progression of traffic along Aurora Avenue North, effectively reducing the mobility of the corridor. These areas of congestion and blocking begin between the signalized intersections at N. 125th Street and N. 130th Street and propagate north to the study area limit at N. 145th Street. Table 9 (next page) shows the current 95th percentile queue lengths that exceed the available storage, as calculated by Synchro.

TABLE 9  
Existing (2005) AM and PM Peak Hour 95th Percentile Queue Lengths Exceeding Available Storage

Aurora Avenue North		Available Storage Length (ft)	AM 95th Percentile Queue (ft)	PM 95th Percentile Queue (ft)
Signalized Intersections				
N. 125 <sup>th</sup> Street				
	Eastbound Left	120 <sup>1</sup>	N/A	190
	Northbound Left	140 <sup>1</sup>	N/A	200
N. 130 <sup>th</sup> Street				
	Eastbound Left	210	N/A	310
	Westbound Left	190	310	300
	Northbound Through (each lane)	330	N/A	950
N. 135 <sup>th</sup> Street				
	Southbound Through (each lane)	660	700	N/A
N. 145 <sup>th</sup> Street				
	Eastbound Left	120	N/A	240
	Westbound Left	170 <sup>1</sup>	380	260
	Northbound Through (each lane)	670	N/A	910
	Southbound Left	250 <sup>1</sup>	N/A	310

<sup>1</sup> Storage lengths are based on striping limits, but turn pocket is preceded by a center TWLTL that provides additional queue storage.

N/A: 95th percentile queue did not exceed available storage for that peak hour.

Storage and queue lengths rounded up to the nearest 10 feet.

The impacts from queuing reported in Table 9 would be limited to the peak hours analyzed. Impacts from queuing would be minimal during off-peak travel hours. The signalized intersections from N. 125th Street to N. 145th Street currently have 95th percentile queue lengths that exceed the available storage during peak hours. This mainly occurs during the PM peak hour except at N. 130th Street, N. 135th Street, and N. 145th Street, which have excessive queuing during the AM peak hour. During the AM peak hour, vehicles in the southbound through lanes at N. 135th Street extend past N. 137th Street. During the PM peak hour, vehicles in the northbound through lanes at N. 130th Street extend past N. 128th Street and vehicles in the northbound through lanes at N. 145 Street extend past N. 143rd Street. The northbound and southbound storage problems are consistent with the corridor's peak direction of travel.

## Forecasted Traffic Volume Growth Trends

The Puget Sound Regional Council's (PSRC) 2030 travel demand model was surveyed to determine the expected growth in traffic volumes along Aurora Avenue North. At the coordination meeting on July 26, 2005, CH2M HILL suggested an AM peak hour growth rate of 0.85 percent per year and a PM peak hour growth rate of 1.23 percent per year as an alternative to the 1.21 percent per year growth rate for both peak periods. All three growth rates were derived from the PSRC's travel demand model (computed assuming annual compound growth) and the City agreed that separate growth rates for each peak period were acceptable.

The AM and PM peak hour traffic volume growth rates were applied to the 2005 existing intersection turning movement volumes to derive year 2010 Build, 2030 No-Build and 2030 Build condition traffic volume forecasts.

Figure 5 shows the year of opening 2010 Build AM and PM peak hour traffic volumes forecasted for the intersection operational analysis. Figure 6 shows the design year 2030 No-Build AM and PM peak hour traffic volumes forecasted for the intersection operational analysis. Figure 7 shows the design year 2030 Build AM and PM peak hour traffic volumes forecasted for the intersection operational analysis.

## Year of Opening (2010)

### Future No-Build Conditions

Future traffic conditions were not analyzed for the year of opening (2010) No-Build condition according to Table 1 of the Methods and Assumptions technical memorandum (see Appendix C). Traffic operations, overall intersection delays, and extensive queues shown in Tables 8 and 9 could be expected to slightly worsen compared to existing (2005) conditions with expected growth in background traffic volumes. Intersection improvements would be in place (by 2010) north of N. 145th Street independent of the project. These improvements (within the City of Shoreline) include widening Aurora Avenue North to provide a southbound BAT lane and a second southbound left-turn lane. These improvements would offset delay increases at other approaches of Aurora Avenue North and N. 145th Street.

### Future Build Conditions

Future traffic conditions were analyzed for the Build condition in the year of opening (2010) and the design year (2030). The Build condition lane channelization and intersection control were analyzed according to the channelization proposed in the Route Development Plan (see Figure 8). The improvements include the following:

- Extending the northbound BAT lane south to the north side of N. 110th Street.
- Widening Aurora Avenue North to provide a southbound BAT lane from north of N. 110th Street to south of N. 145th Street.
- Replacing the center TWLTL with a raised, landscaped center median that narrows at intersections and select mid-block locations to provide left-turn lanes.
- Provide a second left-turn lane at N. 145th Street in the eastbound and westbound directions.
- Provide second left-turn lanes at N. 130th Street in the eastbound, westbound, and southbound directions and an exclusive right-turn in the westbound direction.
- Provide a second left-turn lane at N. 125th Street in the northbound direction and exclusive right-turn lanes in the eastbound and westbound directions.
- Restricting turns from N. 127th Street, N. 128th Street, N. 137th Street, N. 140th Street, and N. 143rd Street to right-out only.

- Prohibiting left-turns into N. 128th Street and N. 143rd Street (southbound only).
- Provide for and allow U-turns (passenger cars only) and left-turns (passenger cars and small delivery trucks) at all mid-block and signalized left-turn lanes.

Additional improvements were assumed to be in place (by 2010) north of N. 145th Street. These improvements (within the City of Shoreline) include widening Aurora Avenue North to provide a southbound BAT lane and a second southbound left-turn lane.

The improvements described above were assumed to be constructed by 2010. Forecasted traffic volumes for both peak hours were used to analyze the study intersections. The average annual growth rates used were 0.85 percent for the AM peak hour and 1.23 percent for the PM peak hour. Forecasted traffic volumes for both peak hours were used to analyze the study intersections. Figure 5 shows the year of opening (2010) Build AM and PM peak hour traffic volumes forecasted for the intersection operational analysis.

Table 10 summarizes the 2010 Build peak hour levels-of-service along Aurora Avenue North.

TABLE 10  
Future Build (2010) Intersection LOS Results

Intersection	AM Peak Hour		PM Peak Hour	
	LOS	Delay <sup>2</sup>	LOS	Delay <sup>2</sup>
Aurora Avenue North & N. 112 <sup>th</sup> Street	A	3	A	5
Aurora Avenue North & N. 115 <sup>th</sup> Street	B	11	B	16
Aurora Avenue North & N. 117 <sup>th</sup> Street	A	9	B	16
Aurora Avenue North & N. 125 <sup>th</sup> Street	C	20	D	37
Aurora Avenue North & N. 128 <sup>th</sup> Street <sup>1</sup>	B	13	B	13
Aurora Avenue North & N. 130 <sup>th</sup> Street	C	31	C	32
Aurora Avenue North & N. 135 <sup>th</sup> Street	A	9	B	13
Aurora Avenue North & N. 137 <sup>th</sup> Street <sup>1</sup>	C	21	C	16
Aurora Avenue North & N. 140 <sup>th</sup> Street <sup>1</sup>	B	11	D	27
Aurora Avenue North & N. 143 <sup>rd</sup> Street <sup>1</sup>	B	13	C	25
Aurora Avenue North & N. 145 <sup>th</sup> Street	D	43	D	44

<sup>1</sup> Unsignalized intersection. Reported delay is for the highest minor street approach delay.

<sup>2</sup> Delay is reported in units of average seconds per vehicle.

Under the Build scenario, all the signalized intersections and stop-controlled approaches intersecting Aurora Avenue North are forecasted to operate at LOS D or better during both peak hours. Each of the stop-controlled approaches restricts the through and left-turn maneuvers that require the largest gaps and, therefore, experience the most delay. Right-turning vehicles require smaller gaps that allow them to enter the traffic stream more easily.

The recommended storage lengths were incorporated into the design to accommodate the 95th percentile queue lengths. In some cases this was not possible due to impacts of widening the side street approaches to accommodate longer or additional turn lanes. This and the longer crossing distances across Aurora Avenue North caused more of the cycle length to be used by the side street approaches and resulted in remaining areas of excessive queuing that exceed the available storage length of turn lanes or extend to an upstream study intersection. These queues block other vehicles and prohibit the progression of traffic along Aurora Avenue North. These queuing impacts cannot be mitigated within the revised project footprint.

Table 11 shows the predicted 95th percentile queue lengths that will exceed the recommended storage, as calculated by Synchro.

TABLE 11  
2010 Build AM and PM Peak Hour 95th Percentile Queue Lengths Exceeding Recommended Storage

<b>Aurora Avenue North</b>			
<b>Signalized Intersections</b>	<b>Recommended Storage Lengths (ft)</b>	<b>AM 95th Percentile Queue (ft)</b>	<b>PM 95th Percentile Queue (ft)</b>
<b>N. 117<sup>th</sup> Street</b>			
Northbound Through (each lane)	820	N/A	1,120
<b>N. 125<sup>th</sup> Street</b>			
Eastbound Left	250	N/A	320
<b>N. 130<sup>th</sup> Street</b>			
Westbound Left (each lane)	170	180	190
Westbound Right	110	N/A	120
<b>N. 135<sup>th</sup> Street</b>			
Westbound Left	120	N/A	130
<b>N. 145<sup>th</sup> Street</b>			
Eastbound Left (each lane)	90	N/A	160
Northbound Through (each lane)	670	N/A	900

N/A: 95th percentile queue did not exceed recommended storage for that peak hour.

Storage and queue lengths rounded up to the nearest 10 feet.

The impacts from queuing reported in Table 11 would be limited to the peak hours analyzed. Impacts from queuing would be minimal during off-peak travel hours. The signalized intersections from N. 117th Street to N. 145th Street are predicted to have at least one approach with 95th percentile queue lengths that exceed the available storage during one peak period. This primarily occurs during the PM peak hour except at N. 130th Street, which has queuing just beyond the double westbound left-turn lanes. During the PM peak hour, vehicles in the northbound through lanes at N. 117th Street and N. 145th Street will extend past the upstream intersection and block the progression of traffic.

## Design Year (2030)

### Future No-Build Conditions

Future traffic conditions were analyzed for the design year (2030) No-Build condition.

The No-Build condition lane channelization and intersection control were assumed to remain the same as currently exists except for improvements north of N. 145th Street (within the City of Shoreline). These improvements were assumed to be in place by 2010 and include widening Aurora Avenue North to provide a southbound BAT lane and a second southbound left-turn lane. Optimization of signal timing was performed for the signalized intersections as a coordinated system. Figure 3 provides the current intersection lane channelization and control.

Forecasted traffic volumes for both peak hours were used to analyze the study intersections. The average annual growth rates used were 0.85 percent for the AM peak hour and 1.23 percent for the PM peak hour. Figure 6 shows the design year (2030) No-Build AM and PM peak hour traffic volumes forecasted for the intersection operational analysis.

Table 12 summarizes the 2030 No-Build peak hour levels-of-service along Aurora Avenue North and at the stop-controlled intersecting streets.

TABLE 12  
Future No-Build (2030) Intersection LOS Results

Intersection	AM Peak Hour		PM Peak Hour	
	LOS	Delay <sup>2</sup>	LOS	Delay <sup>2</sup>
Aurora Avenue North & N. 112 <sup>th</sup> Street	A	3	A	4
Aurora Avenue North & N. 115 <sup>th</sup> Street	A	6	C	29
Aurora Avenue North & N. 117 <sup>th</sup> Street	A	5	D	39
Aurora Avenue North & N. 125 <sup>th</sup> Street	D	41	<b>F</b>	<b>92</b>
Aurora Avenue North & N. 128 <sup>th</sup> Street <sup>1</sup>	<b>F</b>	<b>&gt;150</b>	<b>F</b>	<b>&gt;150</b>
Aurora Avenue North & N. 130 <sup>th</sup> Street	E	68	<b>F</b>	<b>&gt;150</b>
Aurora Avenue North & N. 135 <sup>th</sup> Street	A	8	D	42
Aurora Avenue North & N. 137 <sup>th</sup> Street <sup>1</sup>	<b>F</b>	<b>78</b>	<b>F</b>	<b>&gt;150</b>
Aurora Avenue North & N. 140 <sup>th</sup> Street <sup>1</sup>	C	19	<b>F</b>	<b>&gt;150</b>
Aurora Avenue North & N. 143 <sup>rd</sup> Street <sup>1</sup>	<b>F</b>	<b>&gt;150</b>	<b>F</b>	<b>&gt;150</b>
Aurora Avenue North & N. 145 <sup>th</sup> Street	E	67	<b>F</b>	<b>98</b>

**Bold** text indicates operations exceed goal of LOS E.

<sup>1</sup> Unsignalized intersection. Reported delay is for the highest minor street approach delay.

<sup>2</sup> Delay is reported in units of average seconds per vehicle.

Under the No-Build scenario, all the stop-controlled approaches intersecting Aurora Avenue North are forecasted to operate at LOS F during both peak hours, except during the AM peak hour at N. 140th Street. This would occur because north and southbound traffic are expected to leave minimal gaps for side-street traffic to make a turn.

The signalized intersections between N. 112th Street and N. 117th Street are forecasted to operate at LOS C or better during both peak hours. Beginning with N. 125th Street, the

signalized intersections to the north are forecasted to operate at LOS E or F, with few exceptions. The intersection at N. 135th Street shows LOS D or better during both peak hours, but it is unlikely that the signal would operate this well with queuing and blocking from adjacent signalized intersections.

Table 13 shows the predicted 95th percentile queue lengths that will exceed the available storage, as calculated by Synchro.

TABLE 13  
Future No-Build (2030) AM and PM Peak Hour 95th Percentile Queue Lengths Exceeding Available Storage

<b>Aurora Avenue North</b>			
<b>Signalized Intersections</b>	<b>Available Storage Lengths (ft)</b>	<b>AM 95th Percentile Queue (ft)</b>	<b>PM 95th Percentile Queue (ft)</b>
<b>N. 112<sup>th</sup> Street</b>			
Eastbound Left	50	N/A	60
<b>N. 115<sup>th</sup> Street</b>			
Northbound Through (each lane)	820	N/A	1,290
Southbound Left	120 <sup>1</sup>	N/A	170
<b>N. 117<sup>th</sup> Street</b>			
Northbound Through (each lane)	890	N/A	1,390
<b>N. 125<sup>th</sup> Street</b>			
Eastbound Left	120 <sup>1</sup>	190	400
Westbound Left	150	170	N/A
Northbound Left	140 <sup>1</sup>	160	230
<b>N. 130<sup>th</sup> Street</b>			
Eastbound Left	210	N/A	440
Westbound Left	190	480	620
Westbound Through (each lane)	660	N/A	690
Northbound Through (each lane)	330	N/A	1,400
Southbound Left	320 <sup>1</sup>	N/A	500
<b>N. 135<sup>th</sup> Street</b>			
Westbound Left	120 <sup>1</sup>	N/A	160
Northbound Through (each lane)	1,330	N/A	1,410
<b>N. 145<sup>th</sup> Street</b>			
Eastbound Left	120	170	460
Westbound Left	170 <sup>1</sup>	590	510
Westbound Right	300	N/A	500
Northbound Through (each lane)	660	N/A	1,140
Southbound Left (each lane)	250	N/A	320

<sup>1</sup> Storage lengths are based on striping limits, but turn pocket is preceded by a center TWLTL.

N/A: 95th percentile queue did not exceed available storage for that peak hour.

Storage and queue lengths rounded up to the nearest 10 feet.

The impacts from queuing reported in Table 13 would be limited to the peak hours analyzed. Impacts from queuing would be minimal during off-peak travel hours. During the AM peak hour, excessive queuing is expected at N. 125th Street, N. 130th Street, and N. 145th Street. Although the analysis does not show it, excessive southbound queues could

still be expected at N. 135th Street during the AM peak hour. The 95th percentile queue lengths are reduced by the calculated metering effect of oversaturated, upstream intersections. The metering effect results from oversaturated intersections where heavy turning movement volumes and blocking effects reduce the calculated traffic flows. During the PM peak hour, all but four study intersections (N. 128th Street, N. 137th Street, N. 140th Street, and N. 143rd Street) are predicted to have at least one approach with an excessive queue length. PM peak hour vehicles in the northbound through lanes at N. 115th Street, N. 117th Street, N. 130th Street, N. 135th Street, and N. 145th Street will block the upstream study intersection. This will also have a metering effect at adjacent study intersections, such as N. 125th Street.

### Future Build Conditions

Future traffic conditions were analyzed for the Build condition in the year of opening (2010) and the design year (2030). The Build condition lane channelization and intersection control were analyzed according to the channelization proposed in the Route Development Plan (see Figure 8). The improvements include the following:

- Extending the northbound BAT lane south to the north side of N. 110th Street.
- Widening Aurora Avenue North to provide a southbound BAT lane from north of N. 110th Street to south of N. 145th Street.
- Replacing the center TWLTL with a raised, landscaped center median that narrows at intersections and select mid-block locations to provide left-turn lanes.
- Provide a second left-turn lane at N. 145th Street in the eastbound and westbound directions.
- Provide second left-turn lanes at N. 130th Street in the eastbound, westbound, and southbound directions and an exclusive right-turn in the westbound direction.
- Provide a second left-turn lane at N. 125th Street in the northbound direction and exclusive right-turn lanes in the eastbound and westbound directions.
- Restricting turns from N. 127th Street, N. 128th Street, N. 137th Street, N. 140th Street, and N. 143rd Street to right-out only.
- Prohibiting left-turns into N. 128th Street and N. 143rd Street (southbound only).
- Provide for and allow U-turns (passenger cars only) and left-turns (passenger cars and small delivery trucks) at all mid-block and signalized left-turn lanes.

Additional improvements were assumed to be in place (by 2010) north of N. 145th Street. These improvements (within the City of Shoreline) include widening Aurora Avenue North to provide a southbound BAT lane and a second southbound left-turn lane.

### Design Year (2030)

Future traffic conditions were analyzed for the design year (2030). Forecasted traffic volumes for both peak hours were used to analyze the study intersections. The average annual growth rates used were 0.85 percent for the AM peak hour and 1.23 percent for the

PM peak hour. Figure 7 shows the design year (2030) Build AM and PM peak hour traffic volumes forecasted for the intersection operational analysis.

Table 14 summarizes the 2030 Build peak hour levels-of-service along Aurora Avenue North and provides the 2030 No-Build results from Table 12 for comparison.

TABLE 14  
Future Design Year (2030) No-Build and Build Intersection LOS Results

Intersection	2030 No-Build				2030 Build			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	LOS	Delay <sup>2</sup>	LOS	Delay <sup>2</sup>	LOS	Delay <sup>2</sup>	LOS	Delay <sup>2</sup>
Aurora Avenue North & N. 112 <sup>th</sup> Street	A	3	A	4	A	4	A	8
Aurora Avenue North & N. 115 <sup>th</sup> Street	A	6	C	29	B	13	C	30
Aurora Avenue North & N. 117 <sup>th</sup> Street	A	5	D	39	B	14	E	57
Aurora Avenue North & N. 125 <sup>th</sup> Street	D	41	<b>F</b>	<b>92</b>	C	23	E	78
Aurora Avenue North & N. 128 <sup>th</sup> Street <sup>1</sup>	<b>F</b>	<b>&gt;150</b>	<b>F</b>	<b>&gt;150</b>	B	13	C	21
Aurora Avenue North & N. 130 <sup>th</sup> Street	E	68	<b>F</b>	<b>&gt;150</b>	D	45	E	71
Aurora Avenue North & N. 135 <sup>th</sup> Street	A	8	D	42	A	8	D	40
Aurora Avenue North & N. 137 <sup>th</sup> Street <sup>1</sup>	<b>F</b>	<b>78</b>	<b>F</b>	<b>&gt;150</b>	D	25	C	21
Aurora Avenue North & N. 140 <sup>th</sup> Street <sup>1</sup>	C	19	<b>F</b>	<b>&gt;150</b>	B	11	E	43
Aurora Avenue North & N. 143 <sup>rd</sup> Street <sup>1</sup>	<b>F</b>	<b>&gt;150</b>	<b>F</b>	<b>&gt;150</b>	B	14	E	39
Aurora Avenue North & N. 145 <sup>th</sup> Street	E	67	<b>F</b>	<b>98</b>	D	55	E	79

**Bold** text indicates operations exceed goal of LOS E.

<sup>1</sup> Unsignalized intersection. Reported delay is for the highest minor street approach delay.

<sup>2</sup> Delay is reported in units of average seconds per vehicle.

Under the Build scenario, all of the stop-controlled approaches intersecting Aurora Avenue North are forecasted to operate at LOS E or better during both peak hours. This is because each of the stop-controlled approaches restricts the through and left-turn maneuvers that require the largest gaps and, therefore, experience the most delay. Right-turning vehicles require smaller gaps that allow them to enter the traffic stream more easily.

All of the signalized intersections are forecasted to operate at LOS E or better during both peak hours. This is because of the improvements provided under the Build condition; especially the additional turn lanes at N. 125th Street, N. 130th Street, and N. 145th Street. Some movements are forecasted to remain at LOS F operation, but overall the instances of LOS F intersection operations are predicted to be eliminated.

The recommended storage lengths were incorporated into the design to accommodate the 95th percentile queue lengths. In some cases this was not possible due to limitations of widening the side street approaches for additional turn lanes. This caused more of the cycle

length to be used by the side street approaches and resulted in remaining areas of excessive queuing that exceed the available storage length of turn lanes or extend to an upstream study intersection. These queues block other vehicles and prohibit the progression of traffic along Aurora Avenue North. Table 15 shows the predicted 95th percentile queue lengths that will exceed the recommended storage, as calculated by Synchro.

TABLE 15  
2030 Build AM and PM Peak Hour 95th Percentile Queue Lengths Exceeding Recommended Storage

<b>Aurora Avenue North</b>				
<b>Signalized Intersections</b>	<b>Recommended Storage Lengths (ft)</b>	<b>AM 95th Percentile Queue (ft)</b>	<b>PM 95th Percentile Queue (ft)</b>	
<b>N. 112<sup>th</sup> Street</b>				
Eastbound Left	50	N/A	60	
<b>N. 115<sup>th</sup> Street</b>				
Northbound Through (each lane)	820	N/A	1,300	
<b>N. 117<sup>th</sup> Street</b>				
Northbound Through (each lane)	890	N/A	1,450	
<b>N. 125<sup>th</sup> Street</b>				
Eastbound Left	250	N/A	440	
Westbound Left	150	170	N/A	
<b>N. 130<sup>th</sup> Street</b>				
Eastbound Left (each lane)	180	N/A	220	
Westbound Left (each lane)	170	230	260	
Westbound Right	110	N/A	170	
Northbound Through (each lane)	330	N/A	1,220	
<b>N. 135<sup>th</sup> Street</b>				
Westbound Left	120	N/A	160	
<b>N. 145<sup>th</sup> Street</b>				
Eastbound Left (each lane)	90	N/A	210	
Westbound Left (each lane)	220	300	260	
Westbound Right	300	N/A	460	
Northbound Through (each lane)	670	N/A	1,130	
Southbound Left (each lane)	250	N/A	320	

N/A: 95th percentile queue did not exceed recommended storage for that peak hour.

Storage and queue lengths rounded up to the nearest 10 feet.

The impacts from queuing reported in Table 15 would be limited to the peak hours analyzed. Impacts from queuing would be minimal during off-peak travel hours. By 2030, only the stop-controlled intersections are predicted to have approaches without excessive queuing during AM and PM peak hours. The excessive queues are primarily predicted to occur during the PM peak hour except at N. 125th Street, N. 130th Street, and N. 145th Street, which all have excessive queuing during the AM peak hour. Although the analysis does not show it, excessive southbound queues could still be expected at N. 135th Street during both peak hours. The predicted 95th percentile queue lengths are reduced by the metering effect of upstream intersections. During the PM peak hour, vehicles in the northbound through lanes from N. 115th Street to N. 145th Street will block the upstream

study intersection. This will also have a metering effect at adjacent study intersections like N. 125th Street.

Compared to the No-Build condition, the Build has the same number of intersections and three less approaches with 95th percentile queue lengths that exceed the recommended storage during the AM peak hour. During the PM peak hour, the Build has the same number of intersections and four fewer approaches with 95th percentile queue lengths that exceed the recommended storage. The AM peak hour experiences similar queuing to the No-Build, but the PM peak hour is predicted to have definite improvements to traffic moving along Aurora Avenue North. In addition, both peak travel periods will have reduced delays at stop-controlled approaches, as shown in Table 14.

## Operational Impacts on Transit, Pedestrians, and Safety

The improvements analyzed in the design year (2030) show that traffic operations at signalized intersections and stop-controlled approaches are predicted to improve compared to the No-Build condition (see Table 14). These improvements, combined with the sidewalk, enhanced transit areas, and business access point consolidation into defined driveways, are also expected to provide benefits to transit operators and users, allow greater pedestrian usage and ease, and improve safety for all modes of travel.

### Transit

#### Future No-Build Conditions

Under the No-Build scenario, transit speed and reliability would deteriorate as traffic congestion continues to increase because transit vehicles would be required to share lanes with general-purpose vehicles. At locations where transit vehicles pull out of the traffic lanes to serve transit stops, re-entry into the traffic lanes would involve more delay because there would be fewer adequate gaps in the traffic flow available.

#### Future Build Conditions

Under the Build condition, transit service would improve all along Aurora Avenue North. The extension of the northbound BAT lane to south of N. 112th Street and the construction of a new southbound BAT lane can be expected to improve the speed and reliability of the transit system serving north Seattle along Aurora Avenue North. Specifically, the BAT lane allows buses to avoid the congestion of the through lanes in both directions and for longer lengths of the route. This may allow for increased or new transit service.

In addition, enhanced bus zones and bus shelters would be created and transit signal priorities at signalized intersections would be established to enhance transit speed and reliability. Enhancing transit features along Aurora Avenue North could encourage more transit use by commuters. Each new transit user could remove vehicles from the road, reducing traffic congestion. The bus zones will be enhanced with urban treatments and lighting, thereby clearly defining them as transit areas and making them more secure. These transit-oriented improvements will be integrated with a continuous sidewalk system from N. 110th Street to N. 145th Street.

## Pedestrians

### Future No-Build Conditions

Under the No Build scenario, Aurora Avenue North would continue to be a nonstandard and uncomfortable environment for pedestrians due to the lack of sidewalks. The potential for collisions involving pedestrians could increase due to increasing traffic volumes on the roadway.

### Future Build Conditions

The Aurora Avenue North improvements will improve conditions for pedestrians by providing a continuous sidewalk system on both sides of the roadway, more convenient access to the transit system, and improved pedestrian-scaled lighting at bus stops throughout the corridor. Such elements could reduce pedestrian exposure to conflicts with motor vehicles and has the potential to decrease the number of pedestrian-involved accidents along the corridor.

The amount of time necessary for pedestrians to cross the street is determined by the crossing distance. The crossing distance is made up of shoulder width and number of lanes, which is known as the cross-section of the roadway. The current cross-section varies between 90 and 100 feet. The project will construct a consistent width of 92.5 feet except at N. 125th Street, N. 130th Street, and N. 145th Street where second left-turn lanes will be added. In areas where the new cross-section is wider than the current cross-section, time necessary for pedestrians to cross the street in crosswalks will increase at signalized intersections, but longer crossing times will be accommodated in the signal timing. Otherwise, the pedestrian crossing distances and crossing times will remain constant or decrease.

## Safety

### Future No-Build Conditions

Multiple locations along Aurora Avenue North have been identified as High Accident Locations (HAL) by WSDOT. The safety analysis indicated that the overall accident rate (7.31 accidents per million vehicle-miles) is approximately three times greater than the statewide average for similarly classified roadways. Under the No-Build scenario, accident experience would be expected to worsen. Lack of access controls would lead to accident rates equal to or greater than those under existing conditions. The total number of accidents per year could be higher due to increasing traffic volumes and greater occurrence of conflicting vehicle movements. Under the No-Build conditions, continued land use redevelopment along the corridor would add some sidewalk and defined driveway access points, but sidewalks would likely remain non-continuous and driveway access unmanaged. The overall effect would not be likely to reduce the number of conflicting vehicular movements.

### Future Build Conditions

The safety analysis revealed that nearly half (48.4%) of the accidents were some form of angle or driveway accident. And approximately one-third (32%) of the accidents involved one of the vehicles turning left or the location of the impact being in the left-

turn lane or TWLTL median at an unsignalized location. Removing the center TWLTL and installing a landscaped median will control access at mid-block locations and unsignalized intersections and will limit the conflict points between opposite direction vehicles. This can be expected to contribute to a reduction in the driveway and angle type accidents.

The Build conditions would provide comprehensive access management improvements to Aurora Avenue North such as the addition of curbs and gutters; the application of driveway width and spacing standards; the conversion of the existing two-way left-turn lane into a channelized left and U-turn lane and a raised median; and the restriction of most driveways to right-in/right-out turning maneuvers. The access management provisions that were incorporated into the project are expected to reduce the accident experience along Aurora Avenue North. The *Access Management Manual*<sup>2</sup> indicates that implementing access management increases roadway safety and reduces crash rates. A synthesis of the research from the *Access Management Manual* states the following conclusions:

1. As access density increases, crash rates increase.
2. Roadways with nontraversable medians are safer than undivided roadways or those with continuous TWLTL.
3. U-turns are generally safer than direct left-turns.
4. Medians improve pedestrian safety.

Based on the level of access management provided under the Build condition, it would be expected that the accident experience would be reduced relative to the No-Build.

The Build conditions would also improve safety by reducing congestion and increasing capacity at N. 125th Street, N. 130th Street, and N. 145th Street; constructing new BAT lanes that would provide right-turn only lanes at intersections; and improving signal timing for the entire corridor. The BAT lanes also serve to remove turning movements accessing adjacent businesses from the congested general-purpose travel lanes.

## Operational Impacts on General Purpose Traffic, Freight, and Emergency Vehicle Access

### Traffic Diversion

Traffic diversion occurs when motorists on longer trips intentionally divert from a higher classified arterial to a local collector or residential street as a cut-through route, usually to avoid congestion. In relation to the revised project, Aurora Avenue North is a principal arterial serving local and regional trips. Lower classified, parallel routes west of Aurora Avenue North include Dayton Avenue North, Evanston Avenue North, Fremont Avenue North, and Linden Avenue North, which all pass through mostly residential neighborhoods. Lower classified, parallel routes east of Aurora Avenue North include Stone Avenue North and Ashworth Avenue North, which pass through a mix of commercial retail and residential neighborhoods.

<sup>2</sup> TRB Committee on Access Management. *Access Management Manual*. Transportation Research Board of the National Academies. Washington D.C. 2003.

## Future No-Build Conditions

Without improvements to major signalized intersections, level-of-service will continue to degrade below acceptable levels and motorists may divert into neighborhoods to avoid forecasted, high congestion locations. Locations where this may be most prevalent are at N. 130th Street and N. 145th Street that connect to interchanges with Interstate 5.

## Future Build Conditions

The increase in traffic demand throughout the region and within the Aurora Avenue North corridor necessitates the construction of additional capacity. This additional capacity is needed to serve regional and longer intra-city trips that would potentially divert to parallel, local routes that are not appropriate for regional traffic.

The restrictive, landscaped median included under the Build alternative would affect routing and access to properties along Aurora Avenue North. The build condition would ultimately improve mobility for passenger cars and trucks via the capacity improvements, reduce conflicts from side street and business driveway left-turn movements, consolidate driveways (access management), and focus bus and right-turn maneuvers in the BAT lanes.

The Build alternative would have 9 unsignalized median openings, located between signalized intersections, along the 1.75-mile project. These openings will make it possible for motorists to make left-turns into unsignalized cross streets and properties along the project and to make U-turns to access driveways in the opposing direction. The openings will be designed to accommodate all sizes of passenger cars and trucks, up to a delivery truck. Left-turns for trucks and passenger vehicles and U-turns for passenger vehicles will be allowed from these openings. The same left and U-turn accommodations will be permitted at all signalized intersections. The locations with unsignalized, mid-block median openings and the business driveways they provide direct left-turn access to include:

- Northbound at N. 143rd Street
- Southbound at N. 140th Street
- Northbound at Town and Country 5 Star Dealership (13733 Aurora Avenue North)
- North/Southbound at N. 137th Street
- Northbound at Rite Aid, Bally's Fitness, Dollar Tree, Ross Dress for Less, and Grocery Outlet (13201 Aurora Avenue North)
- Southbound at Albertson's, Kmart, and Petsmart (13000 - 13200 Aurora Avenue North)
- Northbound at N. 127th Street
- Northbound at Les Schwab Tire Store (12215 Aurora Avenue North)
- Southbound at Puetz Golf (11762 Aurora Avenue North)

The lower volume side streets of N. 127th Street, N. 128th Street, N. 137th Street, N. 140th Street, and N. 143rd Street would be limited to right-turn only access onto Aurora Avenue North. It is possible that motorists may avoid these intersections with Aurora Avenue North in favor of a street with a signalized intersection to access Aurora Avenue North. However, any diversion would have little impact for two reasons. First, delays from these stop-controlled side streets under the No-Build condition are forecasted to be greater than 150 seconds. High delays make left-turn and through movements extremely difficult, likely resulting in right-turns from these streets without the revised project. Second, these streets

currently serve and are projected to serve low traffic volumes. Diverted traffic to parallel avenues to Aurora Avenue North would be minimal.

The mobility improvements and mid-block median openings would provide the necessary routing and business access to encourage motorists to use the improved roadway rather than diverting onto neighborhood streets. Bypassing Aurora Avenue North for lower classified streets would not be beneficial to motorists. The Seattle Department of Transportation, in conjunction with area residents, will monitor neighborhood streets using the Neighborhood Traffic Control Program (NTCP) for inappropriate truck traffic to determine whether diversion is occurring and take measures to discourage such actions. If a street has traffic growth resulting from the Aurora Avenue North Transit, Pedestrian, and Safety Improvement Project that is documented, then physical devices may be installed such as traffic circles, diverters, chicanes, or street closures.

## Spillover Parking Impacts on Side Streets

### Future No-Build Conditions

No changes to the Aurora Avenue North shoulder parking or to adjacent business parking lots would occur under the No-Build conditions. Therefore, no impacts to businesses or side street parking operations are expected.

### Future Build Conditions

The parking supply at individual locations (see Aurora Avenue North Transit, Pedestrian, and Safety Improvements Project *Social, Economics, and Environmental Justice Discipline Report*) would be reduced by the revised project. Most of the parking stalls that would be affected by the project are “non-compliant” parking stalls. A non-compliant parking stall is a parking stall that is located within the City right-of-way or one that requires maneuvering to enter or exit the parking stall within the right-of-way.

In order to determine whether the loss of parking stalls as a result of the project will have a spill-over affect on side street parking near the project, a parking occupancy study was conducted on the commercial business properties expected to be affected by a loss in the parking supply. Table 16 (next page) lists the properties. Those properties not expected to be affected were not surveyed and are assumed to not result in any spillover parking impacts. The business properties expected and not expected to be affected were identified using the revised project footprint overlaid on a high-resolution aerial photo.

**TABLE 16**  
Commercial Business Properties Expected to Lose Parking

<b>Business Name</b>	<b>Address</b>
Seattle Super Supplements	14355 Aurora Avenue North
Tobacco Street/Hertz Rental Car/Parker Paints	14333 Aurora Avenue North
Nelson Truck Equipment Sales	14325 Aurora Avenue North
Kidd Valley	14303 Aurora Avenue North
Auto Trim	14101 Aurora Avenue North
Town & Country 5-Star Chrysler, Plymouth, Jeep Dealership	13733 Aurora Avenue North
St. Vincent De Paul	13555 Aurora Avenue North
Car Toys	12815 Aurora Avenue North
Robb's 125th Street Bar and Grill	12255 Aurora Avenue North
Al's Glass	12015 Aurora Avenue North
RB White Electric, Inc.	11728 Aurora Avenue North
76 Station	12248 Aurora Avenue North
Health South	12500 Aurora Avenue North
Dawg Tags Bar and Grill	12534 Aurora Avenue North
Appliance Service Station	12546 Aurora Avenue North
Anderson's Door Company	12714 Aurora Avenue North
Pho of Aurora	12752 Aurora Avenue North
Westlund Buick	12800 Aurora Avenue North
KFC/Ivar's Restaurant	13448 Aurora Avenue North
K Smoke Mart	11726 Aurora Avenue North
The Salvage Broker	13760 Aurora Avenue North
Moore's Professional Collision	1110 North 140th Street
Schuck's Auto Parts	14320 Aurora Avenue North

The study was conducted on November 7th (Wednesday) and 8th (Thursday) 2007 at two different times. The first time was midday between 11 AM and 1 PM and the second was early evening between 4 PM and 6 PM. These two times were selected because traffic volumes peak during these times on Aurora Avenue North and are anticipated to be peak times for commercial business activity. Observers counted the vehicles parked in the designated business parking areas and in the business frontage along the shoulder of Aurora Avenue North. A total of six counts were made during the two-hour midday period and five counts during the two-hour evening period. The parking study was intended to

take samples from two days during a typical week independent of effects from holiday or weekend traffic volumes and business activity. The number of observations was a function of the duration of the study and was taken into account by using the maximum observed parking demand in calculating the expected parking occupancy.

The parking supply at businesses was determined by counting the number of parking stalls within each commercial property and along the frontage of Aurora Avenue North. The side street parking supply was determined by measuring the curb length (minus the required clear distances). The maximum number of parked cars observed was then compared to the parking supply to calculate the existing parking occupancy for each affected commercial business property.

The results of the study showed that for 20 of the 23 (87%) affected properties, the current supply met or exceeded the maximum observed parking demand. The three affected properties where observed demand exceeded the current parking supply included Tobacco Street et al, Nelson Truck Equipment Sales, and Town & Country 5-Star Car Dealership.

It was assumed that parking demand would continue to exceed parking supply at these three properties. With a loss of parking supply due to the build conditions of the completed project, it is reasonable to assume this may cause spillover parking to side streets. The Anderson's Door Company property does not experience parking demand exceeding parking supply according to observations; but would be left with one compliant parking space, likely resulting in spillover parking. The side streets within walking distance (500 feet) of these four properties were studied to determine if the current parking supply would accommodate the spillover parking. They included N. 143rd Street between Aurora Avenue North and Linden Avenue North, N. 137th Street between Aurora Avenue North and Linden Avenue North, and N. 128th Street between Aurora Avenue North and Stone Avenue North. Table 17 (next page) reveals that the spillover parking from all four properties would be accommodated by the adjacent side streets. The parking supply exceeds the demand based on observed conditions and conservative assumptions on demand. To be conservative, a "worst-case" spill-over condition to the side streets was assumed. The "worst-case" number of displaced vehicles was based on the number of parking stalls removed or the difference between maximum observed parking demands and remaining parking stalls, whichever was higher.

TABLE 17  
Side Street Parking Supply with Spillover

Street Name	Parking Supply <sup>1</sup> (No. of Spaces)	Current Occupancy (Max Observed Demand / Supply)	“Worst-Case” Displaced Vehicles	Expected Occupancy (Max Demand + Displaced Vehicles / Supply)
N. 143rd Street, Aurora Avenue N to Linden Avenue N	37	19%	Tobacco Street et al: <b>2</b>  Nelson Truck Equipment Sales: <b>6</b>	41%
N. 137th Street, Aurora Avenue N to Linden Avenue N	39	67%	Town and Country: <b>10 (on-street)</b>	92%
N. 128th Street, Aurora Avenue N to Stone Avenue N	48	81%	Anderson’s Door Company: <b>8</b>	98%

<sup>1</sup> Number of spaces assumes 20 feet per parking space.

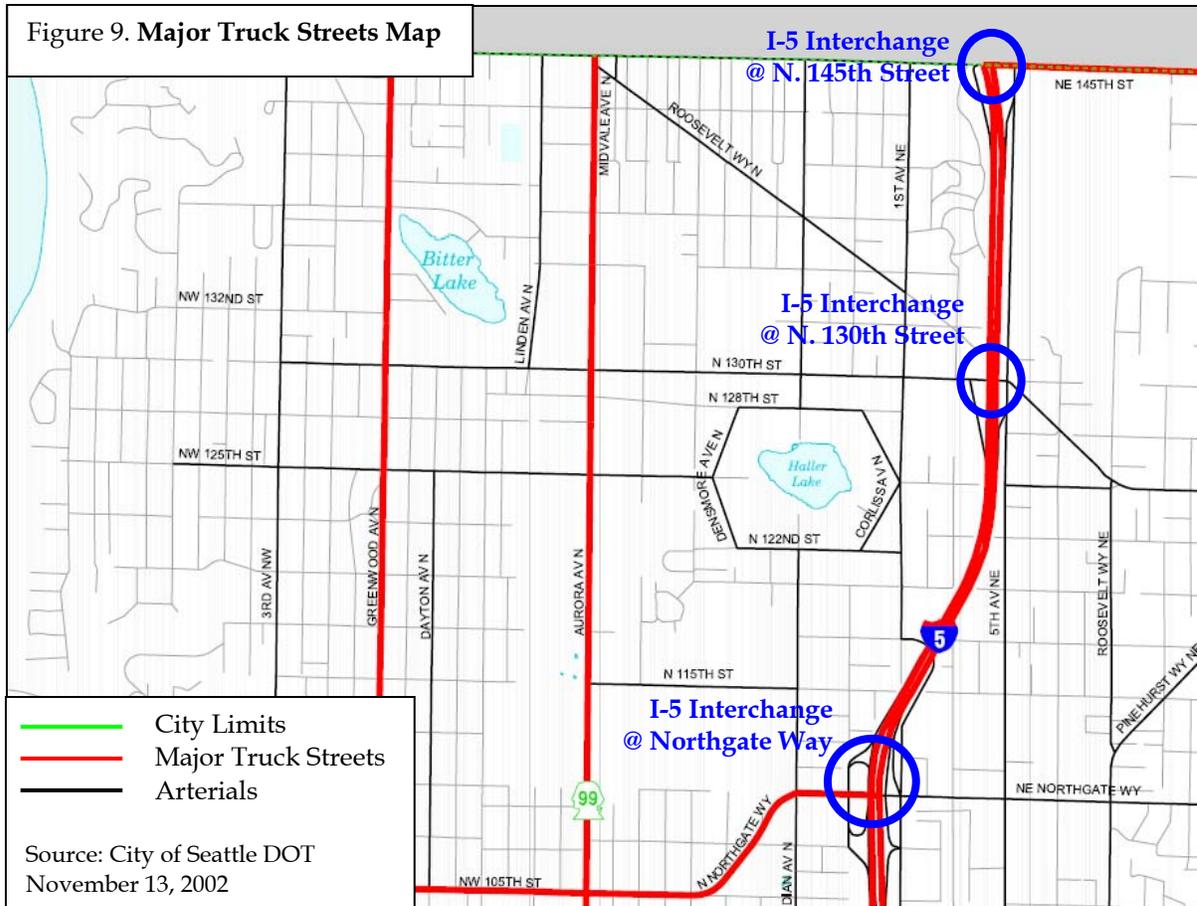
<sup>2</sup> Maximum demand observed during weekday midday and weekday evening.

Of the three side streets studied, N. 128th Street had the highest current, maximum observed parking occupancy with 81 percent occupied stalls. Adding the “worst-case” displaced vehicles to the maximum observed parking demand on N. 128th Street increases the expected occupancy to 98 percent occupied stalls. North 137th Street follows with 92 percent expected occupied stalls and N. 143rd Street has 41 percent expected occupied stalls. In conclusion, there would be enough available parking supply on the side streets adjacent to the four affected commercial business properties. Therefore, it is reasonable to state that the revised project will not cause adverse impacts to the side street parking supply.

### Freight Mobility and Commercial Property Access

The restrictive, landscaped median included under the Build alternative would affect routing and access to properties along Aurora Avenue North. The build condition would ultimately improve mobility for freight via the capacity improvements, reduce conflicts from side street and business driveway left-turn movements, consolidate driveways (access management), and focus bus and right-turn maneuvers in the BAT lanes.

As shown in Figure 9 (next page), the nearest parallel arterials for use as truck circulation are Roosevelt Way North, Linden Avenue North, Dayton Avenue North, and Meridian Avenue North (City of Seattle Department of Transportation, *Major Truck Streets Map*, November 13, 2002). Trucks accessing Aurora Avenue North from regional points would be able to position for right-in/right-out access by using the I-5 interchanges at North 105th Street/Northgate Way, North 130th Street (to and from the south only), and North 145th Street to access properties on both sides of Aurora Avenue North. Once the proposed improvements have been constructed local truck traffic delivery routes will adjust so that access to the properties will be right-in and right-out movements.



Different truck types/sizes would be affected differently by the median. Trucks with trailers passing through the study area would likely benefit from the roadway and access management improvements. Trucks with trailers making on-site deliveries would have to adjust their routes to make right-turn movements into business driveways. This could be accomplished by accessing Aurora Avenue North further upstream via the arterials and major truck streets with Interstate 5 interchanges, as shown in Figure 9. All single-unit and local delivery type trucks would be able to access the mid-block openings to make left-turns.

The Build alternative would have 9 unsignalized median openings, located between signalized intersections, along the 1.75-mile project. These openings will make it possible for trucks to make left-turns into unsignalized cross streets and properties along the project. The openings will be designed to accommodate a single-unit design vehicle, which is typically the size of truck used to make deliveries to residents and businesses. Left-turns for trucks and passenger vehicles and U-turns for passenger vehicles will be allowed from these openings. The same left and U-turn accommodations will be permitted at all signalized intersections. The locations with unsignalized, mid-block median openings and the business driveways they provide direct left-turn access to include:

- Northbound at N. 143rd Street
- Southbound at N. 140th Street
- Northbound at Town and Country 5 Star Dealership (13733 Aurora Avenue North)
- North/Southbound at N. 137th Street

- Northbound at Rite Aid, Bally's Fitness, Dollar Tree, Ross Dress for Less, and Grocery Outlet (13201 Aurora Avenue North)
- Southbound at Albertson's, Kmart, and Petsmart (13000 - 13200 Aurora Avenue North)
- Northbound at N. 127th Street
- Northbound at Les Schwab Tire Store (12215 Aurora Avenue North)
- Southbound at Puetz Golf (11762 Aurora Avenue North)

## Emergency Vehicle Access

There are two fire stations that would respond to calls on Aurora Avenue North and one hospital located outside the immediate study area. Seattle Fire Department Station 24 (401 N. 130th Street) is located approximately 2,200 feet west of Aurora Avenue North at Phinney Avenue North and N. 130th Street. Station 31 (1319 Northgate Way) is located approximately 900 feet east of Aurora Avenue North at Interlake Avenue North and N. 105th Street. Northwest Community Hospital (1550 N. 115th Street) is located approximately 1,400 feet east of Aurora Avenue North at Ashworth Avenue North and N. 115th Street. All three can access Aurora Avenue North directly via a signalized intersection and all signalized intersections will be equipped with emergency vehicle preemption.

The mid-block, median openings will make it possible for smaller emergency response vehicles like medic units, aid units, and command vehicles to make left-turns into unsignalized cross streets and properties. Larger emergency response vehicles like fire engines and ladder trucks would have to adjust the routes to make right-turn movements into business driveways. The larger vehicles with higher clearances could also cross over the raised curb sections to access minor streets such as N. 127th Street, N. 137th Street, N. 140th Street, N. 141st Street, N. 143rd Street, and Roosevelt Way North.

## Construction Traffic Impacts

Construction activity impacts on traffic flow would potentially result from lane closures, detours, and temporary traffic control measures. Revisions to business access typically disrupt access due to driver unfamiliarity with the new access conditions. Temporary striping and lane markings may cause disruptions to normal traffic flows. Delivery and patron access would also be impacted during construction.

### Construction Traffic Mitigation Measures

Impacts related to the Build scenario would be mitigated to the greatest extent possible through the application of construction best management practices including traffic control plans, construction staging plans, and continual communication and coordination with businesses along Aurora Avenue North. City residents would be advised to use alternate routes during periods of closure and regional transit service would be used to provide additional person-movement capacity at these times.

Planning adequate traffic control during design and construction is crucial to a smooth, successful, and safe construction. In addition to providing safety to workers, motorists, and pedestrians, the traffic control plan must provide access to the work zones, business driveway delineation, signage for businesses, and lighting. Continued public information and opportunities for input would be provided throughout the period of construction. In

addition, partnerships with adjacent businesses would be maintained throughout the construction period to ensure that business access needs are met during construction. All transportation modes – pedestrians, bicycles, transit, trucks, and passenger vehicles – would be taken into account.

Measures to address increases in neighborhood traffic impacts could be applied during and after construction. The Seattle Department of Transportation will use the Neighborhood Traffic Control Program (NTCP) to address cut-through traffic issues and inappropriate truck traffic. The NTCP is available to business owners, residents, and anyone in nearby neighborhoods to monitor traffic impacts on adjacent and parallel streets to Aurora Avenue North during and after construction. If a street has traffic growth resulting from the Aurora Avenue North Transit, Pedestrian, and Safety Improvement Project that is documented, then physical devices may be installed such as traffic circles, diverters, chicanes, or street closures.

### *Transit*

Coordination with the King County Metro transit agency would be ongoing throughout the construction period to minimize impacts to transit service. Bus zone relocation or closure would be clearly signed and communicated to transit riders. Temporary stops would be provided in a safe and accessible location, free of conflicts from other traffic and construction activity.

### *Pedestrians*

The needs of pedestrians within the construction zones will be considered and the range of pedestrian needs is wide, including those of the elderly and those with sensory impairments. The following will be considered when developing a traffic control plan for road construction:

- Pedestrians may be separated from work site activities to avoid impedance to the work and safety risks.
- Pedestrians may be separated from other traffic moving through or around the work area.
- Pedestrians may be provided with a safe travel way (temporary sidewalk or bike path).
- Construction flaggers may be provided to facilitate the safe movement of pedestrians through the work zone.
- Well-marked detour routes for pedestrians will be provided to enable direct and safe access to destinations.

### *Traffic Control Plan*

Formal traffic control plans will be prepared for the construction period to ensure that adequate traffic control will be provided during the construction phases and to help ensure that access through the construction zone and to businesses will be safe. Traffic control plans will be prepared in accordance with standards provided in the *Manual on Uniform Traffic Control Devices for Streets and Highways* (FHWA 2003).

### *Construction Staging Plan*

The primary options for construction staging are shift, detour, and half-width construction. Shift construction allows business access during construction and minimizes the spread of construction impacts throughout the community. The shift option maintains the existing

lane configuration of the roadway by using reduced lane widths to maximize roadway capacity and driver comfort during construction. By using shift construction staging, the sidewalk and amenity zone, driveways, and new curb-and-gutter would be constructed for one side. Once completed, traffic would be shifted toward the recently completed section and the opposing sidewalk, driveways, and curb-and-gutter will be constructed. Finally, traffic would be shifted to create a work zone for the construction of the median.

Half-width construction staging is another option that maintains some service along the roadway during construction. With this option, all of the roadway traffic would be placed on one half of the roadway while the other half is under construction. The number of traffic lanes would be reduced, and business access would be more difficult to provide.

Construction detours might be needed if major structural repair of the roadway or extensive underground utility relocation is required. Such detours would usually be considered only if the following conditions apply:

- The route under construction is other than a high-volume route and detour length is less than 10 miles.
- Significant environmental impacts and right-of-way clearance problems are anticipated.
- The cost of maintaining the designated detour route is less than the cost of the half-width construction option.

When detours and lane closures are needed on high-volume multilane highways, they are generally scheduled to occur during the non-peak daytime and nighttime hours when traffic volumes are at their lowest levels. Detour routes, when used will be well signed, using only appropriate arterial routes.

Choosing the sequence of construction requires trade-offs between competing goals of construction. These include minimizing the length of construction, keeping traffic flowing, maximizing access to properties, and ensuring proper pavement construction.

### *Maintaining Access and Communication*

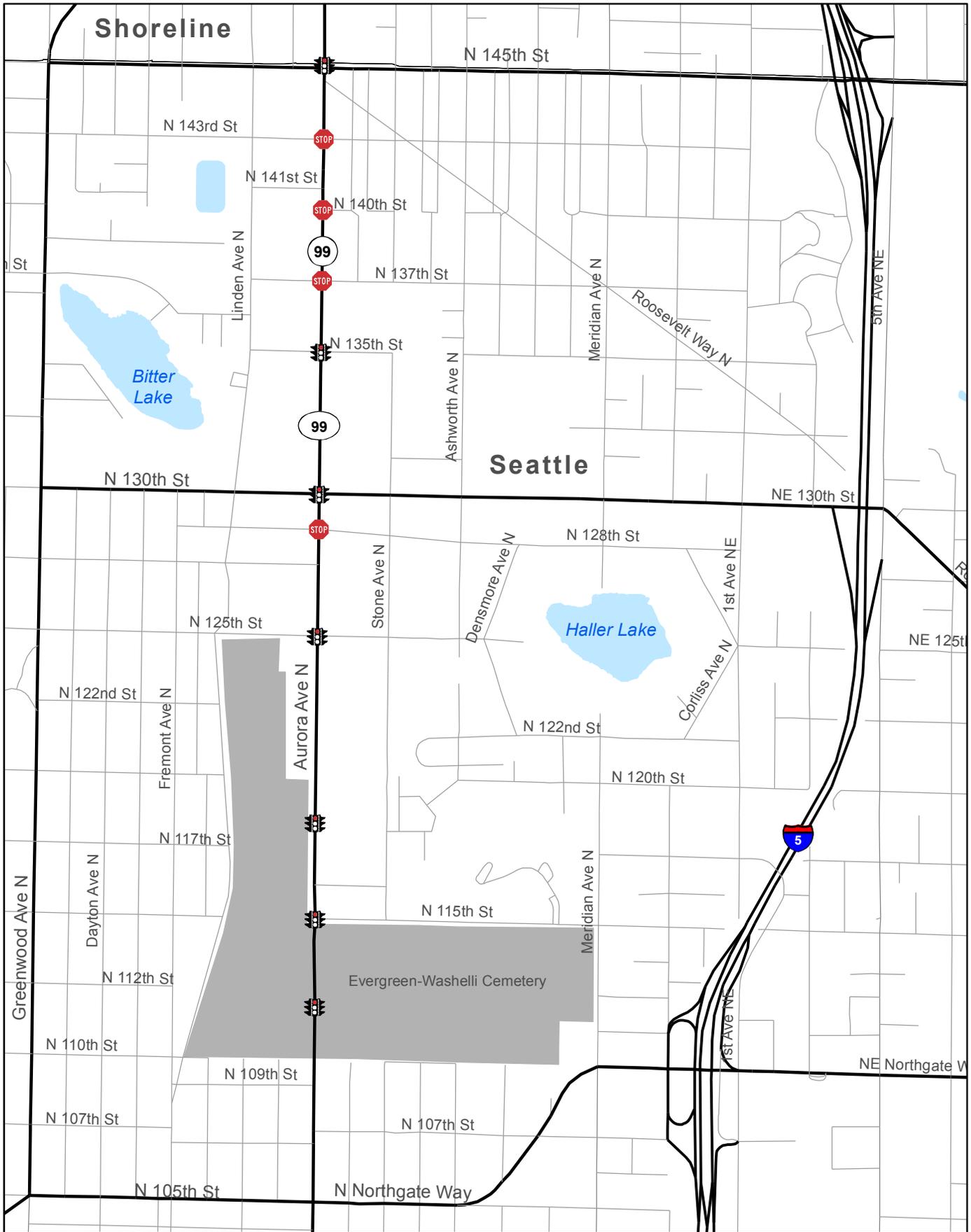
During the course of construction, access to businesses along Aurora Avenue North would be maintained. Temporary access revisions would be well marked and would provide the most direct access to properties possible.

Signing during construction can be divided into two categories, signs that are required to identify the worksite and its related conditions and hazards, and signs that identify business locations and access points that might be obscured during construction.

Owner and tenants along the corridor will be kept informed of construction schedules, schedule changes, and information detailing construction activities. Construction information will be provided via a project website, phone line, newsletters, and personal contact with the contractor and construction management team.

Figures

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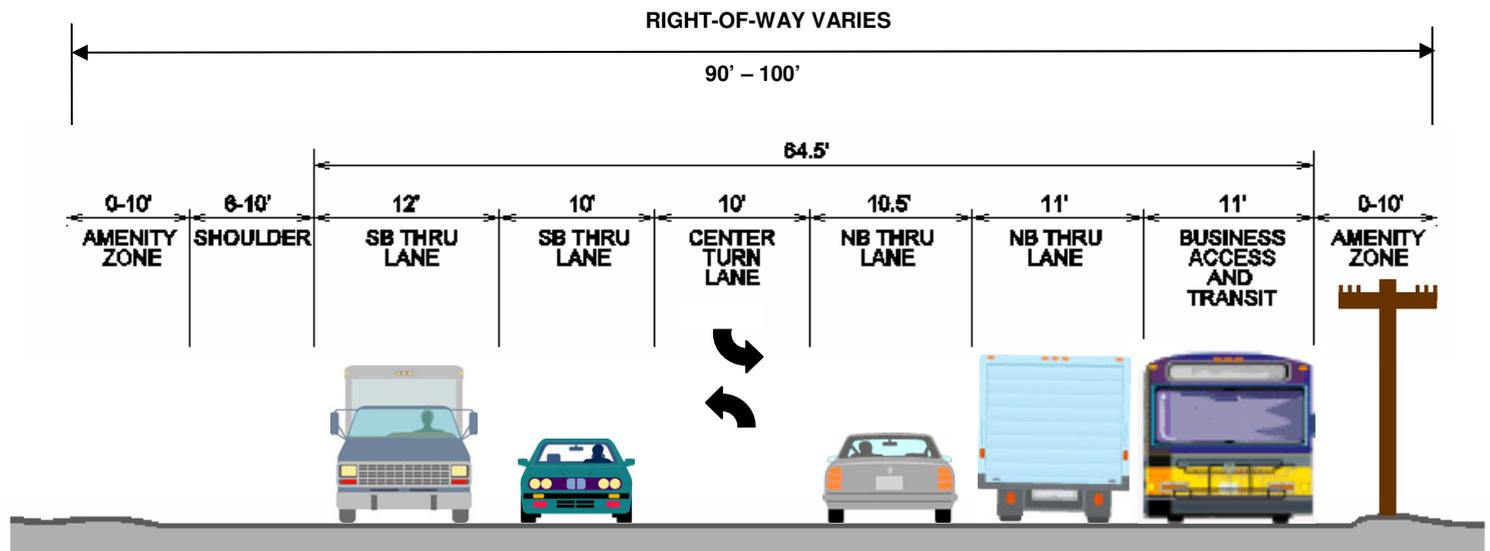


**Figure 1. Vicinity Map**  
**Aurora Avenue North, Transit,**  
**Pedestrian, & Safety Improvements**

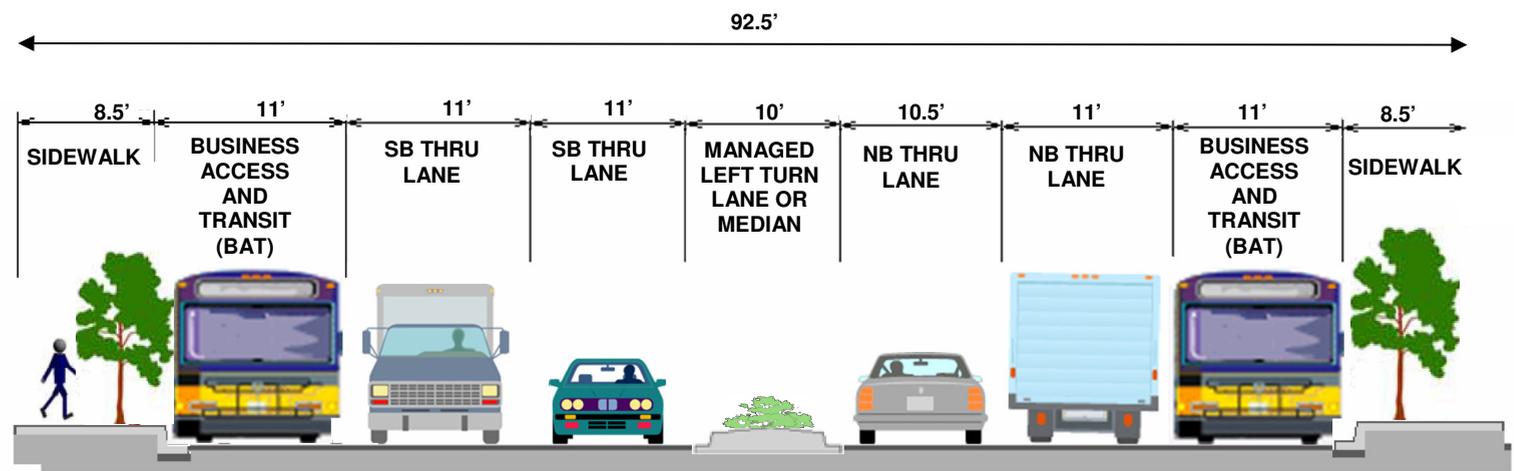
# SDOT Aurora Avenue Transit, Pedestrian, and Safety Improvements Project

North 110<sup>th</sup> Street to North 145<sup>th</sup> Street

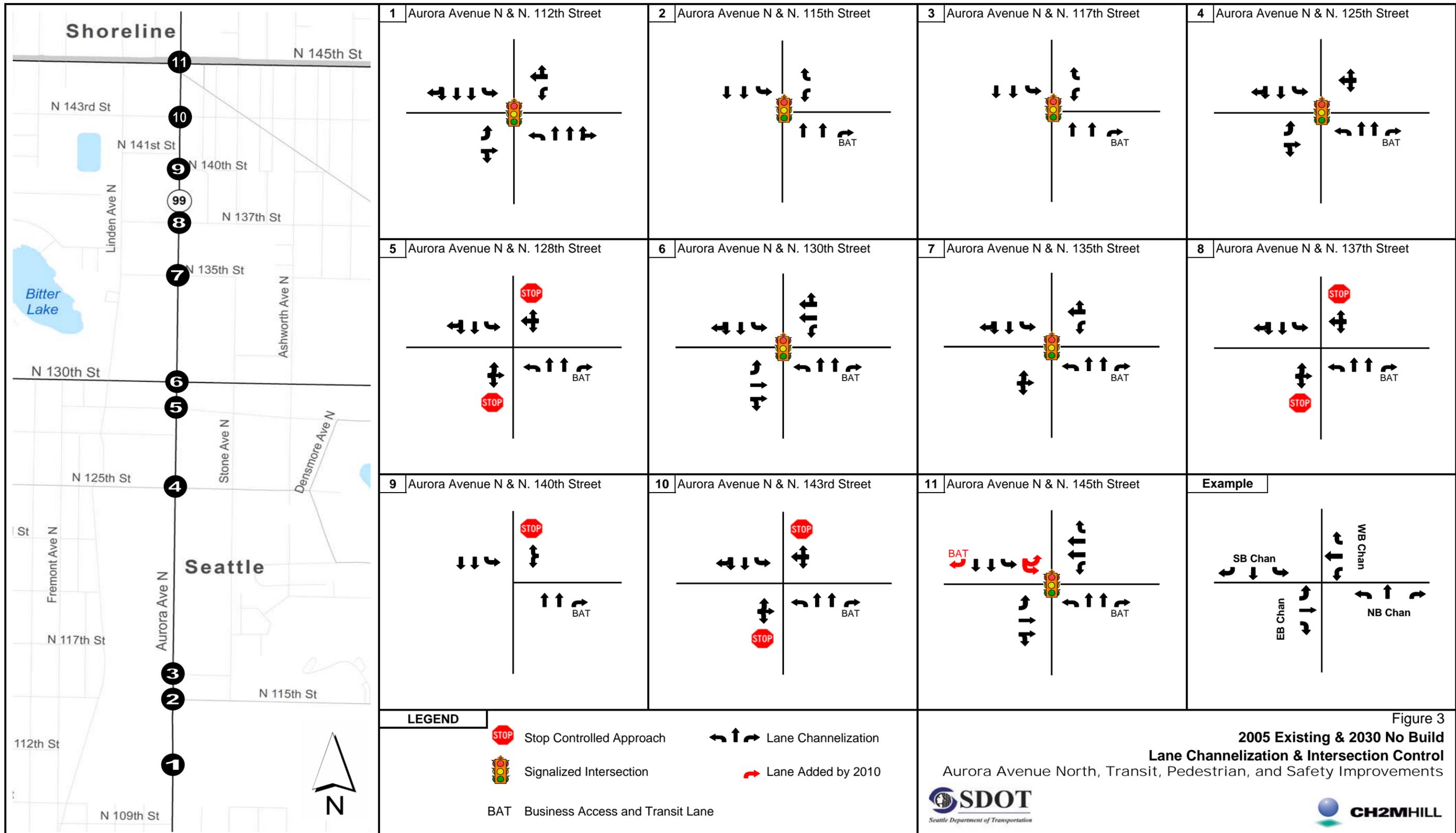
## Existing Cross-section

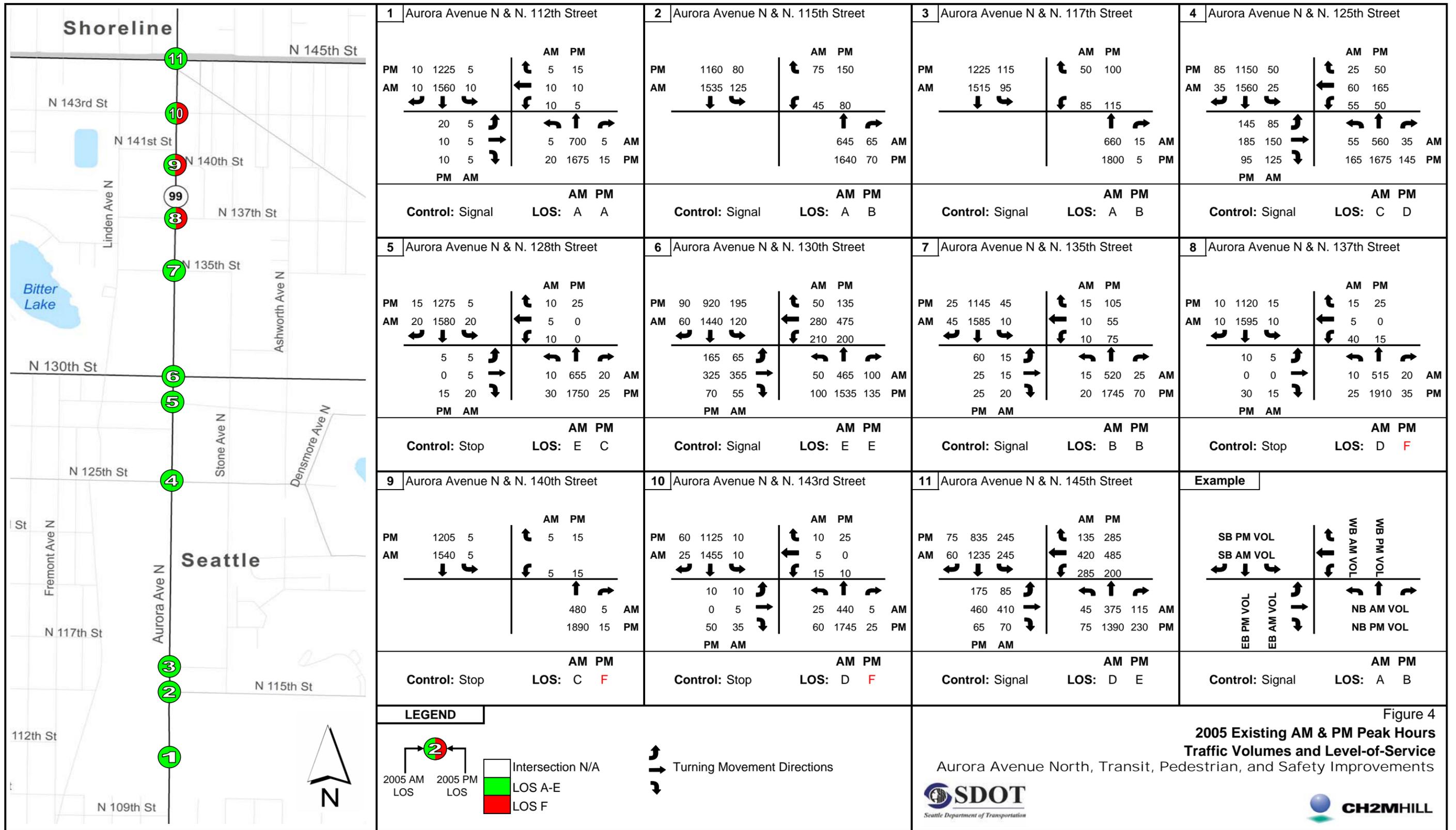


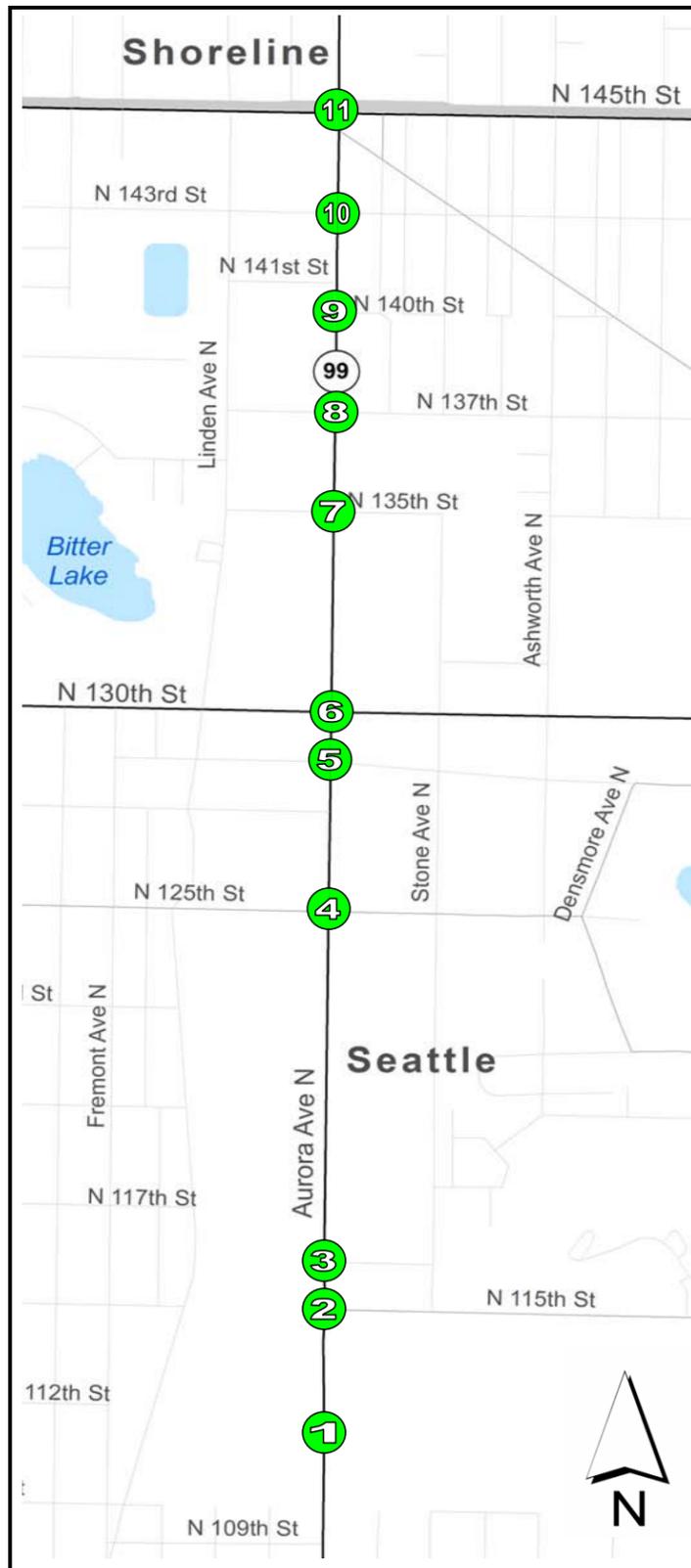
## SDOT Revised Planned Improvements:



**Figure 2: Project Typical Cross Sections**







1 Aurora Avenue N & N. 112th Street																																											
<table border="1"> <tr><th colspan="3">AM</th></tr> <tr><td>15</td><td>1295</td><td>10</td></tr> <tr><td>15</td><td>1625</td><td>15</td></tr> <tr><td>25</td><td>10</td><td>15</td></tr> <tr><td>15</td><td>10</td><td>10</td></tr> <tr><td>15</td><td>10</td><td>10</td></tr> <tr><td>PM</td><td>AM</td><td></td></tr> </table>	AM			15	1295	10	15	1625	15	25	10	15	15	10	10	15	10	10	PM	AM		<table border="1"> <tr><th colspan="3">PM</th></tr> <tr><td>10</td><td>20</td><td></td></tr> <tr><td>15</td><td>15</td><td></td></tr> <tr><td>15</td><td>10</td><td></td></tr> <tr><td>10</td><td>725</td><td>10</td></tr> <tr><td>25</td><td>1775</td><td>20</td></tr> <tr><td>AM</td><td>PM</td><td></td></tr> </table>	PM			10	20		15	15		15	10		10	725	10	25	1775	20	AM	PM	
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Control: Signal LOS: A A

2 Aurora Avenue N & N. 115th Street																																		
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Control: Signal LOS: B B

3 Aurora Avenue N & N. 117th Street																																		
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Control: Signal LOS: A B

4 Aurora Avenue N & N. 125th Street																																																									
<table border="1"> <tr><th colspan="4">AM</th></tr> <tr><td>95</td><td>1225</td><td>55</td><td>35</td></tr> <tr><td>40</td><td>1630</td><td>30</td><td>60</td></tr> <tr><td>155</td><td>90</td><td>15</td><td>15</td></tr> <tr><td>200</td><td>160</td><td>5</td><td>60</td></tr> <tr><td>105</td><td>135</td><td>20</td><td>180</td></tr> <tr><td>PM</td><td>AM</td><td></td><td></td></tr> </table>	AM				95	1225	55	35	40	1630	30	60	155	90	15	15	200	160	5	60	105	135	20	180	PM	AM			<table border="1"> <tr><th colspan="4">PM</th></tr> <tr><td>30</td><td>55</td><td></td><td></td></tr> <tr><td>65</td><td>180</td><td></td><td></td></tr> <tr><td>60</td><td>55</td><td></td><td></td></tr> <tr><td>5</td><td>60</td><td>585</td><td>40</td></tr> <tr><td>20</td><td>180</td><td>1780</td><td>155</td></tr> <tr><td>AM</td><td>PM</td><td></td><td></td></tr> </table>	PM				30	55			65	180			60	55			5	60	585	40	20	180	1780	155	AM	PM		
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Control: Signal LOS: C D

5 Aurora Avenue N & N. 128th Street																												
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1905	45	PM																										

Control: Stop LOS: B B

6 Aurora Avenue N & N. 130th Street																																																									
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Control: Signal LOS: C C

7 Aurora Avenue N & N. 135th Street																																																									
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Control: Signal LOS: A B

8 Aurora Avenue N & N. 137th Street																																													
<table border="1"> <tr><th colspan="4">AM</th></tr> <tr><td>20</td><td>1210</td><td>20</td><td>10</td></tr> <tr><td>25</td><td>1710</td><td>15</td><td>15</td></tr> <tr><td>5</td><td>15</td><td>550</td><td>30</td></tr> <tr><td>20</td><td>30</td><td>2045</td><td>45</td></tr> <tr><td>PM</td><td>AM</td><td></td><td></td></tr> </table>	AM				20	1210	20	10	25	1710	15	15	5	15	550	30	20	30	2045	45	PM	AM			<table border="1"> <tr><th colspan="4">PM</th></tr> <tr><td>75</td><td>55</td><td></td><td></td></tr> <tr><td>5</td><td>15</td><td>550</td><td>30</td></tr> <tr><td>20</td><td>30</td><td>2045</td><td>45</td></tr> <tr><td>AM</td><td>PM</td><td></td><td></td></tr> </table>	PM				75	55			5	15	550	30	20	30	2045	45	AM	PM		
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Control: Stop LOS: C C

9 Aurora Avenue N & N. 140th Street																												
<table border="1"> <tr><th colspan="3">AM</th></tr> <tr><td>1325</td><td>10</td><td>45</td></tr> <tr><td>1675</td><td>10</td><td>55</td></tr> <tr><td>560</td><td>10</td><td>AM</td></tr> <tr><td>2035</td><td>20</td><td>PM</td></tr> </table>	AM			1325	10	45	1675	10	55	560	10	AM	2035	20	PM	<table border="1"> <tr><th colspan="3">PM</th></tr> <tr><td>20</td><td>40</td><td></td></tr> <tr><td>560</td><td>10</td><td>AM</td></tr> <tr><td>2035</td><td>20</td><td>PM</td></tr> </table>	PM			20	40		560	10	AM	2035	20	PM
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Control: Stop LOS: B D

10 Aurora Avenue N & N. 143rd Street																																								
<table border="1"> <tr><th colspan="3">AM</th></tr> <tr><td>70</td><td>1225</td><td></td></tr> <tr><td>40</td><td>1555</td><td></td></tr> <tr><td>70</td><td>30</td><td>475</td><td>35</td></tr> <tr><td>60</td><td>65</td><td>1870</td><td>50</td></tr> <tr><td>PM</td><td>AM</td><td></td><td></td></tr> </table>	AM			70	1225		40	1555		70	30	475	35	60	65	1870	50	PM	AM			<table border="1"> <tr><th colspan="3">PM</th></tr> <tr><td>45</td><td>50</td><td></td></tr> <tr><td>70</td><td>30</td><td>475</td><td>35</td></tr> <tr><td>60</td><td>65</td><td>1870</td><td>50</td></tr> <tr><td>AM</td><td>PM</td><td></td><td></td></tr> </table>	PM			45	50		70	30	475	35	60	65	1870	50	AM	PM		
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Control: Stop LOS: B C

11 Aurora Avenue N & N. 145th Street																																																									
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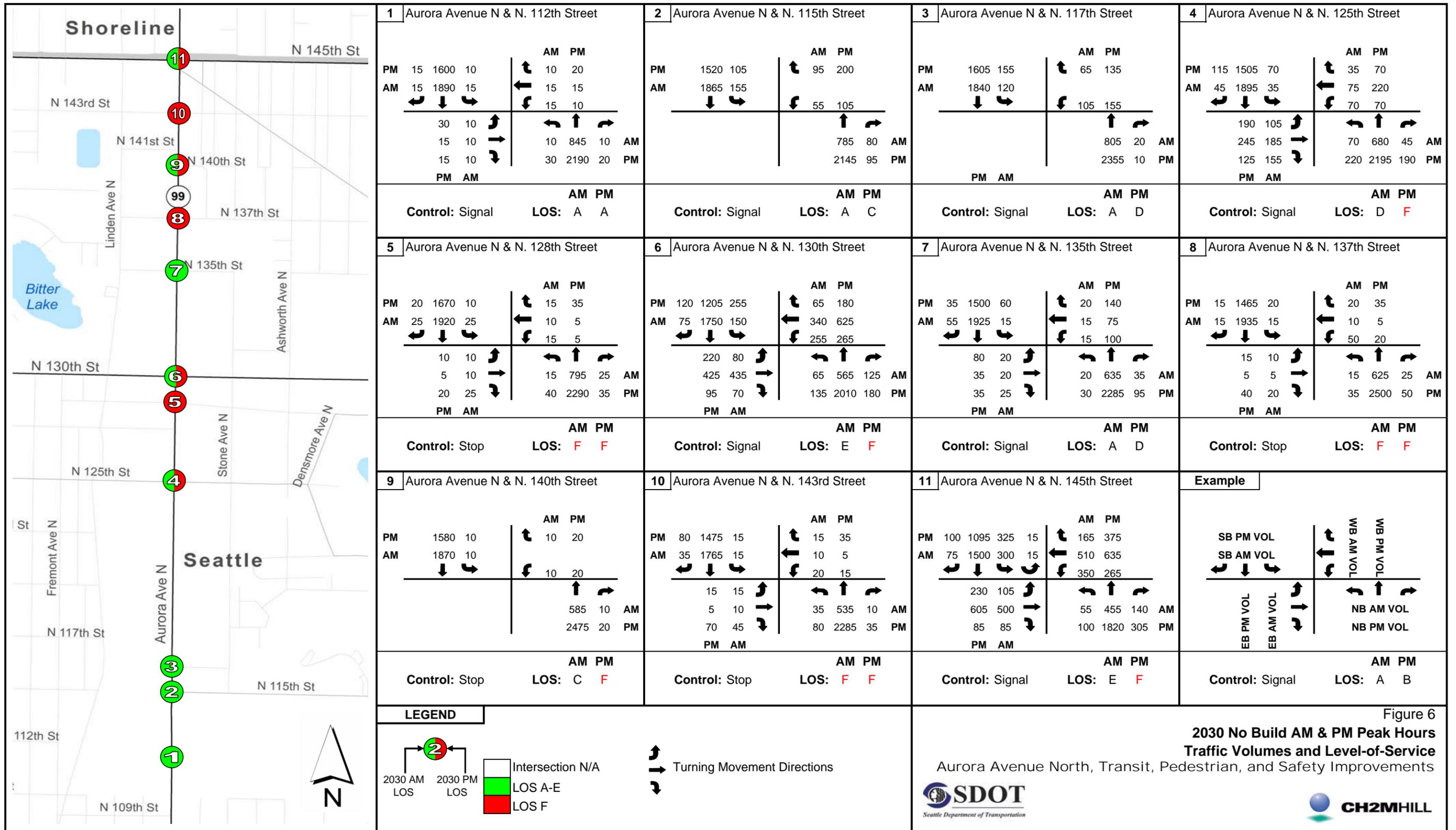
Control: Signal LOS: D D

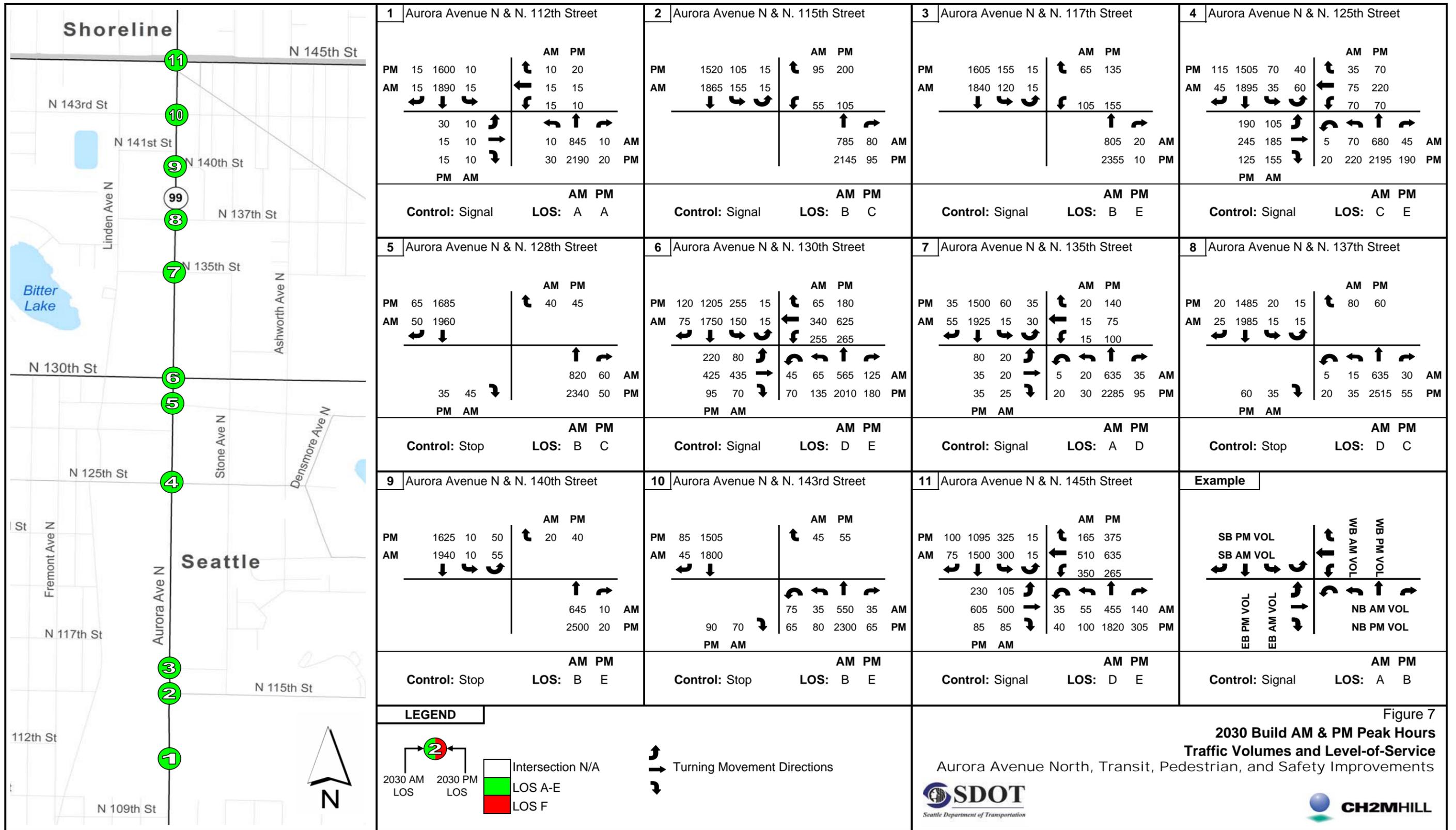
Example																																											
<table border="1"> <tr><th colspan="2">SB PM VOL</th></tr> <tr><td>190</td><td>90</td></tr> <tr><th colspan="2">SB AM VOL</th></tr> <tr><td>490</td><td>430</td></tr> <tr><td>70</td><td>75</td></tr> <tr><th colspan="2">EB PM VOL</th></tr> <tr><td>190</td><td>90</td></tr> <tr><th colspan="2">EB AM VOL</th></tr> <tr><td>490</td><td>430</td></tr> <tr><td>70</td><td>75</td></tr> </table>	SB PM VOL		190	90	SB AM VOL		490	430	70	75	EB PM VOL		190	90	EB AM VOL		490	430	70	75	<table border="1"> <tr><th colspan="2">WB PM VOL</th></tr> <tr><td>145</td><td>305</td></tr> <tr><th colspan="2">WB AM VOL</th></tr> <tr><td>440</td><td>515</td></tr> <tr><td>300</td><td>215</td></tr> <tr><th colspan="2">NB AM VOL</th></tr> <tr><td>35</td><td>50</td></tr> <tr><td>35</td><td>80</td></tr> <tr><th colspan="2">NB PM VOL</th></tr> <tr><td>35</td><td>80</td></tr> <tr><td>35</td><td>80</td></tr> </table>	WB PM VOL		145	305	WB AM VOL		440	515	300	215	NB AM VOL		35	50	35	80	NB PM VOL		35	80	35	80
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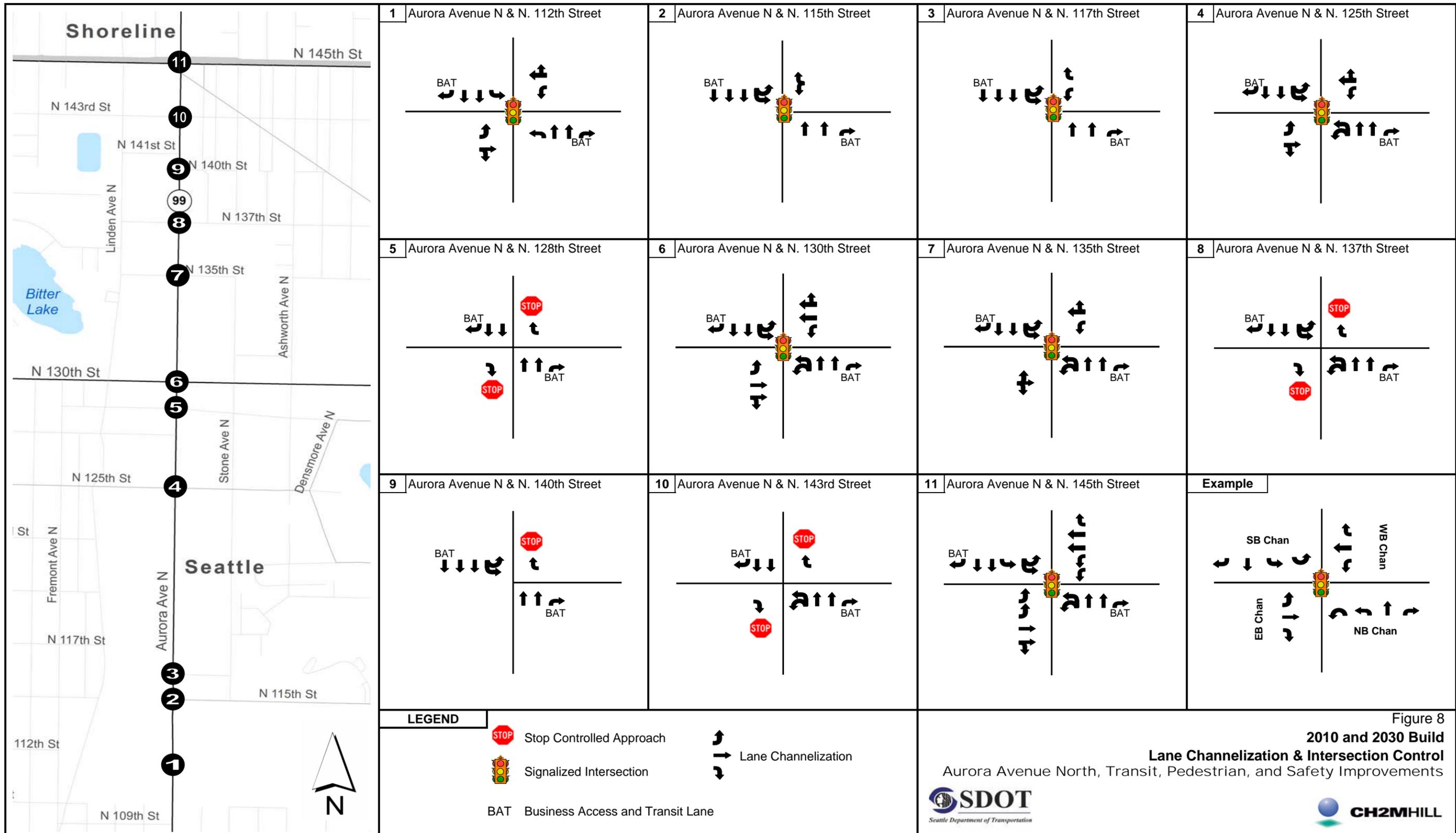
Control: Signal LOS: A B

**LEGEND**

Figure 5  
**2010 Build AM & PM Peak Hours  
 Traffic Volumes and Level-of-Service**  
 Aurora Avenue North, Transit, Pedestrian, and Safety Improvements







## Appendix A

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# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AVE N @ N 145 ST TIME 7:45-8:45

DATE 6-7-05

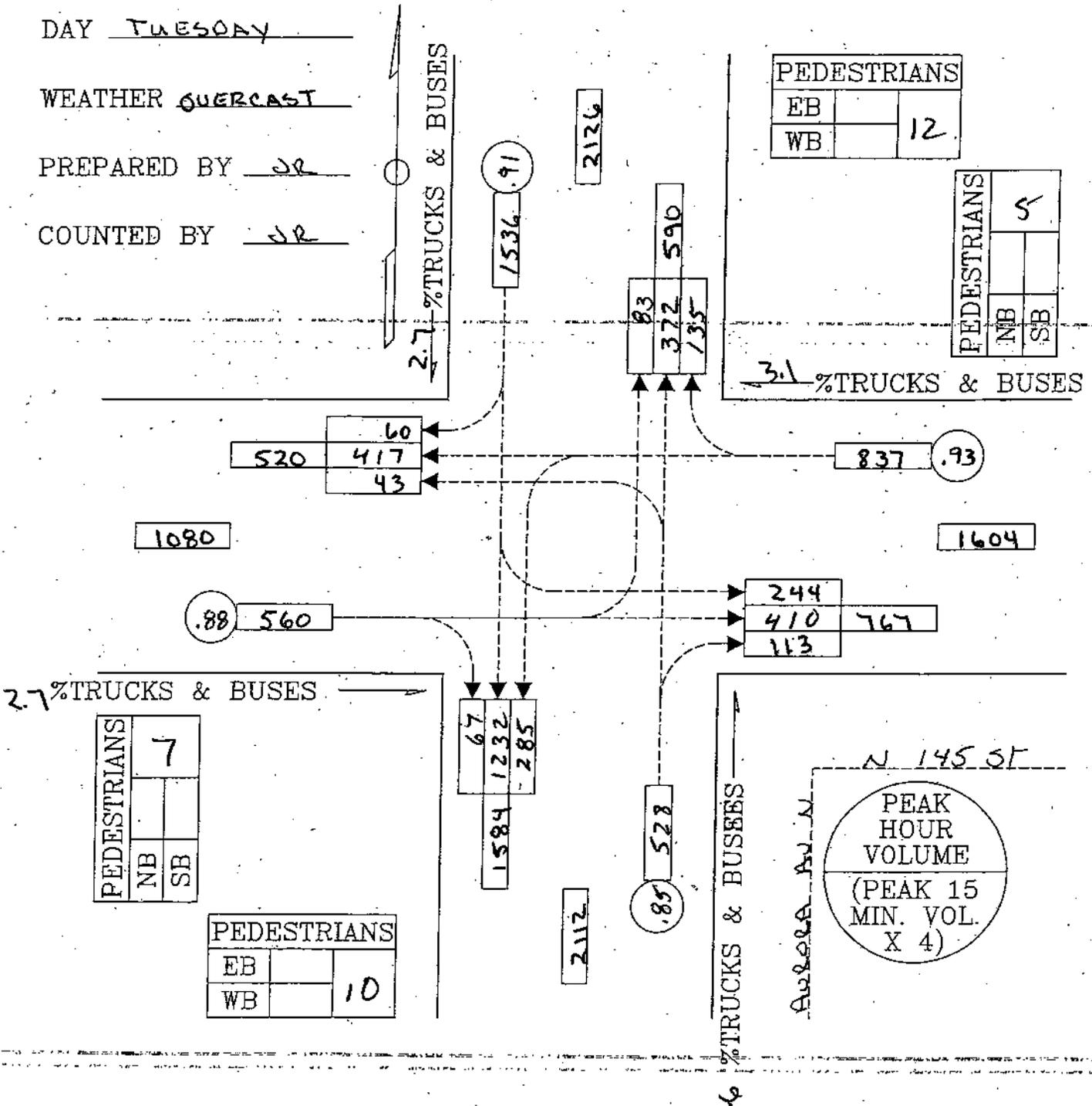
AM PEAK

DAY TUESDAY

WEATHER OVERCAST

PREPARED BY JR

COUNTED BY JR



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AVENUE & N 135 ST TIME 7:30-8:30

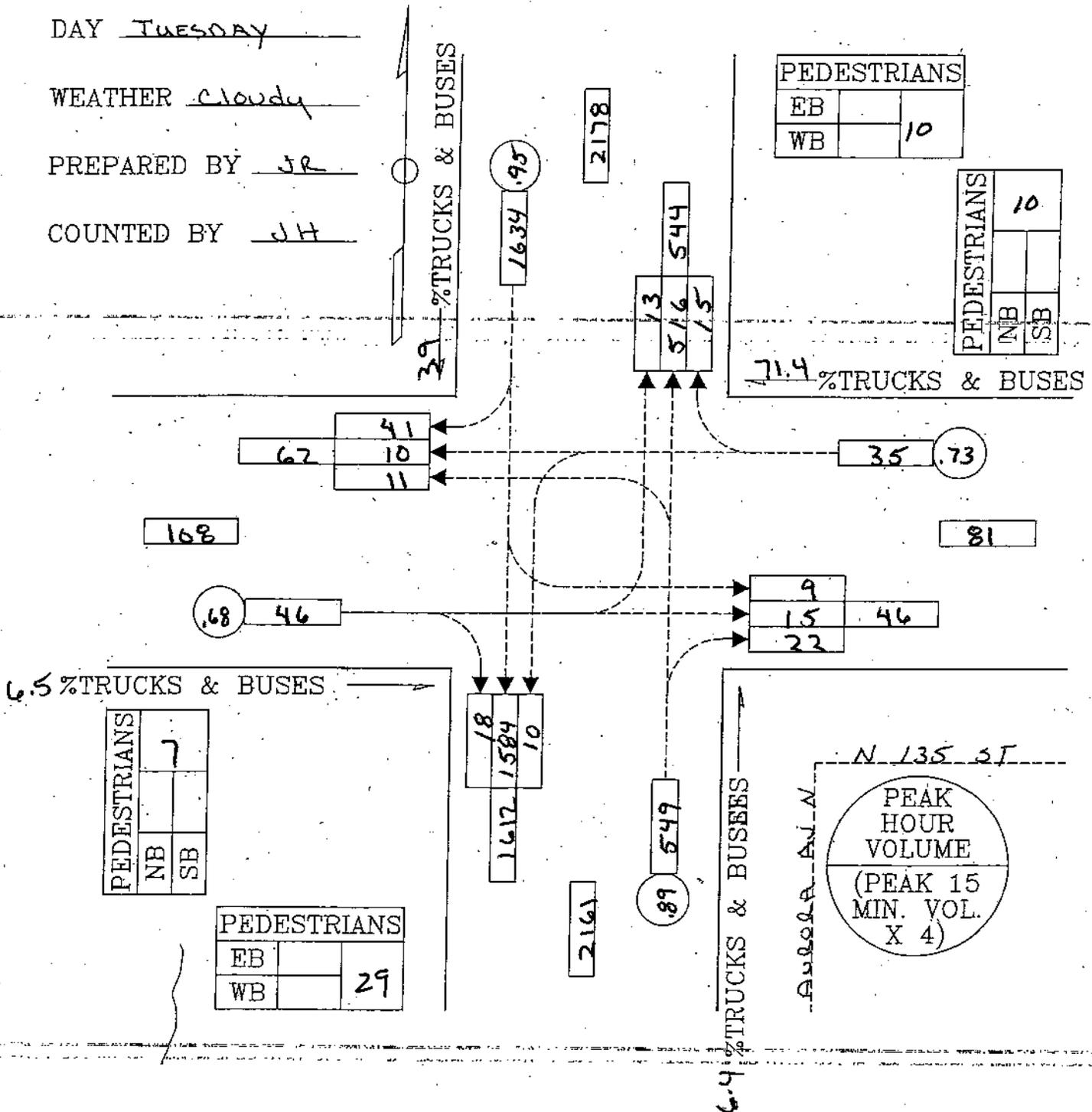
DATE 6-7-05 AM PEAK

DAY TUESDAY

WEATHER Cloudy

PREPARED BY JR

COUNTED BY JH



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION Aurora Aven E N 130 St TIME 7:15-8:15

DATE 6-8-05

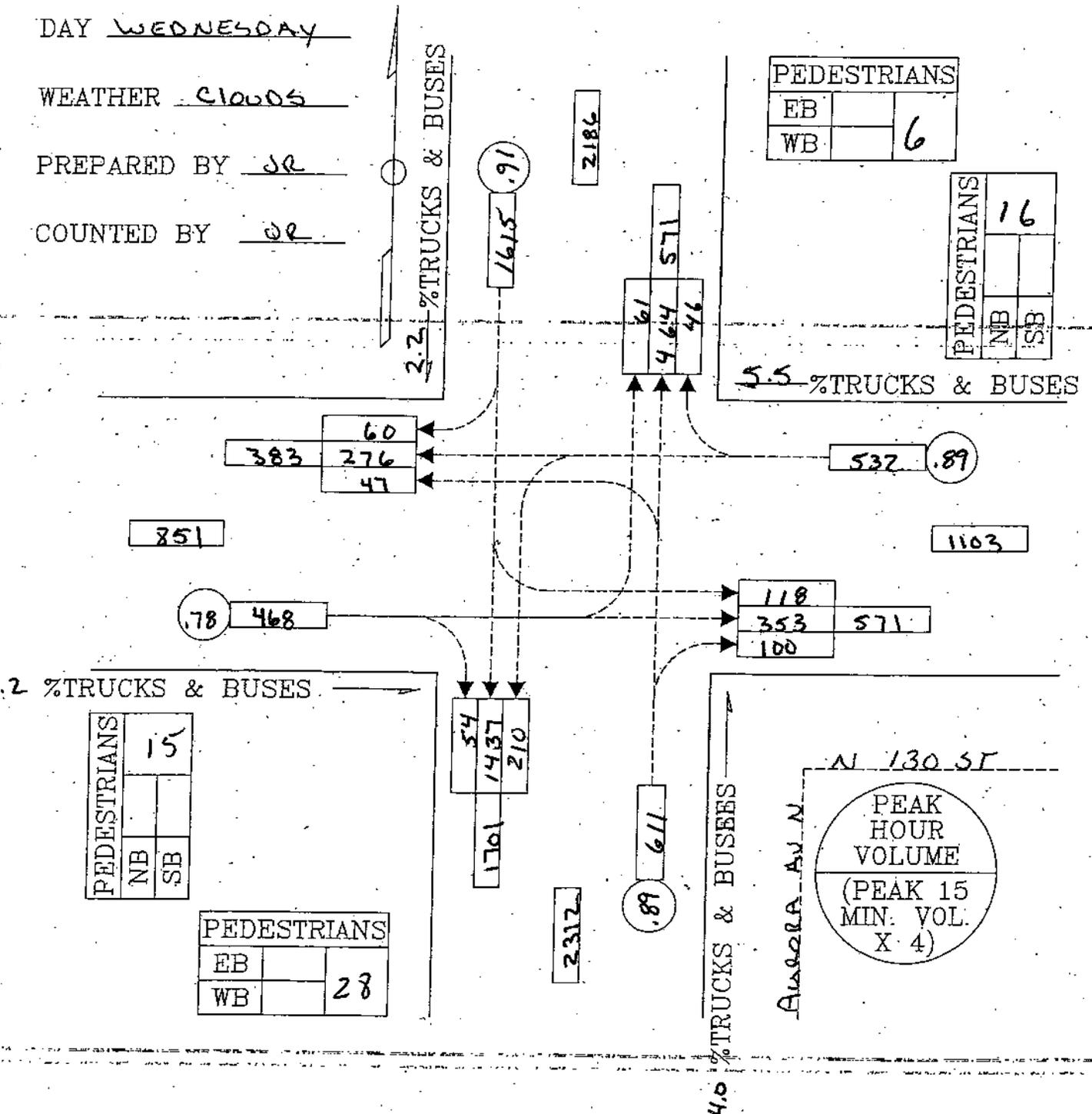
AM PEAK

DAY WEDNESDAY

WEATHER CLOUDS

PREPARED BY JR

COUNTED BY WR



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION Aurora Ave N @ N 117 St TIME 8:00-9:00

DATE 6-9-05

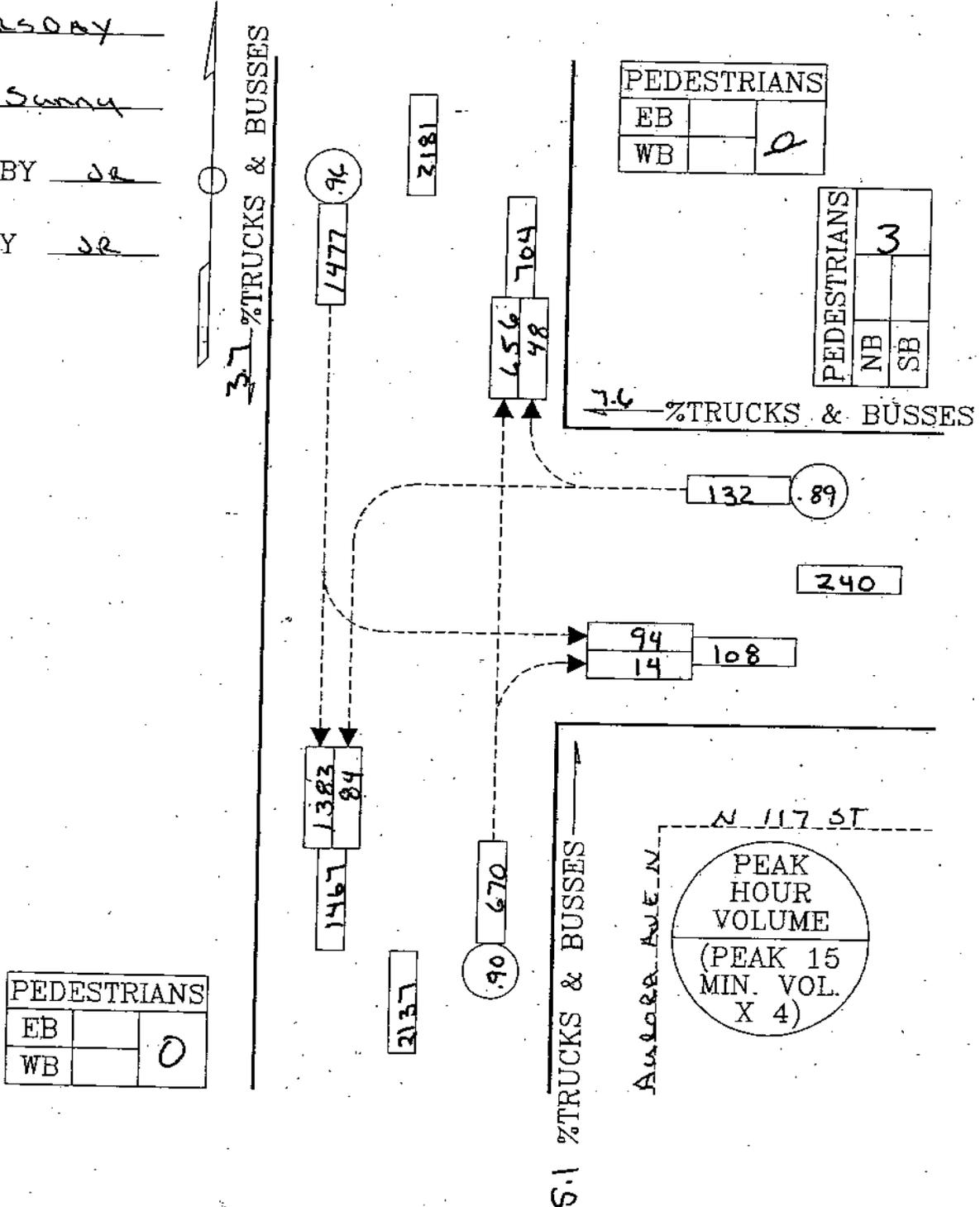
AM PEAK

DAY THURSDAY

WEATHER Sunny

PREPARED BY SR

COUNTED BY SR



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION Aurora Ave N @ N 117 St TIME 4:00-5:00

DATE 6-9-05

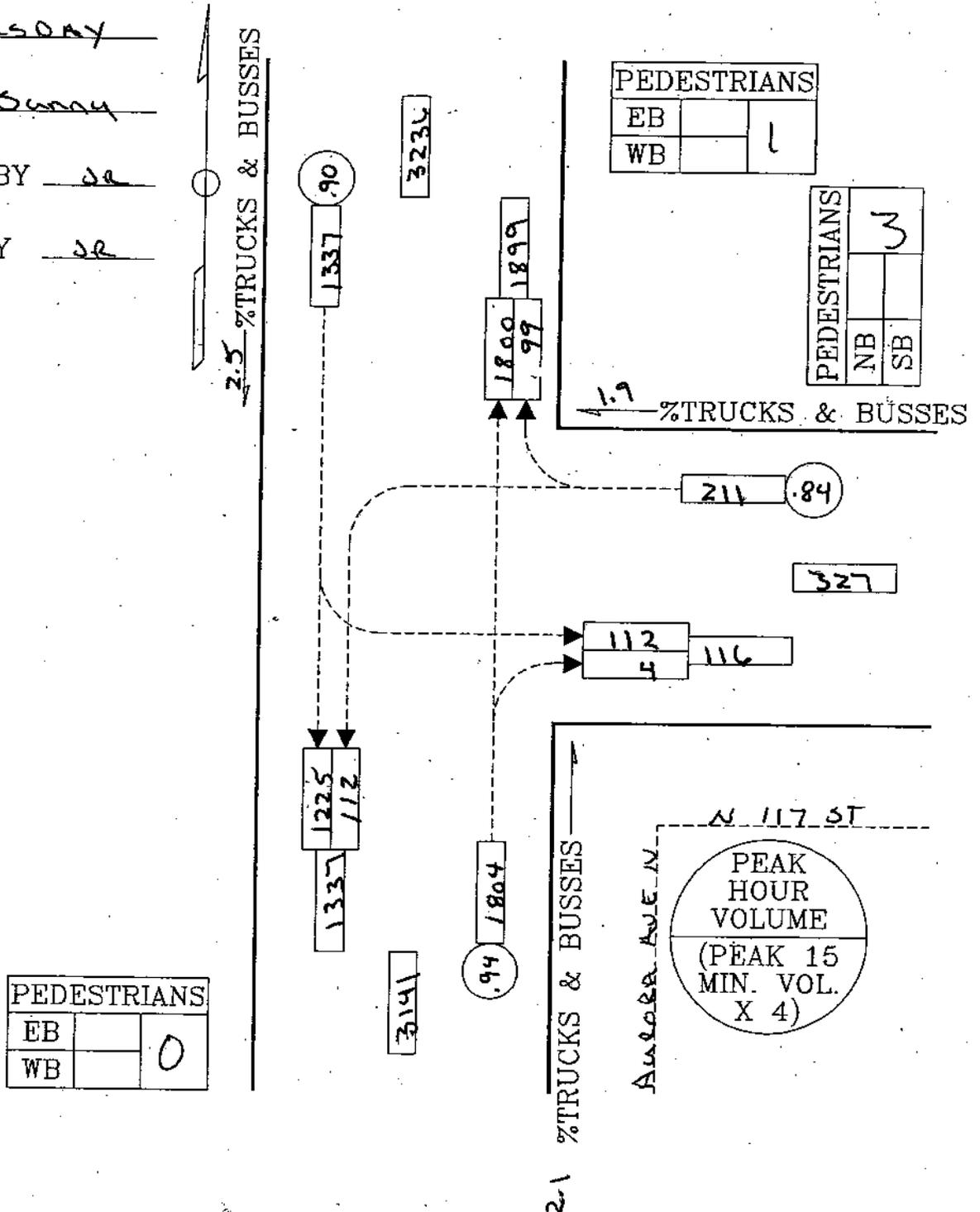
PM PEAK

DAY THURSDAY

WEATHER Sunny

PREPARED BY se

COUNTED BY se



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AVE N & N 115 ST TIME 7:15-8:15

DATE 6-23-05

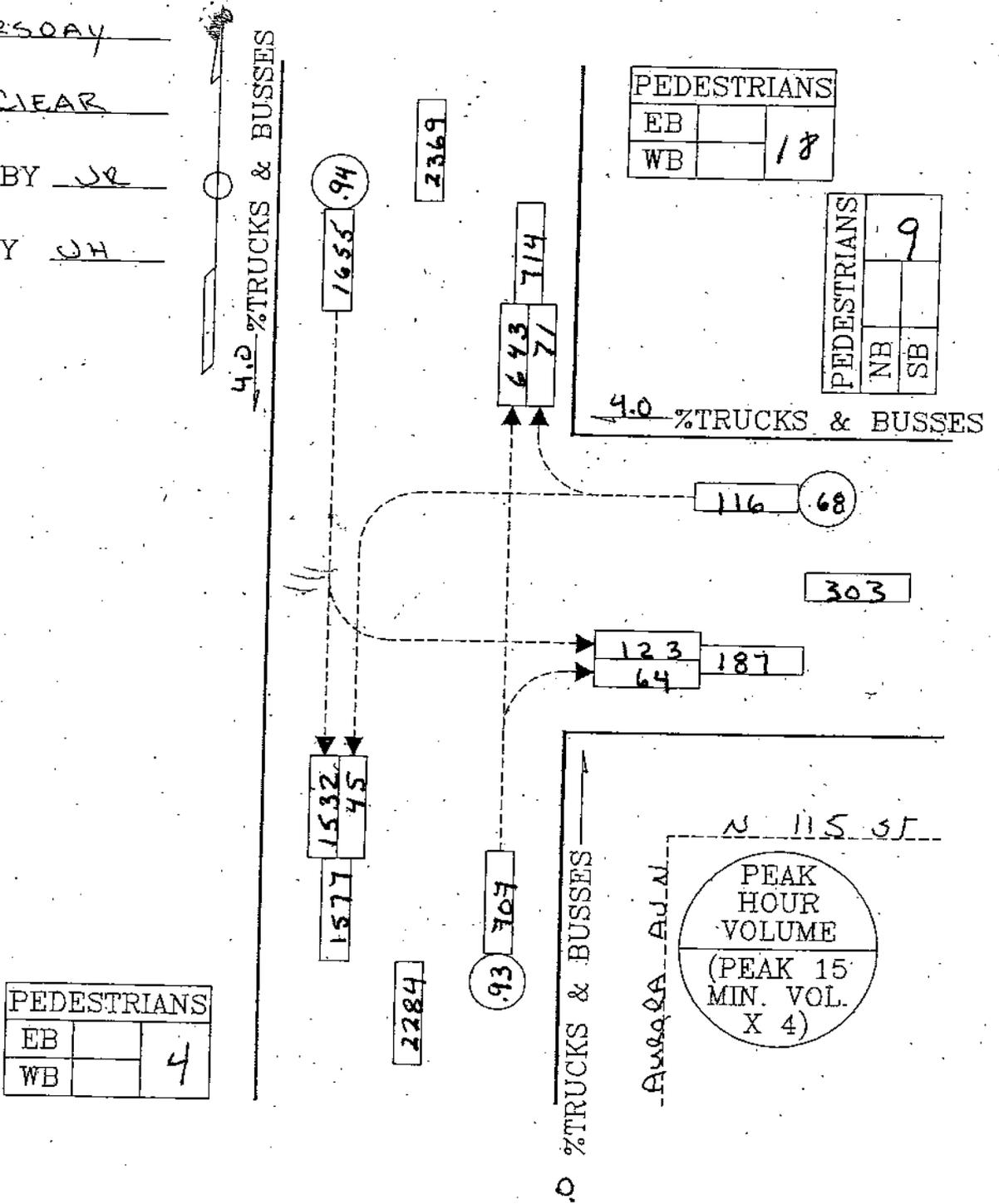
AM PEAK

DAY THURSDAY

WEATHER CLEAR

PREPARED BY JL

COUNTED BY WH



TC<sup>2</sup>

Traffic Count Consultants, Inc.

13623 184th Avenue NE, Woodinville, WA 98072

Phone: (425) 861-8866 FAX: (425) 861-8877

Vehicle Volume Summary

Intersection: Aurora Ave N @ N 115th St  
 Location: Seattle

Date of Count: Thu 12.5.02  
 Checked By: FH

Time Interval Ending at	From North on (SB) Aurora Ave N				From South on (NB) Aurora Ave N				From East on (WB) N 115th St				From West on (EB) n/a				Interval Total
	T	L	S	R	T	L	S	R	T	L	S	R	T	L	S	R	
4:15 P	3	18	274	0	7	0	341	18	5	21	0	49	0	0	0	0	721
4:30 P	5	17	286	0	9	0	441	16	1	17	0	37	0	0	0	0	814
4:45 P	2	16	290	0	5	0	399	19	1	20	0	39	0	0	0	0	783
5:00 P	2	22	260	0	6	0	387	13	3	21	0	38	0	0	0	0	741
5:15 P	1	17	256	0	2	0	410	20	1	21	0	36	0	0	0	0	760
5:30 P	2	19	290	0	9	0	353	23	2	18	0	39	0	0	0	0	742
5:45 P	1	17	228	0	6	0	382	16	0	30	0	32	0	0	0	0	713
6:00 P	3	18	285	0	6	0	342	16	1	21	0	30	0	0	0	0	712
6:15 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Survey</b>	<b>19</b>	<b>144</b>	<b>2167</b>	<b>0</b>	<b>50</b>	<b>0</b>	<b>3065</b>	<b>141</b>	<b>14</b>	<b>169</b>	<b>0</b>	<b>300</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5886</b>

4:15 P to 6:15 P Peak Hour Summary																	
Total	10	72	1092	0	22	0	1637	68	6	79	0	150	0	0	0	0	3098
Approach	1184			1705				229				0				3098	
%HV	1%			1%				3%				n/a				1%	
PHF	0.95			0.93				0.97				n/a				0.95	

**Legend:**  
 T= Number of heavy vehicles (greater than 4 wheels)  
 L= Left-Turn  
 S= Straight  
 R= Right-Turn  
 HV= Heavy Vehicles  
 PHF= Peak hour Factor (Peak hour volume / (4\*Highest 15 minutes))

Prepared For: TSI

K02u123-005p

# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AV N & N 125 ST TIME 7:15- 8:15 AM

DATE 6-1-05

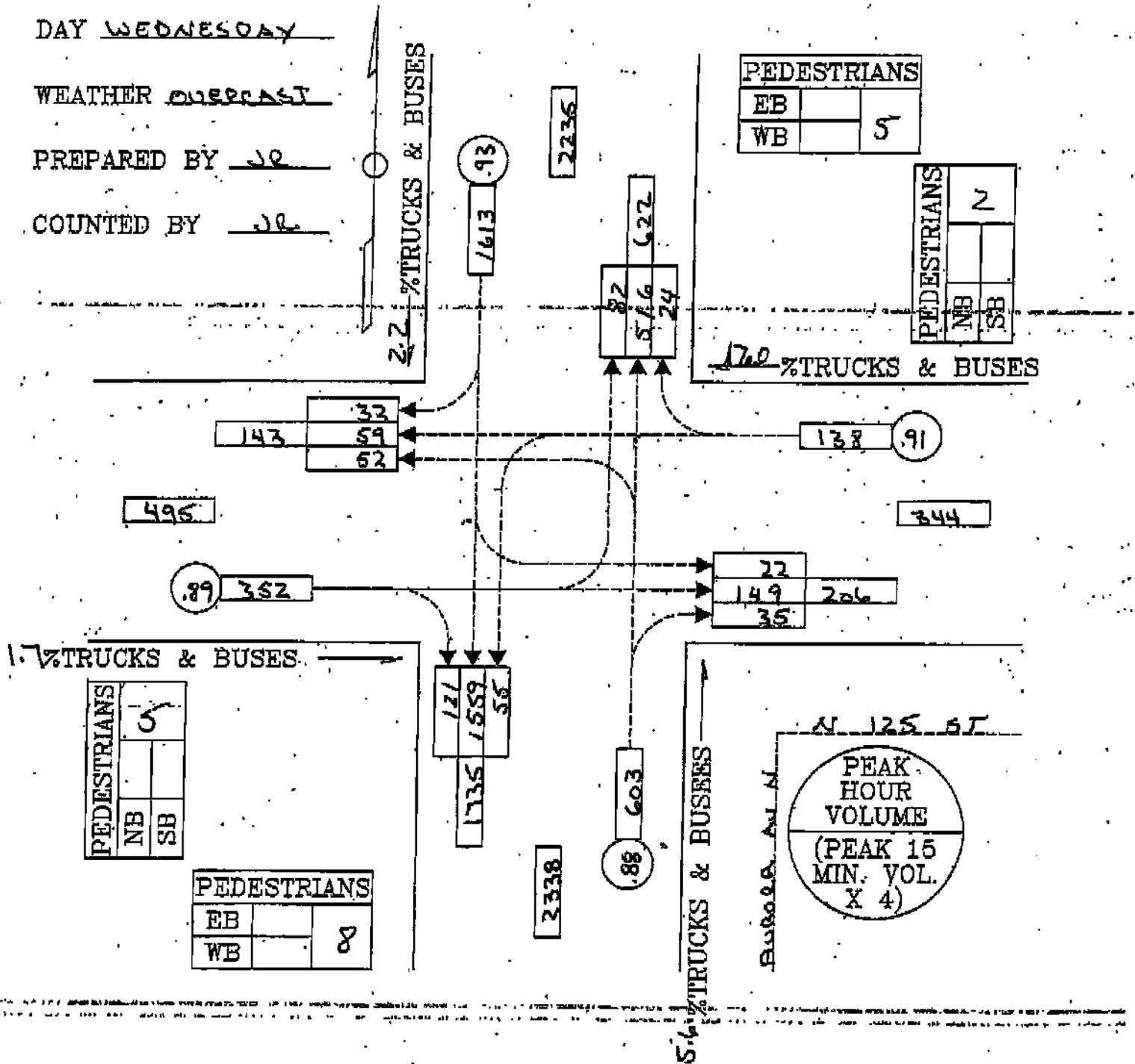
AM PEAK HR

DAY WEDNESDAY

WEATHER OVERCAST

PREPARED BY JE

COUNTED BY JE



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION: AURORA AV N E N 125 ST TIME 4:45-5:45

DATE 6-1-05

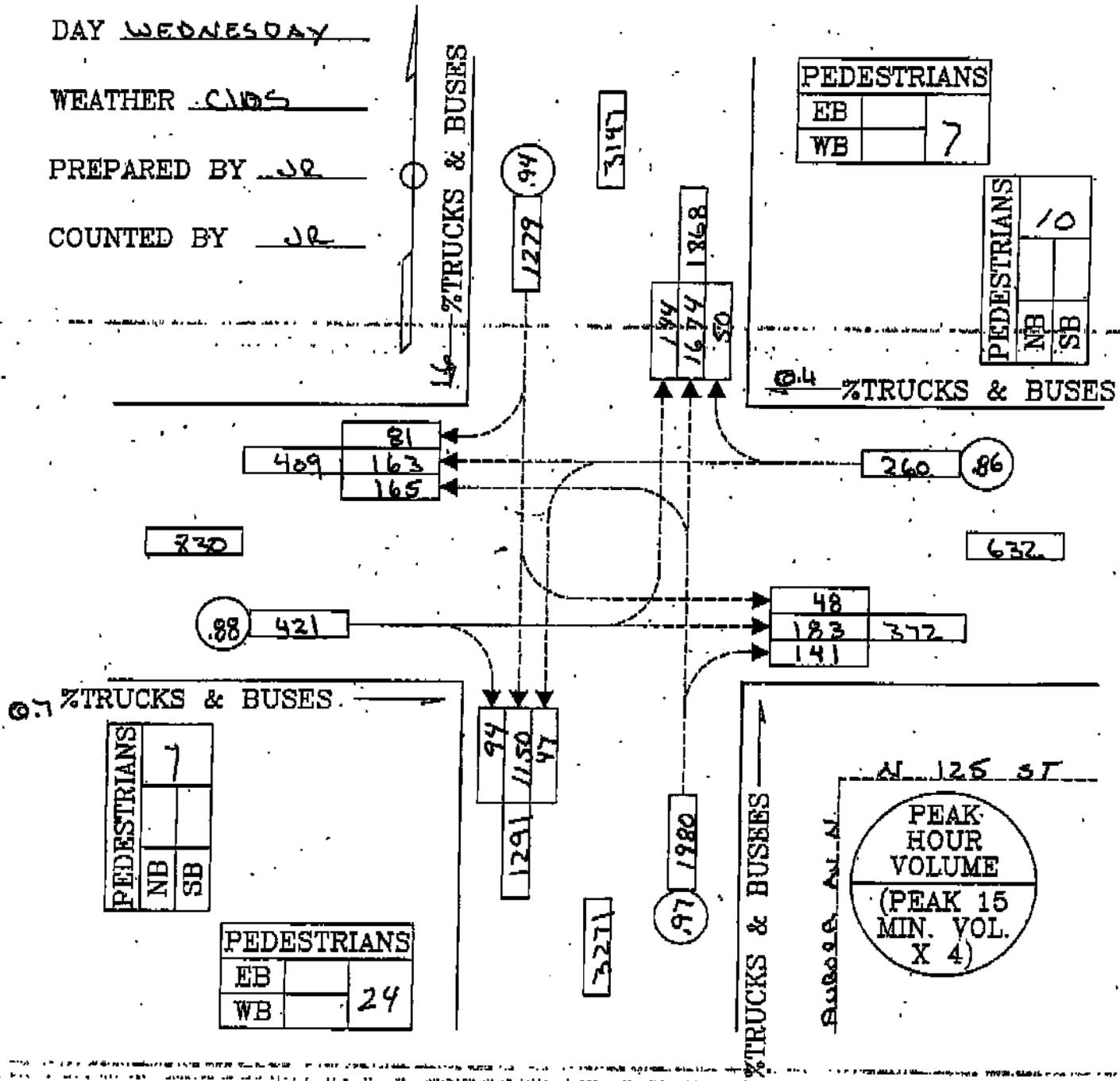
PM PEAK HR

DAY WEDNESDAY

WEATHER CND

PREPARED BY JR

COUNTED BY JR



TC<sup>2</sup> **Traffic Count Consultants, Inc.** 13623 184th Ave NE, Woodinville, WA 98072  
 Phone: (425) 861-8866 FAX: (425) 861-8877

**Vehicle Volume Summary**

Intersection: Aurora Avenue N @ N 130th Street Date of Count: Thu 12.5.02  
 Location: Seattle Checked By: FH

Time Interval Ending at	From North on (SB) Aurora Avenue N				From South on (NB) Aurora Avenue N				From East on (WB) N 130th Street				From West on (EB) N 130th Street				Interval Total
	T	L	S	R	T	L	S	R	T	L	S	R	T	L	S	R	
4:30 P	7	41	238	21	3	28	363	35	1	35	90	30	4	26	50	19	874
4:45 P	6	62	217	19	3	19	363	34	8	56	129	41	3	38	91	23	1092
5:00 P	6	48	255	14	3	24	395	38	6	43	111	30	3	45	89	16	1108
5:15 P	3	39	176	25	4	32	367	28	0	49	136	31	2	40	62	17	1002
5:30 P	1	43	230	28	1	24	407	34	1	40	96	31	3	41	82	13	1069
5:45 P	0	55	234	25	1	37	356	23	1	44	139	29	6	37	84	14	1077
6:00 P	3	43	180	16	1	21	349	28	2	41	116	43	2	63	82	13	995
6:15 P	5	46	215	23	2	23	381	24	0	45	105	40	0	29	83	11	1025
6:30 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Survey</b>	<b>31</b>	<b>377</b>	<b>1745</b>	<b>171</b>	<b>18</b>	<b>206</b>	<b>2981</b>	<b>244</b>	<b>19</b>	<b>353</b>	<b>922</b>	<b>275</b>	<b>28</b>	<b>319</b>	<b>623</b>	<b>126</b>	<b>8342</b>

4:30 P to 5:30 P Peak Hour Summary																	
Total	16	192	878	86	11	99	1532	134	15	188	472	133	11	184	324	69	4271
Approach	1156						1785		793				567				4271
%HV	1%						1%		2%				2%				1%
PHF	0.91						0.95		0.88				0.92				0.96

**Legend:**  
 T= Number of heavy vehicles (greater than 4 wheels)  
 L= Left-Turn  
 S= Straight  
 R= Right-Turn  
 HV= Heavy Vehicles  
 PHF= Peak hour Factor (Peak hour volume / (4\*Highest 15 minutes))

TC<sup>2</sup>

Traffic Count Consultants, Inc.

13623 184th Ave NE, Woodinville, WA 98072

Phone: (425) 861-8866 FAX: (425) 861-8877

**Vehicle Volume Summary**

Intersection: Aurora Avenue N @ N 145th Street  
 Location: Seattle

Date of Count: Tue 12.3.02  
 Checked By: FH

Time Interval Ending at	From North on (SB) Aurora Avenue N				From South on (NB) Aurora Avenue N				From East on (WB) N 145th Street				From West on (EB) N 145th Street				Interval Total
	T	L	S	R	T	L	S	R	T	L	S	R	T	L	S	R	
4:15 P	4	58	174	20	2	17	315	46	6	43	117	28	0	53	127	22	1020
4:30 P	4	51	220	38	4	25	350	62	10	47	123	51	1	43	118	21	1149
4:45 P	1	68	218	12	5	11	340	55	3	52	108	62	1	44	126	19	1115
5:00 P	3	52	212	16	4	16	341	67	4	50	138	60	1	31	121	25	1129
5:15 P	3	76	189	16	2	20	322	49	1	45	123	72	2	48	130	14	1104
5:30 P	2	64	206	17	2	19	353	63	2	52	124	74	0	41	111	17	1141
5:45 P	1	50	224	23	5	17	372	51	1	50	100	79	1	55	95	9	1125
6:00 P	3	54	149	13	2	29	295	38	3	39	118	44	1	53	113	30	975
6:15 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Survey	21	473	1592	155	26	154	2688	431	30	378	951	470	7	368	941	157	8758

**4:45 P to 5:45 P Peak Hour Summary**

	9	242	831	72	13	72	1388	230	8	197	485	285	4	175	457	65	4499
Total																	
Approach		1145				1690				967				697			4499
%HV		1%				1%				1%				1%			1%
PHF		0.96				0.96				0.97				0.91			0.99

**Legend:**  
 T= Number of heavy vehicles (greater than 4 wheels)  
 L= Left-Turn  
 S= Straight  
 R= Right-Turn  
 HV= Heavy Vehicles  
 PHF= Peak hour Factor (Peak hour volume / (4\*Highest 15 minutes))

Prepared For: TSI

K02u123-001p

# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AV N + N 128 ST TIME 7:15 Am - 8:15 Am

DATE 7/01/03

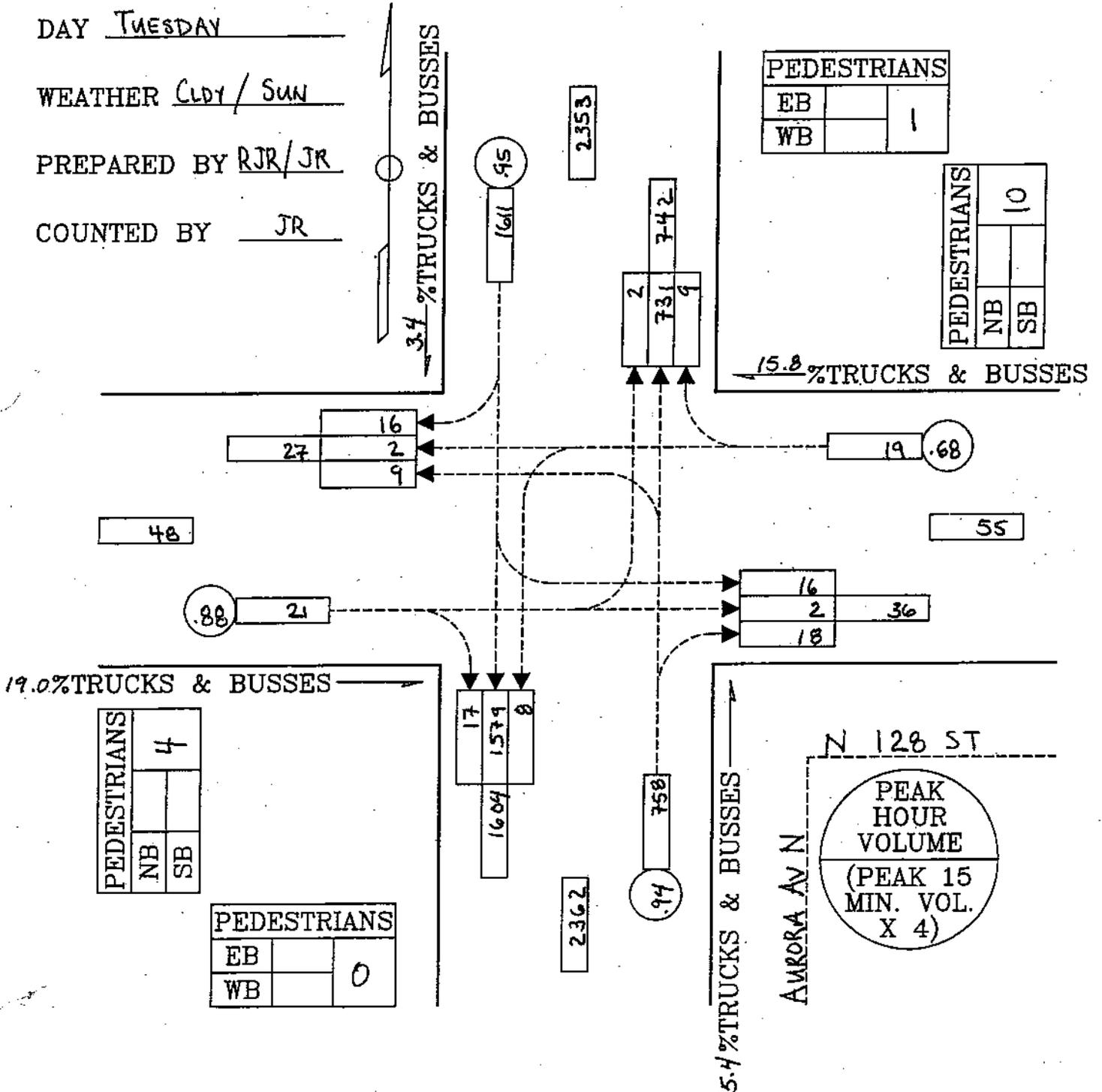
AM PEAK HOUR

DAY TUESDAY

WEATHER CLDY / SUN

PREPARED BY RJR/JR

COUNTED BY JR



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AV N + N 128 ST

TIME 4:45 pm - 5:15 pm

DATE 7/01/03

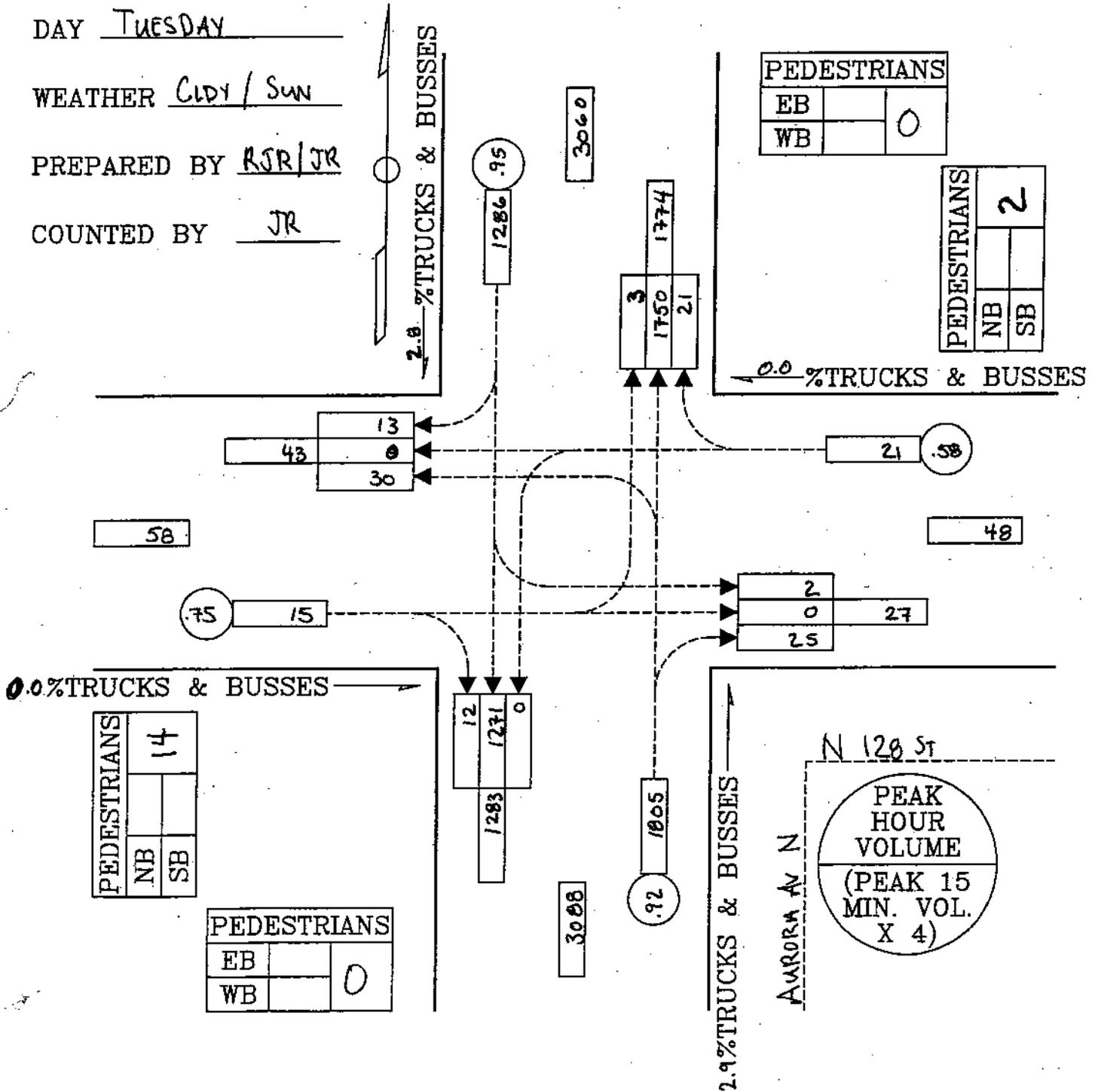
PM PEAK HOUR

DAY TUESDAY

WEATHER CLDY / SUN

PREPARED BY RSR/JR

COUNTED BY JR



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION Aurora Av N & N 135 St TIME 5:00-6:00

DATE 3-2-05

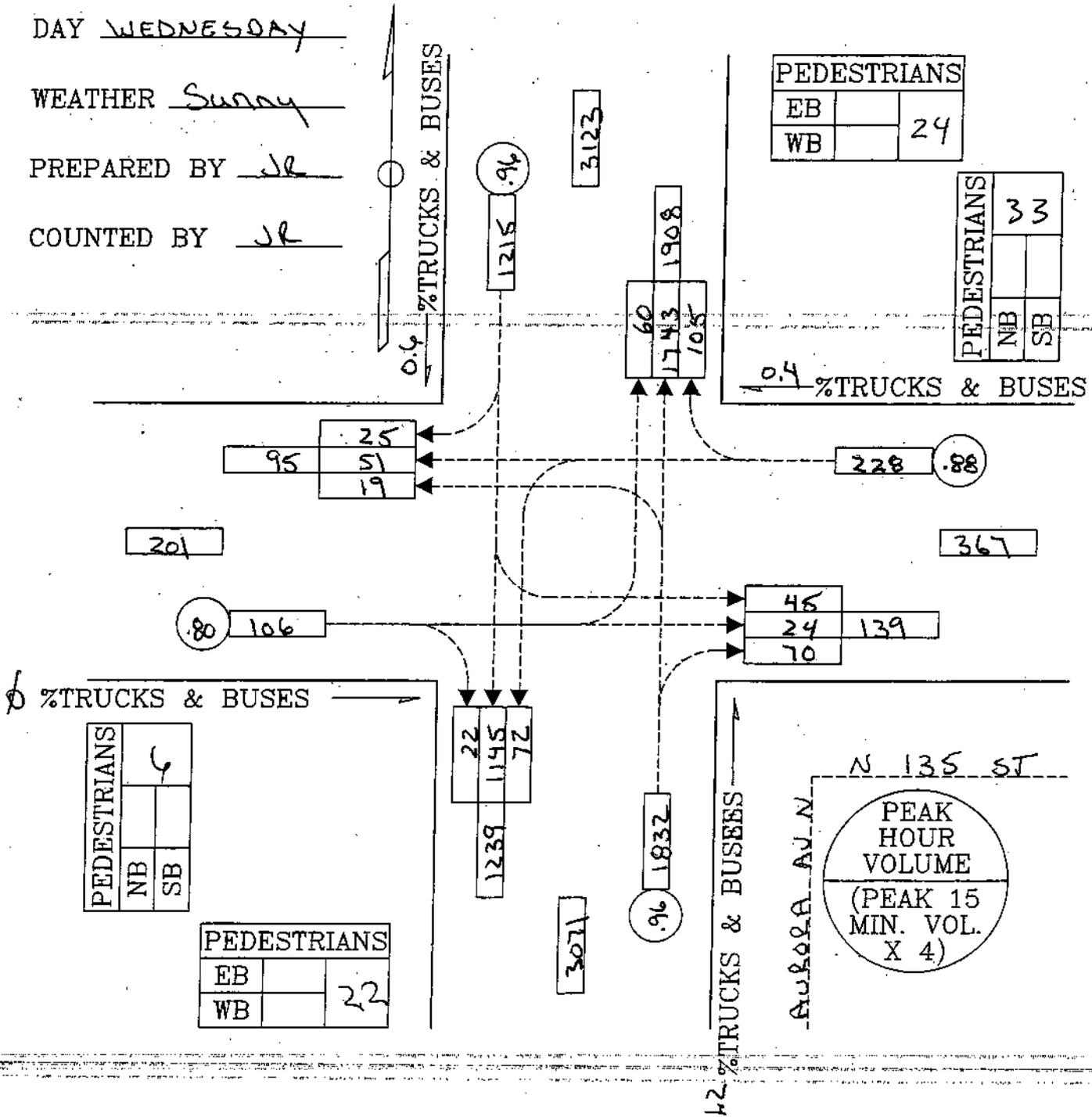
Pm PEAK HR

DAY WEDNESDAY

WEATHER Sunny

PREPARED BY JR

COUNTED BY JR



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AV N E N 137 ST TIME 7:30-8:30 AM

DATE 12-10-02

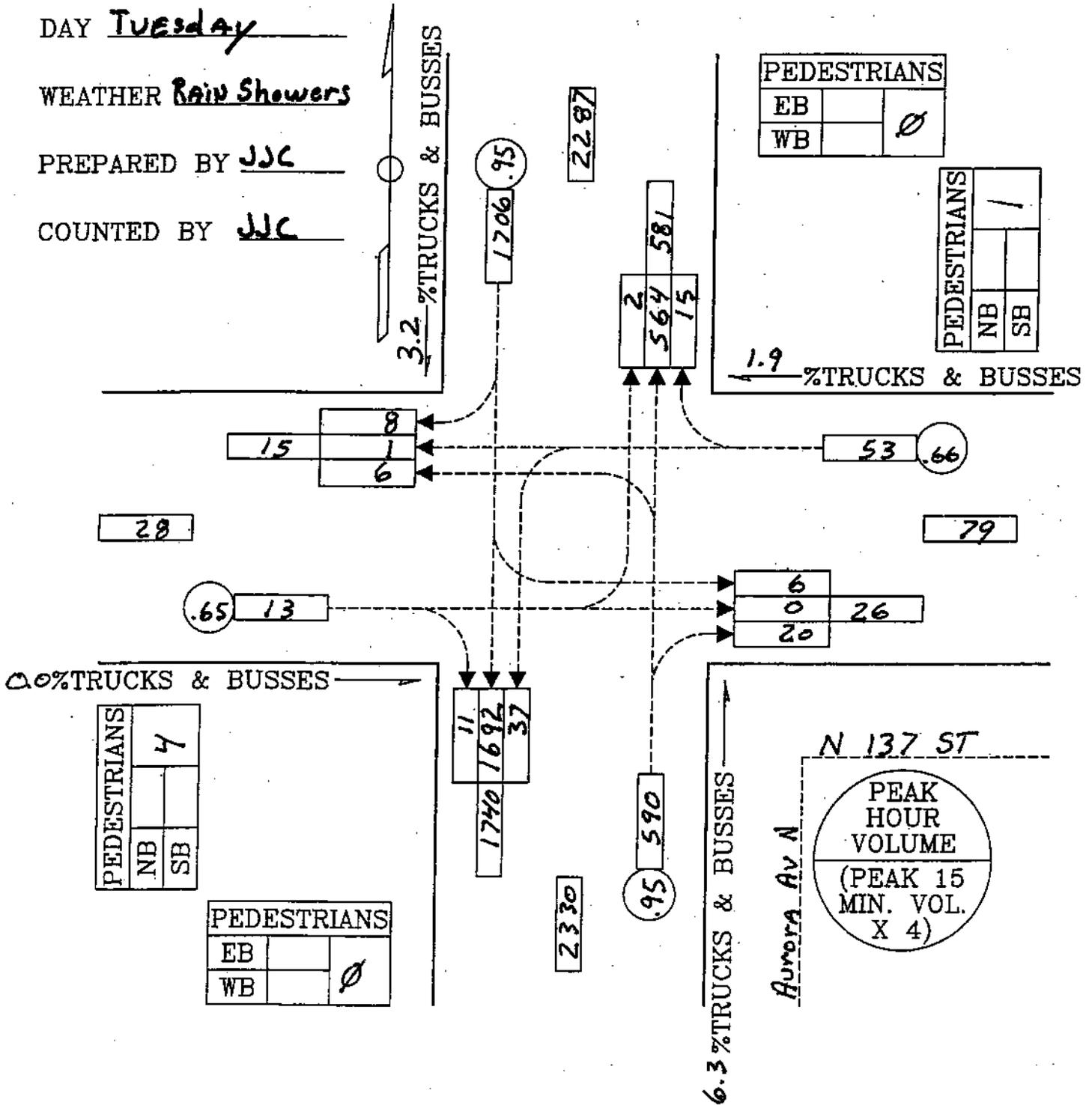
AM PEAK

DAY Tuesday

WEATHER Rain Showers

PREPARED BY JJC

COUNTED BY JJC



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AV N & N 137 ST TIME 4:45-5:45 PM

DATE 12-10-02

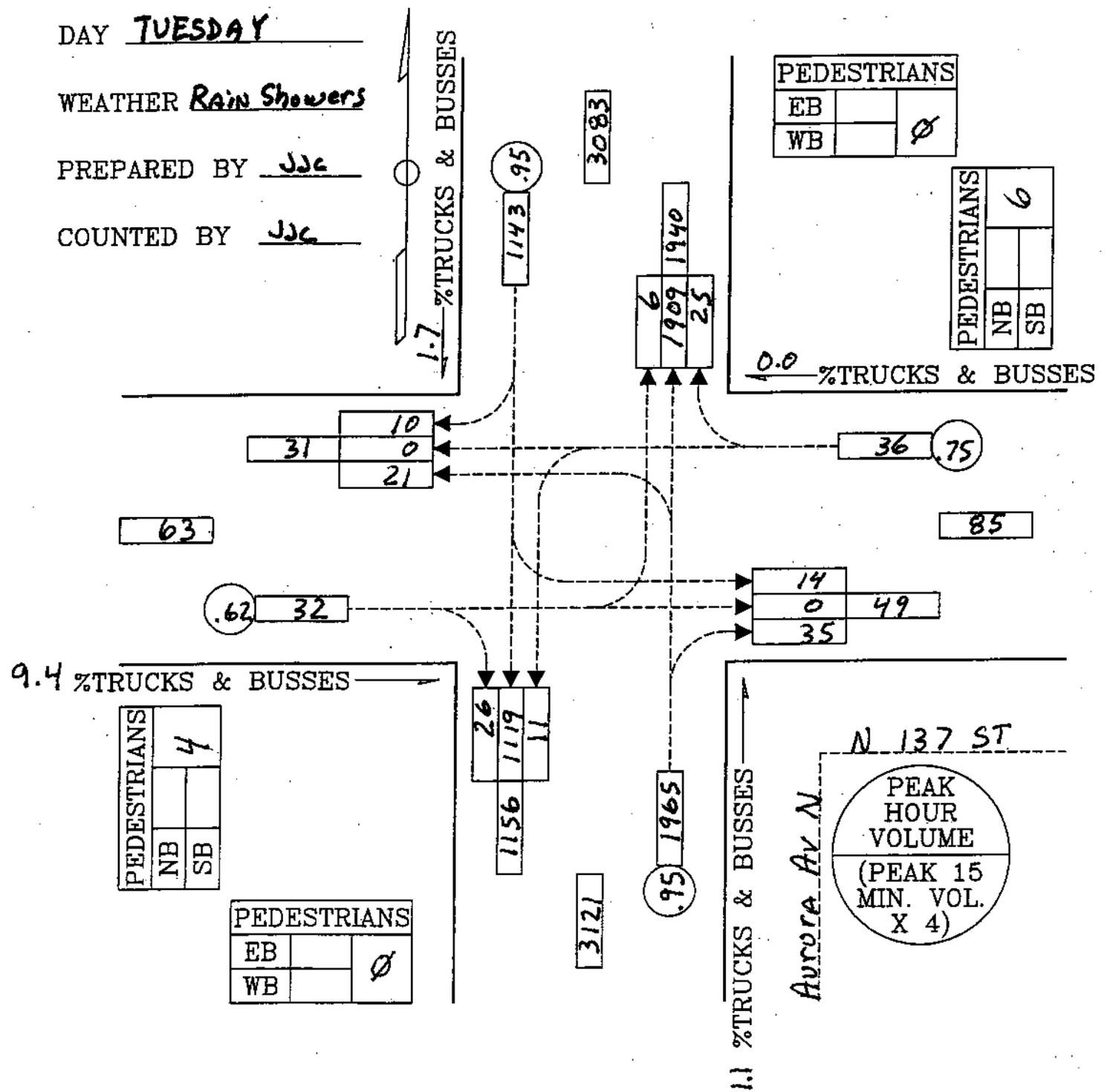
PM PEAK

DAY TUESDAY

WEATHER Rain Showers

PREPARED BY JJC

COUNTED BY JJC



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AV N & N 140 ST TIME 7:00-8:00 AM

DATE 12-05-02

AM PEAK

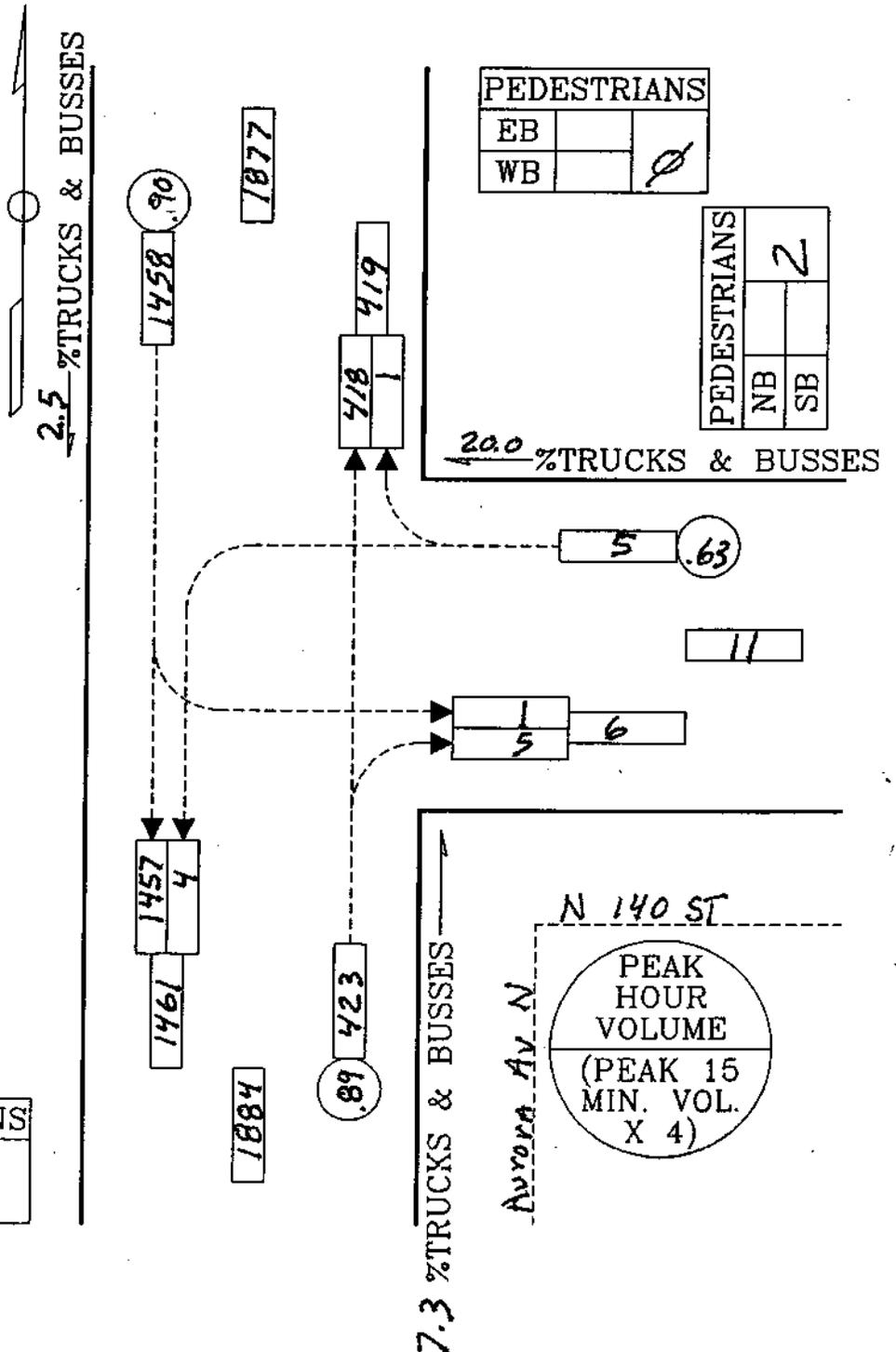
DAY THURSDAY

WEATHER CLOUDY

PREPARED BY JJC

COUNTED BY JJC

PEDESTRIANS		
EB		4
WB		



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AV N & N 140 ST TIME 4:15-5:15 PM

DATE 12-05-02

PM PEAK

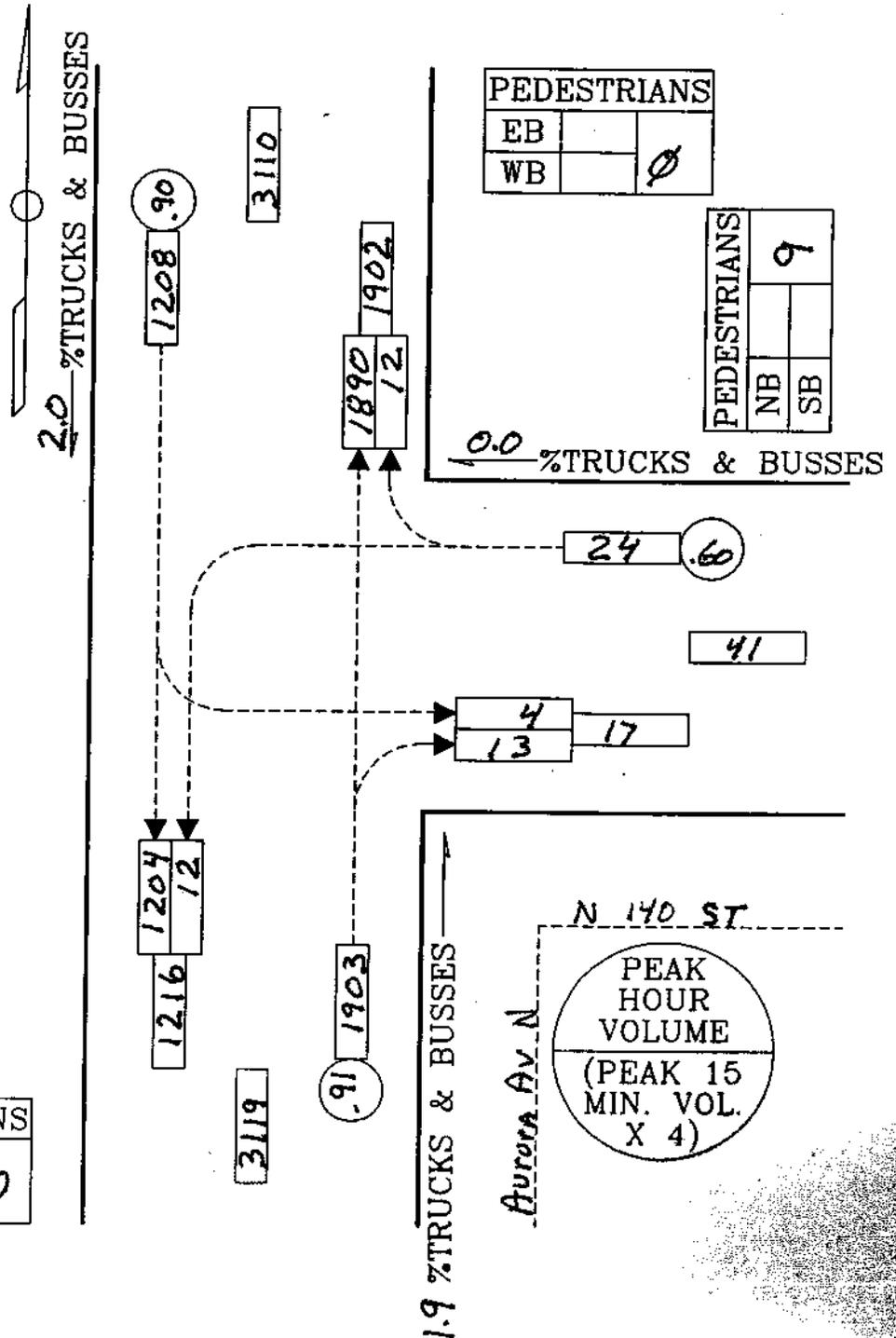
DAY THURSDAY

WEATHER CLOUDY

PREPARED BY JJC

COUNTED BY JJC

PEDESTRIANS		
EB		10
WB		



# VEHICLE VOLUME SUMMARY

CITY OF SEATTLE  
DEPARTMENT OF TRANSPORTATION

LOCATION AURORA AV N E N 143 ST TIME 7:00 - 8:00 AM

DATE 12-04-02

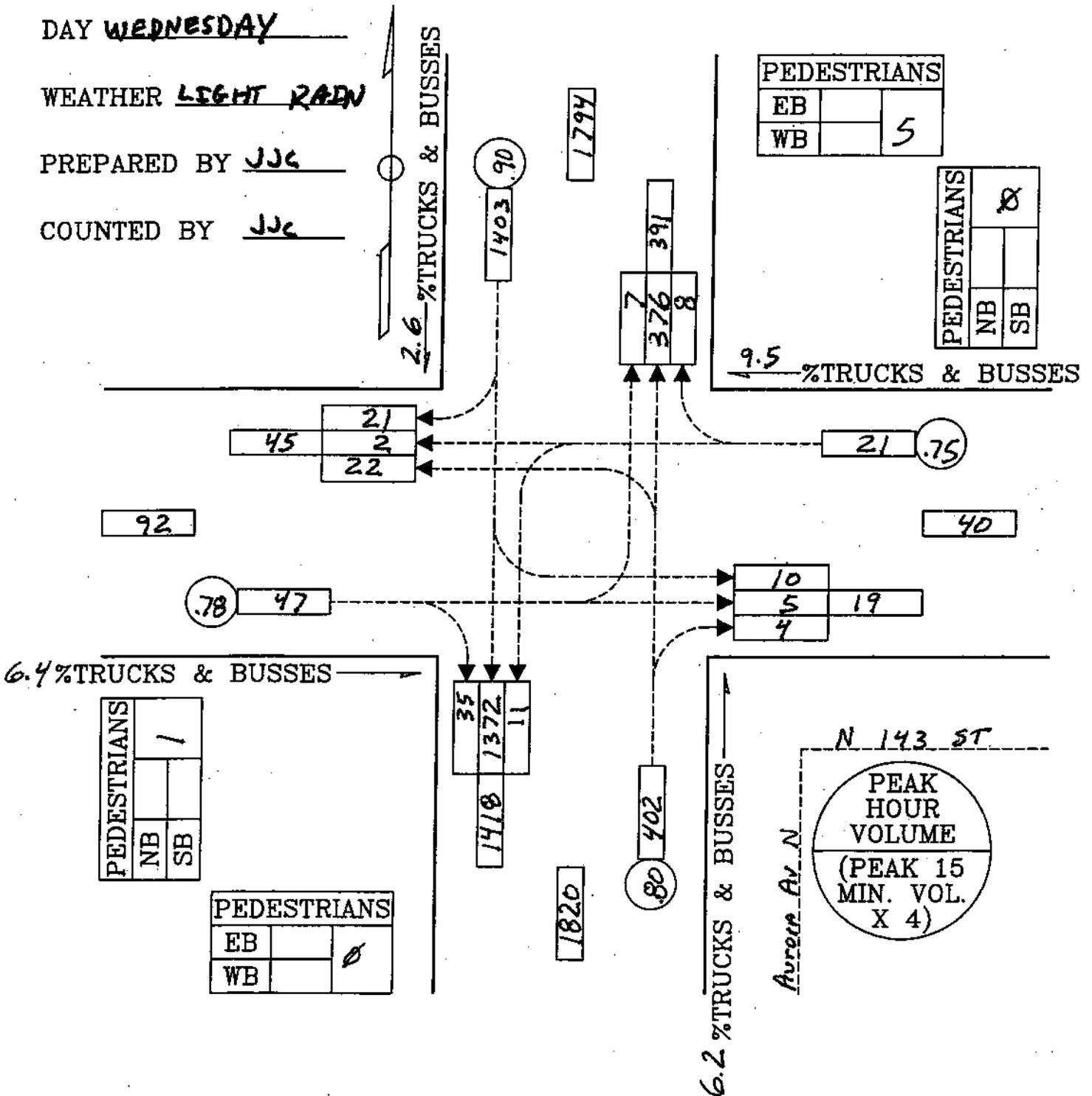
AM PEAK

DAY WEDNESDAY

WEATHER LIGHT RAIN

PREPARED BY JJC

COUNTED BY JJC





## Appendix B

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001/006

# Bus Zone Activity

WEEKDAY ONLY DATA FOR SIGNUP: SPR '06 FINAL, DATED 6/27/2006

SOURCE: SEATTLE METRO APC SYSTEM

ZONE#	ON STREET	NS/FS	CROSS STREET	DIR	TIME	WO	ROUTE	SERV	TYPE	# OF	# OF	# OF	ON	OFF	LOAD	AVG	
										UNIQUE	TOTAL	TIMES	AVG	AVG	APPR	NUM	
									TRIPS	TRIPS	BUS	PSGRS	PSGRS	AVG	SEATS		
									SEEN	SEEN	STOPPED	TOTAL	TOTAL				
6950	Aurora Ave N	FM	N 145th St	S	AAM	I	28	E		1	8	4	0.6	1	0.0	63	
6950	Aurora Ave N	FM	N 145th St	S	AAM	I	358	E		4	29	29	3.0	12	12.8	64	
6950	Aurora Ave N	FM	N 145th St	S	AM	I	28	E		8	79	43	0.9	7	0.4	61	
6950	Aurora Ave N	FM	N 145th St	S	AM	I	358	E		22	146	134	2.7	59	12.4	63	
6950	Aurora Ave N	FM	N 145th St	S	MID	I	358	E		25	179	175	3.4	86	25.8	64	
6950	Aurora Ave N	FM	N 145th St	S	PM	I	358	E		12	83	79	3.2	39	25.1	64	
6950	Aurora Ave N	FM	N 145th St	S	XEV	-	OHD	L		1	53	7	0.0	0	1.5	52	
6950	Aurora Ave N	FM	N 145th St	S	XEV	I	28	L		4	26	15	1.0	4	3.3	58	
6950	Aurora Ave N	FM	N 145th St	S	XEV	I	358	E		8	47	41	2.0	16	22.2	64	
6950	Aurora Ave N	FM	N 145th St	S	XNT	I	28	L		7	49	24	0.8	5	0.9	57	
6950	Aurora Ave N	FM	N 145th St	S	XNT	I	358	E		7	44	42	1.5	10	15.1	64	
TOTALS FOR ZONE# 6950									TOTAL TRIPS OBSERVED:	99			ONS:	238	OFFS:	118	
6990	Aurora Ave N	FS	N 135th St	S	AAM	I	358	E		4	29	27	1.9	8	15.4	64	
6990	Aurora Ave N	FS	N 135th St	S	AM	I	358	E		22	146	130	2.0	43	14.5	63	
6990	Aurora Ave N	FS	N 135th St	S	MID	I	358	E		25	179	176	3.3	83	27.6	64	
6990	Aurora Ave N	FS	N 135th St	S	PM	-	DHD	L		1	13	0	0.0	0	1.0	36	
6990	Aurora Ave N	FS	N 135th St	S	PM	I	358	E		12	82	79	3.7	44	26.7	64	
6990	Aurora Ave N	FS	N 135th St	S	XEV	I	358	E		8	47	45	2.7	21	22.4	64	
6990	Aurora Ave N	FS	N 135th St	S	XNT	I	358	E		7	44	27	0.7	5	15.0	64	
TOTALS FOR ZONE# 6990									TOTAL TRIPS OBSERVED:	79			ONS:	203	OFFS:	99	
7000	Aurora Ave N	FS	N 130th St	S	AAM	I	358	E		4	29	28	1.6	6	17.1	64	
7000	Aurora Ave N	FS	N 130th St	S	AM	I	358	E		22	146	120	1.6	34	15.8	63	
7000	Aurora Ave N	FS	N 130th St	S	MID	I	358	E		25	179	177	4.9	122	29.0	64	
7000	Aurora Ave N	FS	N 130th St	S	PM	-	DHD	L		1	13	0	0.0	0	1.0	36	
7000	Aurora Ave N	FS	N 130th St	S	PM	I	358	E		12	82	81	5.6	67	28.3	64	
7000	Aurora Ave N	FS	N 130th St	S	XEV	I	358	E		8	47	43	3.7	30	23.5	64	
7000	Aurora Ave N	FS	N 130th St	S	XNT	I	358	E		7	44	27	1.6	11	15.3	64	
TOTALS FOR ZONE# 7000									TOTAL TRIPS OBSERVED:	79			ONS:	270	OFFS:	80	
7010	Aurora Ave N	FM	N 125th St	S	AAM	I	358	E		4	29	25	2.4	10	18.2	64	
7010	Aurora Ave N	FM	N 125th St	S	AM	I	358	E		22	146	94	1.1	24	16.7	63	
7010	Aurora Ave N	FM	N 125th St	S	MID	I	358	E		24	166	151	2.4	58	32.7	64	
7010	Aurora Ave N	FM	N 125th St	S	PM	-	DHD	L		1	13	0	0.0	0	1.0	36	
7010	Aurora Ave N	FM	N 125th St	S	PM	I	358	E		13	95	86	2.0	26	32.2	64	
7010	Aurora Ave N	FM	N 125th St	S	XEV	I	358	E		8	47	39	1.4	11	26.1	64	
7010	Aurora Ave N	FM	N 125th St	S	XNT	I	358	E		7	44	32	1.1	8	16.5	64	

AAM: before 6am, AM: 6-9am, MID: 9am-3:15pm, PM: 3:15-6:15pm, XEV: 6:15-9:30pm, XNT: 9:30pm-close

Please refer to "apcnodes.doc" for an explanation of the terms used in this report, and a list of data limitations.

Print Date: 6/30/2006

06/30/2006 FRI 14:20 FAX 206 684 1860

0002/006

# Bus Zone Activity

WEEKDAY ONLY DATA FOR SIGNUP: SPR '06 FINAL, DATED 6/27/2006

SOURCE: SEATTLE METRO APC SYSTEM

ZONE#	ON STREET	NS/FS	CROSS STREET	DIR	TIME	VO	ROUTE	SERV	TYPE	# OF	# OF	# OF	ON	OFF	LOAD	AVG			
										UNIQUE	TOTAL	TIMES	AVG	TOTAL	AVG	APPR	NUM		
										TRIPS	TRIPS	BUS	PSGRS	PSGRS	AVG	SEATS			
										SEEN	SEEN	STOPPED	ONS	OFFS					
<b>TOTALS FOR ZONE#</b>		<b>7010</b>	<b>TOTAL TRIPS OBSERVED:</b>							<b>79</b>				<b>ONS:</b>	<b>136</b>	<b>OFFS:</b>	<b>48</b>		
7040	Aurora Ave N	FS	N 115th St	S	AAM	I	358	E		4	29	19	0.7	3	20.3	64			
7040	Aurora Ave N	FS	N 115th St	S	AM	I	358	E		21	142	94	1.5	31	16.4	62			
7040	Aurora Ave N	FS	N 115th St	S	MID	I	358	E		25	170	132	1.3	32	34.4	64			
7040	Aurora Ave N	FS	N 115th St	S	PM	-	DHD	L		1	13	0	0.0	0	1.0	36			
7040	Aurora Ave N	FS	N 115th St	S	PM	I	358	E		13	95	78	1.0	13	33.3	64			
7040	Aurora Ave N	FS	N 115th St	S	XEV	I	358	E		8	47	37	1.1	9	27.1	64			
7040	Aurora Ave N	FS	N 115th St	S	XNT	I	358	E		7	44	20	0.5	4	17.2	64			
<b>TOTALS FOR ZONE#</b>		<b>7040</b>	<b>TOTAL TRIPS OBSERVED:</b>							<b>79</b>				<b>ONS:</b>	<b>90</b>	<b>OFFS:</b>	<b>29</b>		
7050	Aurora Ave N	NS	WASHELLI	S	AAM	I	358	E		4	29	1	0.0	0	20.8	64			
7050	Aurora Ave N	NS	WASHELLI	S	AM	I	358	E		21	142	16	0.1	2	17.7	62			
7050	Aurora Ave N	NS	WASHELLI	S	MID	I	358	E		25	170	36	0.2	4	35.2	64			
7050	Aurora Ave N	NS	WASHELLI	S	PM	-	DHD	L		1	13	0	0.0	0	1.0	36			
7050	Aurora Ave N	NS	WASHELLI	S	PM	I	358	E		12	87	19	0.2	3	33.8	64			
7050	Aurora Ave N	NS	WASHELLI	S	XEV	I	358	E		9	55	9	0.2	2	28.1	64			
7050	Aurora Ave N	NS	WASHELLI	S	XNT	I	358	E		7	44	2	0.0	0	17.5	64			
<b>TOTALS FOR ZONE#</b>		<b>7050</b>	<b>TOTAL TRIPS OBSERVED:</b>							<b>79</b>				<b>ONS:</b>	<b>10</b>	<b>OFFS:</b>	<b>6</b>		

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 Print Date: 6/30/2006

0003/006

# Bus Zone Activity

WEEKDAY ONLY DATA FOR SIGNUP: SPR '06 FINAL, DATED 6/27/2006

SOURCE: SEATTLE METRO APC SYSTEM

ZONE#	ON STREET	NS/FS	CROSS STREET	DIR	TIME	I/O	ROUTE	SERV	TYPE	# OF	# OF	# OF	ON	OFF	LOAD	AVG	
										UNIQUE	TOTAL	TIMES	AVG	TOTAL	AVG	TOTAL	APPR
									TRIPS	TRIPS	BUS	PSGRS	PSGRS	AVG	SEATS		
									SEEN	SEEN	STOPPED	ONS	OFFS				
7840	Aurora Ave N	FS	WASHELLI ENT	N	AM	O	358	E		12	81	21	0.0	0	0.3	64	
7840	Aurora Ave N	FS	WASHELLI ENT	N	MID	O	358	E		25	175	37	0.1	2	0.2	64	
7840	Aurora Ave N	FS	WASHELLI ENT	N	PM	O	358	E		19	131	21	0.0	1	0.2	64	
7840	Aurora Ave N	FS	WASHELLI ENT	N	XEV	-	DHD	L		1	5	0	0.0	0	0.0	42	
7840	Aurora Ave N	FS	WASHELLI ENT	N	XEV	O	358	E		13	85	10	0.0	0	0.1	64	
7840	Aurora Ave N	FS	WASHELLI ENT	N	XNT	O	358	E		9	59	8	0.0	0	0.1	64	
TOTALS FOR ZONE# 7840									TOTAL TRIPS OBSERVED:	79			ONS:	3	OFFS:	14	
7850	Aurora Ave N	FS	N 115th St	N	AM	O	358	E		12	81	51	0.4	4	1.0	64	
7850	Aurora Ave N	FS	N 115th St	N	MID	O	358	E		25	175	125	0.4	10	0.9	64	
7850	Aurora Ave N	FS	N 115th St	N	PM	O	358	E		19	131	98	0.4	7	1.3	64	
7850	Aurora Ave N	FS	N 115th St	N	XEV	-	DHD	L		1	5	0	0.0	0	0.0	42	
7850	Aurora Ave N	FS	N 115th St	N	XEV	O	358	E		13	85	61	0.2	3	1.6	64	
7850	Aurora Ave N	FS	N 115th St	N	XNT	O	358	E		9	59	44	0.2	1	1.6	64	
TOTALS FOR ZONE# 7850									TOTAL TRIPS OBSERVED:	79			ONS:	25	OFFS:	96	
7880	Aurora Ave N	FS	N 125th St	N	AM	O	358	E		11	75	71	0.3	4	2.0	64	
7880	Aurora Ave N	FS	N 125th St	N	MID	O	358	E		25	176	166	0.8	20	2.3	64	
7880	Aurora Ave N	FS	N 125th St	N	PM	O	358	E		20	136	115	0.4	8	1.7	64	
7880	Aurora Ave N	FS	N 125th St	N	XEV	-	DHD	L		1	5	0	0.0	0	0.0	42	
7880	Aurora Ave N	FS	N 125th St	N	XEV	O	358	E		13	85	72	0.3	4	1.7	64	
7880	Aurora Ave N	FS	N 125th St	N	XNT	O	358	E		9	59	41	0.3	3	1.2	64	
TOTALS FOR ZONE# 7880									TOTAL TRIPS OBSERVED:	79			ONS:	37	OFFS:	148	
7900	Aurora Ave N	FS	N 130th St	N	AM	O	358	E		11	75	72	0.9	10	4.2	64	
7900	Aurora Ave N	FS	N 130th St	N	MID	O	358	E		25	176	170	2.2	55	4.8	64	
7900	Aurora Ave N	FS	N 130th St	N	PM	O	358	E		19	126	119	1.5	29	3.8	64	
7900	Aurora Ave N	FS	N 130th St	N	XEV	-	DHD	L		1	52	2	0.0	0	0.0	45	
7900	Aurora Ave N	FS	N 130th St	N	XEV	O	358	E		14	95	84	1.0	15	2.3	64	
7900	Aurora Ave N	FS	N 130th St	N	XNT	O	358	E		9	59	38	0.7	6	1.0	64	
TOTALS FOR ZONE# 7900									TOTAL TRIPS OBSERVED:	79			ONS:	114	OFFS:	281	
7912	Aurora Ave N	FS	N 135th St	N	AM	O	358	E		11	75	57	0.3	3	1.2	64	
7912	Aurora Ave N	FS	N 135th St	N	MID	O	358	E		25	176	164	1.2	30	2.2	64	
7912	Aurora Ave N	FS	N 135th St	N	PM	O	358	E		19	126	111	0.9	17	2.8	64	
7912	Aurora Ave N	FS	N 135th St	N	XEV	-	DHD	L		1	52	0	0.0	0	0.0	45	
7912	Aurora Ave N	FS	N 135th St	N	XEV	O	358	E		14	95	79	0.8	9	1.5	64	
7912	Aurora Ave N	FS	N 135th St	N	XNT	O	358	E		9	59	39	0.2	2	1.0	64	
TOTALS FOR ZONE# 7912									TOTAL TRIPS OBSERVED:	79			ONS:	60	OFFS:	151	

AAM: before 6am, AM: 6-9am, MID: 9am-3:15pm, PM: 3:15-6:15pm, XEV: 6:15-9:30pm, XNT: 9:30pm-close

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004/006

# Bus Zone Activity

WEEKDAY ONLY DATA FOR SIGNUP: SPR '06 FINAL, DATED 6/27/2006

SOURCE: SEATTLE METRO APC SYSTEM

ZONE#	ON STREET	NS/FS	CROSS STREET	DIR	TIME	VO	ROUTE	SERV	# OF	# OF	# OF	ON	OFF	LOAD	AVG			
									UNIQUE	TOTAL	TIMES	AVG	TOTAL	AVG	APPR	NUM		
									TRIPS	TRIPS	BUS	PSGRS	PSGRS	AVG	SEATS			
									SEEN	SEEN	STOPPED	TOTAL	TOTAL					
75820	Aurora Ave N	FM	N 145th St	N	AM	O	358	E	11	75	73	1.7	19	2.2	24	18.8	64	
75820	Aurora Ave N	FM	N 145th St	N	MID	-	DHD	L	1	65	6	0.1	0	0.1	0	0.3	61	
75820	Aurora Ave N	FM	N 145th St	N	MID	O	358	E	25	176	170	1.8	40	2.6	64	26.1	64	
75820	Aurora Ave N	FM	N 145th St	N	PM	O	358	E	19	126	121	1.4	26	3.3	62	20.6	64	
75820	Aurora Ave N	FM	N 145th St	N	XEV	O	358	E	14	95	88	0.8	12	2.4	34	19.0	64	
75820	Aurora Ave N	FM	N 145th St	N	XNT	O	358	E	9	59	54	0.8	7	2.3	21	14.6	64	
TOTALS FOR ZONE#		75820							TOTAL TRIPS OBSERVED:	79	ONS:			103	OFFS:			205

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# Bus Zone Activity

WEEKDAY DATA FOR SIGNUP: SPR '06 FINAL, DATED 6/27/2006 SOURCE: SEATTLE METRO APC SYSTEM

ZONE#	ON STREET	NS/FS	CROSS STREET	DIR	TIME	TOTAL TRIPS		
						OBSERVED	TOTAL ONS	TOTAL OFFS
6950	Aurora Ave N	FM	N 145th St	S	AAM	5	12	2
6950	Aurora Ave N	FM	N 145th St	S	AM	30	66	17
6950	Aurora Ave N	FM	N 145th St	S	MID	25	86	43
6950	Aurora Ave N	FM	N 145th St	S	PM	12	39	24
6950	Aurora Ave N	FM	N 145th St	S	XEV	13	20	18
6950	Aurora Ave N	FM	N 145th St	S	XNT	14	18	14
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 6950:</b>						<b>99</b>	<b>238</b>	<b>118</b>
6990	Aurora Ave N	FS	N 135th St	S	AAM	4	8	1
6990	Aurora Ave N	FS	N 135th St	S	AM	22	43	13
6990	Aurora Ave N	FS	N 135th St	S	MID	25	83	46
6990	Aurora Ave N	FS	N 135th St	S	PM	13	44	25
6990	Aurora Ave N	FS	N 135th St	S	XEV	8	21	12
6990	Aurora Ave N	FS	N 135th St	S	XNT	7	5	3
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 6990:</b>						<b>79</b>	<b>203</b>	<b>99</b>
7000	Aurora Ave N	FS	N 130th St	S	AAM	4	6	2
7000	Aurora Ave N	FS	N 130th St	S	AM	22	34	16
7000	Aurora Ave N	FS	N 130th St	S	MID	25	122	35
7000	Aurora Ave N	FS	N 130th St	S	PM	13	67	18
7000	Aurora Ave N	FS	N 130th St	S	XEV	8	30	9
7000	Aurora Ave N	FS	N 130th St	S	XNT	7	11	3
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7000:</b>						<b>79</b>	<b>270</b>	<b>80</b>
7010	Aurora Ave N	FM	N 125th St	S	AAM	4	40	10
7010	Aurora Ave N	FM	N 125th St	S	AM	22	24	8
7010	Aurora Ave N	FM	N 125th St	S	MID	24	58	20
7010	Aurora Ave N	FM	N 125th St	S	PM	14	26	11
7010	Aurora Ave N	FM	N 125th St	S	XEV	8	11	4
7010	Aurora Ave N	FM	N 125th St	S	XNT	7	8	3
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7010:</b>						<b>79</b>	<b>136</b>	<b>48</b>
7040	Aurora Ave N	FS	N 115th St	S	AAM	4	3	1
7040	Aurora Ave N	FS	N 115th St	S	AM	21	31	4
7040	Aurora Ave N	FS	N 115th St	S	MID	25	32	12
7040	Aurora Ave N	FS	N 115th St	S	PM	14	13	7
7040	Aurora Ave N	FS	N 115th St	S	XEV	8	9	4
7040	Aurora Ave N	FS	N 115th St	S	XNT	7	4	1
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7040:</b>						<b>79</b>	<b>90</b>	<b>29</b>
7050	Aurora Ave N	NS	WASHELLI	S	AAM	4	0	0
7050	Aurora Ave N	NS	WASHELLI	S	AM	21	2	1
7050	Aurora Ave N	NS	WASHELLI	S	MID	25	4	2
7050	Aurora Ave N	NS	WASHELLI	S	PM	13	3	2
7050	Aurora Ave N	NS	WASHELLI	S	XEV	9	2	1
7050	Aurora Ave N	NS	WASHELLI	S	XNT	7	0	1
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7050:</b>						<b>79</b>	<b>10</b>	<b>6</b>

AAM: before 6am, AM: 6-9am, MID: 9am-3:15pm, PM: 3:15-6:15pm, XEV: 6:15-9:30pm, XNT: 9:30pm-close

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# Bus Zone Activity

WEEKDAY DATA FOR SIGNUP: SPR '06 FINAL, DATED 6/27/2006 SOURCE: SEATTLE METRO APC SYSTEM

ZONE#	ON STREET	NS/FS	CROSS STREET	DIR	TIME	TOTAL TRIPS		
						OBSERVED	TOTAL ONS	TOTAL OFFS
7840	Aurora Ave N	FS	WASHELLI ENT	N	AM	12	0	3
7840	Aurora Ave N	FS	WASHELLI ENT	N	MID	25	2	6
7840	Aurora Ave N	FS	WASHELLI ENT	N	PM	19	1	3
7840	Aurora Ave N	FS	WASHELLI ENT	N	XEV	14	0	0
7840	Aurora Ave N	FS	WASHELLI ENT	N	XNT	9	0	0
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7840:</b>						<b>79</b>	<b>3</b>	<b>14</b>
7850	Aurora Ave N	FS	N 115th St	N	AM	12	4	12
7850	Aurora Ave N	FS	N 115th St	N	MID	25	10	24
7850	Aurora Ave N	FS	N 115th St	N	PM	19	7	25
7850	Aurora Ave N	FS	N 115th St	N	XEV	14	3	21
7850	Aurora Ave N	FS	N 115th St	N	XNT	9	1	14
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7850:</b>						<b>79</b>	<b>26</b>	<b>96</b>
7880	Aurora Ave N	FS	N 125th St	N	AM	11	4	22
7880	Aurora Ave N	FS	N 125th St	N	MID	25	20	59
7880	Aurora Ave N	FS	N 125th St	N	PM	20	8	34
7880	Aurora Ave N	FS	N 125th St	N	XEV	14	4	22
7880	Aurora Ave N	FS	N 125th St	N	XNT	9	3	11
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7880:</b>						<b>79</b>	<b>37</b>	<b>148</b>
7900	Aurora Ave N	FS	N 130th St	N	AM	11	10	46
7900	Aurora Ave N	FS	N 130th St	N	MID	25	55	121
7900	Aurora Ave N	FS	N 130th St	N	PM	19	29	72
7900	Aurora Ave N	FS	N 130th St	N	XEV	15	15	32
7900	Aurora Ave N	FS	N 130th St	N	XNT	9	6	10
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7900:</b>						<b>79</b>	<b>114</b>	<b>281</b>
7912	Aurora Ave N	FS	N 135th St	N	AM	11	3	13
7912	Aurora Ave N	FS	N 135th St	N	MID	25	30	54
7912	Aurora Ave N	FS	N 135th St	N	PM	19	17	53
7912	Aurora Ave N	FS	N 135th St	N	XEV	15	9	22
7912	Aurora Ave N	FS	N 135th St	N	XNT	9	2	9
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 7912:</b>						<b>79</b>	<b>60</b>	<b>151</b>
75820	Aurora Ave N	FM	N 145th St	N	AM	11	19	24
75820	Aurora Ave N	FM	N 145th St	N	MID	26	40	64
75820	Aurora Ave N	FM	N 145th St	N	PM	19	26	62
75820	Aurora Ave N	FM	N 145th St	N	XEV	14	12	34
75820	Aurora Ave N	FM	N 145th St	N	XNT	9	7	21
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 75820:</b>						<b>79</b>	<b>103</b>	<b>205</b>

AAM: before 6am, AM: 6-9am, MID: 9am-3:15pm, PM: 3:15-6:15pm, XEV: 6:15-9:30pm, XNT: 9:30pm-close  
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# Bus Zone Activity

WEEKDAY ONLY DATA FOR SIGNUP: SPR '06 FINAL, DATED 6/27/2006

SOURCE: SEATTLE METRO APC SYSTEM

ZONE#	ON STREET	NS/FS	CROSS STREET	DIR	TIME	I/O	ROUTE	SERV	TYPE	# OF	# OF	# OF	ON	OFF	LOAD	AVG		
										UNIQUE TRIPS SEEN	TOTAL TRIPS SEEN	TIMES BUS STOPPED	AVG PSGRS	TOTAL ONS	AVG PSGRS	TOTAL OFFS	APPR AVG	NUM SEATS
43050	N 130th St	NS	Aurora Ave N	W	AM	O	345	L		5	40	30	0.4	2	0.9	5	6.9	30
43050	N 130th St	NS	Aurora Ave N	W	MID	O	345	L		13	88	82	1.1	14	1.4	18	12.4	30
43050	N 130th St	NS	Aurora Ave N	W	PM	O	345	L		6	44	43	1.6	10	1.9	11	11.5	30
43050	N 130th St	NS	Aurora Ave N	W	XEV	O	345	L		4	28	24	0.8	3	1.1	5	7.9	30
43050	N 130th St	NS	Aurora Ave N	W	XNT	O	345	L		3	22	10	0.2	1	0.5	2	3.0	30
TOTALS FOR ZONE#		43050	TOTAL TRIPS OBSERVED:							31	ONS:			30	OFFS:			40
43110	N 130th St	FS	Aurora Ave N	E	AM	I	345	L		6	41	17	0.3	2	0.2	1	5.1	30
43110	N 130th St	FS	Aurora Ave N	E	MID	I	345	L		13	95	85	1.5	20	1.4	18	12.5	30
43110	N 130th St	FS	Aurora Ave N	E	PM	I	345	L		5	33	31	1.9	9	1.0	5	8.2	30
43110	N 130th St	FS	Aurora Ave N	E	XEV	I	345	L		4	30	24	1.8	7	0.3	1	6.8	30
43110	N 130th St	FS	Aurora Ave N	E	XNT	I	345	L		2	15	7	0.3	1	0.2	0	2.0	30
TOTALS FOR ZONE#		43110	TOTAL TRIPS OBSERVED:							30	ONS:			39	OFFS:			26
75190	N 145th St	FS	Aurora Ave N	E	AM	I	304	L		5	31	19	0.8	4	0.0	0	19.9	42
75190	N 145th St	FS	Aurora Ave N	E	XEV	-	DHD	L		1	76	4	0.0	0	0.1	0	0.8	56
TOTALS FOR ZONE#		75190	TOTAL TRIPS OBSERVED:							6	ONS:			4	OFFS:			0
75370	N 145th St	FS	Aurora Ave N	W	AM	-	DHD	L		1	48	2	0.0	0	0.0	0	0.6	44
75370	N 145th St	FS	Aurora Ave N	W	PM	O	304	L		4	32	26	0.1	0	1.3	5	20.4	50
75370	N 145th St	FS	Aurora Ave N	W	XEV	O	304	L		1	4	0	0.0	0	0.0	0	14.0	64
TOTALS FOR ZONE#		75370	TOTAL TRIPS OBSERVED:							6	ONS:			0	OFFS:			5

AAM: before 6am, AM: 6-9am, MID: 9am-3:15pm, PM: 3:15-6:15pm, XEV: 6:15-9:30pm, XNT: 9:30pm-close

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Print Date: 6/30/2006

# Bus Zone Activity

WEEKDAY DATA FOR SIGNUP: SPR '06 FINAL, DATED 6/27/2006 SOURCE: SEATTLE METRO APC SYSTEM

ZONE#	ON STREET	NS/FS	CROSS STREET	DIR	TIME	TOTAL TRIPS		
						OBSERVED	TOTAL ONS	TOTAL OFFS
43050	N 130th St	NS	Aurora Ave N	W	AM	5	2	5
43050	N 130th St	NS	Aurora Ave N	W	MID	13	14	18
43050	N 130th St	NS	Aurora Ave N	W	PM	6	10	14
43050	N 130th St	NS	Aurora Ave N	W	XEV	4	3	5
43050	N 130th St	NS	Aurora Ave N	W	XNT	3	1	2
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 43050:</b>						<b>31</b>	<b>30</b>	<b>40</b>
43110	N 130th St	FS	Aurora Ave N	E	AM	6	2	2
43110	N 130th St	FS	Aurora Ave N	E	MID	13	20	18
43110	N 130th St	FS	Aurora Ave N	E	PM	5	9	5
43110	N 130th St	FS	Aurora Ave N	E	XEV	4	7	4
43110	N 130th St	FS	Aurora Ave N	E	XNT	2	1	0
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 43110:</b>						<b>30</b>	<b>39</b>	<b>26</b>
75190	N 145th St	FS	Aurora Ave N	E	AM	5	4	0
75190	N 145th St	FS	Aurora Ave N	E	XEV	1	0	0
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 75190:</b>						<b>6</b>	<b>4</b>	<b>0</b>
75370	N 145th St	FS	Aurora Ave N	W	AM	1	0	0
75370	N 145th St	FS	Aurora Ave N	W	PM	4	0	5
75370	N 145th St	FS	Aurora Ave N	W	XEV	1	0	0
<b>TOTAL FOR SELECTED TIME PERIOD(S) FOR ZONE # 75370:</b>						<b>6</b>	<b>0</b>	<b>5</b>

Saturday and Sunday On / Off Zone Data for Selected Zones												
Spring 2006 Signup												
Source: APC LogStop File												
								Observed	Observed		Total	Total
								Average	Average	Scheduled	Average	Average
Day	Keyzone	On Street	Cross Street	Intersect	Direction	Route(s)	In / Out	"Ons"	"Offs"	Trips	"Ons"	"Offs"
								per Trip	per Trip			
Saturday	6950	Aurora Ave N	N 145th St	FM	S	28, 358	In	2.30	1.15	103	236.99	118.60
Saturday	6990	Aurora Ave N	N 135th St	FS	S	358	In	2.43	1.86	66	160.53	123.08
Saturday	7000	Aurora Ave N	N 130th St	FS	S	358	In	2.96	0.84	66	195.60	55.47
Saturday	7010	Aurora Ave N	N 125th St	FM	S	358	In	1.62	0.69	66	106.70	45.33
Saturday	7040	Aurora Ave N	N 115th St	FS	S	358	In	0.88	0.24	66	57.97	15.82
Saturday	7050	Aurora Ave N	WASHELLI	NS	S	358	In	0.21	0.13	66	13.93	8.37
Saturday	7840	Aurora Ave N	WASHELLI ENT	FS	N	358	Out	0.07	0.06	65	4.52	3.75
Saturday	7850	Aurora Ave N	N 115th St	FS	N	358	Out	0.29	1.08	65	19.07	70.18
Saturday	7880	Aurora Ave N	N 125th St	FS	N	358	Out	0.47	1.67	65	30.78	108.60
Saturday	7900	Aurora Ave N	N 130th St	FS	N	358	Out	1.54	3.56	65	100.37	231.63
Saturday	7912	Aurora Ave N	N 135th St	FS	N	358	Out	0.68	1.81	65	43.93	117.80
Saturday	43050	N 130th St	Aurora Ave N	NS	W	345	Out	0.91	2.35	25	22.73	58.71
Saturday	43110	N 130th St	Aurora Ave N	FS	E	345	In	0.91	0.45	25	22.73	11.36
Saturday	75820	Aurora Ave N	N 145th St	FM	N	358	Out	1.30	2.28	65	84.25	148.47
Sunday	6950	Aurora Ave N	N 145th St	FM	S	28, 358	In	2.43	1.23	85	206.35	104.56
Sunday	6990	Aurora Ave N	N 135th St	FS	S	358	In	2.10	1.21	50	105.10	60.40
Sunday	7000	Aurora Ave N	N 130th St	FS	S	358	In	2.71	0.73	50	135.35	36.60
Sunday	7010	Aurora Ave N	N 125th St	FM	S	358	In	1.47	0.63	50	73.65	31.35
Sunday	7040	Aurora Ave N	N 115th St	FS	S	358	In	1.02	0.44	50	51.15	22.05
Sunday	7050	Aurora Ave N	WASHELLI	NS	S	358	In	0.07	0.05	50	3.65	2.40
Sunday	7840	Aurora Ave N	WASHELLI ENT	FS	N	358	Out	0.06	0.13	50	2.90	6.70
Sunday	7850	Aurora Ave N	N 115th St	FS	N	358	Out	0.44	1.19	50	22.25	59.55
Sunday	7880	Aurora Ave N	N 125th St	FS	N	358	Out	0.57	1.40	50	28.65	69.80
Sunday	7900	Aurora Ave N	N 130th St	FS	N	358	Out	1.30	3.26	50	65.05	162.95
Sunday	7912	Aurora Ave N	N 135th St	FS	N	358	Out	0.56	1.23	50	27.85	61.45
Sunday	43050	N 130th St	Aurora Ave N	NS	W	345	Out	0.73	1.54	17	12.33	26.17
Sunday	43110	N 130th St	Aurora Ave N	FS	E	345	In	1.08	0.57	16	17.33	9.08
Sunday	75820	Aurora Ave N	N 145th St	FM	N	358	Out	1.30	2.57	50	65.10	128.70

## Bus Stop Activity Report – Explanatory Notes

The bus stop activity report is an aggregation of bus passenger loading (ons and offs) data collected by Metro's Automatic Passenger Counter (APC) system. The information shown in this report is based on a sample of data collected during an entire service period (e.g., the Fall service period runs between early September and early February). These notes are intended to assist in interpretation of the Bus Stop Activity Report by interpreting the terms and headings used in the report, and by describing the limitations of the report. The underlined terms and headings refer to the headings used in the print version of the report. The field columns used in electronic Desktop APC Application are noted in parentheses when different terms are used.

### TERMS AND HEADINGS

**Header Information:** The most important information contained in the header is the service period name. There are three service periods per year: Spring (early February to early June), Summer (early June to early September), and Fall (early September to early February). Typically, ridership is higher during the Fall and Spring service periods and lowest during the Summer service period.

**Zone#:** The zone# is a two- to five-digit number representing a unique bus stop, or zone. There may be more than one zone associated with what may appear to be a single bus stop. For example, each bay at a transit center has a unique zone number. Data from each zone requested are shown separately.

**On Street:** On Street gives the name of the street on which the zone is located.

**NS/FS (Inter):** NS/FS is a two-letter abbreviation that references the location of the zone with respect to the nearest cross street. The abbreviations used are as follows:

AT at  
 BT between  
 FM far side of the intersection, mid block  
 FS far side of the intersection  
 NM near side of the intersection, mid block  
 OP opposite, or across from

**Cross Street:** This field gives the nearest cross street to the zone.

**Dir:** This field indicates the bus's direction of travel.

**Period:** This field indicates the time period, using the following abbreviations:

AAM before 6:00 am  
 AM 6:00 am – 9:00 am  
 MID 9:00 am – 3:15 pm  
 PM 3:15 pm – 6:15 pm  
 XEV 6:15 pm – 9:30 pm  
 XNT 9:30 pm – end of service

**I/O (InOut):** this indicates whether the trip is inbound (I) or outbound (O). For most trips, "I" indicates the trip is traveling toward downtown Seattle, and "O" indicates the trip is traveling away from downtown Seattle.

**Route (SignRt):** This field contains the route number. Occasionally, some trips are assigned to route 0 (zero), which indicates the bus just completed or is just starting revenue service and the APC system is unable to discern the bus' route.

**Type Serv (Ex):** This field indicates whether the trip is local (L) or express (E).

**# of Unique Trips Seen (ObsTrips):** This field gives the number of unique scheduled trips sampled by the APC system during the service period. For example, the trip of route 101 that leaves the University Street Station for Renton every weekday at 4:08 is a unique trip. If the system were to collect data on this trip on two different occasions during a given service period (e.g., on April 20 and May 4), this would count as a single unique trip.

**# of Total Trips Seen (TotalObs):** This indicates the total number of trips of a given route in a given direction for which the APC system collected data during a given service period. To clarify the difference between unique and total trips, if the APC system were to observe one trip five times and another trip ten times, the Bus Stop Activity report would indicate two unique trips and fifteen total trips.

## Bus Stop Activity Report – Explanatory Notes

**# of Times Bus Stopped (Stops):** This field gives the number of times the bus actually stopped at this stop, out of the number of total trips seen.

**On Avg Psgrs (AvgOns/Trip):** This field shows the average number of passengers boarding (or deboarding, if offs) the route per trip at this stop, based on the # OF UNIQUE TRIPS SEEN.

**Total Ons (OnsObs):** This field equals the # OF UNIQUE TRIPS SEEN multiplied by ON(OFF) AVG PSGRS. This is the average total number of Ons(Offs) for a single weekday (for a given route during the specified time period).

**Load Appr Avg (AvgArrLoad/Trip):** This field indicates the average passenger load on the bus as it approached the zone, based on the # OF UNIQUE TRIPS SEEN.

**Avg Num Seats (AvgSeats/Trip):** This gives the average number of seats on buses assigned to these routes, based on the # OF UNIQUE TRIPS SEEN.

### LIMITATIONS

The APC system is Metro's primary source of ridership and travel time information and is the only source of detailed information at the bus stop level. Overall, the accuracy of the data collected is very good, since about 95% of the unique trips are sampled during a given service period, and many of these trips are sampled three or more times. However, the data does have several limitations.

First, the APC system does not collect any data on subcontracted service. As a result, to the extent that subcontracted service stops at a given stop and riders board and alight such service at that stop, total ons and offs for that stop will be low.

Another limitation of the data collected by the APC system is that, due to the automated nature of the system, ons and offs are occasionally incorrectly assigned to a bus zone just before or after the correct zone. To verify boardings and alightings that seem unusually high or low, it is helpful to examine data from other service periods to determine whether data from those service periods are similar. Also, one should examine data for one or two bus zones on either side of the zone of interest.

A third shortcoming of the APC data is the lack of sufficient data on a small number of unique trips. The goal of the APC system is to collect at least three observations from every unique trip Metro operates. However, because of the automated nature of the system, as well as the large amount of data collected, the system does not achieve the three observations for benchmark for every route. For a given trip, the system may actually make fewer than three observations or some of the observations collected may be lost, due to processing errors.

While most trips have at least three observations, some trips have only one or two observations, and a few trips have no valid APC data available. The fewer times a given trip is observed, the more prone data from that trip is to be skewed by a non-typical observation. When no APC data is available for a given trip, total ons and offs at individual bus zones may be low.

A final limitation of the data, related to the shortcoming just described, is the accuracy of the data in providing information at different levels of aggregation. As with all collections of data, APC data is most accurate at highly aggregated levels, such as system- or district-wide ons and offs. As the "slice" of data to be examined becomes smaller, it also becomes more subject to being skewed by non-typical data. For example, a major accident that closes down I-5 for one day will not affect system-wide data collected over an entire service period. However, such an accident may radically affect data from bus trips that usually operate on I-5 and whose vehicles were equipped with passenger counters on the day of the accident. If only two observations of a particular unique trip are collected during a service period, and one of these observations occurred on the day of the accident, then half of the data available on the trip would be skewed.

## **Bus Stop Activity Report – Explanatory Notes**

As with any data source, the above limitations point to a need to perform a “reality check” on the data in the Bus Zone Activity report. The following types of questions might be asked regarding the data shown in the report:

Do the bus routes shown on the report match those that actually stop at the zone(s)?

For any given route and time period, does the # OF UNIQUE TRIPS SEEN equal the scheduled number of trips?

Do the ons and offs for each route appear reasonable?

The weaknesses described above do not detract from the usefulness of APC data, especially at an aggregate level. It is the only source of detailed information on the bus stop level and planners frequently used this data to help determine where to add, delete, or change bus service.

## Appendix C

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**FINAL**

**City of Seattle**  
**Revised Aurora Avenue North Transit, Pedestrian and**  
**Safety Improvement Project**

**Traffic Operations Technical Memorandum**  
**Methods and Assumptions**

PREPARED FOR: Ken Lee/Seattle Department of Transportation

PREPARED BY: Tim Newkirk/CH2M HILL

DATE: February 6, 2008

This memorandum outlines the methods and assumptions that will be used for the Seattle Aurora Corridor project. It applies to the analysis performed for both the original and revised project. One goal of this memo is to achieve consensus within the project team which will help produce consistent and defensible analysis. This memo will identify the analysis years and study area limits. Travel demand forecasting and modeling methodologies will be defined. In addition, traffic analysis scenarios and the software that will be used to support design decisions will be identified. Lastly, the operations parameters and assumptions will be outlined.

### Analysis Years

The AM and PM peak hours will be analyzed for each scenario in Table 1.

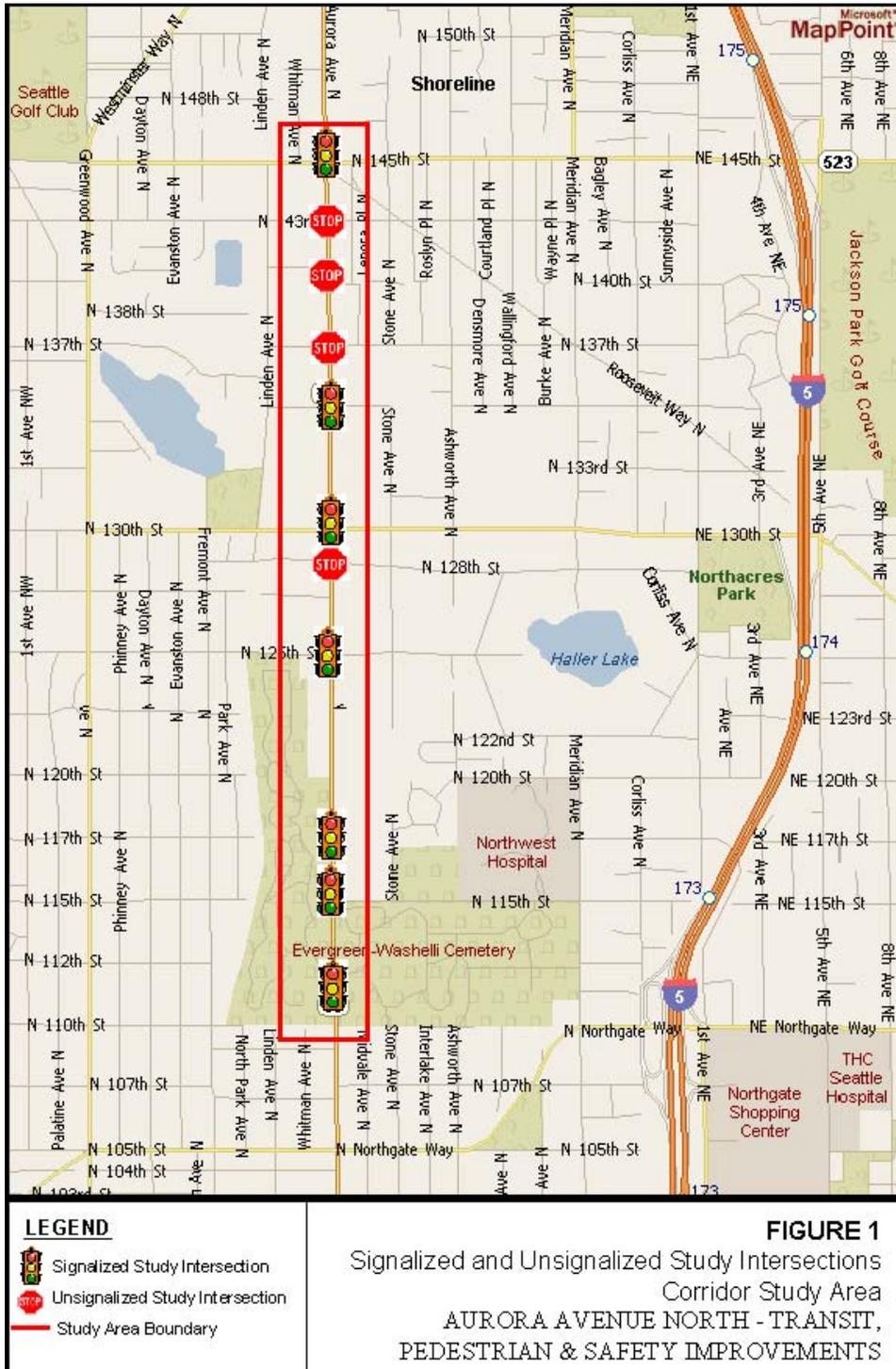
- Existing Year (2005)
- Year of Opening (2010)
- Design Year (2030)

TABLE 1  
Traffic Analysis Scenarios

Condition	Existing (2005)	Year of Opening (2010)	Design Year (2030)
Existing	AM and PM		
No-Build			AM and PM
Build		AM and PM	AM and PM

## Study Area Limits

The study area for this project is defined as Aurora Avenue North between North 110<sup>th</sup> Street and North 145<sup>th</sup> Street in the City of Seattle (see Figure 1). This is approximately 1.7 miles and includes eleven (11) study intersections. Other intersections or mid-block driveways may be added to the traffic model, but will first require PM approval from CH2M HILL and the CITY for change management and adjustment to the current scope of work (SOW).



## Forecasting/Modeling Methodology

As directed by the Scope of Work (SOW), CH2M HILL obtained from the City of Seattle and the Puget Sound Regional Council's latest calibrated EMME/2 travel demand model. At the coordination meeting on July 26, 2005, CH2M HILL suggested an AM peak hour growth rate of **0.85** percent per year and a PM peak hour growth rate of **1.23** percent per year as an alternative to the **1.21** percent per year growth rate for both peak periods. All three growth rates were derived from the PSRC's travel demand model. The City agreed that separate growth rates for each peak period were acceptable.

The growth rates will be applied to the final 2005 AM and PM peak hour traffic volumes to reach forecasted 2010 and 2030 traffic volumes. The traffic volumes will be rounded to the nearest 5 vehicles; if less than 5 vehicles are present it will remain that value. The 2030 traffic volumes will be used for both Build and No-Build scenarios.

## Operational Analysis Methods/Parameters

### General Parameters

Existing conditions will be represented by data from the year 2005. In addition, the City of Seattle's model will be used to forecast both AM and PM volumes for the year of opening (2010) and the design year (2030).

### Existing AM and PM Peak Hour Scenarios

In order to understand existing travel patterns, the Synchro model developed during the Route Development Plan process, and provided by the City, will be used as the base conditions. The Synchro files will be updated to reflect existing (2005) conditions. In addition, volumes will be balanced between intersections for consistency.

### Intersection Analysis

#### *Software*

All intersection analysis will be performed using the Synchro software package (version 6). This software implements methods from the Highway Capacity Manual (HCM) and will be used to analyze both signalized and unsignalized intersections. The level-of-service (LOS), intersection delays (per vehicle), and lane group queuing results will be reported using Synchro methodology, which is accepted by WSDOT.

#### *BAT Lane Coding*

The curb lane (Lane #1) will be marked as a Business Access and Transit (BAT) lane in both directions along Aurora Avenue. This lane will operate as a normal right-turn lane for general purpose vehicles at controlled intersections, but transit vehicles will be allowed to continue through the intersection. In the Synchro model, this lane will be coded as a general purpose right-turn lane that drops and does not permit through vehicles because Synchro does not have the ability to model a BAT lane. Also, no adjustments will be made to the existing or forecasted approach volumes because buses make up a small portion of the right-turn volume.

### Study Area

Synchro results will be reported for eleven (11) total intersections, seven signalized intersections and four unsignalized, within the Aurora Corridor study area. The intersections are listed in Table 2.

TABLE 2  
Study Intersections

Intersection Type	Intersecting Street
Signalized (7)	N. 112th Street
	N. 115th Street
	N. 117th Street
	N. 125th Street
	N. 130th Street
	N. 135th Street
	N. 145th Street
Unsignalized (4)	N. 128th Street
	N. 137th Street
	N. 140th Street
	N. 143rd Street

### Intersection Parameters

Refer to Table 3 for a list of all intersection parameters/inputs that will be assumed for this project.

TABLE 3  
Arterial Operations Parameters/Assumptions

Arterial Intersection Parameters	Condition		
	Existing	2010 - Year of Opening	2030 - Design Year
Peak Hour Factor	From traffic count and by approach	0.92 for intersection	0.92 for intersection
Conflicting Bikes and Pedestrian per Hour	From traffic count, otherwise assume 20 peds/bikes	Assume 1% growth in number of conflicting pedestrians	Assume 1% growth in number of conflicting pedestrians
Area Type	"Other"	Same as Existing	Same as Existing
Ideal Saturation Flow Rate (for all mvmts)	1,900 passenger cars per hour green per lane	Same as Existing	Same as Existing
Lane Width	From CAD files	Based on design	No-Build: Same as Existing Build: Based on design
Percent Heavy Vehicles	From traffic count, otherwise 2%	Same as Existing	Same as Existing
Percent Grade	From CAD files	Based on design	No-Build: Same as Existing Build: Based on design
Parking Maneuvers per	No parking maneuvers	Same as Existing	Same as Existing

TABLE 3

## Arterial Operations Parameters/Assumptions

Arterial Intersection Parameters	Condition		
	Existing	2010 - Year of Opening	2030 - Design Year
Hour			
Bus Blockages	Headway information provided by transit agencies	Assume 1% growth in number of transit stops	Assume 1% growth in number of transit stops
Intersection signal phasing and coordination	From current timing plans provided by City of Seattle	Optimized by Synchro	Optimized by Synchro
Intersection signal timing optimization limits	From current timing plans provided by City of Seattle	Between 60-160 seconds	Between 60-160 seconds
Minimum Green time	From current timing plans provided by City of Seattle	Based on pedestrian times (7 sec. walk and 3.5 feet per second for FDW clearance) 10 sec. if no crosswalk 15 sec. for protected LT phase 10 sec. for prot/perm LT phase	Based on pedestrian times (7 sec. walk and 3.5 feet per second for FDW clearance) 10 sec. if no crosswalk 15 sec. for protected LT phase 10 sec. for prot/perm LT phase
Yellow and all-red time	From current timing plans provided by City of Seattle	New signals: (Y) = 3.5 seconds and (R) = 1 second	New signals: (Y) = 3.5 seconds and (R) = 1 second
Right Turn on Red	Allow	Allow	Allow
Right Turn Overlaps	From current timing plans provided by City of Seattle	Identify if used	Identify if used
95th percentile vehicle queues calculated based on an average of 25 feet per vehicle	Yes	Yes	Yes
Level of service goals (for mitigation) per HCM 2000	N/A	LOS E (signalized intersections from Synchro, unsignalized intersections from the HCM)	LOS E (signalized intersections from Synchro, unsignalized intersections from the HCM)

LOS, delay, and vehicle queues will be reported from Synchro.