RESOLUTION R-5079

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF KIRKLAND ADOPTING THE 100TH AVENUE NE CORRIDOR STUDY.

WHEREAS, the City Council approved a 100th Avenue NE Corridor Study ("Study") as part of the 2013-2018 Capital Improvement Program update; and

WHEREAS, in the spring of 2013, work began on the Study with the goal of assessing corridor needs and providing recommended improvements; and

WHEREAS, the limits of the Study were established from the intersection of 100th Avenue NE and NE 132nd Street, north to the City limits at NE 145th; and

WHEREAS, to seek public input and guide development of the Study, community outreach was conducted through 2013 and 2014; and

WHEREAS, the Transportation Commission was consulted throughout the Study and provided its expertise, review, and recommendations; and

WHEREAS, the Study identified four goals of addressing safety needs for all travel modes, providing improved accessibility and connectivity for non-motorized users, creating improved traffic flow and reduced congestion without adding traffic lanes, and addressing environmental concerns while improving salmon stream passage; and

WHEREAS, the Study recommendations are categorized into four groupings with an estimated project total of $13,485,000 in today's dollars, including $3,209,160 in soft-costs if designed as one package and $10,275,840 for construction costs if built as one package.

NOW, THEREFORE, be it resolved by the City Council of the City of Kirkland as follows:

Section 1. The 100th Avenue NE Corridor Study attached as Exhibit A and Study supplemental documents attached as Exhibit B and incorporated by this reference are adopted.

Passed by majority vote of the Kirkland City Council in open meeting this 6th day of January, 2015.

Signed in authentication thereof this 6th day of January, 2015.

MAYOR

Attest:

City Clerk

R-5079
Exhibit A

100th Ave NE Corridor Study

(City of Kirkland – CST0083)

PENDING

Final Report

Submitted to

City of Kirkland

Submitted by

Concord Engineering

710 Second Avenue
Suite 830
Seattle, WA 98104
Phone: (206) 682-0567
August 28, 2014

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LIST OF EXHIBITS

EXECUTIVE SUMMARY

STUDY OVERVIEW

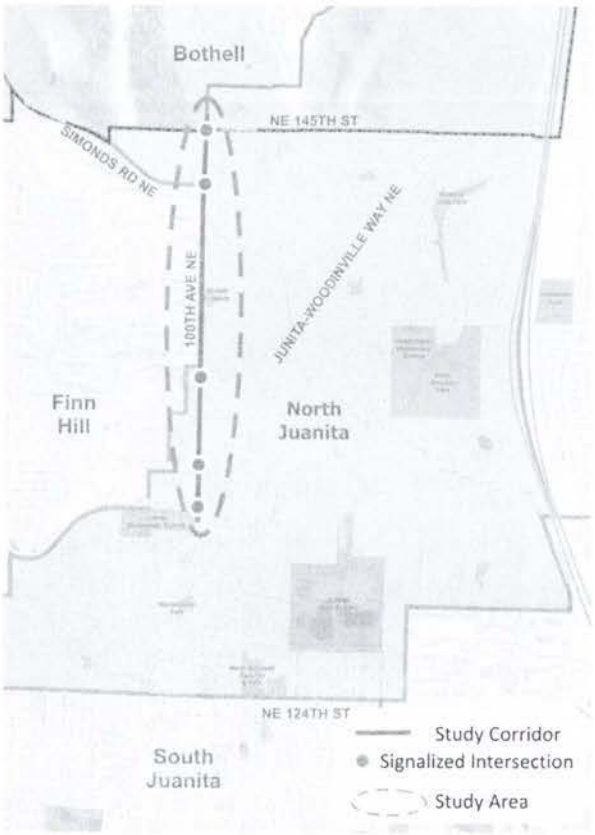
The 100th Avenue Corridor Study evaluates existing conditions, gathers inputs from stakeholders and corridor users of all modes through public outreach, analyzes potential operational and safety improvements for all modes of travel, and recommends a Corridor Plan that contains a variety of projects that would improve the overall performance and safety of the corridor.

STUDY OBJECTIVES

The objective of the study is to identify potential corridor-wide and localized spot enhancements to address issues related to traffic operations, safety, non-motorized traffic safety and mobility, and midblock and business accessibility. The purpose is to improve the overall corridor performance and safety for all modes of travel.

COMMUNITY OUTREACH

Community involvement, support, and common vision for future improvements play a critical role in developing and implementing a successful corridor plan. During the course of the study, in order to fully engage the public in the study, the project team made a large effort to reach out to the public through a project website, direct-mail surveys and local public outreach meetings.



Key Audiences

- Community groups and organizations such as the Juanita and Finn Hill Neighborhood Communities
- Businesses and residents along the project corridor
- Users of the project corridor, such as commuters, both local and regional

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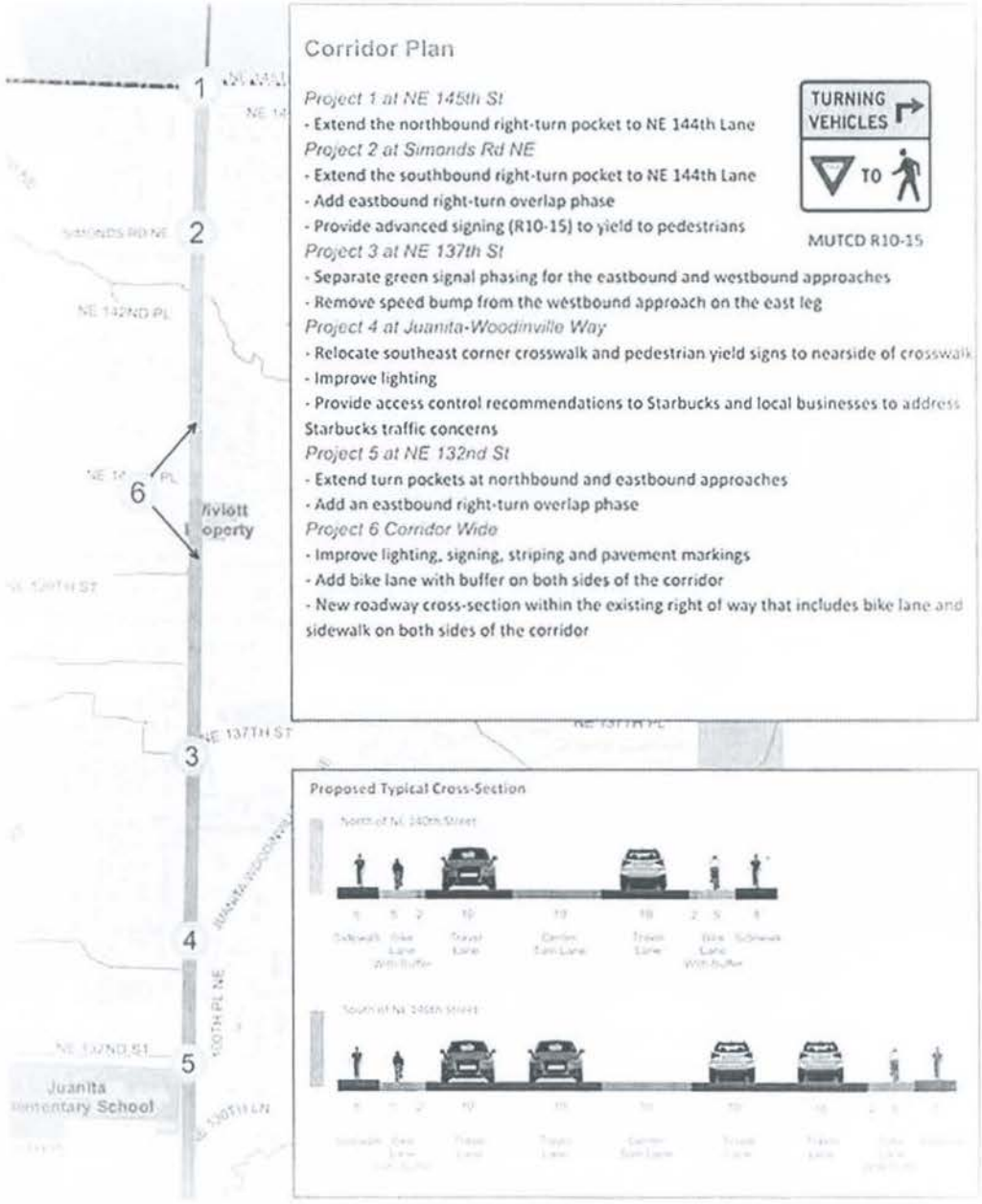
THE RECOMMENDED PLAN

The recommended Corridor Plan includes a variety of projects that meet the objectives of the study. These projects would improve traffic operations, safety, and midblock accessibility immediately, as well as provide a long-term path forward to improve the corridor performance into the future.



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ESTIMATED COST

The recommended improvements were grouped into four itemized categories for cost estimating. The total cost of the recommended improvements is about $13.5 million including design, construction, and all the incidental costs.

More than half ($7.35 million) of the cost is to provide the intersection improvements. Building the roadway improvement will cost about 33% ($4.4 million) of the total estimated cost.

DESIGN				ENGINEER'S ESTIMATE	
ITEM NO	DESCRIPTION	QTY	UNIT	UNIT PRICE	EXTENSION
1	Intersection Design	4	Intersection	$350,000	$1,400,000
2	Roadway Improvements Design	1	LS	$550,000	$550,000
3	Culvert Design	1	LS	$136,000	$136,000
4	ITS Design	5	Intersection	$60,000	$300,000
	PE Cost Estimate (Apprx. 10% of PE Costs based on past similar projects - federal)				$225,000
	Culvert PE Cost Estimate				$54,000
	Culvert Permit Fees				$5,000
	WSDOT Admin				$2,100
	15% Contingency of Design				$357,900
				Subtotal:	**$3,030,000**

CONSTRUCTION				ENGINEER'S ESTIMATE	
ITEM NO	DESCRIPTION	QTY	UNIT	UNIT PRICE	EXTENSION
1	Intersection	5	Intersection	$800,000	$4,000,000
2	Roadway Improvements	1	LS	$2,000,000	$2,000,000
3	Culvert	1	LS	$425,000	$425,000
4	ITS	5	Intersection	$71,000	$355,000
	CE Cost Estimate (Apprx. 15% of CN Costs based on past similar projects - federal)				$635,500
	Roadway Inspection (Apprx. 15% of CN Costs)				$953,250
	Culvert Insepection				$50,000
	WSDOT Admin				$2,250
	30% Contingency of Construction				$2,034,000
				Subtotal:	**$10,455,000**

DESIGN + CONSTRUCTION				ENGINEER'S ESTIMATE	
ITEM NO	DESCRIPTION	QTY	UNIT	UNIT PRICE	EXTENSION
1	Intersection	4/5	Intersection	$1,470,218	$7,351,088
2	Roadway Improvements	1	LS	$4,441,838	$4,441,838
3	Culvert	1	LS	$818,988	$818,988
4	ITS	5	Intersection	$174,618	$873,088

TOTAL Project Budget:	**$13,485,000**

MEETING OBJECTIVES

Objective or Request from the Public	Recommended Improvements
Improve safety in the corridor, especially for bicycles and pedestrians	– Provide separated sidewalks and bicycle lanes with 2-foot buffer from auto travel lanes on both sides of the study corridor to improve travel environment and safety for bicycles and pedestrians – Separate green signal phasing for the eastbound and westbound traffic at 100th Avenue NE and NE 137th Street to resolve alignment conflict issue – Provide two-way-left-turn lane throughout the study corridor to improve midblock accessibility and safety – Improve lighting along the study corridor to improve visibility – Trim vegetation for better visibility – Improve signing, striping, and pavement markings to improve visibility during wet conditions
Reduce congestion, but not interested in adding lanes for auto traffic	– Intersection improvements at 100th Avenue NE and NE 132nd Street to alleviate congestion during rush hours – Extend turn pockets for more storage space at locations where turning traffic blocks other movements – Provide signal overlap phase to increase intersection capacity – Propose ideas that could address local businesses traffic concerns caused by the Starbucks drive through traffic
Improve midblock accessibility and safety	– Provide two-way-left-turn lane throughout the study corridor to improve midblock accessibility and safety – Improve signing, striping, and pavement markings to improve visibility during wet conditions

STUDY BACKGROUND

PROJECT OVERVIEW

The 100th Avenue corridor serves as a major arterial connecting residential neighborhoods and businesses, as well as a key north-south route between the cities of Kirkland, Kenmore, and Bothell. 100th Avenue NE between NE 132nd Street and NE 145th Street is located in the North Juanita and Finn Hill neighborhoods (Exhibit 1). This segment of the corridor, referred to as the study corridor hereafter, serves a mix of local commercial, residential, and institutional land uses throughout the day, and commuters during morning and evening peak periods.

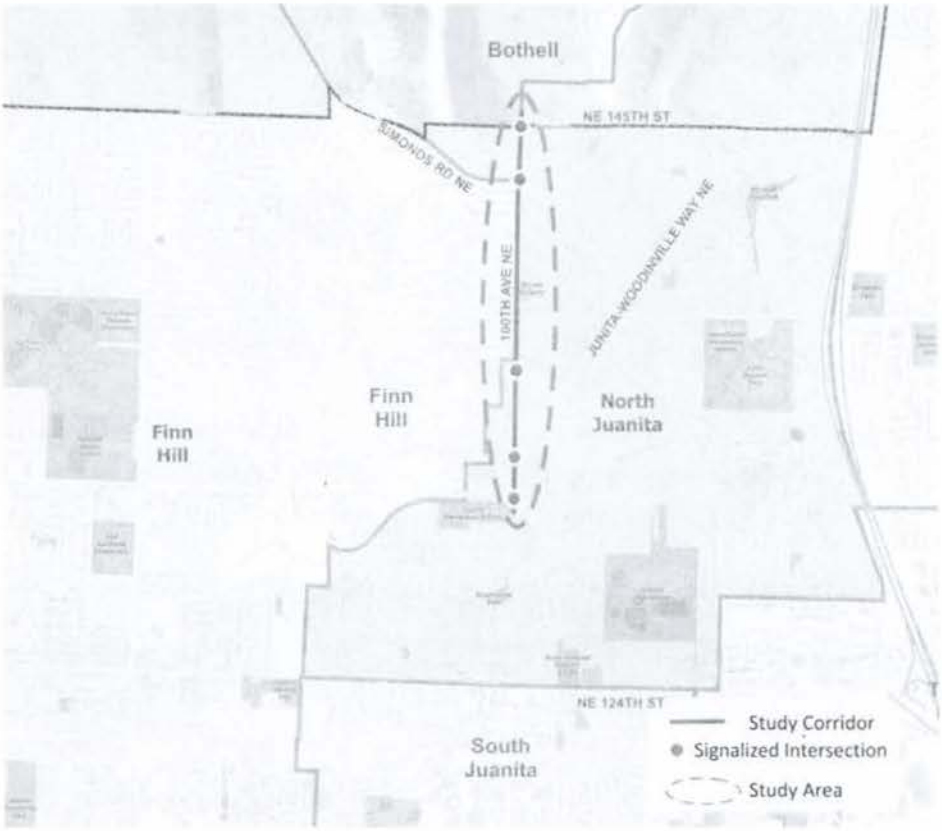

Exhibit 1–Study Corridor Vicinity Map

The 100th Avenue Corridor Study evaluates existing conditions, gathers inputs from stakeholders and corridor users of all modes through public outreach, analyzes potential operational and safety improvements for all modes of travel, and identifies improvements that would improve the overall performance and safety of the corridor.

STUDY PURPOSE/OBJECTIVE

The objective of the study is to identify potential corridor-wide and localized spot enhancements to address issues related to traffic operations, safety, non-motorized traffic safety and mobility, and midblock and business accessibility. The purpose is to improve the overall corridor performance and safety for all modes of travel.

COMMUNITY OUTREACH

Corridor users such as local residents, businesses, and commuters see and experience safety and operational issues through repetitive trips through the corridor. Their knowledge and opinions add an element that cannot be obtained through normal data collection methods, calculations, or brief field visits. Consequently, community involvement, support, and common vision for future improvements play a critical role in developing and implementing a successful corridor plan.

During the course of the study, in order to fully engage the public in the study, the project team made a large effort to reach out to the public through a project website, mail-out surveys and local public outreach meetings. Insights from the community outreach are highlighted throughout the report.

Key Audiences Engaged

- Community groups and organizations, such as the Juanita and Finn Hill Neighborhood Communities
- Businesses and residents along the project corridor
- Users of the project corridor, such as commuters, both local and regional

Public Outreach Meetings,

- January 13, 2014
- May 12, 2014

STUDY METHODS

In addition to community outreach the following methods were utilized during the study to identify potential improvements along the corridor:

- Field observations: the project team visited the corridor to identify safety, operation, accessibility, and mobility issues. Through field visits the project team also identified potential improvements to address these issues.
- Analysis of collision records: Collision records from January 2012 to December 2013 provided a listing of all recorded collisions during the two-year period for the study corridor. The project team evaluated the collisions for type of collision, location of collision,

pavement conditions, daylight or darkness conditions, time of day, and the direction of traveling vehicles.

- Traffic operational analysis:
  - Synchro 7.0, a traffic operational analysis software tool, was used to model the existing and alternative conditions to evaluate the benefits and impacts of potential roadway and signal improvements. This tool provides convenient methods to evaluate potential changes to traffic signals or traffic lanes.
  - VISSIM 5.4, a microscopic traffic simulation and operational analysis software tool, was used to model the existing and alternative conditions to evaluate the benefits and impacts of potential roadway and signal improvements at the intersection of 100th Avenue NE and NE 132nd Street.

CORRIDOR DESCRIPTION

This section of the report presents an overview of the existing corridor and identifies potential safety, operational and non-motorized mobility issues along the study corridor.

100th Avenue NE between NE 132nd Street and NE 145th Street was incorporated into City of Kirkland through the 2011 annexation from King County. This segment of 100th Avenue NE, classified as a principal arterial, is the main north-south route for the Finn Hill and North Juanita neighborhoods in northwest Kirkland, and connects Kirkland with Bothell.

LAND USE

The land use along the corridor (Exhibit 2), per the City of Kirkland comprehensive land use map, changes from commercial between NE 132nd Street and NE 138th Place, to mixed high and medium residential north of NE 138th Street with a pocket of commercial land use located on the west side of the street at NE 142nd Place.

The south half of the study corridor, located in the mixed commercial, institutional, and high density residential land use area, serves local residents and students, business employees, shoppers, visitors, and commuters that arrive via various modes of travel throughout the day.

This segment of the corridor features:

- Closely spaced driveways for business access.
- Frequent trips in and out of the business areas on both sides of the corridor. Heavy commute traffic in the morning and evening commute hours.
- School traffic to and from Juanita Elementary School and Juanita High School.

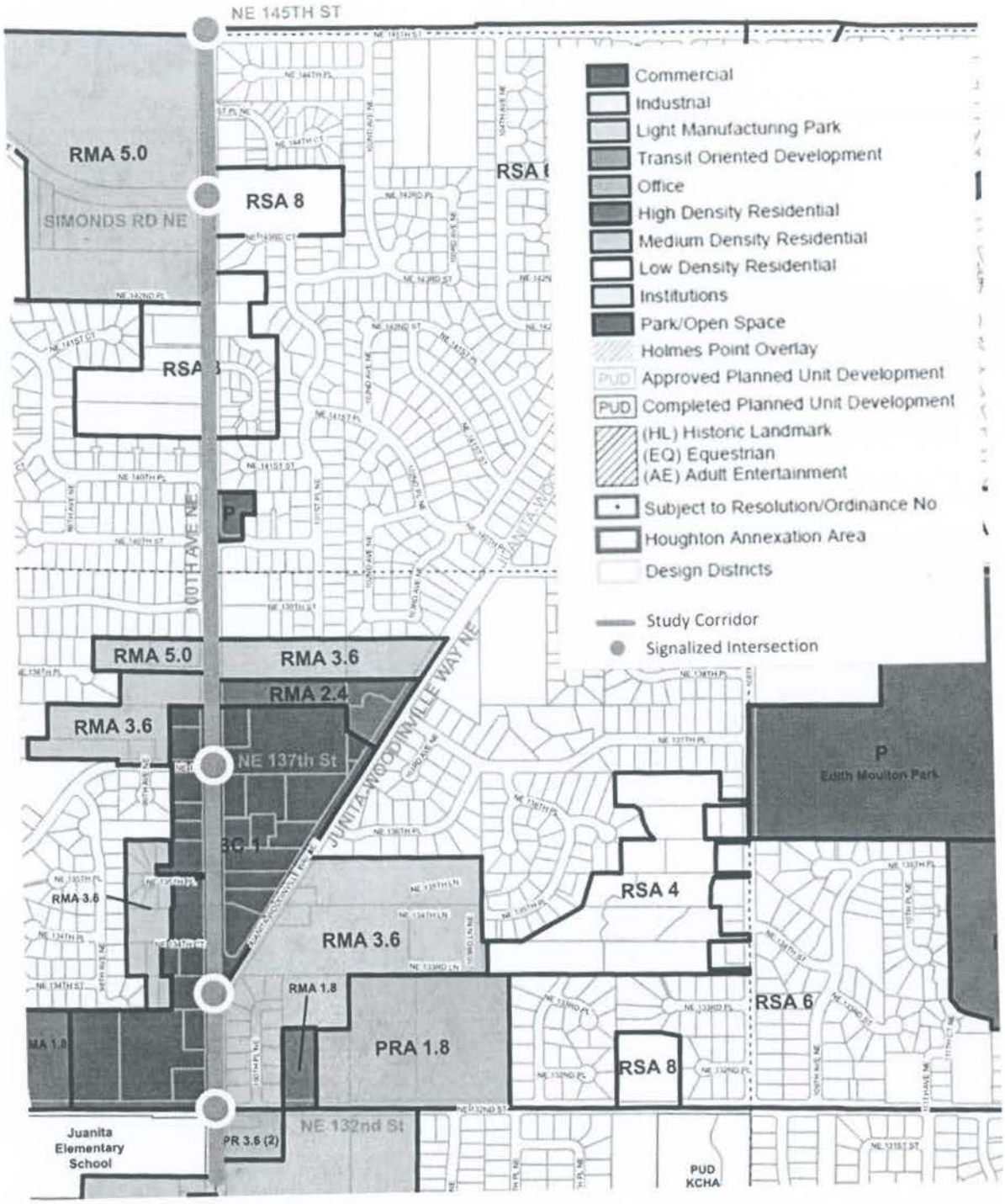

Exhibit 2–Study Corridor Land Use

The north half of the study corridor that falls in the residential land use area, serves all trip types but features:

- Widely spaced driveways for side streets and residential access.
- Commute traffic gathers from side streets in the morning commute hours as it goes south and dissipates in the evening commute hours to the side streets as it goes north.

PHYSICAL CONDITIONS

This section describes the physical conditions of the existing corridor including the roadway cross-section and the lighting conditions.

Roadway Cross-Section

The cross-section of the study corridor transitions from a five-lane cross-section to a three-lane cross-section at NE 138th Place, where the land use changes from commercial to residential. Exhibit 3 shows the typical sections of the existing roadway and total pavement width at various locations.

Between NE 132nd Street and NE 138th Place, the roadway consists of a five-lane cross-section with two lanes in each direction and a left-turn pocket or two-way-left-turn (TWLT) lane. Concrete sidewalks are provided on both sides of the roadway. There are no designated bicycle facilities such as sharrows or bicycle lanes.

North of NE 138th Place the roadway transitions to a two-lane cross-section until it reaches 145th Street NE. Widening occurs at the two signalized intersections at the cross streets of Simonds Road NE and NE 145th Street to provide left-turn and/or right-turn pockets. North of NE 140th Street, except at the signalized intersections, there are no continuous concrete sidewalks or designated bicycle facilities. The lack of sidewalk and bicycle facilities requires pedestrians and bicyclists to use the widened paved shoulder for their travel needs.

Public Inputs on the Study Corridor

- Improve safety for all people and all modes of travel, i.e., autos, bicycles, and pedestrians
- Relieve congestion during rush hours
- Improve midblock access
- Install bicycle facilities and sidewalks
- Minimal interest in more auto lanes to accommodate and attract more auto traffic
- Prefer intersection and spot enhancements to improve safety and operation
- Desire for expeditious implementation of improvements
- Appreciate and support City's efforts for improving the corridor

The total pavement width varies from 39 feet to 60 feet along the corridor between NE 132nd Street and NE 145th Street with the narrowest segment located south of NE 140th Street.

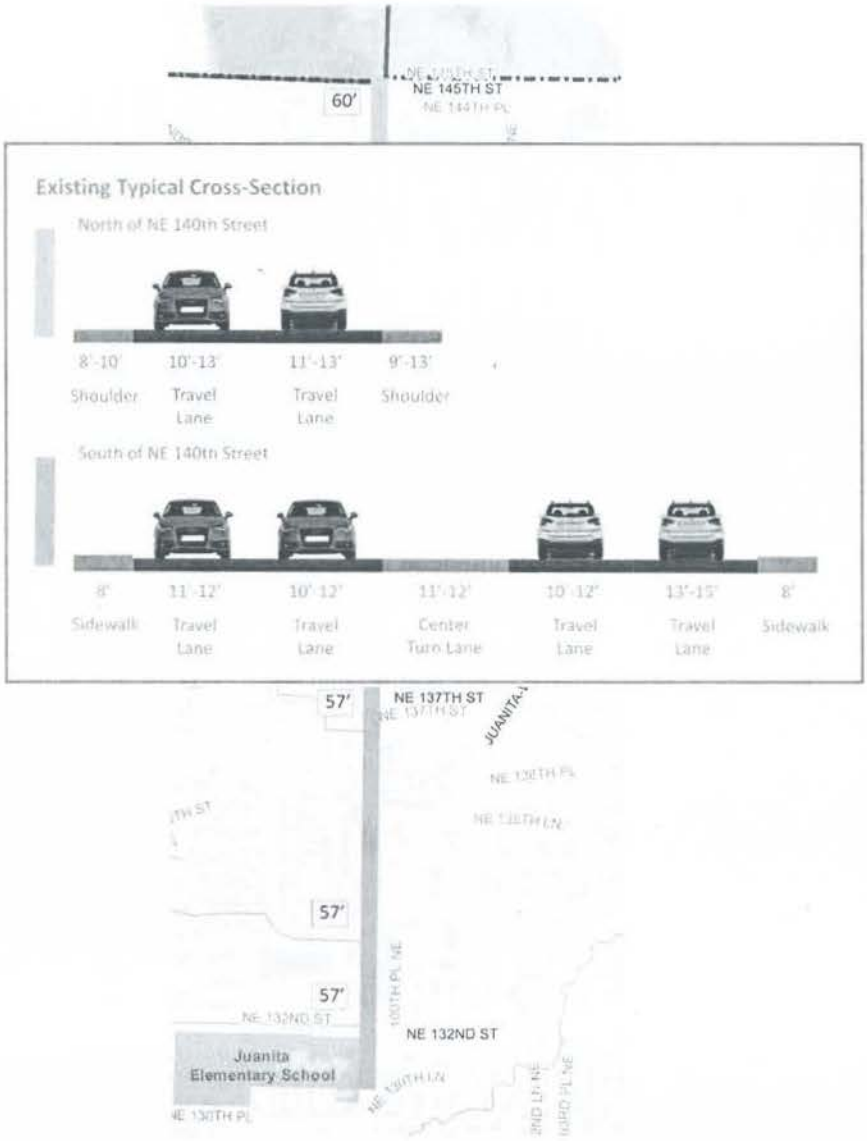

Exhibit 3–Study Corridor Physical Conditions

Street Lighting

Street Lighting is provided along the corridor. South of NE 140th Street, streetlights on steel poles with a spacing of approximately 170 feet are provided on the eastside. North of NE 140th Street, streetlights mounted on joint-use timber power poles with variable spacing of approximately 200 feet are provided on the west side of the corridor.

Field observations identified a few locations with poor lighting conditions because of low light intensity and lack of lighting uniformity. This is caused by a combination of factors such as:

- Long distances between light poles
- Long distances from light poles to the roadway
- Variable vertical distance from the luminaire to the roadway surface
- Tree canopies blocking the lights

Outstanding Issues

- Poor lighting north of NE 140th Street
- Dark spots north of NE 140th Street create uncertain roadway conditions
- Safety concerns to vehicular and non-motorized traffic

These dark spots create uncertain roadway conditions and pose safety concerns to both vehicular and non-motorized traffic.

Exhibit 4–Study Corridor Volumes

TRAFFIC OPERATIONS

This section describes the traffic operations at the signalized intersections in the study area and identifies the operational and safety issues.

Traffic Flow

Peak hour intersection turning movement counts from the five signalized intersections were collected in 2013 (Appendix A). Average Annual Daily Traffic (AADT) volumes of 2013 were provided by the City of Kirkland and are shown in Exhibit 4 with the peak hour approach volumes along the corridor. The volume data shows that the southern portion of the corridor experiences the highest traffic demand, with 29,915 AADT at NE 132nd Street. Continuing north, demand decreases to 16,149 AADT past NE Simonds Road.

Peak hour turning movement counts show that the peak direction of travel is southbound in the morning commute hours and northbound in the evening commute hours. As with the AADT counts, morning and evening peak hour demand is heaviest near NE 132nd Street.

Signalized Intersections

Traffic signals are one of the largest factors determining how much traffic a roadway may carry. It is the number of lanes and the percentage of time that the traffic signal displays green lights that will determine the amount of vehicles that may pass through a signalized intersection.

Most of the congestion occurring on the study corridor is caused by the traffic signal at NE 132nd Street. This traffic signal has a limited amount of time to display green lights for northbound and southbound traffic. This time is limited because the signal must display green time for cross-street traffic and traffic using turn lanes. Since green time cannot be extended for northbound and southbound traffic, the intersection needs more lanes to increase the vehicle flow rate during the green time it has. This will improve the capacity of the intersection to serve more approaching vehicles that occur during peak hours.

Other traffic signals on the study corridor have less traffic on side streets or less traffic in left turn lanes. This allows more time for green lights northbound and southbound that, in turn, allows more traffic to flow. Coupled with lighter traffic north of Juanita-Woodinville Way the remaining signals in the study corridor have less congestion.

100th Avenue NE & NE 132nd Street

In the morning peak period, the southbound and eastbound approaches are the peak directions of travel. In addition to the commuter, local and residential traffic, this intersection also serves the school traffic to and from Juanita Elementary and High Schools, located just east and west of the corridor on NE 132nd Street, respectively.

In the evening peak period, the northbound and westbound approaches are the peak directions of travel. Field observation revealed that the northbound through traffic experiences excessively long delays with queues backing up to the intersection at NE 124th Street. This intersection is the choke point for northbound traffic throughout the entire corridor.

Outstanding Issues

- Long delays and queues in peak directions and travel movements during rush hours
- Inadequate storage space in right-turn pockets in eastbound, westbound, and northbound approaches
- No designated bike facilities

100th Avenue NE & Juanita-Woodinville Way NE

Juanita-Woodinville Way NE, a northeast-southwest corridor, serves residential and commercial areas along the corridor and provides access to I-405. In the morning peak period, the southwest direction through and left-turn are the two heaviest movements of travel. In the evening peak period, the northeast direction through is the heaviest movement, but the southwest direction left-turn carries a large amount of traffic from Juanita-Woodinville Way NE to 100th Avenue NE as well. Turning movement counts showed that over 25% of the northbound traffic on 100th Avenue NE turned right onto Juanita-Woodinville Way NE.

In the morning peak period, the Starbucks located on the west side of 100th Avenue NE attracts more drive through traffic than the business' drive through loop can accommodate. According to reports from the public, this results in vehicles queuing on the west leg of the intersection and blocking the access to other businesses.

Safety concerns have been raised by pedestrians using the crosswalk located at the southeast corner of the intersection to cross the northbound channelized right-turn lane. Attributable factors to the safety concerns could include:

- High speed of the right-turning vehicles
- Poor sight distance caused by existing roadway geometrics and blocking foliage
- Poor location of the yield signs
- Insufficient lighting levels

Outstanding Issues

- Starbucks drive through traffic concerns
- Pedestrian safety concerns crossing the northbound channelized right-turn lane
- No designated bike facilities

100th Avenue NE & NE 137th Street

The peak direction of travel at this intersection is southbound and eastbound in the morning peak period and northbound in the evening peak period. The eastbound and westbound approach each has a shared left-through lane and a right-turn pocket.

The westbound shared left-through lane aligns with the eastbound shared left-through lane creating a conflict point, as shown in Exhibit 5, where through traffic from opposite directions must shift right to avoid running into each other. In addition, drivers using the east leg of the intersection have complained about the speed bump slowing down the progression of the eastbound traffic to cross the intersection when the signal is green.

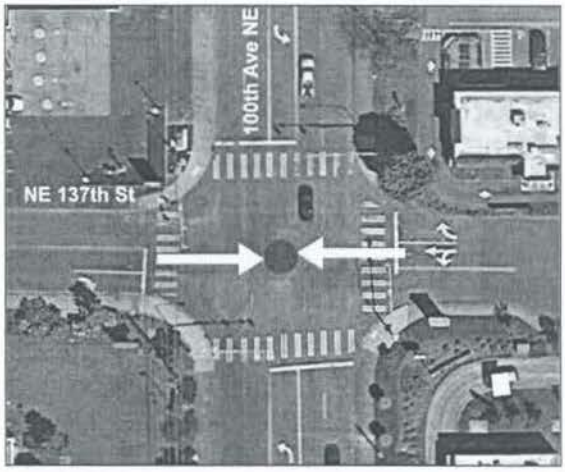

Exhibit 5–100th Avenue NE & NE 137th Street East-West Alignment Conflict

Outstanding Issues

- Conflicting eastbound and westbound channelization and lane alignment
- Slowed progression of westbound traffic on the east leg of the intersection caused by the speed bump on the east leg of the intersection
- No designated bike facilities

100th Avenue NE & Simonds Road NE

Simonds Road NE provides access to the cities of Kenmore and Bothell. It serves residential and commercial areas along the corridor and the school traffic to and from Inglemoor High School, located about 1.2 miles to the west. It also connects to SR 522 around the north end of Lake Washington. The peak direction of travel is southbound and eastbound in the morning peak period and northbound in the evening peak period with a heavy left turn movement from northbound to westbound.

Outstanding Issues

- Unsafe walking conditions across the south leg of the intersection
- No safe place to walk on northwest quadrant of the intersection
- Inadequate southbound right-turn pocket storage
- No designated bike facilities

The intersection has heavy southbound right turn traffic coming from NE 145th Street and heavy eastbound left turn traffic as part of a route between the City of Kenmore and the I-405 interchange at NE 160th Street. The route uses Simonds Road, 100th Avenue NE, NE 145th Street and Juanita-Woodinville Way and can be impacted by regional traffic traveling around the north end of Lake Washington.

In the morning peak period, the southbound right-turn pocket is too short to provide adequate storage space for the southbound right-turn traffic. The heavy eastbound right-turning movement makes it very challenging for pedestrians to cross NE 100th Avenue using the crosswalk on the south leg of the intersection. The southbound paved shoulder approaching the intersection converts to a right turn lane forcing pedestrians to walk in the street or in ungraded tall grass behind the curb for over 100 feet.

100th Avenue NE & NE 145th Street

In the morning peak period, southbound through and northbound right-turn are the two heaviest movements. In the evening peak period, the northbound through and westbound left-turn are the two heaviest movements. Due to the short right-turn pocket, some northbound right-turning traffic is blocked by northbound through traffic. This prevents vehicles from moving to the right-turn pocket and utilizing the right-turn overlap phase.

Outstanding Issues

- Inadequate northbound right-turn pocket storage causes northbound right-turn overlap to be underutilized
- No designated bike facilities

As noted above, this intersection is part of a route between the City of Kenmore and I-405. Much of the traffic using NE 145th Street also uses Simonds Road NE.

Safety

The project team analyzed collision data collected from January 2012 through December 2013. A typical accident analysis looks at three-year collision data. For this corridor study, the 2011 collision data was incomplete, thus was not included in the accident analysis.

A total of 100 collisions were reported during the two-year period for the roadway segment on 100th Avenue NE from NE 132nd Street to south of NE 145th Street. As shown in the collision summary in Exhibit 6, the two most frequent collision types are rear-end and turning-traffic related collisions. The 63 rear-end collisions account for 63% of the total collisions. The most striking pattern is over one third of all collisions occurred between the hours of 3:30 PM and 6:30 PM. These can be related to heavy congestion during these three hours. Another striking pattern is two thirds of the collisions occurred during the dark months of October through March and only one third occurred during the lighter months of April through September. The 20 turning-traffic related collisions account for 20% of the total collisions. The turning-traffic related collisions consist mostly of vehicles turning out of or into driveways or uncontrolled intersections.

Collision Statistics
(January 2012 – December 2013)

- 100 collisions in the two-year period
- Two most frequent accident types are rear-end and turning-traffic related
- 60% of the total collision are rear-end
- 20% of the total collisions are turning-traffic related, consisting mostly of vehicles turning out of or into driveways or uncontrolled intersection
- 1/3 of all collisions occurred between 3:30 PM and 6:30 PM
- 2/3 of all collisions occurred during the dark months of October through March
- Three accidents involved pedestrians
- All signalized intersections averaged five or more collisions per year

In addition, according to the collision data, three pedestrian accidents were reported during the two year period. Two were caused by vehicles failing to yield to pedestrians in crosswalks at the signalized intersection of NE 137th Street. The third was caused by a vehicle using the roadway shoulder to bypass another vehicle and hitting a pedestrian walking on the roadway shoulder. All three pedestrian collisions occurred during hours of darkness when the pavement was wet.

According to City of Kirkland's criteria, there is no high-accident location along the corridor.

Accident Location	All Types	Rear End	Turn Related	Fixed Object	Side Swipe	Disregard Signal	Pedestrian Involved
132nd St & 100th Ave	17	10	2	0	0	5	0
132nd to Juan-Wood	7	5	2	0	0	0	0
Juan-Wood & 100th Ave	10	6	3	1	0	0	0
Juan-Wood to 137th St	8	2	5	1	0	0	0
137th St & 100th Ave	16	10	2	0	0	2	2
137th St to Simons Rd	18	16	2	0	0	0	0
Simons Rd & 100th Ave	16	8	4	1	1	2	0
Simons Rd to 145th St	8	6	0	1	0	0	1
Total	**100**	**63**	**20**	**4**	**1**	**9**	**3**

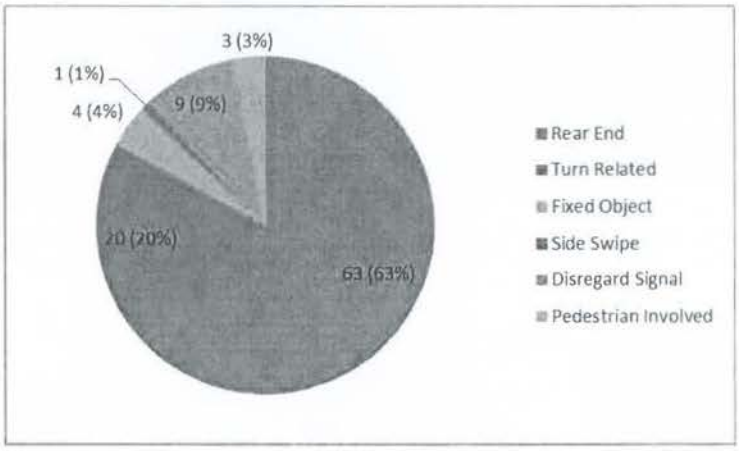

Exhibit 6–Collision Summary (January 2012 to December 2013)

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Active Transportation

Pedestrian crosswalks are provided at all signalized intersections with push-button actuated pedestrian walk phases. All signalized pedestrian crossings provide WALK (Walking Man) displays concurrently with parallel green displays for vehicles. This poses safety concerns for pedestrians when heavy right turn traffic turns through crosswalks. Most of the curb ramps do not meet current ADA standards. Sidewalk is provided on both sides of the corridor from NE 132nd Street to NE 140th Street. Between NE 140th Street and NE 145th Street, a combination of paved shoulders and two segments of sidewalk are provided for pedestrian walkways. One segment of the sidewalk is located on the west side of the corridor from the Simonds Road NE intersection south about 250 feet. The other segment is located on the east side of the corridor from NE 145th Street south about 300 feet.

Throughout the corridor, non-motorized traffic is required to use sub-standard sidewalk, paved shoulder directly adjacent to motorist traffic, unpaved shoulder, or ungraded areas for their travel needs. For example, the southbound right turn pocket at Simonds Road completely takes away the paved shoulder and forces pedestrians onto the landscaping. This poses safety concerns to pedestrians and bicyclists travelling on the corridor. Low lighting levels and poor lighting uniformity put pedestrians and bicyclists at risk during hours of darkness.

Outstanding Issues

- No continuous sidewalk along the corridor
- Low lighting levels with poor uniformity
- No designated bike facilities

Midblock Accessibility

Left-turning traffic onto side streets at unsignalized intersections or into driveways utilizes the two-way-left-turn lanes where available. In areas north of NE 139th Street, where there are no two-way-left-turn lanes, left-turning traffic sit in the through lane waiting for adequate gaps in the opposing traffic.

Impatient drivers queued behind the left-turning traffic sometimes use the paved shoulder to pass. Vehicular traffic using the paved shoulder poses a safety concern for pedestrians and bicyclists using the paved shoulders. This can be more problematic at night in areas with poor lighting.

Long traffic queues during peak hours make access from unsignalized intersections or driveways difficult or hazardous.

Outstanding Issues

- Lack of storage space for left-turning traffic at midblock or unsignalized intersection slows down traffic progression and creates an unsafe travel environment for non-motorized traffic using paved shoulders
- Access between 100th Avenue NE and adjacent properties or side streets can be difficult or hazardous during heavy traffic hours

Transit

King County Metro Transit (Metro) provides public transit service along the 100th Avenue NE corridor. Buses routes, connecting City of Kirkland to other cities, operate on some segments of the study corridor include:

- Route 234/235: operates all day between Kenmore and Bellevue through Kirkland
- Route 238: operates all day between Kirkland and Bothell
- Route 244: operates during morning peak period between Redmond and Kenmore through Kirkland
- Route 257: operates during morning peak period between Downtown Seattle and Kingsgate through Kirkland
- Route 260: operates during morning peak period between Downtown Seattle and Finn Hill in Kirkland. This route is scheduled to be removed in September 2014.

CORRIDOR PLAN

The recommended Corridor Plan includes a variety of projects that meet the objectives of the study. These projects would improve traffic operations, safety, and midblock accessibility immediately as well as provide a long-term path forward to improve the corridor performance into the future. These recommended projects are shown in Exhibit 7 and described in the following subsections.

The Corridor Plan does not recommend the addition of auto travel lanes to accommodate or attract more auto traffic, but the intersections with operational or safety issues will need treatments in order to improve the overall corridor safety and operational performance.

PROJECT 1: 100TH AVENUE NE & NE 145TH STREET

Recommended project identified to improve traffic operations at this intersection include:

- Extend the northbound right-turn pocket to NE 144th Lane.

PROJECT 2: 100TH AVENUE NE & SIMONDS ROAD NE

Recommended projects identified to improve traffic operations and pedestrian safety at this intersection include:

- Extend southbound right-turn pocket to NE 144th Lane.
- Provide an eastbound right-turn overlap phase with northbound protected left-turn phase.
- Provide advance signing (MUTCD R10-15) to remind eastbound vehicular traffic that it is the law for right turning vehicles to yield to pedestrians when proceeding on a green ball.

MUTCD R10-15

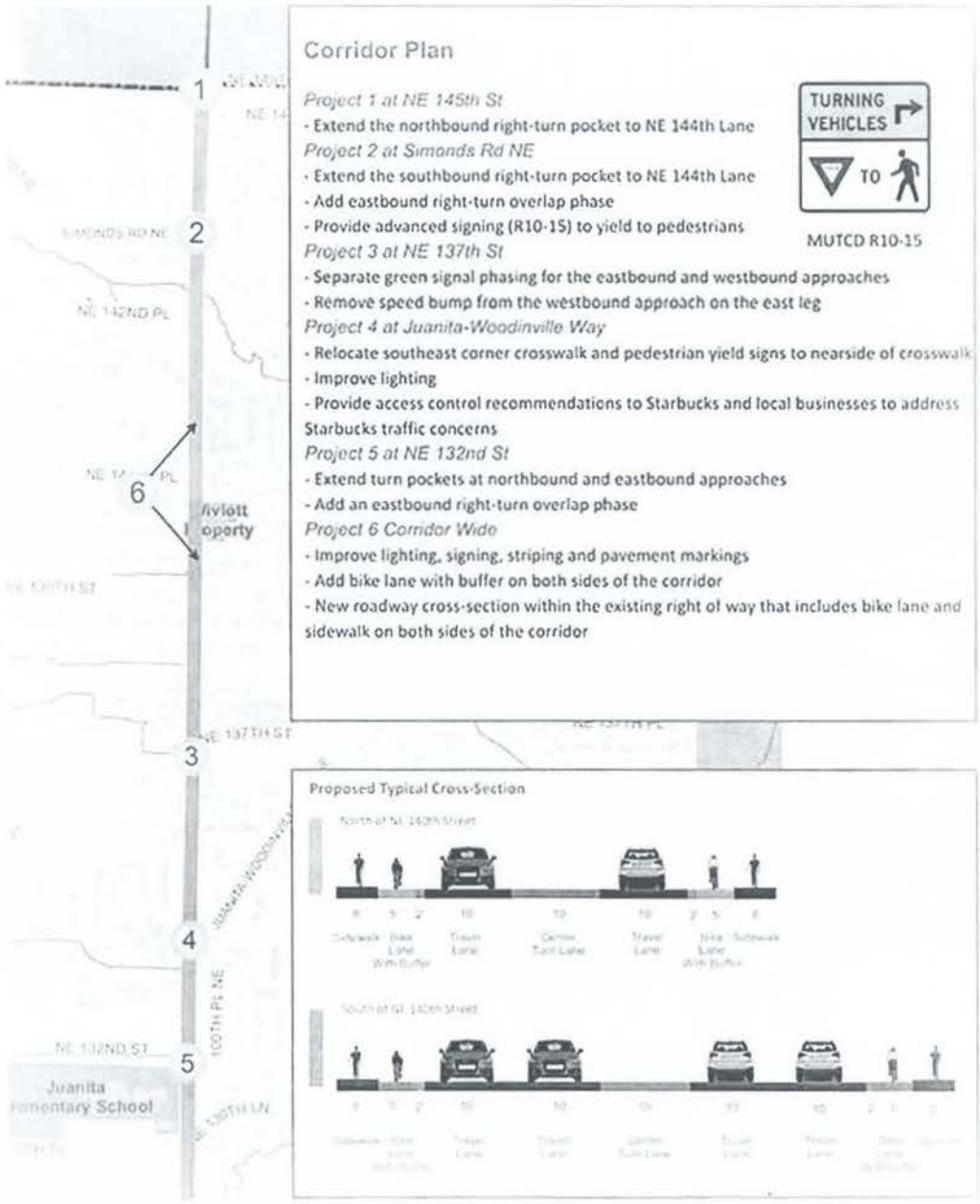

Exhibit 7–Corridor Plan

PROJECT 3: 100TH AVENUE NE & NE 137TH STREET

Potential improvements identified to improve the safety of eastbound and westbound traffic operations include the following three options demonstrated in Exhibit 8. The benefit of these options is improved safety; however, the intersection will operate less efficiently with longer delays for traffic.

Option 1 – this option changes the eastbound and westbound concurrent green signal phasing to separate green signal phasing to eliminate conflicts caused by the alignment issues. This will improve safety, but reduce the efficiency of the intersection operations causing longer signal delays.

Option 2 – this option rechannelizes the eastbound and westbound approaches to a left-turn only lane and a shared right-through lane. Some citizens at the public meeting preferred to keep the eastbound right only lane due to high traffic demand.

Option 3 – this option rechannelizes the westbound approach to a shared left-through-right lane and convert the existing westbound through and left lane to an eastbound incoming lane. Channelization for eastbound approach stays unchanged. However, this option will likely cause the traffic signal to remain red longer for northbound and southbound traffic because westbound traffic will need longer green displays to disperse all the traffic in one lane.

After taking into account public comments, Option 1 was recommended.

With respect to the slowed westbound traffic progression caused by the speed bump located on the east leg of the intersection, removal of the speed bump from the westbound approach on the east leg is desirable.

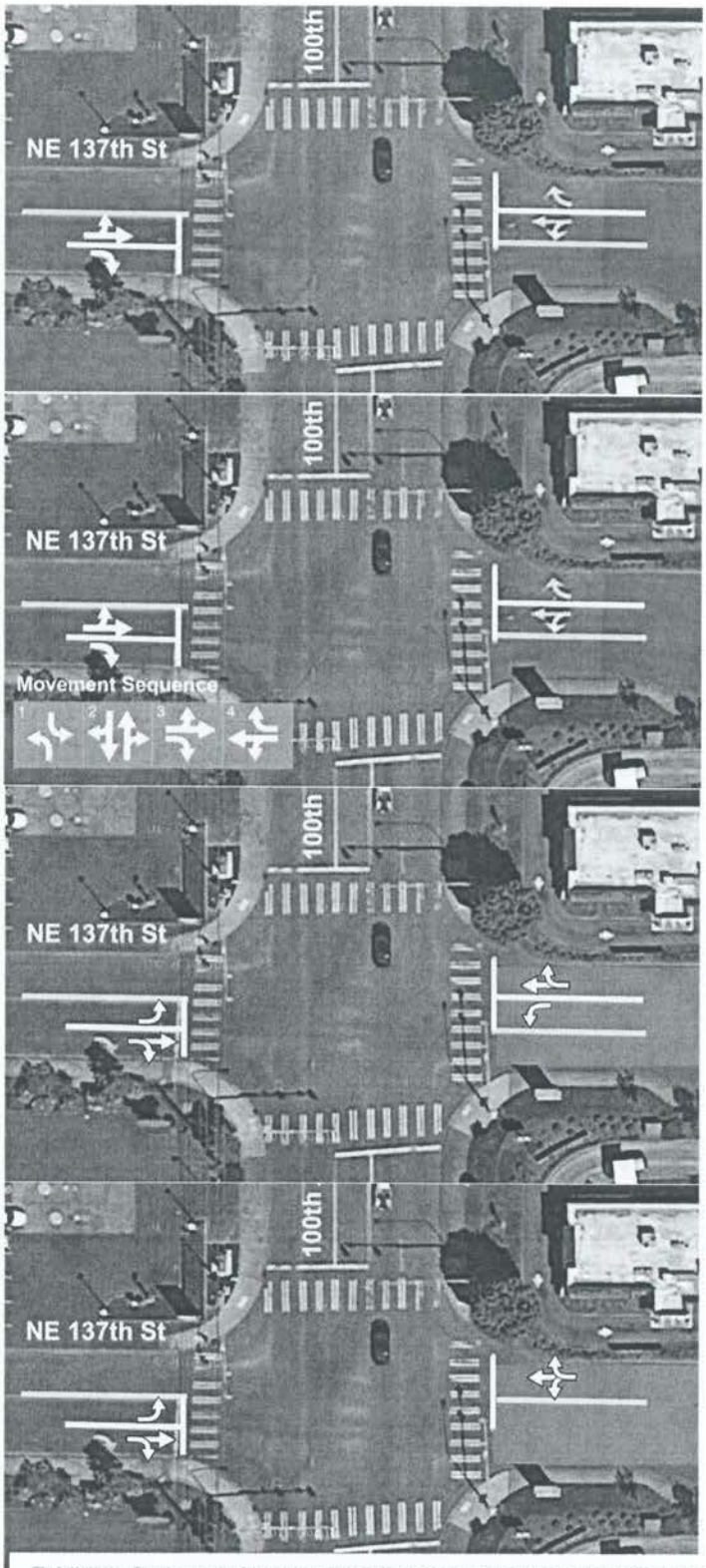

Exhibit 8–Options to Resolve Existing East-West Alignment Conflict

Existing: eastbound and westbound alignment is problematic with concurrent phasing.

Option 1: change the eastbound and westbound concurrent phasing to separate green signal phasing to eliminate conflicts caused by the alignment issues.

Option 2: rechannelize the eastbound and westbound approaches to a left-turn only lane and a shared right-through lane.

Option 3: rechannelize the westbound approach to a shared left-through-right lane and convert the existing westbound through and left lane to an eastbound incoming lane

PROJECT 4: 100TH AVENUE NE & JUANITA-WOODINVILLE WAY NE

Recommended projects to improve pedestrian safety at the crosswalk on the east leg include:

- Relocate the southeast corner crosswalk closer to 100th Ave NE to make crossing pedestrians visible to northbound traffic and non-motorized traffic.
- Relocate the pedestrian yield signs from the far side to the near side of the crosswalk.
- Install additional lighting on the nearside of the crosswalk to better illuminate the sidewalk and pedestrians crossing.

Some access control ideas that could address Starbucks and local businesses traffic concerns include:

- Starbucks to find ways to expeditiously serve drive through customers during hours when traffic could block the intersection.
- Starbucks drive through customers to enter at NE 134th Court and queue across the parking stalls in front of 7-Eleven (Exhibit 9).
- Collaborate with 7-Eleven to develop a time-of-day usage of the parking stalls for Starbucks drive through customers.
- Change the drive through loop from counterclockwise to clockwise and have drive through customers enter from the driveway south of the intersection and exit from the west leg of the intersection (Exhibit 9).

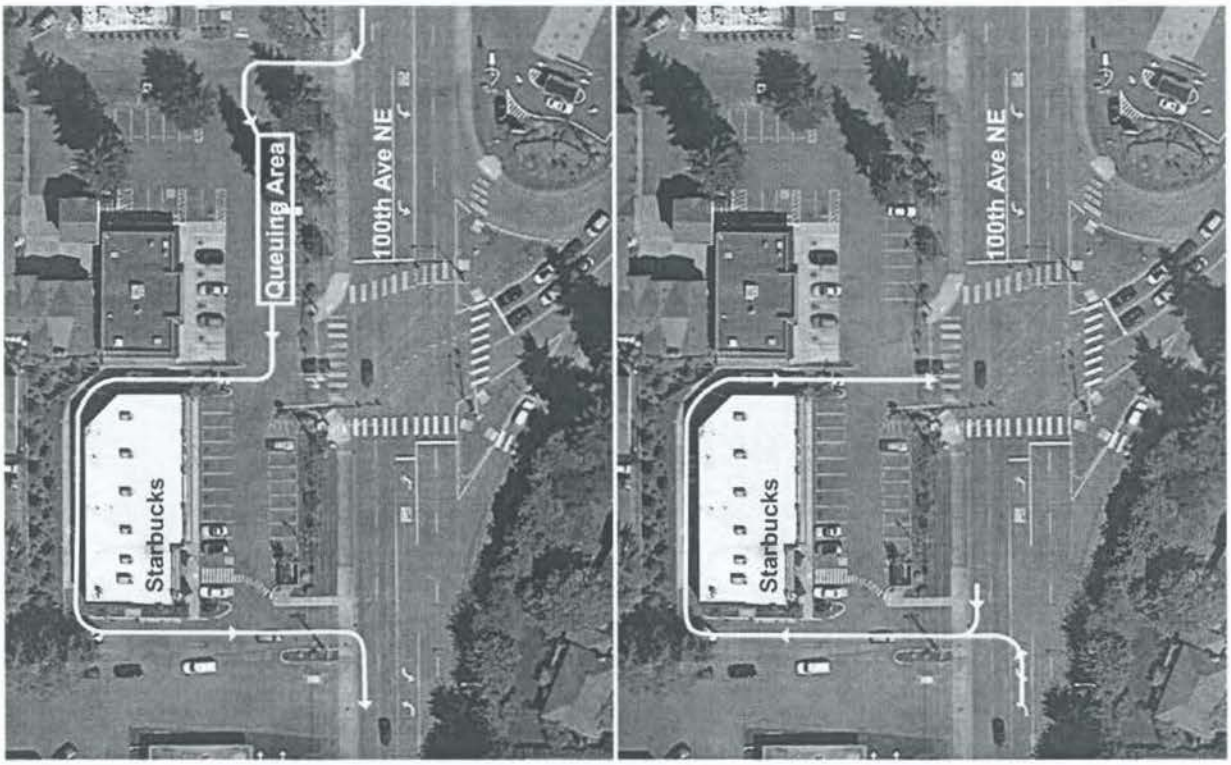

Exhibit 9– Ideas to Address Starbucks Drive Through Issue

PROJECT 5: 100TH AVENUE NE & NE 132ND STREET

Recommended improvements identified to improve traffic operations at this intersection are conceptually illustrated in Exhibit 10 and listed as follows:

- Extend the northbound right-turn pocket and left-turn pocket to 350 feet long.
- Extend the eastbound right-turn pocket from 165 feet to 500 feet and add an eastbound right-turn overlap (eastbound green right -turn arrow operating simultaneously with the northbound left -turn green arrow) to the traffic signal.

With the extended turn pockets, the turning vehicles would be able to get out of the way of the through traffic sooner to improve the progression of the traffic through the intersection. These improvements were simulated using Synchro. With the proposed improvements, during the morning peak hour conditions, the overall intersection delay would decrease slightly with the

intersection operating at LOS D. For the evening peak hour conditions, the overall intersection delay would decrease by 5.5 seconds with the intersection operating at LOS E. LOS E is considered acceptable operating conditions on an arterial corridor by the City of Kirkland. The modeled results are included in Appendix B and the Synchro outputs are included in Appendix C.

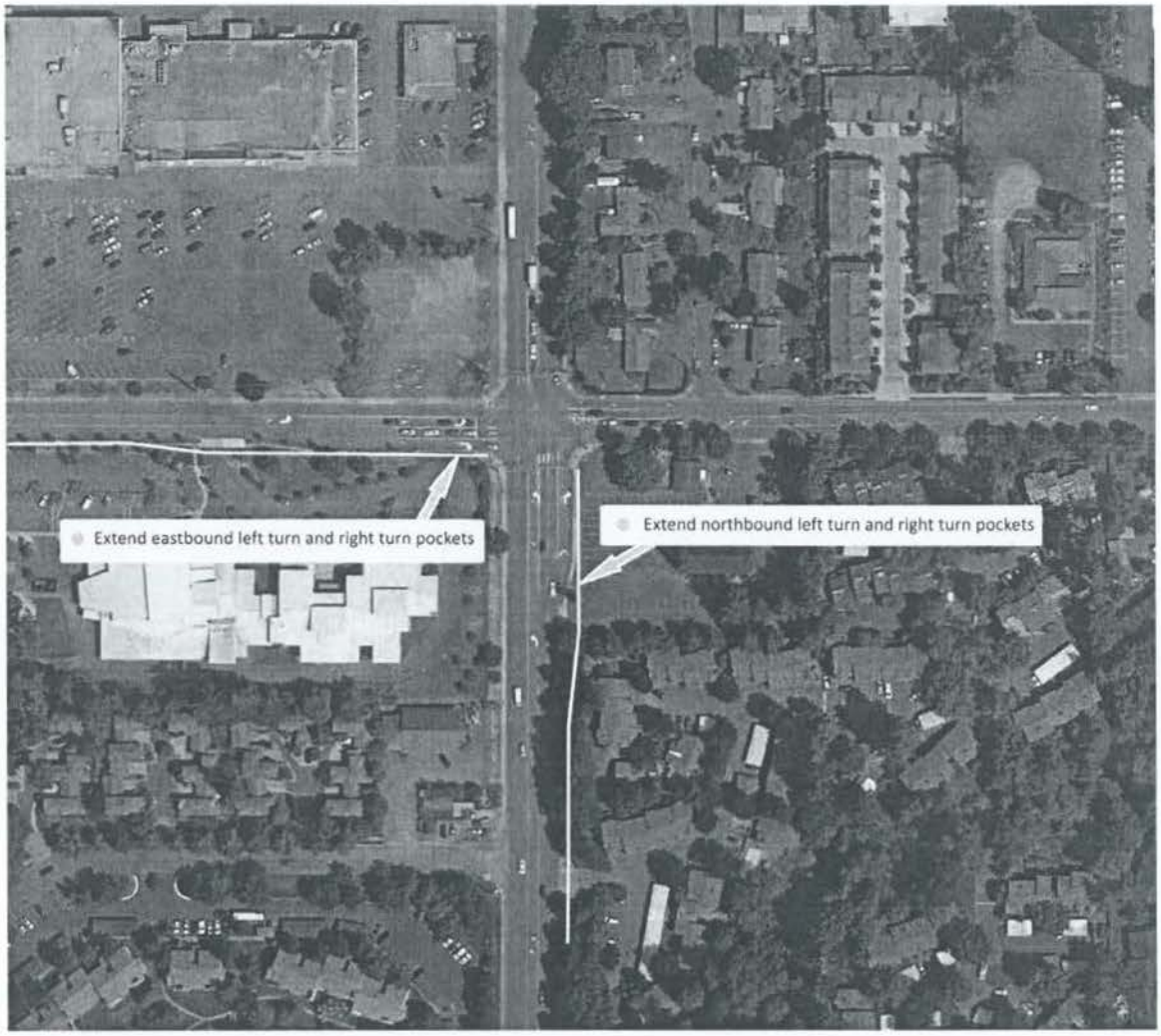

Exhibit 10–100th Avenue NE & NE 132nd Street Intersection Improvements Schematic

PROJECT 6: CORRIDOR-WIDE

Recommended projects identified to improve corridor-wide pedestrian and bicycle mobility and safety, and midblock accessibility along the corridor include:

- Provide buffered bicycle lane on both sides of the study corridor.
- Install new sidewalk segments and improve existing sidewalks to provide continuous pedestrian walk path along both sides of the corridor.
- As part of widening street for new bicycles lanes and sidewalks, replace or modify existing culvert for Juanita Creek tributary crossing of 100th Avenue south of Simonds Road intersection to support the wider street and allow fish passage.
- Provide a two-way-left-turn lane between the existing two-way-left-turn lane south of 138th Street and Simonds Road.
- Enhance street lighting by installing new street lights.
- Provide and enhance signing, striping and pavement markings to improve visibility of the markings during dark or wet conditions.

STREET LIGHTING

Street lighting along the entire corridor should be improved to meet the City's standards. A planning level lighting analysis was conducted using the Roadway Optimizer function of the lighting analysis software AGI32. An American-made roadway luminaire that has 120 LEDs was used as the test luminaire for the analysis. According to IESNA American National Standard Practice for Roadway Lighting (RP-8-00), minimum light level of 1.5 fc is desired for the study corridor with a maximum uniformity ratio of 3.0. To meet these requirements, Roadway Optimizer calculated a luminaire spacing of approximately 200 feet on both sides of a 60-foot wide corridor with a 35-foot mounting height, an 8-foot arm, and a 3-foot setback from the curb face. These parameters will need to be further adjusted and refined during the street lighting design phase.

PROPOSED ROADWAY CROSS-SECTION

The recommended typical roadway cross-section along the corridor is shown in Exhibit 11. The cross-section assumes no on-street parking, which is consistent with the current condition along the study corridor.

North of NE 140th Street, the cross-section includes:

- One 10-foot travel lane in each direction
- One 10-foot two-way-left-turn lane or turn lane
- One 5-foot bicycle lane on both sides, with a 2-foot buffer separating the bicycle lane from the travel lane
- One 8-foot sidewalk on both sides

The width of the existing right-of-way (ROW) north of NE 140th Street varies from 60.7 feet to 99.4 feet. This typical cross-section (60 feet) fits within the existing roadway right-of-way. From the traffic operations perspective, the Synchro models showed that the intersections would operate at LOS E or better with the three travel lane cross-section (Appendices B and C).

Recommendations from the Public and Stakeholders

- Provide at least 5' bike lanes along the entire project from NE 132nd Street to NE 145th Street with a long-term plan to create buffered or protected bike lanes in the corridor.
- Develop a design that expands the roadway in its most constricted form from the current 40 feet to fully utilize the City owned right-of-way.
- Continue to work on minimizing conflicts between turning vehicles and those traveling by bike or walking as the design process moves forward.

South of NE 140th Street, the cross-section includes:

- Two 10-foot travel lanes in each direction
- One 10-foot two-way-left-turn lane or turn lane
- One 5-foot bicycle lane on both sides, with a 2-foot buffer separating the bicycle lane from the travel lane
- One 8-foot sidewalk on both sides

The width of the existing ROW south of NE 140th Street varies from 93.1 feet to 108 feet. This typical cross-section (80 feet) fits within the existing roadway right-of-way. From the traffic operations perspective, the Synchro models showed that the intersections would operate at LOS E or better with the five travel lane cross-section (Appendices B and C).

In addition, considering the many turning movements and multiple driveways on the study corridor, the bicycle lane design should also consider bike boxes, tightening intersections, skip striping through intersections, and other tools to ensure safety of all users along the corridor.

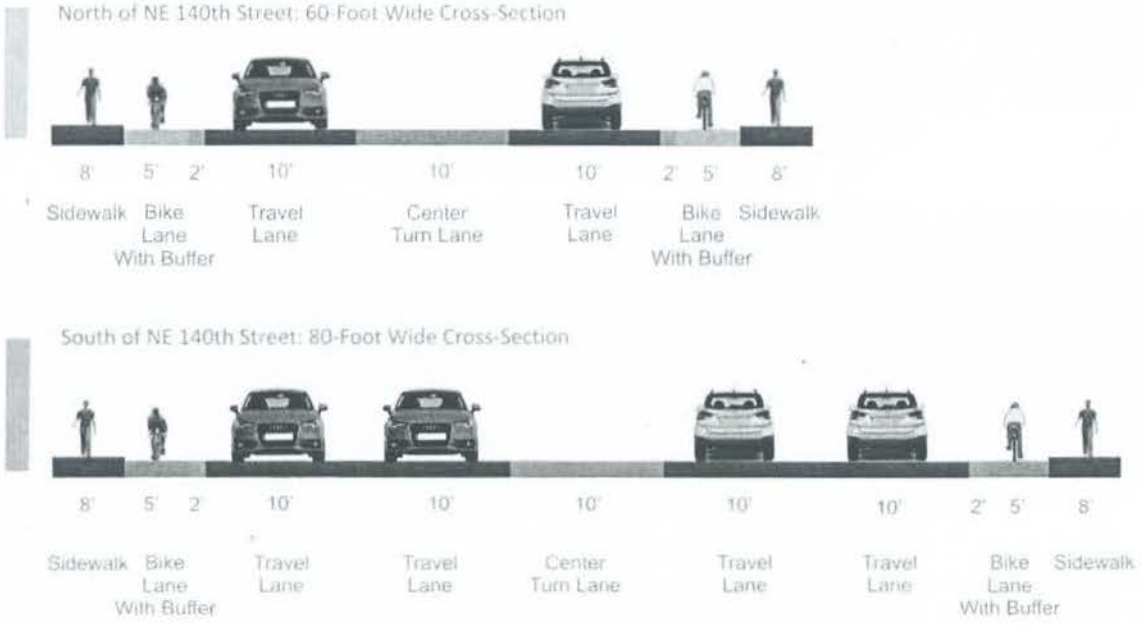

Exhibit 11–Recommended Typical Cross-Section

ESTIMATED COST

The recommended improvements were grouped into four itemized categories for cost estimating. The total cost of the recommended improvements is about $13.5 million including both design and construction and all related incidental costs.

More than half ($7.35 million) of the cost is to provide the intersection improvements. Building the roadway improvement will cost about 33% ($4.4 million) of the total estimated cost.

DESIGN				ENGINEER'S ESTIMATE	
ITEM NO	DESCRIPTION	QTY	UNIT	UNIT PRICE	EXTENSION
1	Intersection Design	4	Intersection	$350,000	$1,400,000
2	Roadway Improvements Design	1	LS	$550,000	$550,000
3	Culvert Design	1	LS	$136,000	$136,000
4	ITS Design	5	Intersection	$60,000	$300,000
	PE Cost Estimate (Apprx. 10% of PE Costs based on past similar projects - federal)				$225,000
	Culvert PE Cost Estimate				$54,000
	Culvert Permit Fees				$5,000
	WSDOT Admin				$2,100
	15% Contingency of Design				$357,900
				Subtotal:	**$3,030,000**

CONSTRUCTION				ENGINEER'S ESTIMATE	
ITEM NO	DESCRIPTION	QTY	UNIT	UNIT PRICE	EXTENSION
1	Intersection	5	Intersection	$800,000	$4,000,000
2	Roadway Improvements	1	LS	$2,000,000	$2,000,000
3	Culvert	1	LS	$425,000	$425,000
4	ITS	5	Intersection	$71,000	$355,000
	CE Cost Estimate (Apprx. 15% of CN Costs based on past similar projects - federal)				$635,500
	Roadway Inspection (Apprx. 15% of CN Costs)				$953,250
	Culvert Insepection				$50,000
	WSDOT Admin				$2,250
	30% Contingency of Construction				$2,034,000
				Subtotal:	**$10,455,000**

DESIGN + CONSTRUCTION				ENGINEER'S ESTIMATE	
ITEM NO	DESCRIPTION	QTY	UNIT	UNIT PRICE	EXTENSION
1	Intersection	4/5	Intersection	$1,470,218	$7,351,088
2	Roadway Improvements	1	LS	$4,441,838	$4,441,838
3	Culvert	1	LS	$818,988	$818,988
4	ITS	5	Intersection	$174,618	$873,088

TOTAL Project Budget:	**$13,485,000**

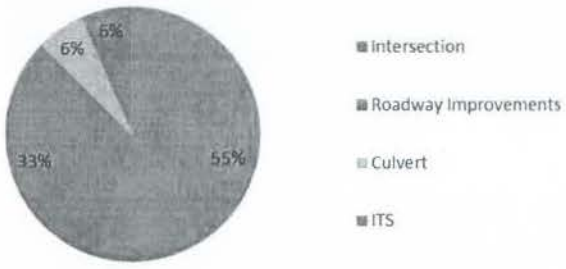

Exhibit 12–Estimated Cost

MEETING OBJECTIVES

The recommended improvements will meet the stated objectives and satisfy most of the requests received from the general public and stakeholders.

Exhibit 13–Meeting Objectives

Objective or Request from the Public	Recommended Improvements
Improve safety in the corridor, especially for bicycles and pedestrians	– Provide separated sidewalks and bicycle lanes with 2-foot buffer from auto travel lanes on both sides of the study corridor to improve travel environment and safety for bicycles and pedestrians – Separate green signal phasing for the eastbound and westbound traffic at 100th Avenue NE and NE 137th Street to resolve alignment conflict issue – Provide two-way-left-turn lane throughout the study corridor to improve midblock accessibility and safety – Improve lighting along the study corridor to improve visibility – Trim vegetation for better visibility – Improve signing, striping, and pavement markings to improve visibility during wet conditions
Reduce congestion, but not interested in adding lanes for auto traffic	– Intersection improvements at 100th Avenue NE and NE 132nd Street to alleviate congestion during rush hours – Extend turn pockets for more storage space at locations where turning traffic blocks other movements – Provide signal overlap phase to increase intersection capacity – Propose ideas that could address local businesses traffic concerns caused by the Starbucks drive through traffic
Improve midblock accessibility and safety	– Provide two-way-left-turn lane throughout the study corridor to improve midblock accessibility and safety – Improve signing, striping, and pavement markings to improve visibility during wet conditions

LONG-TERM IMPROVEMENTS

Looking at 20-year horizon, to further improve the corridor traffic operations to accommodate future growth, the potential long-term improvements could include:

- Add a through lane in the northbound direction from NE 139th Street to NE 145th Street
- Add a through lane in the southbound direction from NE 145th Street to NE 140th Street
- Provide protected bicycle lane that separate bicycles and vehicles via a protected barrier on both sides of the corridor

These long-term improvements will improve the operations and safety of the non-motorized traffic and likely improve the motorized traffic operations north of NE 139th Street. However, without increasing the intersection capacity at 100th Avenue NE and NE 132nd Street, the intersection will still be the choke point along the corridor metering the southbound and northbound traffic in the morning and evening rush hours, respectively.

APPENDIX A – VOLUMES

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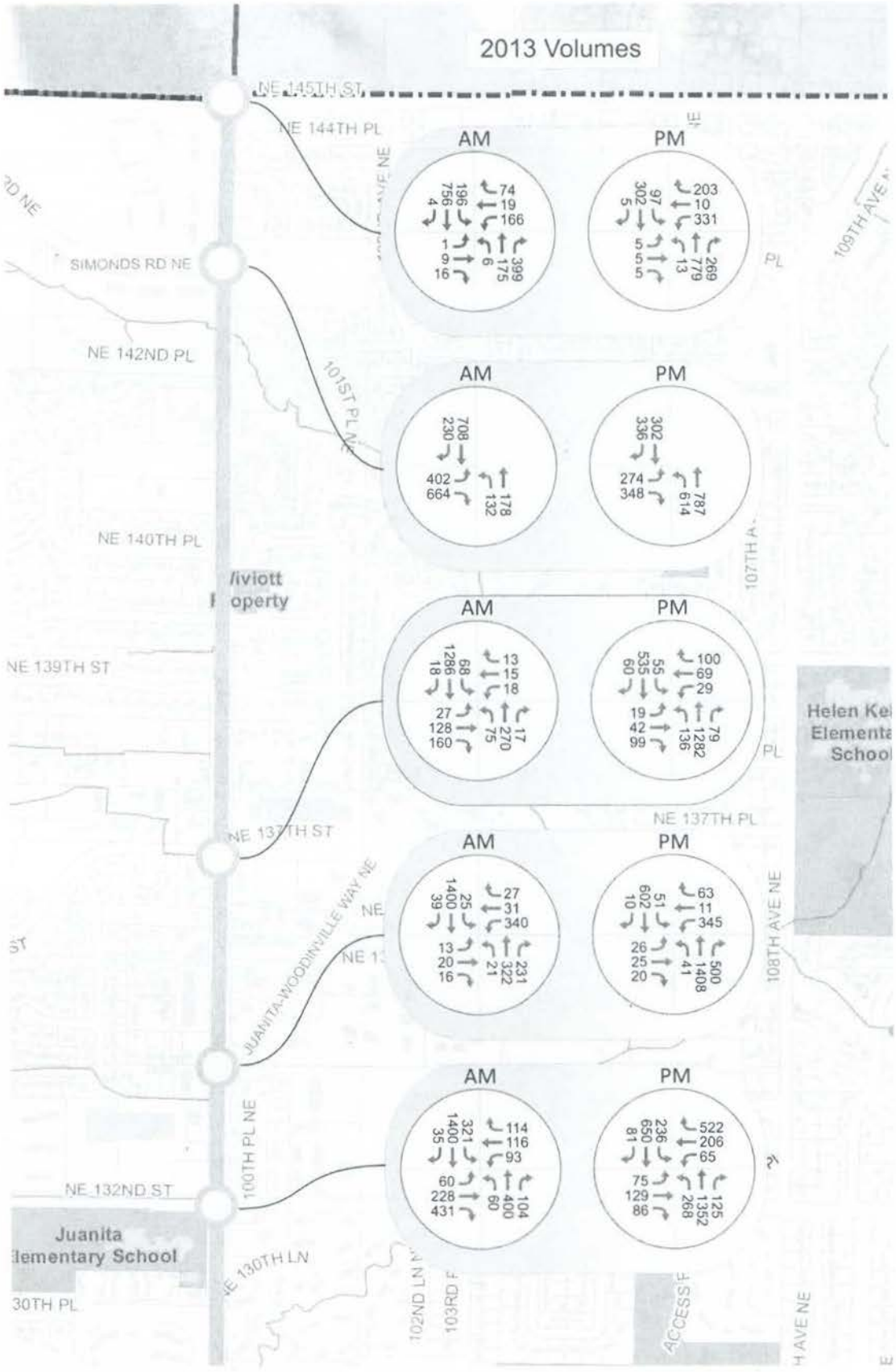
ENGINEERING



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APPENDIX B – SUMMARY OF MOES

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2013 MOEs for 2013 Existing Conditions and 2013 with Recommended Plan

		Intersection		Approach Delay								Longest Q95	
				Eastbound		Westbound		Northbound		Southbound			
		LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	Movement	Length (feet)
Existing	***AM Peak***												
	100th Ave NE & NE 132nd St	D	40.2	E	58.4	D	42.5	D	36.9	C	34.0	SBT	#874
	100th Ave NE & Juan-Wood Way	C	26.6	D	53.6	D	50.8	A	5.5	C	27.2	SBT	839
	100th Ave NE & 137th St	B	14.3	D	47.4	D	37.5	A	5.8	A	7.3	SBT	#284
	100th Ave NE & Simonds Rd	E	63.3	F	102.5	C	21.0	C	31.1	-	-	EBR	#828
	100th Ave NE & NE 145thSt	C	25.0	D	40.1	E	60.2	B	10.4	C	20.9	SBT	814
	PM Peak												
	100th Ave NE & NE 132nd St	E	63.5	D	48.2	F	109.9	E	60.2	D	36.5	NBT	#799
	100th Ave NE & Juan-Wood Way	B	15.3	E	56.5	D	48.1	A	8.6	A	7.6	NBT	#464
	100th Ave NE & 137th St	B	10.6	D	36.2	D	46.5	A	6.3	A	2.9	NBT	265
	100th Ave NE & Simonds Rd	C	20.7	C	33.5	B	15.8	B	18.5	-	-	NBL	502
	100th Ave NE & NE 145thSt	C	29.9	D	52.3	C	33.2	C	30.3	C	23.2	NBT	#1136
Recommended Plan	***AM Peak***												
	100th Ave NE & NE 132nd St	D	39.8	E	60.9	D	49.5	C	31.0	C	32.6	SBT	685
	100th Ave NE & Juan-Wood Way	B	17.1	D	53.6	E	73.1	A	5.3	A	4.7	WBT	276
	100th Ave NE & 137th St	C	21.0	D	44.5	D	50.9	B	15.6	B	15.4	SBT	m500
	100th Ave NE & Simonds Rd	E	56.1	E	75.5	B	11.2	D	48.5	-	-	SBT	#956
	100th Ave NE & NE 145thSt	C	23.7	D	44.1	E	70.4	A	2.7	B	19.2	SBT	772
	PM Peak												
	100th Ave NE & NE 132nd St	E	58.0	D	51.0	F	87.8	E	56.5	D	38.4	WBR	#773
	100th Ave NE & Juan-Wood Way	B	17.2	E	56.5	E	69.2	A	5.7	B	10.5	WBT	273
	100th Ave NE & 137th St	A	9.0	D	39.4	D	45.0	A	1.8	A	6.1	WBT	151
	100th Ave NE & Simonds Rd	B	15.5	C	34.9	A	5.9	B	16.8	-	-	EBL	352
	100th Ave NE & NE 145thSt	C	30.4	D	55.0	D	53.2	C	24.6	B	14.3	NBT	#825

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APPENDIX C – SYNCHRO OUTPUTS

Lanes, Volumes, Timings
2: 100th Ave NE & NE 131st Way/132nd St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	228	431	93	116	114	60	400	104	321	1400	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	11	12	12	12	12
Grade (%)		-2%			2%			6%			0%	
Storage Length (ft)	185		165	180		160	215		105	230		0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1805	1900	1615	1718	1809	1500	1717	3319	1536	1787	3556	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1799	1900	1545	1678	1809	1474	1713	3319	1432	1739	3556	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			183			161			105		2	
Link Speed (mph)		25			35			35			35	
Link Distance (ft)		2034			2370			2708			681	
Travel Time (s)		55.5			46.2			52.8			13.3	
Confl. Peds. (#/hr)	2		19	19		2	7		16	16		7
Confl. Bikes (#/hr)						4						
Peak Hour Factor	0.99	0.99	0.99	0.71	0.71	0.71	0.95	0.95	0.95	0.88	0.88	0.88
Heavy Vehicles (%)	1%	1%	1%	4%	4%	4%	2%	2%	2%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	6	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	61	230	435	131	163	161	63	421	109	365	1631	0
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	3	8		7	4	1	5	2	7	1	6	
Permitted Phases			8			4			2			
Detector Phase	3	8	8	7	4	1	5	2	7	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	15.0	32.0	32.0	15.0	27.0	15.0	15.0	29.0	15.0	15.0	29.0	
Total Split (s)	17.0	36.0	36.0	18.0	37.0	45.0	16.0	41.0	18.0	45.0	70.0	
Total Split (%)	12.1%	25.7%	25.7%	12.9%	26.4%	32.1%	11.4%	29.3%	12.9%	32.1%	50.0%	
Yellow Time (s)	5.0	5.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.9	-1.9	-1.9	-1.9	-1.9	-1.1	-1.1	-1.1	-1.9	-1.1	-1.4	
Total Lost Time (s)	4.6	4.6	4.6	3.1	3.1	3.9	3.9	3.9	3.1	3.9	3.6	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	None	None	C-Max	
Act Effct Green (s)	10.4	29.4	29.4	14.2	35.5	69.0	10.0	46.7	61.7	34.2	73.2	
Actuated g/C Ratio	0.07	0.21	0.21	0.10	0.25	0.49	0.07	0.33	0.44	0.24	0.52	
v/c Ratio	0.46	0.58	0.93	0.76	0.36	0.20	0.51	0.38	0.16	0.84	0.88	
Control Delay	72.6	55.5	58.0	87.2	46.0	2.7	76.8	39.1	5.6	68.0	24.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	
Total Delay	72.6	55.5	58.0	87.2	46.0	2.7	76.8	39.1	5.6	68.0	26.4	
LOS	E	E	E	F	D	A	E	D	A	E	C	
Approach Delay		58.4			42.5			36.9			34.0	
Approach LOS		E			D			D			C	
Queue Length 50th (ft)	54	186	240	117	123	0	56	160	2	273	732	

Lanes, Volumes, Timings
2: 100th Ave NE & NE 131st Way/132nd St

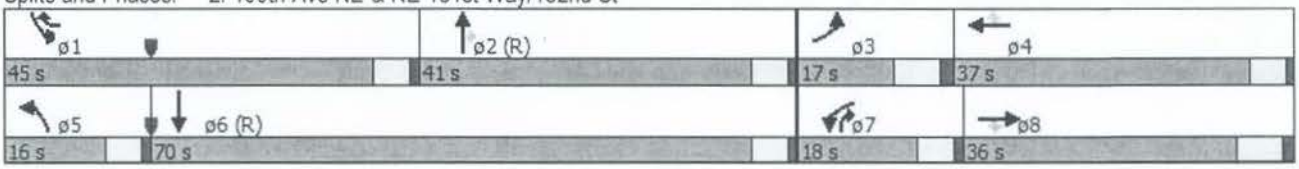
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	102	275	#438	146	148	12	105	224	40	368	#874	
Internal Link Dist (ft)		1954			2290			2628			601	
Turn Bay Length (ft)	185		165	180		160	215		105	230		
Base Capacity (vph)	159	426	488	182	459	879	148	1106	707	524	1861	
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	105	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.38	0.54	0.89	0.72	0.36	0.18	0.43	0.38	0.15	0.70	0.93	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 130 (93%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 40.2 Intersection LOS: D
Intersection Capacity Utilization 84.0% ICU Level of Service E
Analysis Period (min) 15
Description: Overlap A :1; Ovl B:7
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: 100th Ave NE & NE 131st Way/132nd St



Lanes, Volumes, Timings
3: 100th Ave NE & Juanita-Woodinville Wy

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	20	16	340	31	27	21	322	231	25	1400	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		25	225		80	85		75	120		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	25			50			25			50		
Satd. Flow (prot)	1805	1753	0	1665	1682	1568	1770	3504	1583	1787	3536	0
Flt Permitted	0.950			0.950	0.960		0.102			0.498		
Satd. Flow (perm)	1799	1753	0	1658	1677	1533	190	3504	1493	922	3536	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17				94			233		3	
Link Speed (mph)		25			35			35			35	
Link Distance (ft)		1167			5713			681			1039	
Travel Time (s)		31.8			111.3			13.3			20.2	
Confl. Peds. (#/hr)	2		5	2		5	1		9	9		1
Confl. Bikes (#/hr)			2						1			
Peak Hour Factor	0.94	0.94	0.94	0.84	0.84	0.84	0.88	0.88	0.88	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	5	0	0	3	0
Shared Lane Traffic (%)				46%								
Lane Group Flow (vph)	14	38	0	219	223	32	24	366	262	29	1654	0
Turn Type	Split	NA		Split	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	8	8		7	7			2		1	6	
Permitted Phases						7	2		2	6		
Detector Phase	8	8		7	7	7	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	27.0	27.0		26.0	26.0	26.0	23.0	23.0	23.0	13.0	23.0	
Total Split (s)	27.0	27.0		40.0	40.0	40.0	60.0	60.0	60.0	13.0	73.0	
Total Split (%)	19.3%	19.3%		28.6%	28.6%	28.6%	42.9%	42.9%	42.9%	9.3%	52.1%	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	C-Max	C-Max	C-Max	None	C-Max	
Act Effct Green (s)	7.5	7.5		24.5	24.5	24.5	91.6	91.6	91.6	98.0	98.0	
Actuated g/C Ratio	0.05	0.05		0.18	0.18	0.18	0.65	0.65	0.65	0.70	0.70	
v/c Ratio	0.15	0.35		0.75	0.76	0.09	0.19	0.16	0.25	0.04	0.67	
Control Delay	65.5	49.2		54.2	54.6	1.4	13.8	7.9	1.6	12.9	27.2	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	
Total Delay	65.5	49.2		54.2	54.6	1.4	13.8	7.9	1.6	12.9	27.4	
LOS	E	D		D	D	A	B	A	A	B	C	
Approach Delay		53.6			50.8			5.5			27.2	
Approach LOS		D			D			A			C	
Queue Length 50th (ft)	12	19		112	114	0	4	35	0	13	693	
Queue Length 95th (ft)	36	56		137	140	2	14	57	8	m28	839	
Internal Link Dist (ft)		1087			5633			601			959	

Lanes, Volumes, Timings
3: 100th Ave NE & Juanita-Woodinville Wy

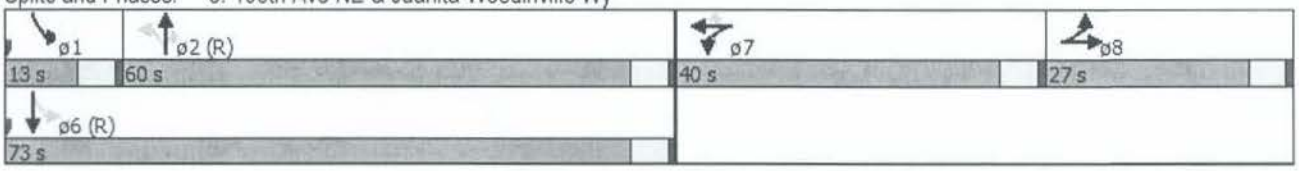
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)				225		80	85		75	120		
Base Capacity (vph)	296	302		428	432	464	124	2292	1057	701	2477	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	267	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.05	0.13		0.51	0.52	0.07	0.19	0.16	0.25	0.04	0.75	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of 1st Green, Master Intersection
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 26.6 Intersection LOS: C
Intersection Capacity Utilization 63.5% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: 100th Ave NE & Juanita-Woodinville Wy



Lanes, Volumes, Timings
4: 100th Ave NE & NE 137th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	128	160	18	15	13	75	270	17	68	1286	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		100	0		90	95		0	70		0
Storage Lanes	0		1	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1846	1571	0	1814	1583	1752	3468	0	1787	3564	0
Flt Permitted		0.941			0.652		0.143			0.564		
Satd. Flow (perm)	0	1749	1544	0	1212	1545	264	3468	0	1058	3564	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			140			55		8			2	
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		504			762			1039			550	
Travel Time (s)		13.7			20.8			49.6			10.7	
Confl. Peds. (#/hr)	6		3	3		6	9		1	1		9
Peak Hour Factor	0.82	0.82	0.82	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	1%	1%	1%
Bus Blockages (#/hr)	0	0	2	0	0	0	0	0	10	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	189	195	0	35	14	81	308	0	74	1418	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4		4	2			6		
Detector Phase	8	8	8	4	4	4	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	30.0	30.0	30.0	26.0	26.0	26.0	13.0	22.0		15.0	20.0	
Total Split (s)	38.0	38.0	38.0	38.0	38.0	38.0	13.0	87.0		15.0	89.0	
Total Split (%)	27.1%	27.1%	27.1%	27.1%	27.1%	27.1%	9.3%	62.1%		10.7%	63.6%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		-1.0	-1.0		-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Act Effct Green (s)		20.7	20.7		20.7	20.7	107.4	100.4		107.2	100.3	
Actuated g/C Ratio		0.15	0.15		0.15	0.15	0.77	0.72		0.77	0.72	
v/c Ratio		0.73	0.56		0.20	0.05	0.29	0.12		0.09	0.56	
Control Delay		72.8	22.7		52.4	0.4	8.6	5.0		3.1	7.5	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		72.8	22.7		52.4	0.4	8.6	5.0		3.1	7.5	
LOS		E	C		D	A	A	A		A	A	
Approach Delay		47.4			37.5			5.8			7.3	
Approach LOS		D			D			A			A	
Queue Length 50th (ft)		167	45		28	0	15	33		9	228	
Queue Length 95th (ft)		213	94		60	0	29	62		m10	m284	
Internal Link Dist (ft)		424			682			959			470	
Turn Bay Length (ft)			100			90	95			70		

Lanes, Volumes, Timings
4: 100th Ave NE & NE 137th St

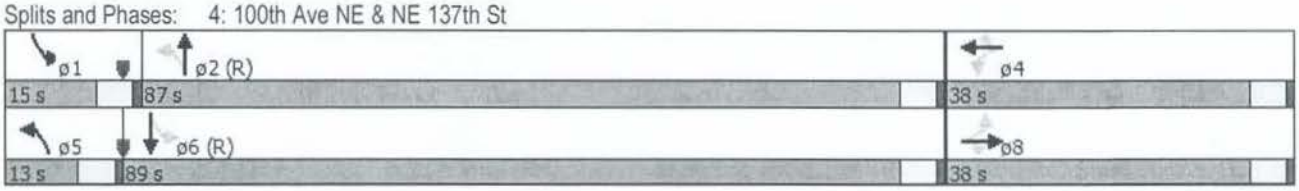
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)		424	480		294	416	301	2489		895	2552	
Starvation Cap Reductn		0	0		0	0	0	0		0	0	
Spillback Cap Reductn		0	0		0	0	0	0		0	0	
Storage Cap Reductn		0	0		0	0	0	0		0	0	
Reduced v/c Ratio		0.45	0.41		0.12	0.03	0.27	0.12		0.08	0.56	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 68 (49%), Referenced to phase 2:NBTL and 6:SBTL, Start of 1st Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 14.3 Intersection LOS: B
Intersection Capacity Utilization 67.1% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: 100th Ave NE & NE 137th St



Lanes, Volumes, Timings
5: 100th Ave NE & Simonds Rd NE

8/29/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	402	664	132	178	708	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	500	240			100
Storage Lanes	1	1	1			1
Taper Length (ft)	25		25			
Satd. Flow (prot)	1787	1599	1770	1863	1881	1599
Flt Permitted	0.950		0.101			
Satd. Flow (perm)	1781	1558	188	1863	1881	1577
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		253				86
Link Speed (mph)	35			35	35	
Link Distance (ft)	644			1827	886	
Travel Time (s)	12.5			35.6	17.3	
Confl. Peds. (#/hr)	1	1	1			1
Confl. Bikes (#/hr)		2				
Peak Hour Factor	0.83	0.83	0.84	0.84	0.87	0.87
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	484	800	157	212	814	264
Turn Type	NA	Perm	pm+pt	NA	NA	Perm
Protected Phases	8		5	2	6	
Permitted Phases		8	2			6
Detector Phase	8	8	5	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	27.0	27.0	15.0	11.0	31.0	31.0
Total Split (s)	49.0	49.0	15.0	91.0	76.0	76.0
Total Split (%)	35.0%	35.0%	10.7%	65.0%	54.3%	54.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	45.0	45.0	87.0	87.0	73.0	73.0
Actuated g/C Ratio	0.32	0.32	0.62	0.62	0.52	0.52
v/c Ratio	0.84	1.19	0.68	0.18	0.83	0.31
Control Delay	58.9	128.9	39.2	7.5	35.2	15.4
Queue Delay	0.0	0.0	0.0	0.0	1.0	0.0
Total Delay	58.9	128.9	39.2	7.5	36.2	15.4
LOS	E	F	D	A	D	B
Approach Delay	102.5			21.0	31.1	
Approach LOS	F			C	C	
Queue Length 50th (ft)	410	~713	54	73	488	84
Queue Length 95th (ft)	496	#828	68	39	701	163
Internal Link Dist (ft)	564			1747	806	
Turn Bay Length (ft)		500	240			100

Lanes, Volumes, Timings
5: 100th Ave NE & Simonds Rd NE

8/29/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Base Capacity (vph)	574	672	241	1157	980	862
Starvation Cap Reductn	0	0	0	0	43	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.84	1.19	0.65	0.18	0.87	0.31

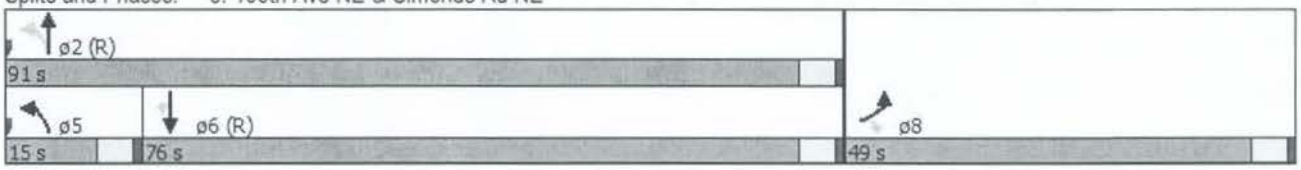
Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 115 (82%), Referenced to phase 2:NBTL and 6:SBT, Start of 1st Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.19
Intersection Signal Delay: 63.3 Intersection LOS: E
Intersection Capacity Utilization 85.2% ICU Level of Service E
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: 100th Ave NE & Simonds Rd NE



Lanes, Volumes, Timings
6: 100th Ave NE & NE 145th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	9	16	166	19	74	6	175	399	196	756	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		160	50		150	100		65
Storage Lanes	0		0	0		1	1		1	1		1
Taper Length (ft)	25			25			25			75		
Satd. Flow (prot)	0	1642	0	0	1748	1553	1770	1863	1583	1787	1881	1599
Flt Permitted		0.998			0.957		0.950			0.554		
Satd. Flow (perm)	0	1642	0	0	1748	1516	1770	1863	1583	1042	1881	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		28				110			499			94
Link Speed (mph)		30			30			35			30	
Link Distance (ft)		1432			3078			886			2311	
Travel Time (s)		10.4			70.0			17.3			52.5	
Confl. Bikes (#/hr)			2			3						
Peak Hour Factor	0.57	0.57	0.57	0.63	0.63	0.63	0.80	0.80	0.80	0.87	0.87	0.87
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	46	0	0	293	117	8	219	499	225	869	5
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	Perm
Protected Phases	3	3		4	4	1	5	2	4	1	6	
Permitted Phases						4			2	6		6
Detector Phase	3	3		4	4	1	5	2	4	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	11.0		22.0	22.0	15.0	13.0	25.0	22.0	15.0	20.0	20.0
Total Split (s)	13.0	13.0		36.0	36.0	15.0	13.0	76.0	36.0	15.0	78.0	78.0
Total Split (%)	9.3%	9.3%		25.7%	25.7%	10.7%	9.3%	54.3%	25.7%	10.7%	55.7%	55.7%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		-1.0			-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	0.0
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lead	Lag	Lead	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	C-Max	None	None	C-Max	C-Max
Act Effct Green (s)		8.4			29.3	40.0	6.5	77.9	111.2	92.5	90.3	89.3
Actuated g/C Ratio		0.06			0.21	0.29	0.05	0.56	0.79	0.66	0.64	0.64
v/c Ratio		0.37			0.80	0.23	0.10	0.21	0.37	0.30	0.72	0.00
Control Delay		40.1			77.0	18.3	55.5	29.8	1.2	11.5	23.3	0.0
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Total Delay		40.1			77.0	18.3	55.5	29.8	1.2	11.5	23.5	0.0
LOS		D			E	B	E	C	A	B	C	A
Approach Delay		40.1			60.2			10.4			20.9	
Approach LOS		D			E			B			C	
Queue Length 50th (ft)		16			264	34	7	140	6	84	528	0
Queue Length 95th (ft)		27			248	45	m14	m183	3	120	814	0
Internal Link Dist (ft)		1352			2998			806			2231	
Turn Bay Length (ft)						160	50		150	100		65
Base Capacity (vph)		131			399	519	113	1036	1380	748	1213	1053

Lanes, Volumes, Timings
6: 100th Ave NE & NE 145th St

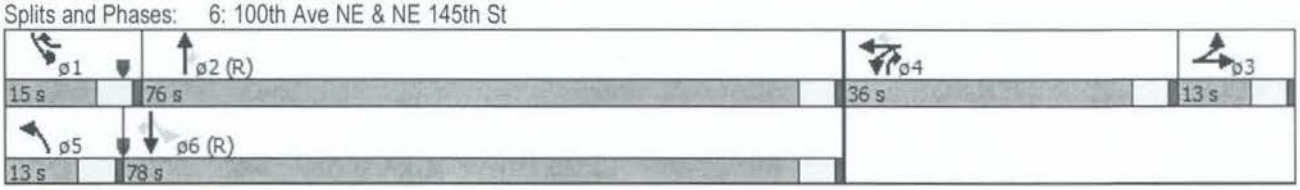
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0			0	0	0	0	0	0	0	0
Spillback Cap Reductn		0			0	0	0	0	0	0	31	0
Storage Cap Reductn		0			0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.35			0.73	0.23	0.07	0.21	0.36	0.30	0.74	0.00

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 25 (18%), Referenced to phase 2:NBT and 6:SBTL, Start of 1st Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 25.0 Intersection LOS: C
Intersection Capacity Utilization 70.8% ICU Level of Service C
Analysis Period (min) 15
Description: Overlap A P: 1NBRT & OverlapB : 4: WB: Permissive disable phase 5 for construction fenced in west leg
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: 100th Ave NE & NE 145th St



Lanes, Volumes, Timings
2: 100th Ave NE & NE 131st Way/132nd St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	129	86	65	206	522	268	1352	125	236	650	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	11	12	12	12	12
Grade (%)		-2%			2%			6%			0%	
Storage Length (ft)	185		165	180		160	215		105	230		0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1805	1900	1615	1769	1862	1171	1734	3351	1551	1770	3448	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1763	1900	1580	1755	1862	1121	1698	3351	1455	1759	3448	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			132			94			66		11	
Link Speed (mph)		25			35			35			35	
Link Distance (ft)		2034			2370			2708			681	
Travel Time (s)		55.5			46.2			52.8			13.3	
Confl. Peds. (#/hr)	16		6	6		16	20		14	14		20
Peak Hour Factor	0.83	0.83	0.83	0.93	0.93	0.93	0.97	0.97	0.97	0.93	0.93	0.93
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	65	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	90	155	104	70	222	561	276	1394	129	254	786	0
Turn Type	Prot	NA	Perm	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	3	8		7	4	1	5	2	7	1	6	
Permitted Phases			8			4			2			
Detector Phase	3	8	8	7	4	1	5	2	7	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	15.0	32.0	32.0	15.0	27.0	15.0	15.0	29.0	15.0	15.0	29.0	
Total Split (s)	17.0	32.0	32.0	15.0	30.0	28.0	38.0	65.0	15.0	28.0	55.0	
Total Split (%)	12.1%	22.9%	22.9%	10.7%	21.4%	20.0%	27.1%	46.4%	10.7%	20.0%	39.3%	
Yellow Time (s)	5.0	5.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.9	-1.9	-1.9	-1.9	-1.9	-1.1	-1.1	-1.1	-1.9	-1.1	-1.4	
Total Lost Time (s)	4.6	4.6	4.6	3.1	3.1	3.9	3.9	3.9	3.1	3.9	3.6	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	None	None	C-Max	
Act Effct Green (s)	11.4	22.9	22.9	10.7	22.2	51.2	27.3	61.1	72.6	29.8	63.9	
Actuated g/C Ratio	0.08	0.16	0.16	0.08	0.16	0.37	0.20	0.44	0.52	0.21	0.46	
v/c Ratio	0.62	0.50	0.28	0.52	0.75	1.17	0.82	0.95	0.16	0.68	0.50	
Control Delay	80.3	58.3	5.3	75.8	71.9	129.1	72.7	53.0	8.3	56.0	30.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0	
Total Delay	80.3	58.3	5.3	75.8	71.9	129.1	72.7	62.5	8.3	56.0	30.1	
LOS	F	E	A	E	E	F	E	E	A	E	C	
Approach Delay		48.2			109.9			60.2			36.5	
Approach LOS		D			F			E			D	
Queue Length 50th (ft)	80	130	0	62	195	~560	242	636	26	241	216	
Queue Length 95th (ft)	128	179	19	115	278	#597	331	#799	59	#379	286	

Lanes, Volumes, Timings
2: 100th Ave NE & NE 131st Way/132nd St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1954			2290			2628			601	
Turn Bay Length (ft)	185		165	180		160	215		105	230		
Base Capacity (vph)	159	371	415	150	357	480	422	1462	806	376	1579	
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	2	0	80	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.57	0.42	0.25	0.47	0.62	1.17	0.65	1.01	0.16	0.68	0.50	

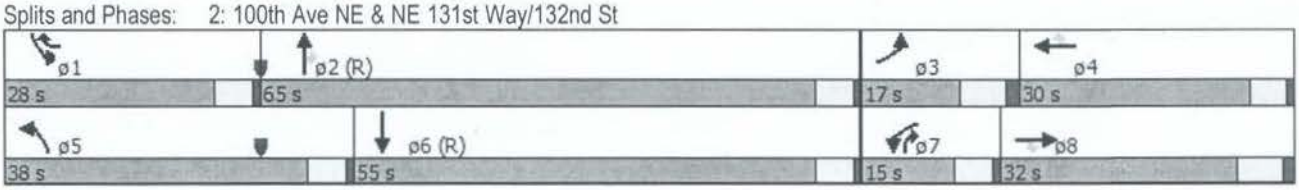
Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 122 (87%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Natural Cycle: 145
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.17
Intersection Signal Delay: 63.5 Intersection LOS: E
Intersection Capacity Utilization 85.9% ICU Level of Service E
Analysis Period (min) 15
Description: Overlap A :1; Ovl B:7

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: 100th Ave NE & NE 131st Way/132nd St



Lanes, Volumes, Timings
3: 100th Ave NE & Juanita-Woodinville Wy

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	25	20	345	11	63	41	1408	500	51	602	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		25	225		80	85		75	120		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	25			50			25			50		
Satd. Flow (prot)	1805	1759	0	1698	1707	1599	1787	3560	1599	1787	3566	0
Flt Permitted	0.950			0.950	0.955		0.396			0.103		
Satd. Flow (perm)	1794	1759	0	1691	1701	1567	744	3560	1541	194	3566	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		25				94			116		2	
Link Speed (mph)		25			35			35			35	
Link Distance (ft)		1167			5713			681			1039	
Travel Time (s)		31.8			111.3			13.3			20.2	
Confl. Peds. (#/hr)	4		2	2		4	1		4	4		1
Confl. Bikes (#/hr)			1									
Peak Hour Factor	0.81	0.81	0.81	0.88	0.88	0.88	0.96	0.96	0.96	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	2	0	0	0	0
Shared Lane Traffic (%)				49%								
Lane Group Flow (vph)	32	56	0	200	204	72	43	1467	521	56	673	0
Turn Type	Split	NA		Split	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	8	8		7	7			2		1	6	
Permitted Phases						7	2		2	6		
Detector Phase	8	8		7	7	7	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	27.0	27.0		26.0	26.0	26.0	23.0	23.0	23.0	13.0	23.0	
Total Split (s)	27.0	27.0		40.0	40.0	40.0	60.0	60.0	60.0	13.0	73.0	
Total Split (%)	19.3%	19.3%		28.6%	28.6%	28.6%	42.9%	42.9%	42.9%	9.3%	52.1%	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	C-Max	C-Max	C-Max	None	C-Max	
Act Effct Green (s)	8.3	8.3		22.7	22.7	22.7	89.9	89.9	89.9	99.0	99.0	
Actuated g/C Ratio	0.06	0.06		0.16	0.16	0.16	0.64	0.64	0.64	0.71	0.71	
v/c Ratio	0.30	0.44		0.73	0.74	0.22	0.09	0.64	0.51	0.26	0.27	
Control Delay	69.3	49.2		55.0	55.7	7.6	7.1	9.2	5.1	10.8	7.4	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.6	0.5	0.0	0.0	
Total Delay	69.3	49.2		55.0	55.7	7.6	7.1	9.8	5.5	10.8	7.4	
LOS	E	D		D	E	A	A	A	A	B	A	
Approach Delay		56.5			48.1			8.6			7.6	
Approach LOS		E			D			A			A	
Queue Length 50th (ft)	29	28		185	189	20	7	177	62	9	65	
Queue Length 95th (ft)	56	63		250	257	46	m11	m464	m80	35	158	
Internal Link Dist (ft)		1087			5633			601			959	

Lanes, Volumes, Timings
3: 100th Ave NE & Juanita-Woodinville Wy

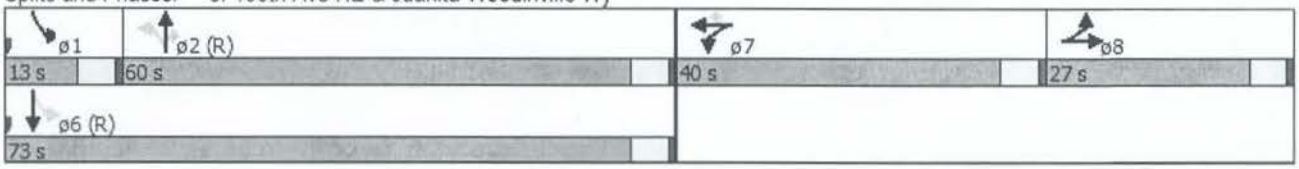
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)				225		80	85		75	120		
Base Capacity (vph)	296	309		436	438	472	477	2286	1031	239	2522	
Starvation Cap Reductn	0	0		0	0	0	0	406	180	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.11	0.18		0.46	0.47	0.15	0.09	0.78	0.61	0.23	0.27	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of 1st Green, Master Intersection
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 15.3 Intersection LOS: B
Intersection Capacity Utilization 65.6% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: 100th Ave NE & Juanita-Woodinville Wy



Lanes, Volumes, Timings
4: 100th Ave NE & NE 137th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	19	42	99	29	69	100	136	1282	79	55	535	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		100	0		90	95		0	70		0
Storage Lanes	0		1	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1853	1586	0	1853	1599	1787	3534	0	1787	3513	0
Flt Permitted		0.765			0.865		0.368			0.163		
Satd. Flow (perm)	0	1433	1542	0	1622	1543	692	3534	0	307	3513	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			116			105		7			14	
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		504			762			1039			550	
Travel Time (s)		13.7			20.8			49.6			10.7	
Confl. Peds. (#/hr)	8		7	7		8			4	4		
Confl. Bikes (#/hr)			4			7			1			1
Peak Hour Factor	0.85	0.85	0.85	0.95	0.95	0.95	0.97	0.97	0.97	0.87	0.87	0.87
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	2	0	0	0	0	0	10	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	71	116	0	104	105	140	1403	0	63	684	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4		4	2			6		
Detector Phase	8	8	8	4	4	4	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	30.0	30.0	30.0	26.0	26.0	26.0	15.0	22.0		15.0	20.0	
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	19.0	84.0		19.0	84.0	
Total Split (%)	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	13.6%	60.0%		13.6%	60.0%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		-1.0	-1.0		-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Act Effct Green (s)		13.9	13.9		13.9	13.9	115.9	109.6		113.1	106.6	
Actuated g/C Ratio		0.10	0.10		0.10	0.10	0.83	0.78		0.81	0.76	
v/c Ratio		0.50	0.45		0.65	0.42	0.22	0.51		0.20	0.26	
Control Delay		70.8	15.0		78.2	15.1	4.0	6.6		2.5	3.0	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		70.8	15.0		78.2	15.1	4.0	6.6		2.5	3.0	
LOS		E	B		E	B	A	A		A	A	
Approach Delay		36.2			46.5			6.3			2.9	
Approach LOS		D			D			A			A	
Queue Length 50th (ft)		62	0		93	0	18	144		4	42	
Queue Length 95th (ft)		104	49		151	55	65	265		8	48	
Internal Link Dist (ft)		424			682			959			470	

Lanes, Volumes, Timings
4: 100th Ave NE & NE 137th St

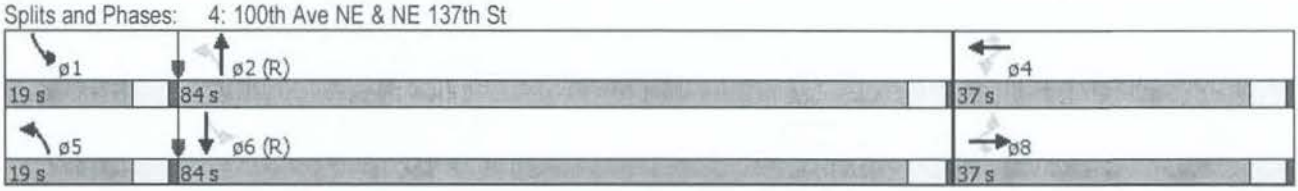
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)			100			90	95			70		
Base Capacity (vph)		337	452		382	443	700	2769		417	2678	
Starvation Cap Reductn		0	0		0	0	0	0		0	0	
Spillback Cap Reductn		0	0		0	0	0	0		0	0	
Storage Cap Reductn		0	0		0	0	0	0		0	0	
Reduced v/c Ratio		0.21	0.26		0.27	0.24	0.20	0.51		0.15	0.26	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 12 (9%), Referenced to phase 2:NBTL and 6:SBTL, Start of 1st Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 10.6 Intersection LOS: B
Intersection Capacity Utilization 65.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 4: 100th Ave NE & NE 137th St



Lanes, Volumes, Timings
5: 100th Ave NE & Simonds Rd NE

8/29/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	274	348	614	787	302	336
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	500	240			100
Storage Lanes	1	1	1			1
Taper Length (ft)	25		25			
Satd. Flow (prot)	1787	1599	1787	1881	1881	1599
Flt Permitted	0.950		0.441			
Satd. Flow (perm)	1787	1599	830	1881	1881	1599
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		382				228
Link Speed (mph)	35			35	35	
Link Distance (ft)	644			1827	886	
Travel Time (s)	12.5			35.6	17.3	
Peak Hour Factor	0.91	0.91	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	301	382	646	828	318	354
Turn Type	NA	Perm	pm+pt	NA	NA	Perm
Protected Phases	8		5	2	6	
Permitted Phases		8	2			6
Detector Phase	8	8	5	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	27.0	27.0	15.0	11.0	31.0	31.0
Total Split (s)	39.0	39.0	45.0	101.0	56.0	56.0
Total Split (%)	27.9%	27.9%	32.1%	72.1%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	30.2	30.2	101.8	101.8	66.5	66.5
Actuated g/C Ratio	0.22	0.22	0.73	0.73	0.48	0.48
v/c Ratio	0.78	0.59	0.79	0.61	0.36	0.40
Control Delay	65.7	8.0	27.2	7.0	26.1	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.7	8.0	27.2	7.0	26.1	11.7
LOS	E	A	C	A	C	B
Approach Delay	33.5			15.8	18.5	
Approach LOS	C			B	B	
Queue Length 50th (ft)	256	0	282	223	207	130
Queue Length 95th (ft)	356	86	502	404	343	232
Internal Link Dist (ft)	564			1747	806	
Turn Bay Length (ft)		500	240			100
Base Capacity (vph)	446	686	883	1367	893	879
Starvation Cap Reductn	0	0	0	0	0	0

Lanes, Volumes, Timings
5: 100th Ave NE & Simonds Rd NE

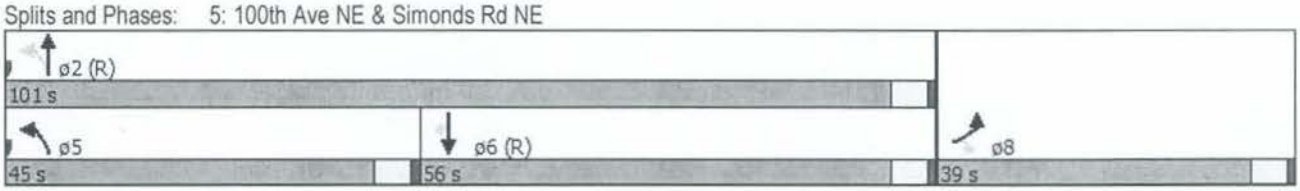
8/29/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.56	0.73	0.61	0.36	0.40

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 45 (32%), Referenced to phase 2:NBTL and 6:SBT, Start of 1st Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 20.7 Intersection LOS: C
Intersection Capacity Utilization 75.1% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: 100th Ave NE & Simonds Rd NE



Lanes, Volumes, Timings
6: 100th Ave NE & NE 145th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↱	↰	↑	↱	↰	↑	↱
Volume (vph)	5	5	5	331	10	203	13	779	269	97	302	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		160	50		150	100		65
Storage Lanes	0		0	0		1	1		1	1		1
Taper Length (ft)	25			25			25			75		
Satd. Flow (prot)	0	1785	0	0	1795	1599	1787	1881	1599	1805	1900	1615
Flt Permitted		0.984			0.954		0.950			0.056		
Satd. Flow (perm)	0	1785	0	0	1795	1599	1776	1881	1560	106	1900	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9				145			256			132
Link Speed (mph)		30			30			35			30	
Link Distance (ft)		1432			3078			886			2311	
Travel Time (s)		10.4			70.0			17.3			52.5	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.56	0.56	0.56	0.92	0.92	0.92	0.91	0.91	0.91	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	1%	1%	1%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	27	0	0	371	221	14	856	296	111	347	6
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	NA
Protected Phases	3	3		4	4	1	5	2	4	1	6	
Permitted Phases						4			2	6		
Detector Phase	3	3		4	4	1	5	2	4	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	11.0	11.0		22.0	22.0	15.0	13.0	25.0	22.0	15.0	20.0	
Total Split (s)	11.0	11.0		52.0	52.0	15.0	13.0	62.0	52.0	15.0	64.0	
Total Split (%)	7.9%	7.9%		37.1%	37.1%	10.7%	9.3%	44.3%	37.1%	10.7%	45.7%	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		-1.0			-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lead	Lag	Lead	Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	C-Max	None	None	C-Max	
Act Effct Green (s)		8.2			37.4	49.3	6.8	72.8	110.2	86.7	82.3	0.0
Actuated g/C Ratio		0.06			0.27	0.35	0.05	0.52	0.79	0.62	0.59	0.00
v/c Ratio		0.24			0.77	0.34	0.16	0.88	0.23	0.59	0.31	0.05
Control Delay		52.3			45.8	12.0	74.0	39.9	0.6	35.9	19.5	0.6
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		52.3			45.8	12.0	74.0	39.9	0.6	35.9	19.5	0.6
LOS		D			D	B	E	D	A	D	B	A
Approach Delay		52.3			33.2			30.3			23.2	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)		16			311	74	13	708	0	46	156	0
Queue Length 95th (ft)		27			420	136	m21	#1136	12	114	289	0
Internal Link Dist (ft)		1352			2998			806			2231	
Turn Bay Length (ft)						160	50		150	100		65
Base Capacity (vph)		112			615	670	114	977	1381	205	1116	132

Lanes, Volumes, Timings
6: 100th Ave NE & NE 145th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0			0	0	0	0	0	0	0	0
Spillback Cap Reductn		0			0	0	0	0	0	0	0	0
Storage Cap Reductn		0			0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.24			0.60	0.33	0.12	0.88	0.21	0.54	0.31	0.05

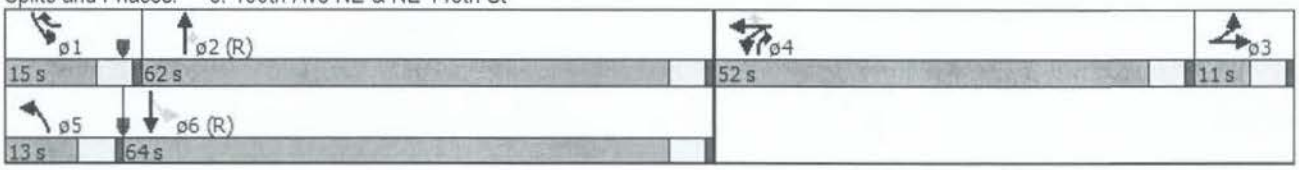
Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 114 (81%), Referenced to phase 2:NBT and 6:SBTL, Start of 1st Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 29.9 Intersection LOS: C
Intersection Capacity Utilization 81.9% ICU Level of Service D
Analysis Period (min) 15
Description: Overlap A P: 1NBRT & OverlapB : 4: WB: Permissive disable phase 5 for construction fenced in west leg

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: 100th Ave NE & NE 145th St



Lanes, Volumes, Timings
2: #100th Ave NE & NE 131st Way/132nd St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	228	431	93	116	114	60	400	104	321	1400	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	11	12	12	12	12
Grade (%)		-2%			2%			6%			0%	
Storage Length (ft)	300		500	180		160	350		350	230		0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1805	1900	1615	1718	1809	1500	1717	3319	1536	1787	3556	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1799	1900	1545	1678	1809	1474	1713	3319	1432	1739	3556	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			105			161			109		2	
Link Speed (mph)		25			35			35			35	
Link Distance (ft)		2034			2370			2708			681	
Travel Time (s)		55.5			46.2			52.8			13.3	
Confl. Peds. (#/hr)	2		19	19		2	7		16	16		7
Confl. Bikes (#/hr)						4						
Peak Hour Factor	0.99	0.99	0.99	0.71	0.71	0.71	0.95	0.95	0.95	0.88	0.88	0.88
Heavy Vehicles (%)	1%	1%	1%	4%	4%	4%	2%	2%	2%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	6	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	61	230	435	131	163	161	63	421	109	365	1631	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	3	8	5	7	4	1	5	2	7	1	6	
Permitted Phases			8			4			2			
Detector Phase	3	8	5	7	4	1	5	2	7	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	15.0	32.0	15.0	15.0	27.0	15.0	15.0	28.0	15.0	15.0	28.0	
Total Split (s)	15.0	32.0	20.0	16.0	33.0	45.0	20.0	47.0	16.0	45.0	72.0	
Total Split (%)	10.7%	22.9%	14.3%	11.4%	23.6%	32.1%	14.3%	33.6%	11.4%	32.1%	51.4%	
Yellow Time (s)	5.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.9	-1.9	-1.9	-1.9	-1.9	-1.1	-1.1	-1.1	-1.9	-1.1	-1.4	
Total Lost Time (s)	4.6	4.6	3.1	3.1	3.1	3.9	3.9	3.9	3.1	3.9	3.6	
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	None	None	C-Max	
Act Effct Green (s)	9.5	22.5	37.6	12.8	28.1	61.5	12.9	55.0	68.6	34.2	76.7	
Actuated g/C Ratio	0.07	0.16	0.27	0.09	0.20	0.44	0.09	0.39	0.49	0.24	0.55	
v/c Ratio	0.50	0.75	0.87	0.84	0.45	0.22	0.40	0.32	0.14	0.84	0.84	
Control Delay	76.9	71.6	53.1	101.2	53.9	3.1	66.3	32.6	4.5	68.7	23.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	
Total Delay	76.9	71.6	53.1	101.2	53.9	3.1	66.3	32.6	4.5	68.7	24.5	
LOS	E	E	D	F	D	A	E	C	A	E	C	
Approach Delay		60.9			49.5			31.0			32.6	
Approach LOS		E			D			C			C	
Queue Length 50th (ft)	54	202	283	119	135	0	55	141	0	288	672	

Lanes, Volumes, Timings
2: #100th Ave NE & NE 131st Way/132nd St

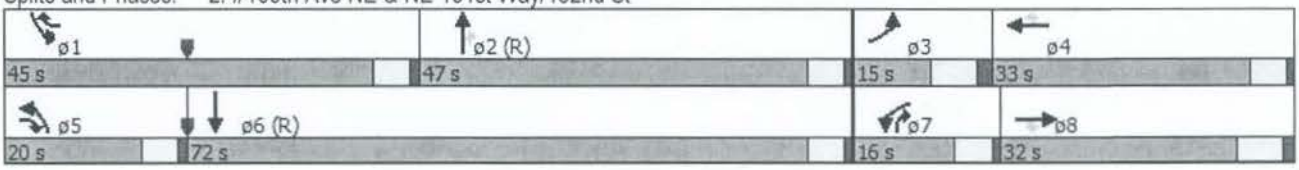
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	104	286	390	#150	154	12	102	211	36	373	685	
Internal Link Dist (ft)		1954			2290			2628			601	
Turn Bay Length (ft)	300		500	180		160	350		350	230		
Base Capacity (vph)	134	371	535	158	393	809	199	1303	767	524	1948	
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	135	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.46	0.62	0.81	0.83	0.41	0.20	0.32	0.32	0.14	0.70	0.90	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 138 (99%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 39.8 Intersection LOS: D
Intersection Capacity Utilization 83.5% ICU Level of Service E
Analysis Period (min) 15
Description: Overlap A :1; Ovl B:7
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: #100th Ave NE & NE 131st Way/132nd St



Lanes, Volumes, Timings
3: #100th Ave NE & Juanita-Woodinville Wy

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	13	20	16	340	31	27	21	322	231	25	1400	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		25	225		80	85		75	120		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	25			50			25			50		
Satd. Flow (prot)	1805	1753	0	1665	1682	1568	1770	3504	1583	1787	3536	0
Flt Permitted	0.950			0.950	0.960		0.105			0.500		
Satd. Flow (perm)	1799	1753	0	1658	1677	1533	196	3504	1493	925	3536	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17				94			254		3	
Link Speed (mph)		25			35			35			35	
Link Distance (ft)		1167			5713			681			1039	
Travel Time (s)		31.8			111.3			13.3			20.2	
Confl. Peds. (#/hr)	2		5	2		5	1		9	9		1
Confl. Bikes (#/hr)			2						1			
Peak Hour Factor	0.94	0.94	0.94	0.84	0.84	0.84	0.88	0.88	0.88	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	2%	2%	2%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	5	0	0	3	0
Shared Lane Traffic (%)				46%								
Lane Group Flow (vph)	14	38	0	219	223	32	24	366	262	29	1654	0
Turn Type	Split	NA		Split	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	8	8		7	7			2		1	6	
Permitted Phases						7	2		2	6		
Detector Phase	8	8		7	7	7	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	27.0	27.0		26.0	26.0	26.0	23.0	23.0	23.0	13.0	23.0	
Total Split (s)	28.0	28.0		31.0	31.0	31.0	67.0	67.0	67.0	14.0	81.0	
Total Split (%)	20.0%	20.0%		22.1%	22.1%	22.1%	47.9%	47.9%	47.9%	10.0%	57.9%	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	C-Max	C-Max	C-Max	None	C-Max	
Act Effct Green (s)	7.5	7.5		22.9	22.9	22.9	93.2	93.2	93.2	99.6	99.6	
Actuated g/C Ratio	0.05	0.05		0.16	0.16	0.16	0.67	0.67	0.67	0.71	0.71	
v/c Ratio	0.15	0.35		0.81	0.81	0.10	0.18	0.16	0.24	0.04	0.66	
Control Delay	65.5	49.2		78.1	78.6	0.6	12.9	7.7	1.4	2.3	4.5	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	
Total Delay	65.5	49.2		78.1	78.6	0.6	12.9	7.7	1.4	2.3	4.7	
LOS	E	D		E	E	A	B	A	A	A	A	
Approach Delay		53.6			73.1			5.3			4.7	
Approach LOS		D			E			A			A	
Queue Length 50th (ft)	12	19		203	207	0	5	37	0	2	50	
Queue Length 95th (ft)	36	56		271	276	0	m14	56	8	m4	81	
Internal Link Dist (ft)		1087			5633			601			959	

Lanes, Volumes, Timings
3: #100th Ave NE & Juanita-Woodinville Wy

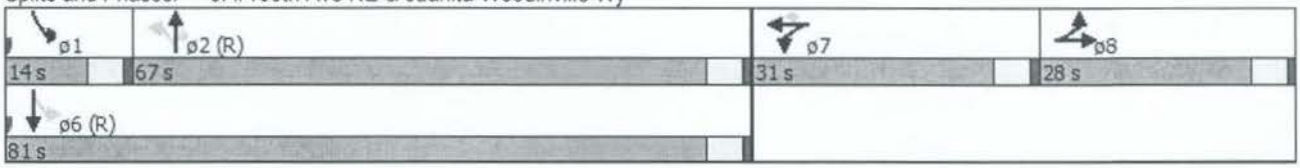
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)				225		80	85		75	120		
Base Capacity (vph)	309	314		321	324	371	130	2332	1078	719	2517	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	171	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	245	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.05	0.12		0.68	0.69	0.09	0.18	0.16	0.24	0.04	0.73	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of 1st Green, Master Intersection
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 17.1 Intersection LOS: B
Intersection Capacity Utilization 63.5% ICU Level of Service B
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: #100th Ave NE & Juanita-Woodinville Wy



Lanes, Volumes, Timings
4: #100th Ave NE & NE 137th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	27	128	160	18	15	13	75	270	17	68	1286	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		100	0		90	95		0	70		0
Storage Lanes	0		1	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1846	1571	0	1814	1583	1752	3468	0	1787	3564	0
Flt Permitted		0.991			0.974		0.120			0.561		
Satd. Flow (perm)	0	1842	1544	0	1810	1545	221	3468	0	1053	3564	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			163			94		6			1	
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		504			762			1039			550	
Travel Time (s)		13.7			20.8			49.6			10.7	
Confl. Peds. (#/hr)	6		3	3		6	9		1	1		9
Peak Hour Factor	0.82	0.82	0.82	0.94	0.94	0.94	0.93	0.93	0.93	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	1%	1%	1%
Bus Blockages (#/hr)	0	0	2	0	0	0	0	0	10	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	189	195	0	35	14	81	308	0	74	1418	0
Turn Type	Split	NA	Perm	Split	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	8	8		4	4		5	2		1	6	
Permitted Phases			8			4	2			6		
Detector Phase	8	8	8	4	4	4	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	30.0	30.0	30.0	26.0	26.0	26.0	15.0	22.0		15.0	20.0	
Total Split (s)	30.0	30.0	30.0	26.0	26.0	26.0	15.0	69.0		15.0	69.0	
Total Split (%)	21.4%	21.4%	21.4%	18.6%	18.6%	18.6%	10.7%	49.3%		10.7%	49.3%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		-1.0	-1.0		-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Act Effct Green (s)		19.9	19.9		8.2	8.2	98.4	90.5		97.4	90.0	
Actuated g/C Ratio		0.14	0.14		0.06	0.06	0.70	0.65		0.70	0.64	
v/c Ratio		0.72	0.54		0.33	0.08	0.33	0.14		0.10	0.62	
Control Delay		72.3	17.5		71.0	0.8	15.4	15.7		6.8	15.8	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		72.3	17.5		71.0	0.8	15.4	15.7		6.8	15.8	
LOS		E	B		E	A	B	B		A	B	
Approach Delay		44.5			50.9			15.6			15.4	
Approach LOS		D			D			B			B	
Queue Length 50th (ft)		167	26		31	0	33	89		16	322	
Queue Length 95th (ft)		214	74		68	0	89	167		m21	m500	
Internal Link Dist (ft)		424			682			959			470	
Turn Bay Length (ft)			100			90	95			70		

Lanes, Volumes, Timings
4: #100th Ave NE & NE 137th St

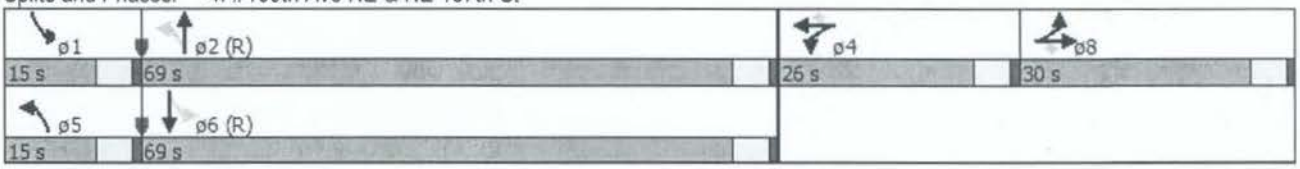
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)		345	421		285	322	281	2243		814	2291	
Starvation Cap Reductn		0	0		0	0	0	0		0	0	
Spillback Cap Reductn		0	0		0	0	0	0		0	0	
Storage Cap Reductn		0	0		0	0	0	0		0	0	
Reduced v/c Ratio		0.55	0.46		0.12	0.04	0.29	0.14		0.09	0.62	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 124 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of 1st Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 21.0 Intersection LOS: C
Intersection Capacity Utilization 67.1% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: #100th Ave NE & NE 137th St



Lanes, Volumes, Timings
5: #100th Ave NE & Simonds Rd NE

8/29/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	402	664	132	178	708	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	500	240			300
Storage Lanes	1	1	1			1
Taper Length (ft)	25		25			
Satd. Flow (prot)	1787	1599	1770	1863	1881	1599
Flt Permitted	0.950		0.062			
Satd. Flow (perm)	1781	1559	115	1863	1881	1577
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		91				192
Link Speed (mph)	35			35	35	
Link Distance (ft)	644			1827	886	
Travel Time (s)	12.5			35.6	17.3	
Confl. Peds. (#/hr)	1	1	1			1
Confl. Bikes (#/hr)		2				
Peak Hour Factor	0.83	0.83	0.84	0.84	0.87	0.87
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	484	800	157	212	814	264
Turn Type	NA	pm+ov	pm+pt	NA	NA	Perm
Protected Phases	8	5	5	2	6	
Permitted Phases		8	2			6
Detector Phase	8	5	5	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	27.0	15.0	15.0	11.0	31.0	31.0
Total Split (s)	41.0	34.0	34.0	99.0	65.0	65.0
Total Split (%)	29.3%	24.3%	24.3%	70.7%	46.4%	46.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag		Lead	Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	37.0	67.0	95.0	95.0	61.0	61.0
Actuated g/C Ratio	0.26	0.48	0.68	0.68	0.44	0.44
v/c Ratio	1.03	1.00	0.36	0.17	0.99	0.33
Control Delay	98.1	61.8	14.2	9.0	61.2	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	98.1	61.8	14.2	9.0	61.2	9.2
LOS	F	E	B	A	E	A
Approach Delay	75.5			11.2	48.5	
Approach LOS	E			B	D	
Queue Length 50th (ft)	~468	614	105	133	671	73
Queue Length 95th (ft)	#601	#825	32	35	#956	88
Internal Link Dist (ft)	564			1747	806	
Turn Bay Length (ft)		500	240			300

Lanes, Volumes, Timings
5: #100th Ave NE & Simonds Rd NE

8/29/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Base Capacity (vph)	472	802	432	1264	819	795
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.03	1.00	0.36	0.17	0.99	0.33

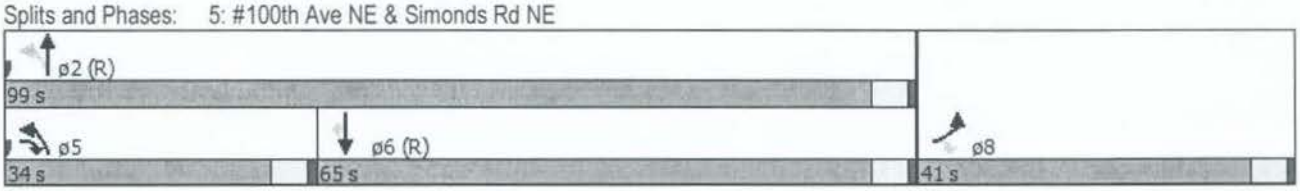
Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 24 (17%), Referenced to phase 2:NBTL and 6:SBT, Start of 1st Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 56.1 Intersection LOS: E
Intersection Capacity Utilization 85.2% ICU Level of Service E
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: #100th Ave NE & Simonds Rd NE



Lanes, Volumes, Timings
6: #100th Ave NE & NE 145th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↰	↱	↰	↑	↱	↰	↑	↱
Volume (vph)	1	9	16	166	19	74	6	175	399	196	756	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		160	50		300	100		65
Storage Lanes	0		0	0		1	1		1	1		1
Taper Length (ft)	25			25			25			75		
Satd. Flow (prot)	0	1638	0	0	1748	1553	1770	1863	1583	1787	1881	1599
Flt Permitted		0.998			0.957		0.950			0.557		
Satd. Flow (perm)	0	1638	0	0	1748	1516	1770	1863	1583	1048	1881	1599
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		28				109			499			94
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		1432			3078			886			2311	
Travel Time (s)		10.4			70.0			17.3			45.0	
Confl. Bikes (#/hr)			2			3						
Peak Hour Factor	0.57	0.57	0.57	0.63	0.63	0.63	0.80	0.80	0.80	0.87	0.87	0.87
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	2%	2%	2%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	46	0	0	293	117	8	219	499	225	869	5
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	Perm
Protected Phases	3	3		4	4	1	5	2	4	1	6	
Permitted Phases						4			2	6		6
Detector Phase	3	3		4	4	1	5	2	4	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	11.0		22.0	22.0	15.0	13.0	25.0	22.0	15.0	20.0	20.0
Total Split (s)	11.0	11.0		35.0	35.0	15.0	13.0	79.0	35.0	15.0	81.0	81.0
Total Split (%)	7.9%	7.9%		25.0%	25.0%	10.7%	9.3%	56.4%	25.0%	10.7%	57.9%	57.9%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		-1.0			-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	0.0
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lead	Lag	Lead	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	C-Max	None	None	C-Max	C-Max
Act Effct Green (s)		7.2			28.8	39.5	6.5	79.6	112.3	94.2	92.0	91.0
Actuated g/C Ratio		0.05			0.21	0.28	0.05	0.57	0.80	0.67	0.66	0.65
v/c Ratio		0.42			0.82	0.23	0.10	0.21	0.36	0.30	0.70	0.00
Control Delay		44.0			71.2	6.6	99.5	3.3	0.9	10.6	21.5	0.0
Queue Delay		0.1			24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		44.1			95.8	6.6	99.5	3.3	0.9	10.6	21.6	0.0
LOS		D			F	A	F	A	A	B	C	A
Approach Delay		44.1			70.4			2.7			19.2	
Approach LOS		D			E			A			B	
Queue Length 50th (ft)		16			252	4	7	20	0	79	494	0
Queue Length 95th (ft)		28			234	11	m14	m15	m0	112	772	0
Internal Link Dist (ft)		1352			2998			806			2231	
Turn Bay Length (ft)						160	50		300	100		65
Base Capacity (vph)		110			387	514	113	1059	1385	764	1236	1072

Lanes, Volumes, Timings
6: #100th Ave NE & NE 145th St

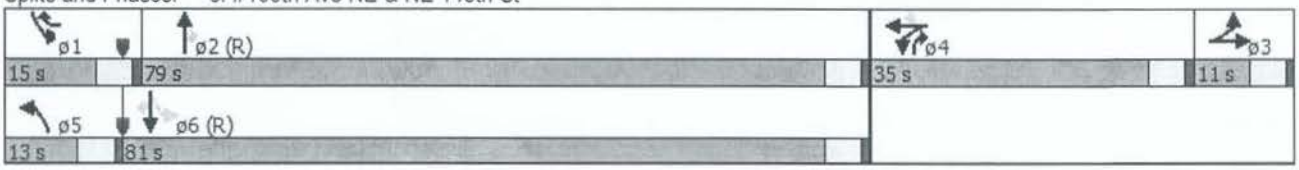
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0			0	0	0	0	0	0	0	0
Spillback Cap Reductn		1			94	0	0	0	0	0	11	0
Storage Cap Reductn		0			0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.42			1.00	0.23	0.07	0.21	0.36	0.29	0.71	0.00

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of 1st Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 23.7 Intersection LOS: C
Intersection Capacity Utilization 70.8% ICU Level of Service C
Analysis Period (min) 15
Description: Overlap A P: 1NBRT & OverlapB : 4: WB: Permissive disable phase 5 for construction fenced in west leg
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: #100th Ave NE & NE 145th St



Lanes, Volumes, Timings
2: 100th Ave NE & NE 131st Way/132nd St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	129	86	65	206	522	268	1352	125	236	650	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	11	12	12	12	12
Grade (%)		-2%			2%			6%			0%	
Storage Length (ft)	300		500	180		160	350		350	230		0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1805	1900	1615	1769	1862	1171	1734	3351	1551	1770	3448	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1763	1900	1580	1755	1862	1121	1698	3351	1455	1759	3448	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			104			66			129		11	
Link Speed (mph)		25			35			35			35	
Link Distance (ft)		2034			2370			2708			681	
Travel Time (s)		55.5			46.2			52.8			13.3	
Confl. Peds. (#/hr)	16		6	6		16	20		14	14		20
Peak Hour Factor	0.83	0.83	0.83	0.93	0.93	0.93	0.97	0.97	0.97	0.93	0.93	0.93
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	65	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	90	155	104	70	222	561	276	1394	129	254	786	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	
Protected Phases	3	8	5	7	4	1	5	2	7	1	6	
Permitted Phases			8			4			2			
Detector Phase	3	8	5	7	4	1	5	2	7	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	15.0	32.0	15.0	15.0	27.0	15.0	15.0	29.0	15.0	15.0	29.0	
Total Split (s)	15.0	32.0	38.0	15.0	32.0	34.0	38.0	59.0	15.0	34.0	55.0	
Total Split (%)	10.7%	22.9%	27.1%	10.7%	22.9%	24.3%	27.1%	42.1%	10.7%	24.3%	39.3%	
Yellow Time (s)	5.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.9	-1.9	-1.9	-1.9	-1.9	-1.1	-1.1	-1.1	-1.9	-1.1	-1.4	
Total Lost Time (s)	4.6	4.6	3.1	3.1	3.1	3.9	3.9	3.9	3.1	3.9	3.6	
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	None	None	C-Max	
Act Effct Green (s)	10.1	22.1	51.8	10.7	22.7	58.5	27.5	55.1	66.6	36.7	64.6	
Actuated g/C Ratio	0.07	0.16	0.37	0.08	0.16	0.42	0.20	0.39	0.48	0.26	0.46	
v/c Ratio	0.69	0.52	0.16	0.52	0.74	1.08	0.81	1.06	0.17	0.55	0.49	
Control Delay	90.0	59.8	4.2	75.8	70.1	96.3	64.0	60.2	1.0	48.1	35.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	90.0	59.8	4.2	75.8	70.1	96.3	64.0	60.2	1.0	48.1	35.3	
LOS	F	E	A	E	E	F	E	E	A	D	D	
Approach Delay		51.0			87.8			56.5			38.4	
Approach LOS		D			F			E			D	
Queue Length 50th (ft)	81	132	0	62	195	~537	247	~727	0	208	222	
Queue Length 95th (ft)	#138	179	26	115	272	#773	m238	m#738	m0	338	443	

Lanes, Volumes, Timings
2: 100th Ave NE & NE 131st Way/132nd St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		1954			2290			2628			601	
Turn Bay Length (ft)	300		500	180		160	350		350	230		
Base Capacity (vph)	134	371	729	150	384	520	422	1318	779	463	1597	
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.67	0.42	0.14	0.47	0.58	1.08	0.65	1.06	0.17	0.55	0.49	

Intersection Summary

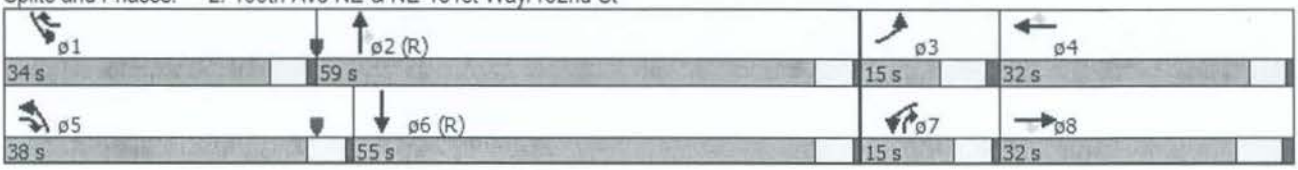
Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 6 (4%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Natural Cycle: 145
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.08
Intersection Signal Delay: 58.0 Intersection LOS: E
Intersection Capacity Utilization 85.9% ICU Level of Service E
Analysis Period (min) 15
Description: Overlap A :1; Ovl B:7

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: 100th Ave NE & NE 131st Way/132nd St



Lanes, Volumes, Timings
3: 100th Ave NE & Juanita-Woodinville Wy

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	25	20	345	11	63	41	1408	500	51	602	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		25	225		80	85		75	120		0
Storage Lanes	0		0	1		1	1		1	1		0
Taper Length (ft)	25			50			25			50		
Satd. Flow (prot)	1805	1759	0	1698	1707	1599	1787	3560	1599	1787	3566	0
Flt Permitted	0.950			0.950	0.955		0.396			0.107		
Satd. Flow (perm)	1794	1759	0	1691	1701	1567	744	3560	1541	201	3566	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		25				94			135		2	
Link Speed (mph)		25			35			35			35	
Link Distance (ft)		1167			5713			681			1039	
Travel Time (s)		31.8			111.3			13.3			20.2	
Confl. Peds. (#/hr)	4		2	2		4	1		4	4		1
Confl. Bikes (#/hr)			1									
Peak Hour Factor	0.81	0.81	0.81	0.88	0.88	0.88	0.96	0.96	0.96	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	2	0	0	0	0
Shared Lane Traffic (%)				49%								
Lane Group Flow (vph)	32	56	0	200	204	72	43	1467	521	56	673	0
Turn Type	Split	NA		Split	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases	8	8		7	7			2		1	6	
Permitted Phases						7	2		2	6		
Detector Phase	8	8		7	7	7	2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	27.0	27.0		26.0	26.0	26.0	23.0	23.0	23.0	13.0	23.0	
Total Split (s)	27.0	27.0		28.0	28.0	28.0	72.0	72.0	72.0	13.0	85.0	
Total Split (%)	19.3%	19.3%		20.0%	20.0%	20.0%	51.4%	51.4%	51.4%	9.3%	60.7%	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lag	Lag	Lag	Lead		
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	C-Max	C-Max	C-Max	None	C-Max	
Act Effct Green (s)	8.3	8.3		20.7	20.7	20.7	91.9	91.9	91.9	100.9	100.9	
Actuated g/C Ratio	0.06	0.06		0.15	0.15	0.15	0.66	0.66	0.66	0.72	0.72	
v/c Ratio	0.30	0.44		0.80	0.81	0.23	0.09	0.63	0.49	0.25	0.26	
Control Delay	69.3	49.2		79.7	81.0	6.4	6.1	6.1	3.0	14.1	10.2	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.4	0.4	0.0	0.0	
Total Delay	69.3	49.2		79.7	81.0	6.4	6.1	6.6	3.4	14.1	10.2	
LOS	E	D		E	F	A	A	A	A	B	B	
Approach Delay		56.5			69.2			5.7			10.5	
Approach LOS		E			E			A			B	
Queue Length 50th (ft)	29	28		185	189	0	7	164	39	19	152	
Queue Length 95th (ft)	56	63		269	273	25	m8	m190	m49	57	214	
Internal Link Dist (ft)		1087			5633			601			959	

Lanes, Volumes, Timings
3: 100th Ave NE & Juanita-Woodinville Wy

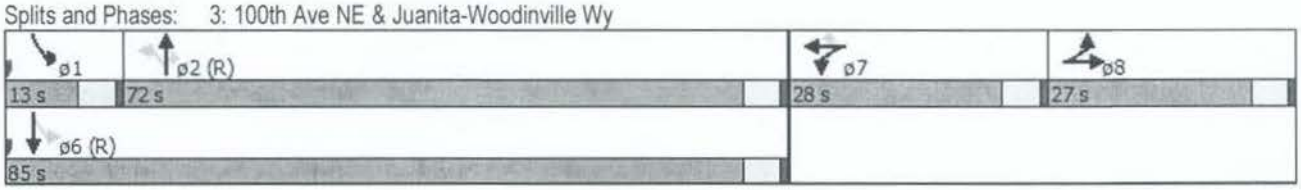
8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)				225		80	85		75	120		
Base Capacity (vph)	296	309		291	292	346	488	2336	1057	246	2571	
Starvation Cap Reductn	0	0		0	0	0	0	378	173	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.11	0.18		0.69	0.70	0.21	0.09	0.75	0.59	0.23	0.26	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of 1st Green, Master Intersection
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 17.2 Intersection LOS: B
Intersection Capacity Utilization 65.6% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: 100th Ave NE & Juanita-Woodinville Wy



Lanes, Volumes, Timings
4: 100th Ave NE & NE 137th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	19	42	99	29	69	100	136	1282	79	55	535	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		100	0		90	95		0	70		0
Storage Lanes	0		1	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1853	1586	0	1853	1599	1787	3534	0	1787	3513	0
Flt Permitted		0.985			0.985		0.348			0.137		
Satd. Flow (perm)	0	1845	1541	0	1847	1538	655	3534	0	258	3513	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			116			105		6			11	
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		504			762			1039			550	
Travel Time (s)		13.7			20.8			49.6			10.7	
Confl. Peds. (#/hr)	8		7	7		8			4	4		
Confl. Bikes (#/hr)			4			7			1			1
Peak Hour Factor	0.85	0.85	0.85	0.95	0.95	0.95	0.97	0.97	0.97	0.87	0.87	0.87
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	2	0	0	0	0	0	10	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	71	116	0	104	105	140	1403	0	63	684	0
Turn Type	Split	NA	Perm	Split	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	8	8		4	4		5	2		1	6	
Permitted Phases			8			4	2			6		
Detector Phase	8	8	8	4	4	4	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	30.0	30.0	30.0	26.0	26.0	26.0	15.0	22.0		15.0	20.0	
Total Split (s)	30.0	30.0	30.0	26.0	26.0	26.0	15.0	69.0		15.0	69.0	
Total Split (%)	21.4%	21.4%	21.4%	18.6%	18.6%	18.6%	10.7%	49.3%		10.7%	49.3%	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		-1.0	-1.0		-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Act Effct Green (s)		10.7	10.7		13.1	13.1	102.3	94.8		98.8	91.5	
Actuated g/C Ratio		0.08	0.08		0.09	0.09	0.73	0.68		0.71	0.65	
v/c Ratio		0.50	0.52		0.60	0.44	0.26	0.59		0.24	0.30	
Control Delay		73.7	18.4		74.5	15.8	1.4	1.8		5.5	6.2	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		73.7	18.4		74.5	15.8	1.4	1.8		5.5	6.2	
LOS		E	B		E	B	A	A		A	A	
Approach Delay		39.4			45.0			1.8			6.1	
Approach LOS		D			D			A			A	
Queue Length 50th (ft)		63	0		93	0	2	24		8	66	
Queue Length 95th (ft)		106	51		151	56	9	35		18	100	
Internal Link Dist (ft)		424			682			959			470	

Lanes, Volumes, Timings
4: 100th Ave NE & NE 137th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)			100			90	95			70		
Base Capacity (vph)		344	380		291	330	574	2396		308	2298	
Starvation Cap Reductn		0	0		0	0	0	0		0	0	
Spillback Cap Reductn		0	0		0	0	0	0		0	0	
Storage Cap Reductn		0	0		0	0	0	0		0	0	
Reduced v/c Ratio		0.21	0.31		0.36	0.32	0.24	0.59		0.20	0.30	

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 66 (47%), Referenced to phase 2:NBTL and 6:SBTL, Start of 1st Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.60
Intersection Signal Delay: 9.0 Intersection LOS: A
Intersection Capacity Utilization 65.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 4: 100th Ave NE & NE 137th St

Lanes, Volumes, Timings
5: 100th Ave NE & Simonds Rd NE

8/29/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	274	348	614	787	302	336
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	500	240			300
Storage Lanes	1	1	1			1
Taper Length (ft)	25		25			
Satd. Flow (prot)	1787	1599	1787	1881	1881	1599
Flt Permitted	0.950		0.405			
Satd. Flow (perm)	1787	1599	762	1881	1881	1599
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		236				354
Link Speed (mph)	35			35	35	
Link Distance (ft)	644			1827	886	
Travel Time (s)	12.5			35.6	17.3	
Peak Hour Factor	0.91	0.91	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	301	382	646	828	318	354
Turn Type	NA	pm+ov	pm+pt	NA	NA	Perm
Protected Phases	8	5	5	2	6	
Permitted Phases		8	2			6
Detector Phase	8	5	5	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	27.0	15.0	15.0	11.0	31.0	31.0
Total Split (s)	40.0	58.0	58.0	100.0	42.0	42.0
Total Split (%)	28.6%	41.4%	41.4%	71.4%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag		Lead	Lead		Lag	Lag
Lead-Lag Optimize?						
Recall Mode	None	None	None	C-Max	C-Max	C-Max
Act Effct Green (s)	28.6	74.4	103.4	103.4	57.6	57.6
Actuated g/C Ratio	0.20	0.53	0.74	0.74	0.41	0.41
v/c Ratio	0.82	0.40	0.74	0.60	0.41	0.41
Control Delay	71.4	6.2	9.3	3.2	28.4	6.4
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0
Total Delay	71.4	6.2	9.3	3.2	28.4	6.4
LOS	E	A	A	A	C	A
Approach Delay	34.9			5.9	16.8	
Approach LOS	C			A	B	
Queue Length 50th (ft)	264	63	76	30	141	37
Queue Length 95th (ft)	352	88	71	33	m225	m74
Internal Link Dist (ft)	564			1747	806	
Turn Bay Length (ft)		500	240			300
Base Capacity (vph)	459	1082	959	1388	773	866
Starvation Cap Reductn	0	0	0	0	0	0

Lanes, Volumes, Timings
5: 100th Ave NE & Simonds Rd NE

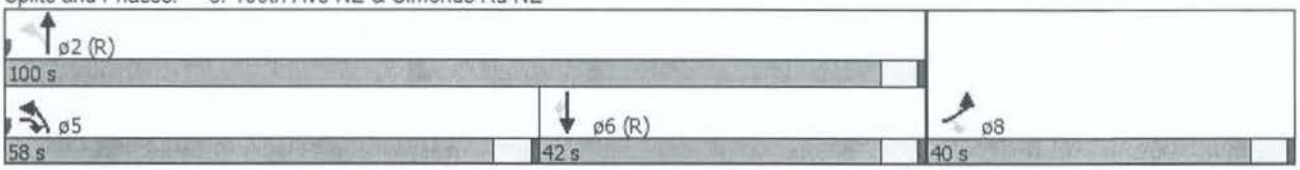
8/29/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Spillback Cap Reductn	0	0	0	46	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.35	0.67	0.62	0.41	0.41

Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 102 (73%), Referenced to phase 2:NBTL and 6:SBT, Start of 1st Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 15.5 Intersection LOS: B
Intersection Capacity Utilization 75.1% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: 100th Ave NE & Simonds Rd NE



Lanes, Volumes, Timings
6: 100th Ave NE & NE 145th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↰	↱	↰	↑	↱	↰	↑	↱
Volume (vph)	5	5	5	331	10	203	13	779	269	97	302	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		160	50		300	100		65
Storage Lanes	0		0	0		1	1		1	1		1
Taper Length (ft)	25			25			25			75		
Satd. Flow (prot)	0	1785	0	0	1795	1599	1787	1881	1599	1805	1900	1615
Flt Permitted		0.984			0.954		0.950			0.109		
Satd. Flow (perm)	0	1785	0	0	1795	1599	1776	1881	1560	207	1900	1567
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9				165			296			94
Link Speed (mph)		30			30			35			30	
Link Distance (ft)		1432			3078			886			2311	
Travel Time (s)		10.4			70.0			17.3			52.5	
Confl. Peds. (#/hr)							2		1	1		2
Peak Hour Factor	0.56	0.56	0.56	0.92	0.92	0.92	0.91	0.91	0.91	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	0%	1%	1%	1%	1%	1%	1%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	27	0	0	371	221	14	856	296	111	347	6
Turn Type	Split	NA		Split	NA	pm+ov	Prot	NA	pm+ov	pm+pt	NA	Perm
Protected Phases	3	3		4	4	1	5	2	4	1	6	
Permitted Phases						4			2	6		6
Detector Phase	3	3		4	4	1	5	2	4	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	11.0		22.0	22.0	15.0	13.0	25.0	22.0	15.0	20.0	20.0
Total Split (s)	11.0	11.0		37.0	37.0	15.0	13.0	77.0	37.0	15.0	79.0	79.0
Total Split (%)	7.9%	7.9%		26.4%	26.4%	10.7%	9.3%	55.0%	26.4%	10.7%	56.4%	56.4%
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)		-1.0			-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	0.0
Total Lost Time (s)		4.0			4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0
Lead/Lag	Lag	Lag		Lead	Lead	Lead	Lead	Lag	Lead	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	C-Max	None	None	C-Max	C-Max
Act Effct Green (s)		7.1			31.8	43.0	6.8	80.0	111.9	93.2	88.8	87.8
Actuated g/C Ratio		0.05			0.23	0.31	0.05	0.57	0.80	0.67	0.63	0.63
v/c Ratio		0.28			0.91	0.37	0.16	0.80	0.23	0.45	0.29	0.01
Control Delay		55.0			79.3	9.5	68.3	31.7	0.5	15.3	14.3	0.0
Queue Delay		0.0			0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Total Delay		55.0			79.3	9.5	68.3	32.2	0.5	15.3	14.3	0.0
LOS		D			E	A	E	C	A	B	B	A
Approach Delay		55.0			53.2			24.6			14.3	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)		16			328	31	13	595	2	38	136	0
Queue Length 95th (ft)		27			#505	86	m23	#825	5	61	230	0
Internal Link Dist (ft)		1352			2998			806			2231	
Turn Bay Length (ft)						160	50		300	100		65
Base Capacity (vph)		98			423	620	114	1075	1326	263	1205	1018

Lanes, Volumes, Timings
6: 100th Ave NE & NE 145th St

8/29/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Starvation Cap Reductn		0			0	0	0	42	0	0	0	0
Spillback Cap Reductn		0			0	0	0	0	0	0	0	0
Storage Cap Reductn		0			0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.28			0.88	0.36	0.12	0.83	0.22	0.42	0.29	0.01

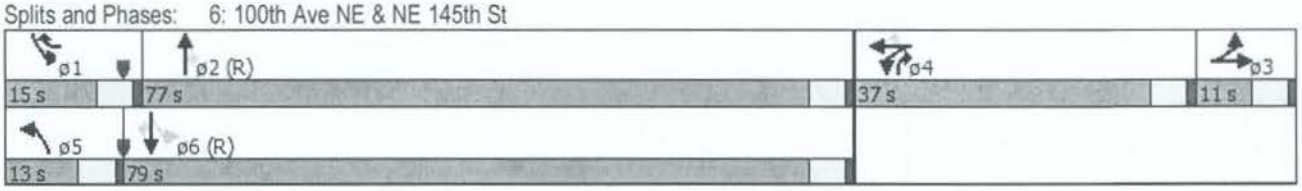
Intersection Summary

Area Type: Other
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 74 (53%), Referenced to phase 2:NBT and 6:SBTL, Start of 1st Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 30.4 Intersection LOS: C
Intersection Capacity Utilization 81.9% ICU Level of Service D
Analysis Period (min) 15
Description: Overlap A P: 1NBRT & OverlapB : 4: WB: Permissive disable phase 5 for construction fenced in west leg

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: 100th Ave NE & NE 145th St



CITY OF KIRKLAND
Department of Public Works
123 Fifth Avenue, Kirkland, WA 98033 425.587.3800
www.kirklandwa.gov

MEMORANDUM

To: File

From: Frank Reinart, P.E., Project Engineer

Date: December 11, 2014

Subject: 100TH AVENUE NE CORRIDOR STUDY SUPPLEMENTAL DOCUMENTS

The documents attached to this memorandum were received by the City after the completion of the final draft of the 100th Avenue NE Corridor Study (Study). These documents represent additional information and potential recommendations relevant to the overall Study approach and its recommended strategies, and should be used along with the Study during the future design of the 100th Avenue NE Corridor.

The attached documents are:

- An October 17, 2014, technical design memorandum prepared by BergerABAM to provide additional information and recommendations for options for the Cedar Creek culvert under 100th Avenue NE. This culvert may need to be modified or replaced during improvement of the 100th Avenue Corridor. The need for modification or replacement of this culvert was incorporated into the recommendations of the Study, but the Study did not provide detail on how those recommendations may be implemented.
- A December 1, 2014, letter from the Finn Hill Neighborhood Alliance providing additional comments and suggestions to the Study.

BergerABAM

1301 Fifth Avenue, Suite 1200, Seattle, Washington 98101-2677
206/357-5600 • 206/357-5601 Fax • www.abam.com

Technical Design Memorandum

Date: 17 October 2014

Subject: 100th Avenue NE Corridor Study – Culvert Technical Design Memorandum

From: Rob Schurman, P.E.

To: Flora Lee, P.E. and Frank Reinart, P.E.

Route to: Xiaoping Zhang, P.E., Susan Johnson, P.E., Ross French, P.E., and Project File

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INTRODUCTION

The purpose of this memorandum is to document the existing culvert assessment and potential fish passage retrofit options for the 100th Avenue NE culvert located just south of Simonds Road NE, in Kirkland, WA.

EXISTING CONDITIONS

The Cedar Creek culvert crossing of 100th Avenue NE is located approximately 4,500 feet upstream of the Cedar Creek confluence with Juanita Creek. The crossing is a reinforced concrete box culvert that is 4-feet wide by 3-feet tall. The culvert is 104 feet in length and has an overall slope of 1.5 percent. The crossing contains a large fill prism and the roadway, 100th Avenue NE, is 18 feet above the culvert invert.

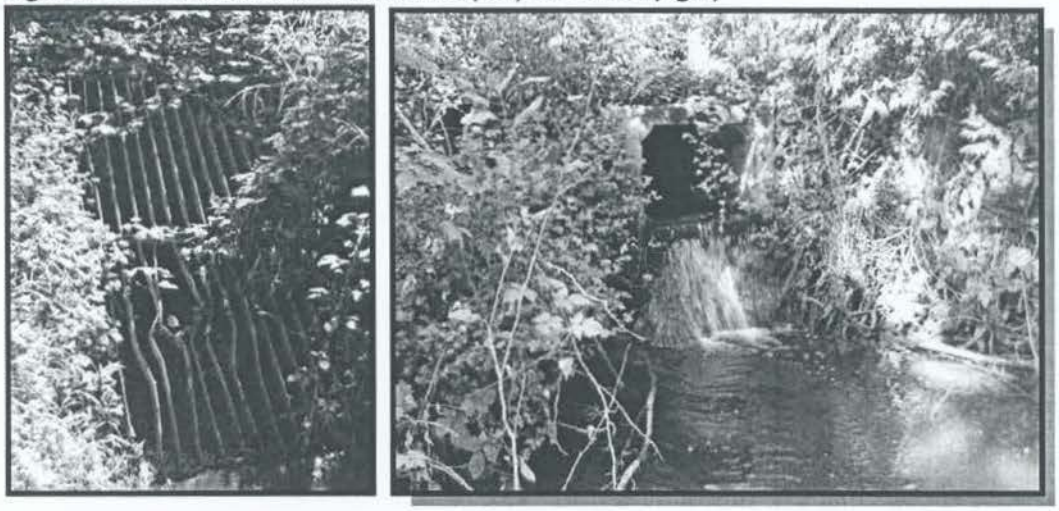
In 1989, King County Public Works designed an inline regional detention pond immediately upstream of the 100th Avenue NE culvert. The upstream side of the culvert was tied into the eastern side of a 96-inch diameter control structure. This control structure regulates the Cedar Creek flows through the box culvert and detains higher flows until they can be released at a predetermined rate.

Currently, Cedar Creek flows through a 7-foot wide by 9-foot tall trash rack and into a 60-inch diameter concrete pipe. The 60-inch concrete pipe is 35 feet in length and has an overall slope similar to the concrete box culvert. The 60-inch concrete pipe ties into the western side of the 96-inch diameter control structure with a debris birdcage. The control structure contains a vertical concrete restrictor wall with a 4-foot by 2-foot orifice with an adjustable restrictor plate. The vertical concrete restrictor wall separates the 60-inch diameter concrete pipe from the concrete box culvert. The restrictor plate can be adjusted up or down by the surface water management division to limit the flow through the orifice. When stream flows are higher than the capacity of the orifice, the water surface levels upstream increase until the overflow elevation of 187.90 is reached. At this point the flows bypass the restrictor plate and orifice by entering the debris

birdcage and over-topping the concrete restrictor wall. Once the flows bypass the restrictor plate and orifice they enter into the 3-foot by 4-foot box culvert. The box culvert continued east under 100th Avenue NE.

The concrete box culvert outlet is perched approximately 4-feet above the downstream tailwater pool (Figure 1). The outlet drop creates a significant barrier to all fish species at all flows.

Figure 1 – 100th Avenue NE Culvert Inlet (left) and Outlet (right)



EXISTING CULVERT ASSESSMENT

The following documents the existing culvert assessment and includes various measurements and observations including bankfull width, longitudinal profile, sediment assessment, channel banks, potential debris loading, and constraints.

Bankfull width is the most important parameter in culvert design. During the site visit, the bankfull width was measured upstream of the culvert. The bankfull width upstream was measured at 6 feet which is similar to bankfull widths of other Juanita Creek tributaries reported in the 2000 Habitat Inventory and Assessment of Juanita Creek.

The longitudinal profile was estimated from the 1989 100th Avenue NE – Phase II plans developed by King County. The longitudinal profile of the stream graded through the Simonds Road Regional Detention Pond was calculated at 2.0 percent.

This stream channel is moderately sloped pool-riffle channel composted of primarily sand and fine gravels. However, during the site visit there were some 8-inch cobbles present in both the upstream and downstream reaches. Upstream, the channel appears stable, with no observable bank erosion. Downstream, there was some erosion at the perched outfall and along the northern bank of the channel. The higher sand content in the stream substrate indicates that the reach is unstable and prone to erosion.

The surrounding area is composed mostly of Alderwood and Kitsap Loam with slopes ranging from 6 to 30 percent. Aerials show no indication of slope instability and King County Landslide maps do not show this area as an area of risk. Further geotechnical investigation is recommended, but it seems that slope stability will not a concern.

The culvert is located along a heavily vegetated stream channel and buffer with surrounding residential parcels. The upstream channel was heavily vegetated with trees and underbrush. Large woody debris (LWD) was present along the upstream and downstream channel during the site visit. Wood in the upstream reach of the channel is large (greater than 1-foot diameter) and is generally either well-embedded or in stable debris jams. Little debris transport is anticipated and since most wood transported by the stream is bankfull width or less, the proposed culvert sized larger than bankfull width should transport the expected debris. However, there will still be the potential for larger debris jams and the risk of plugging is possible.

The only constraint identified was the inline regional detention pond. In 1989, the 100th Avenue NE – Phase II project installed a control structure in order to regulate flows downstream. This constraint interferes with the natural stream process and migration of aquatic species through the culvert. Maintaining the regional detention pond may require a more engineered approach to fish passage.

CULVERT REPLACEMENT OPTIONS AND FEASIBILITY

The design of the culvert was based on the Washington State Department of Fish and Wildlife (WDFW) 2013 Water Crossing Design Guidelines. This manual provides five different water crossing design methods. The five water crossing design methods are:

1. No-Slope Culvert
2. Stream Simulation Culvert
3. Bridge
4. Temporary Culvert or Bridge
5. Hydraulic Design

A selection guide is provided to help the designer select which of the five methods is the most appropriate for the specific site conditions. The core of the selection process is based on bankfull width, slope, floodplain utilization, channel stability, debris prone and constraints. Utilizing the selection guide and observations, the following describes each water crossing design method and its feasibility to the site.

The No-Slope Culvert was determined to be not feasible because the estimated channel gradient between upstream and downstream is too great to allow a culvert to be installed at zero gradient. Estimates show that a minimum 17-foot tall culvert would be required to meet the zero slope requirement while fulfilling the 20 percent downstream and 40 percent upstream

countersink requirements. This tall culvert would also be required to allow adequate clearance to pass debris during flood events. Additionally, a white paper titled "Fish Passage Effectiveness of Recently Constructed Road Crossing Culverts in the Puget Sound Region of Washington State" showed that new or repaired culverts permitted as no-slope or unknown design were barriers in 45 percent of the cases.

If the recommended option described below is determined to be not permitable by the agencies, the Stream Simulation and Bridge are also feasible options that can meet the requirements of the WDFW Water Crossing Guidelines. Both options would require maintaining the inline regional detention facility volume which will be necessary in order to prevent downstream flooding and channel erosion. Options for the mitigation of the detention volume is outside the scope of work and would require an additional study to determine the feasibility. However, it should be noted that there is additional risk to mitigate the inline detention because the final mitigation may not completely replicate the original function of the inline facility.

The Temporary Culvert or Bridge is not feasible because it is not a short duration, one or two season, solution.

The Hydraulic Design was also determined to be a feasible option and is part of the recommended option. The goal is to limit the culvert extension (if needed for the improvements along 100th Avenue NE) and reconstruct the downstream reach of Cedar Creek using the roughened channel method. This approach will remove the risk of providing similar inline detention, but there is still the risk that the agencies will not approve this approach because the control structure and inline detention remain. However, similar mitigations have been performed and accepted by WDFW in recent years.

RECOMMENDATIONS

Based on the culvert assessment and replacement options, it's recommended that the 100th Avenue NE culvert remain, minimize the extension if needed, and mitigate the perched downstream outfall with a roughened channel. However, before finalizing this recommended option, a review of the feasibility of the permitability of the option is recommended.

Construction of the culvert extension and downstream channel mitigation will be offline thus minimizing traffic interruptions to 100th Avenue NE. Additionally, the cost for the downstream mitigation and minimal culvert extension would be significantly less than the replacement of the culvert and regional detention mitigation. The culvert extension and downstream mitigation will need to be constructed during the summer months outside of the fish migration window. It's estimated that this extension and stream mitigation would be constructed within a 90-day period.

December 1, 2014

Frank Reinart, P.E.
Project Engineer
City of Kirkland
123 Fifth Avenue
Kirkland WA 98033

RE: 100th Avenue NE Corridor Study Comments

Dear Mr. Reinart:

We appreciate you reaching out to the Finn Hill Neighborhood Alliance (FHNA) recently to discuss the next steps on the 100th Avenue NE Corridor Project. We understand that the City Council will be adopting the Corridor Study in December 2014, along with the work plan to complete the design of the corridor improvements. We have had the opportunity to review the draft corridor study, and offer you the following comments:

- We strongly support the overall project goals and objectives.
- We ask that you treat the corridor study project recommendations summarized on Page IV in a non-prescriptive manner, and provide flexibility in how the projects are designed and implemented as more resources are directed to evaluate options and phasing, and as the City seeks additional stakeholder input.
- During this next phase of the project, we ask that you further evaluate opportunities to implement near-term, smaller-scale, and affordable projects that address the pedestrian and bicycle safety needs. We noted that the corridor study focused on corridor-wide treatments with no smaller-scale ped/bike projects specifically identified.
- We ask that you actively work with stakeholders, such as the Finn Hill Neighborhood Alliance and Juanita Neighborhood Association, to review and provide input on the design alternatives and phasing of the projects, similar to the successful process used as part for the Juanita Drive Corridor Study.
- Any improvements at the 100th Avenue NE and NE 132nd Street intersection should consider the improvement concepts prepared as part of the NE 132nd Street Corridor Master Plan prepared in 2008.
- Improvements at the intersections should consider the addition of bicycle facilities as part of any intersection project to provide a continuous bicycle lane along the corridor. For example, the northbound bicycle lane south of NE 132nd Street currently ends where the northbound right-turn pocket begins.
- With the potential for redevelopment of the former Albertson's site, we ask that any improvements account for these likely impacts to operations, circulation, and access. The

corridor project has an opportunity to help guide what the City envisions for the 100th Avenue NE and NE 132nd Street intersection and other key access points.

- Finally, consider how the proposed fire station could impact the design and/or needs along the corridor, and how the two projects could be leveraged together to provide greater public benefit.

Please feel free to contact us if you have any questions regarding this letter. Thank you again for your efforts on this important project and we look forward to working with you on this next phase of the project.

Respectfully,
On Behalf of the Finn Hill Neighborhood Alliance Board of Directors

Scott Morris, President

cc: City Council
Kurt Triplett, City Manager
Kathy Brown, Public Works Director
Dave Snider, Capital Projects Manager
Rod Steitzer, Capital Projects Supervisor
David Godfrey, Transportation Engineering Manager