Cross Kirkland Corridor/132nd Avenue NE Trail Crossing Study

Prepared for

August 2022

Prepared by

Parametrix

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Cross Kirkland Corridor/132nd Avenue NE Trail Crossing Study

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ACRONYMS AND ABBREVIATIONS

CIP	Capital Improvement Program
CKC	Cross Kirkland Crossing
FHWA	Federal Highway Administration
HAWK	High Intensity Activated Crosswalk
LOS	level of service
MSE	Mechanically Stabilized Earth
MUTCD	Manual of Uniform Traffic Control Devices
PHB	pedestrian hybrid beacon
PSE	Puget Sound Energy
ROM	rough order of magnitude
ROW	right-of-way
RRFB	Rectangular Rapid Flashing Beacon
v/c	volume to capacity
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

The Eastrail is a major new shared use path that will eventually include over 26 miles of high quality paved trail connecting east side communities. The trail crossing featured in this study is at the boundary of a section of Eastrail owned and managed by the City of Kirkland (the Cross Kirkland Corridor) and an adjacent section owned and managed by King County. Both jurisdictions are interested in developing a safe, high quality crossing at this location.

In 2014, Kirkland built the 5.75-mile section of the former BNSF rail line as interim ten-foot-wide crushed gravel trail from the South Kirkland Park and Ride through Totem Lake to Slater Avenue NE-132nd Avenue NE. In 2022, King County opened the portion of the trail directly to the east of the Slater Avenue NE-132nd Avenue NE crossing, as shown in the Figure ES-1, which will extend to Woodinville connecting Kirkland to the wider regional trail system including the Sammamish River Trail. Historically, approximately 300 trail users traverse the trail in this location per day and it is anticipated that this will grow to between 600 and 750 users per day when Eastrail extends to the east. The ultimate use of this trail is estimated to be between 2,000 and 3,000 users per day in this vicinity according to the Eastrail Corridor Master Plan.

The current crossing of Slater Avenue NE-132nd Avenue NE presents a challenge for trail users, requiring out-of-direction travel and navigation of the intersection of Slater Avenue NE and NE 124th Street. The out-of-direction travel required to make this crossing is approximately 800 feet, adding delay for those traveling along the trail. The temporary connection also requires the trail users to cross the free right movement for westbound traffic on NE 124th Street turning right to northbound Slater Avenue NE. Some users also attempt to jaywalk across Slater Avenue NE-132nd Avenue NE, creating safety concerns at the crossing.

Figure ES-1. Project Area

The City of Kirkland, in partnership with King County, has evaluated both at-grade and grade-separated trail crossing alternatives of Slater Avenue NE-132nd Avenue NE. One near-term and two long-term alternatives were selected that best meet the purpose and need of the crossing.

Alternative 1A, the near-term solution, would include an at-grade crossing with a narrowed roadway and a pedestrian signal. This alternative could be implemented quicker than the other alternatives and would provide a significant benefit in the immediate term. The improvements associated with Alternative 1A will be added to the City's Capital Improvement Program (CIP).

Two other alternatives have been identified which could provide longer term benefits: Alternative 2, which would add capacity to the NE 124th Street/Slater Avenue NE intersection thus reducing queues spilling across the Cross Kirkland Crossing (CKC) trail crossing, and Alternative 3, which would construct a pedestrian bridge at the trail crossing. Only one of these alternatives would be constructed.

Alternative 2 increases vehicle capacity and would reduce the traffic queues that spillback from the NE 124th Street/Slater Avenue NE intersection through the trail crossing. This would improve visibility of the trail crossing and user comfort.

Alternative 3 (bridge) performed the highest compared to all the alternatives on the project goal to Improve Nonmotorized Connections but had lower performance for the Minimizes Impacts and Feasible Solutions goals. Alternative 3 would also have greater conflicts with utilities (PSE alignment), higher construction costs, and construction duration as well as more long-term maintenance costs.

The final recommendation is to proceed with the design and construction of Alternative 1A due to the pressing need to implement a safer crossing. It is recommended to monitor trail and traffic volumes to determine if Alternative 2 or Alternative 3 should be pursued as a long- term solution. This recommendation received support from the Transportation Commission and City Council.

1. INTRODUCTION

The City of Kirkland and King County Parks are each developing segments of the Eastrail, a major shared-use path connecting Renton, Bellevue, Kirkland, Redmond, and Woodinville. The City of Kirkland's segment of the Eastrail, the Cross-Kirkland Corridor, extends from 108th Avenue NE to Slater Avenue NE-132nd Avenue NE. King County is developing several segments of the trail, including the segment that extends north from Slater Avenue NE-132nd Avenue NE. Both the City of Kirkland and King County Parks are interested in developing a high-quality, safe trail crossing at Slater Avenue NE-132nd Avenue NE. This study, funded by the King County Parks Levy, evaluated several alternative approaches to provide a long-term crossing at this location.

In May 2022, King County's Eastrail system opened east of Slater Avenue NE-132nd Avenue NE, effectively connecting the communities of Kirkland and Woodinville. Approximately 300 trail users currently traverse the trail in this location, and it is anticipated that this will grow to between 600 and 750 users per day when Eastrail opens. The projected long-term use of the trail is 2,000 to 3,000 users per day.

The current crossing of Slater Avenue NE-132nd Avenue NE presents a challenge for trail users, requiring out-of-direction travel and navigation of the intersection of Slater Avenue NE and NE 124th Street (see Figure 1). The intersection of NE 124th Street/Slater Avenue NE is challenging for trail users as there are heavy traffic volumes and it includes a free right for vehicles on the east leg. The out-of-direction travel required to make this crossing is approximately 800 feet, adding delay for those traveling along the CKC. Some users also attempt to jaywalk across Slater Avenue NE-132nd Avenue NE, creating safety concerns at the crossing.

Figure 1. Existing Connection

The City of Kirkland, in partnership with King County, has evaluated both at-grade and grade-separated trail crossing alternatives of Slater Avenue NE-132nd Avenue NE to identify a preferred alternative for implementation. This report documents:

- Goals and criteria
- Baseline conditions
- Alternatives development
- Feasibility (including costs, construction duration, and other identified constraints)
- Alternative evaluation
- Recommendation

2. GOALS AND CRITERIA

Goals were identified to guide the evaluation of alternatives. The following goals were established by the project team, in coordination with King County:

- Improves Nonmotorized Connections – A successful solution would improve the safety of the trail crossing and connections to the cities bike lanes and sidewalks; crossings and connections would be intuitive and comfortable for the trail users.
- Fits Context – This goal addresses the need to provide intuitive connections to the urban environment.
- Minimizes Impacts – Measuring impacts provides a balanced solution such that trail users can experience an improved nonmotorized connection without significantly degrading traffic operations or access to adjacent businesses. The analysis also measured impacts to right of way, critical areas, and utilities.
- Feasible Solution – Lastly a successful solution would be feasible to construct, as it relates to cost, schedule to construct, and maintenance requirements.

Evaluation criteria were developed based on each goal, as summarized in Table 1. The evaluation criteria were identified to measure how well each of the alternatives fulfilled the project goals.

Table 1. Goals and Evaluation Criteria

Goals and Evaluation Criteria	As Defined As
Goal: Improves Nonmotorized Connections	
Safety of crossings and connections.	Consistency with design standards
	Consider queues and their impacts to sight lines, potential for minimization of traffic conflicts
Intuitiveness of crossings and connections	Qualitative evaluation of directness of connections to intersecting sidewalks and existing bike lanes
	Qualitative evaluation of consistency of crossing concept with other (nearby) crossings in the CKC and Eastrail corridors
User comfort	Does the crossing feel safe for the user, is it convenient?
	Quantitative comparison of delay between alternatives (for east-west travel)
	Quantitative comparison of crossing distance between alternatives (for east-west travel)
Goals: Fits Context	
Aesthetics and scale relative to context of surroundings	Quality of integration with surrounding land uses
	Connections accommodate access to adjacent businesses and the trail

Table 1. Goals and Evaluation Criteria (continued)

Goals and Evaluation Criteria	As Defined As
Goal: Minimizes Impacts	
Traffic impacts on study intersections and driveways	Changes to access including reducing some or all turn movements to and from businesses. Changes to study intersection operations as measured by intersection level of service (LOS) and delay.
Impacts to traffic safety	Potential conflicts between trail users and vehicles
Impacts to ROW	Approximate ROW needed
Impacts to critical areas	Approximate impact to wetlands and sensitive areas
Impacts to drainage and groundwater	Affects drainage requirements
Impacts to utilities	Potential conflicts to PSE alignment and other utilities
Impact to Sound Transit easement rights	Impact to easement rights
Goal: Feasible Solution	
Cost to construct	Quantitative comparison of alternatives
Schedule to construct	Qualitative comparison durations and potential to close trail use
Long-term maintenance and life cycle costs	Qualitative comparison of alternatives

3. BASELINE CONDITIONS

This chapter summarizes existing and future conditions, including the transportation network and constraints (built and natural). This information was used to help identify criteria, identify gaps, identify issues which would hinder the operations of either at grade or grade separated crossings, and develop improvement alternatives.

3.1 Land Use and Transportation Network and Volumes

Currently, the Eastrail including the CKC and adjacent King County segment is a gravel surface corridor that was once part of the 42-mile former BNSF rail corridor, now called the Eastrail. Planning efforts for the Eastrail have indicated a desire for the corridor to accommodate more than just a trail, including the potential for transit, wildlife habitat, connection to walkable retail communities, and access to parks and other community amenities.

The crossing of Slater Avenue NE-132nd Avenue NE was the terminus of the CKC until May 2022. Eastrail is now open east from Slater Avenue NE-132nd Avenue NE to Woodinville. Today, to travel between the City's portion of the Eastrail and the County's portion, trail users must divert to the NE 124th Street/Slater Avenue NE intersection and use the intersections crosswalks. This diversion is 800 feet out-of-direction travel (see Figure 2). This out of direction travel distance and delay at the signal adds about 5 minutes of delay for trail users. The intersection of NE 124th Street/Slater Avenue NE also includes free right for vehicles on the east leg, which can be challenging for some users navigating the intersection. Some users also engage in jaywalking to avoid the out-of-direction travel.

Figure 2. Temporary Connection from CKC and Eastrail

On-street bicycle facilities and sidewalks are present near the CKC crossing at Slater Avenue NE-132nd Avenue NE. Most streets near the crossing provide sidewalks. Bicycle lanes exist today on Slater Avenue NE-132nd Avenue NE through the study area. NE 124th Street does not provide bicycle lanes however east of Slater Avenue NE, the roadway does have paved shoulders which can provide a refuge for bicycles lanes. West of Slater Avenue NE there are no paved shoulders on NE 124th Street. Trail user counts were collected near the Slater Avenue NE-132nd Avenue NE crossing. In Fall 2019, there were approximately 300 trail users per day along the CKC at its crossing with 120th Avenue NE (nearest available count data). It is anticipated that this will grow to between 600 and 750 users per day when Eastrail opens. Trail use is forecasted to increase to 2,000 to 3,000 users per day in the long term horizon.

Slater Avenue NE-132nd Avenue NE is a 5-lane collector arterial south of NE 126th Place and narrows to 3-lanes to the north, and has a posted speed limit of 35 mph. The roadway carries 15,000 vehicles per day (in 2022). This is down from 2019 where daily volumes peaked at 20,500 vehicles per day. The street network and traffic volumes near the crossing are shown on Figure 3. Pre-Covid, traffic queues at the NE 124th Street/Slater Avenue NE intersection would regularly extend as far as the trail crossing during the AM and PM peak periods.

NE 124th Street is classified by the City as a principal arterial and is five lanes. The signalized intersections along NE 124th Street are coordinated. In 2019 NE 124th Street carried about 27,000 to 34,000 vehicles per day in the project vicinity. (Updated 24 hour volumes were not collected for NE 124th Street in 2022 for this project).

Traffic volumes were collected in January 2022 and compared to historic counts that were taken in Fall 2019 to determine if traffic volume should be adjusted to reflect pre-Covid levels. Based on the count comparison, traffic volumes in the vicinity are approximately 20 to 30 percent lower in 2022 than in Fall of 2019. This differs with trends seen in other areas within the region which have seen peak hour traffic return to near pre-Covid levels. It was determined that the analysis would use year 2022 volumes, as it is unclear if or when traffic volumes will return to pre-Covid levels. Overestimating traffic volumes could erroneously indicate that proposed solutions would not operate well today or in the future. The analysis includes a year 2035 horizon year, where traffic volumes are expected to exceed (meaning will be greater than were experienced in a) pre-Covid conditions. Alternatives which operate acceptably for the year 2035 forecasted condition, would also operate acceptably in the short term if traffic volumes returned to pre-Covid conditions in the next few years.

It is anticipated that traffic volumes will grow by approximately 25 percent between today and the year 2035. Year 2035 traffic volumes are shown in Figure 4. This growth assumption includes planned developments in the vicinity. Based on anticipated growth, queuing would likely extend to the trail crossing by year 2035 in both the AM and PM peak periods.

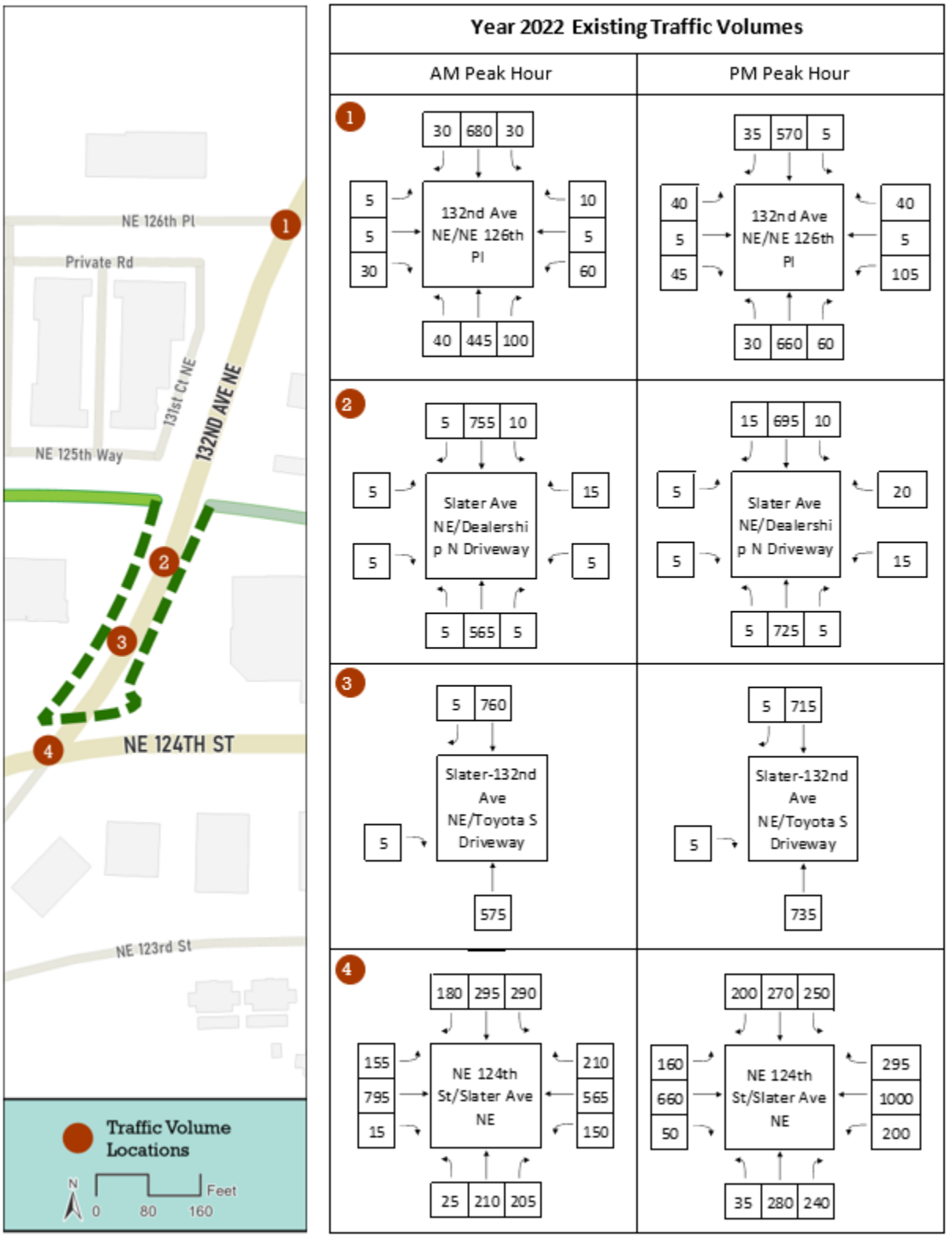


Figure 3. Existing Peak Hour Traffic Volumes

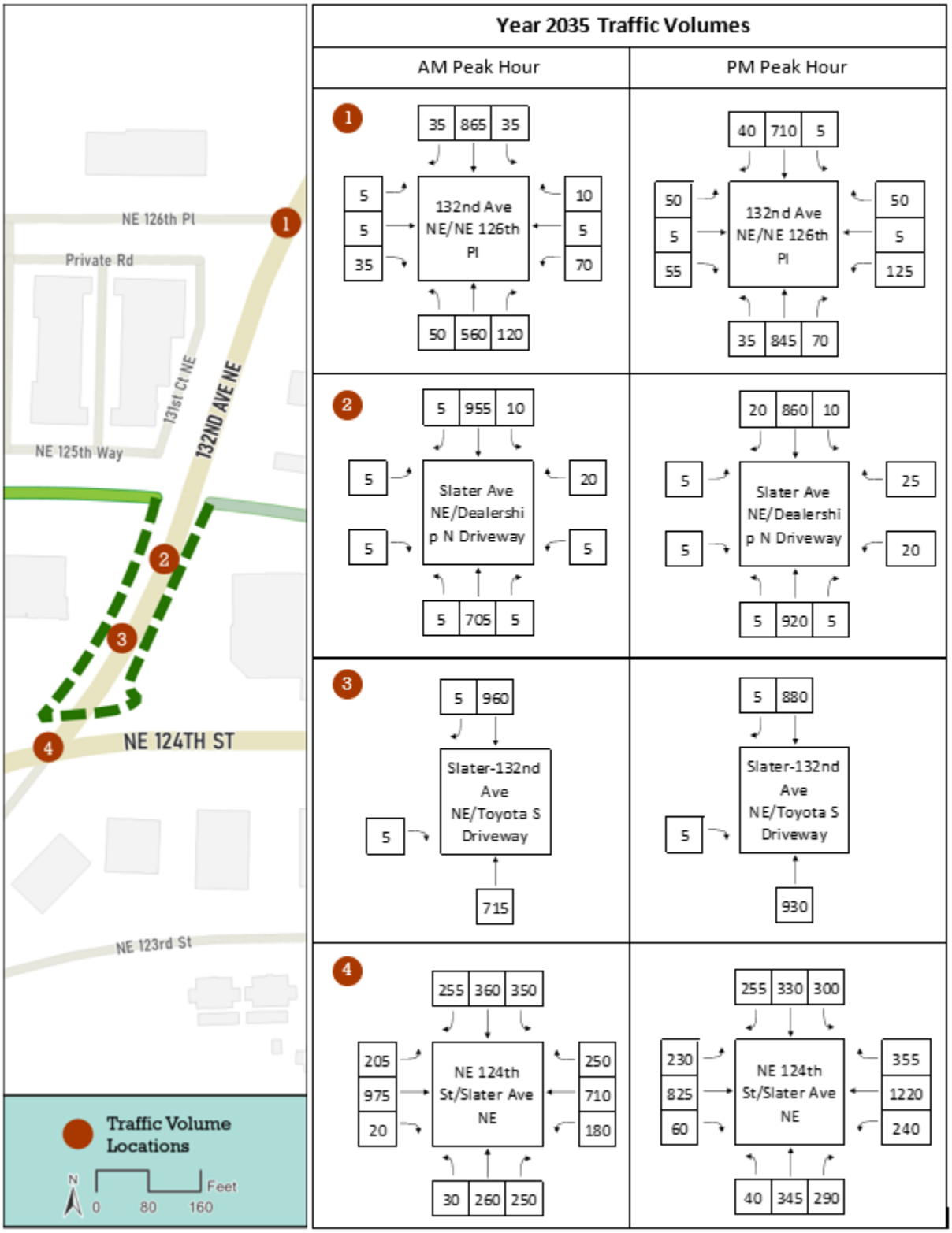


Figure 4. Year 2035 Peak Hour Traffic Volumes

At present, the study intersections (with year 2022 volumes) operate at LOS D or better (see Table 2). However, the NE 124th Street/Slater Avenue NE signalized intersection has a volume to capacity (v/c) ratio of 0.90 which indicates some movements are approaching capacity. By the year 2035 with 25 percent growth, the operations degrade to LOS E/F for both study intersections in the PM and AM peaks. The southbound left turn at NE 124th Street/Slater Avenue NE has a v/c ratio of 1.48, meaning queues would compound through the hour and stack to the north.

Several movements of the NE 124th Street/Slater Avenue NE intersection operate at LOS E or F with v/c ratios exceeding 1.0 today and in the year 2035. For a full list of intersection operations, Synchro reports are included in Appendix A.

Table 2. Existing and Year 2035 No Build Alternative Traffic Operations (LOS and V/C Ratios)

Location		Existing Conditions		Year 2035 No Build Alternative	
		AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
132nd Ave NE/NE 126th Pl (TWSC)[a]	Westbound left	C / 0.31	D / 0.56	F / 0.55	F / 0.96
NE 124th St/Slater Ave NE (Signal)	Overall	D / 0.87	D / 0.90	E / 0.95	F / 1.04
	Southbound left	D / 0.74	D / 0.87	E / 1.07	F / 1.48

Synchro version 11; level of service (LOS) and volume to capacity (v/c) ratio are from Synchro report

a TWSC = two-way stop controlled

3.2 Other Constraints

The trail crossing at Slater Avenue NE-132nd Avenue NE includes wetlands, located on both the north and south sides of the right-of-way (ROW), as shown on Figure 5. These wetlands almost extend to the edge of ROW of Slater Avenue NE-132nd Avenue NE. They include both Category III and IV wetlands.

The ROW on the west side of Slater Avenue NE-132nd Avenue NE is offset from the east side. This was researched and confirmed to be accurate as a portion of the north edge of the trail corridor in the northwest quadrant of the crossing was sold to the adjacent parcel in the late 1990s and the south edge of the was extended through a land purchase. This shift effectively reduces the right of way width available to construct improvements and makes finding an alignment for the grade separated crossing challenging.

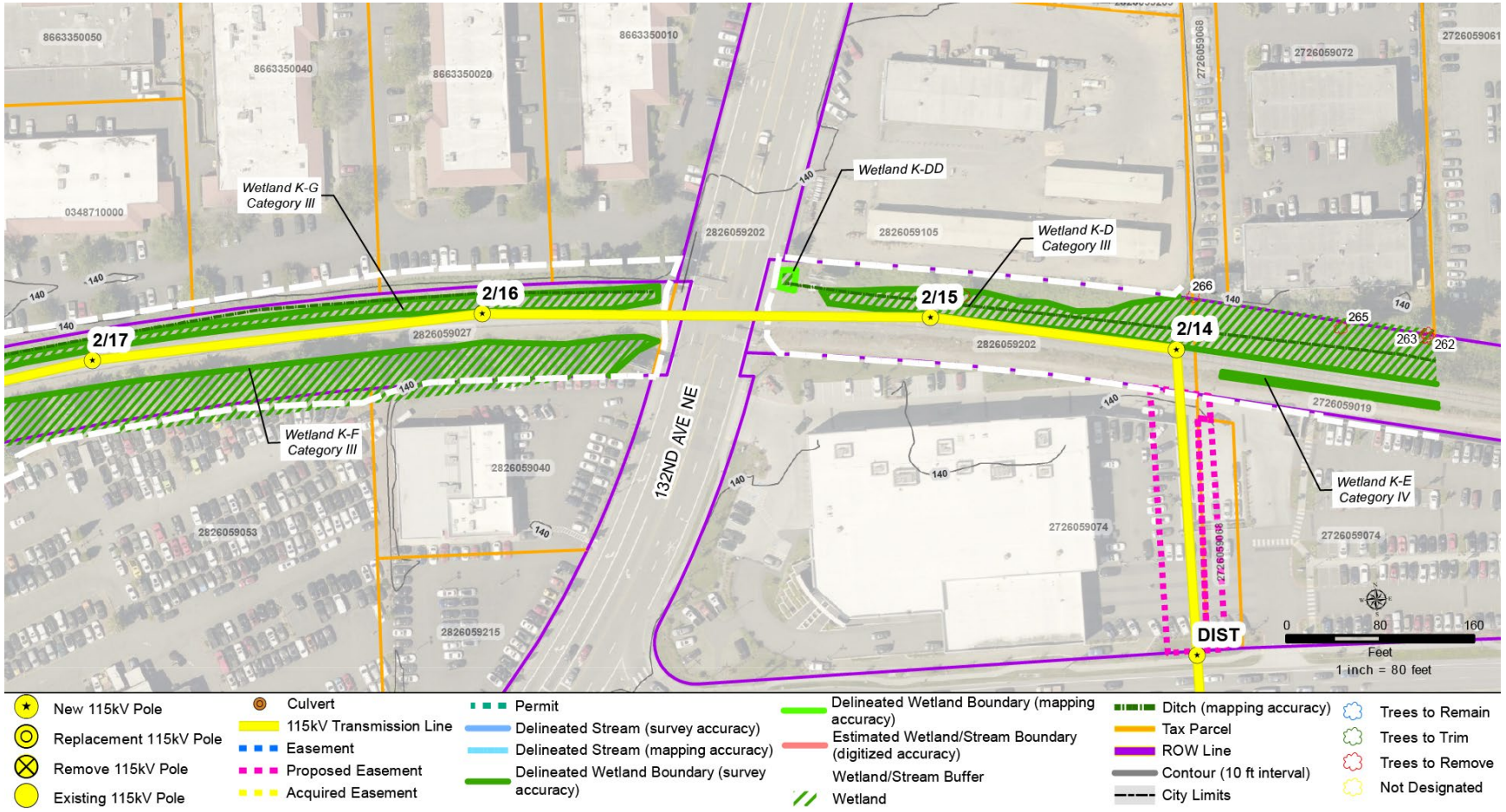


Figure 5. Wetlands, ROW, and PSE Alignment

There are also existing and planned utilities located within the trail corridor, including a 115kV Puget Sound Energy (PSE) power line (shown as the yellow line in Figure 5), the York sanitary sewer line, and other underground utilities (telecom, gas, storm, water). The PSE powerlines within the trail corridor are planned and currently undergoing design. There are also existing PSE power lines on Slater Avenue NE-132nd Avenue NE in the north-south direction.

Key existing utilities within the CKC/Eastrail corridor include:

- York twin sewer force mains (to remain) running along the south edge of the CKC with a 25-foot easement.
- Fiber optics line
- Surface ditches

Key existing utilities within the Slater Avenue NE-132nd Avenue NE ROW include:

- Underground telecom duct bank
- Underground gas line
- Underground water line
- Underground sanitary sewer line
- Overhead power lines along the east side of the roadway

4. ALTERNATIVES DEVELOPMENT

The approach to developing alternatives was to first identify solutions that may fit within the existing curbs thus they could be easy to construct and implement in the short term. Additional alternatives were also identified that might require modifications outside the existing curbs. These improvements could provide additional benefits but may be harder to fund, permit, construct, and/or implement.

A total of four types of alternatives were developed – in which two are at-grade and two are grade separated. In developing these alternatives, several variations or subsets of alternatives were identified and explored.

4.1 At-Grade

Two approaches were used to define at-grade trail crossing alternatives. The first approach was to narrow and signalize the crossing at the trail (Alternative 1 and variations). The second approach identified a more substantial modification to the roadway that could minimize queue spillback from the intersection of Slater Avenue NE and NE 124th Street (Alternative 2). Alternative 2 is not independent of Alternative 1, but would be constructed in addition the improvements identified for Alternative 1. A benefit of developing Alternative 2 as an approach that adds to rather than modifying Alternative 1 is that Alternative 2 could be constructed as a future phase without requiring reconstruction of the primary crossing.

4.1.1 Alternative 1 – Narrow Roadway at Trail Crossing

Alternative 1 included three variations, called Alternative 1A, Alternative 1B, and Alternative 1C. Each of these alternatives integrated signalization to provide traffic control at the trail crossings of Slater Avenue NE-132nd Avenue NE.

4.1.1.1 Traffic Control at the Trail Crossing

Three types of traffic controls were considered:

- A Rectangular Rapid Flashing Beacon (RRFB)
- A High Intensity Activated Crosswalk (HAWK) or pedestrian hybrid beacon (PHB)
- A full pedestrian signal

Of the traffic control considered, an RRFB is the lowest level of treatment which is activated to alert vehicles that the crosswalk is in use. A HAWK or PHB provides greater level of traffic control by requiring all vehicles to stop (then proceed if the crosswalk is clear), when a pedestrian or bicycle is in the vicinity of the crosswalk. A full pedestrian signal provides the greatest level of traffic control of the three options by stopping the vehicles for the duration of time a pedestrian or bicycle is approaching the crosswalk until they clear the roadway completely. The following describes the operations of the three traffic control devices.

When a pedestrian or bicyclist is present, an **RRFB** flashes yellow lights and is a warning for vehicles alerting about the presence of pedestrians or bicyclists in the crosswalk. When pedestrians or bicyclists are present in the crosswalk, motorcyclists must stop and yield. When no pedestrians are present, the lights are not activated or lit and the lights appears black to vehicles.

A **HAWK or PHB** operates with a yellow-red-flashing red sequence. The signal is activated by bicyclists or pedestrians with a push button. A yellow light is then activated to alert vehicles that there is a bicycle or pedestrian approaching the roadway. The next signal phase is a solid red which requires all vehicles to stop. After a period of solid red, the light will switch to a flashing red. At that point, vehicles must stop, check for pedestrians or bicycles in the travel way, and can continue. When no pedestrians are present, the signal is not lit and appears black to vehicles. A HAWK or PHB can be coordinated with adjacent signals.

Based on the Manual of Uniform Traffic Control Devices (MUTCD), a HAWK or PHB should be considered when traffic volumes and pedestrian volumes exceed the thresholds identified in the MUTCD Figure 4F-1. (See Figure 6 below).

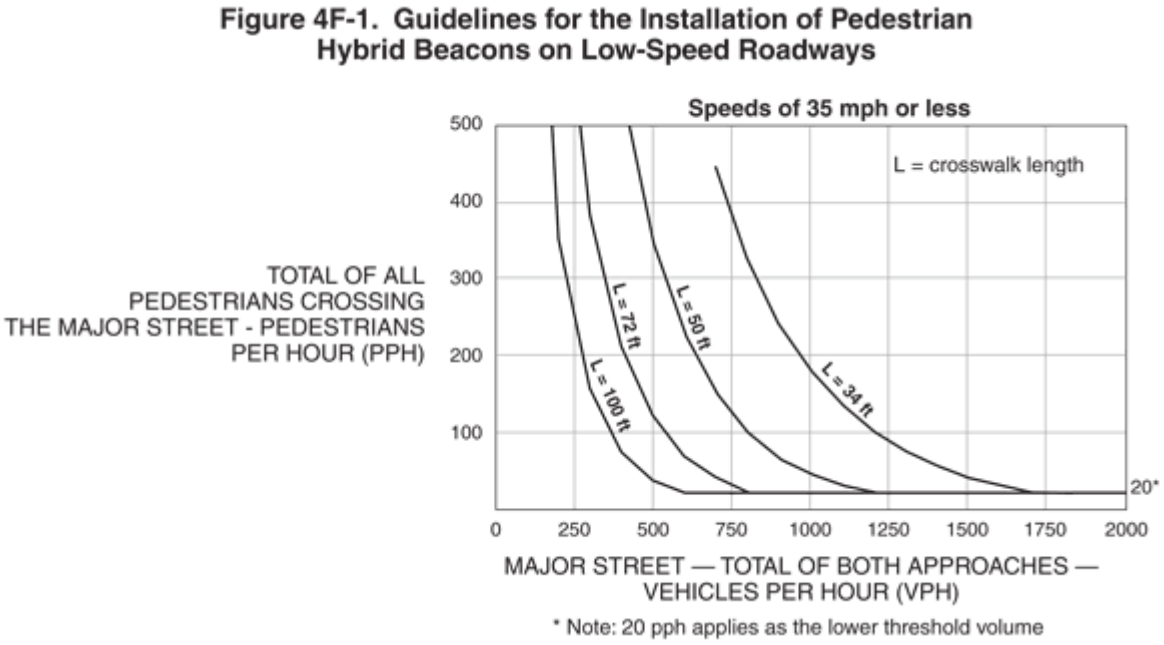


Figure 6. MUTCD Figure 4F-1 – Pedestrian Hybrid Beacon Thresholds

A **full pedestrian signal** will fully stop all the vehicles while the pedestrians or bicycles are in the crosswalk. Like the other signals, a full pedestrian signal is activated with a push button by the pedestrians or bicyclists. A full pedestrian signal can be coordinated with adjacent signals.

Of the three signal options, the full pedestrian signal results in the most delay for vehicles but also removes the decision making that occurs with the other two signals (RRFB or HAWK/PHB). With a full pedestrian signal, drivers are forced to stop with the red light; with a RRFB or HAWK/PHB, the driver can proceed if the driver determines the travel way is clear.

Based on the MUTCD, a full pedestrian signal should be considered when traffic volumes and pedestrian volumes exceed the thresholds identified in the MUTCD Figure 4C-5. (See Figure 7 below).

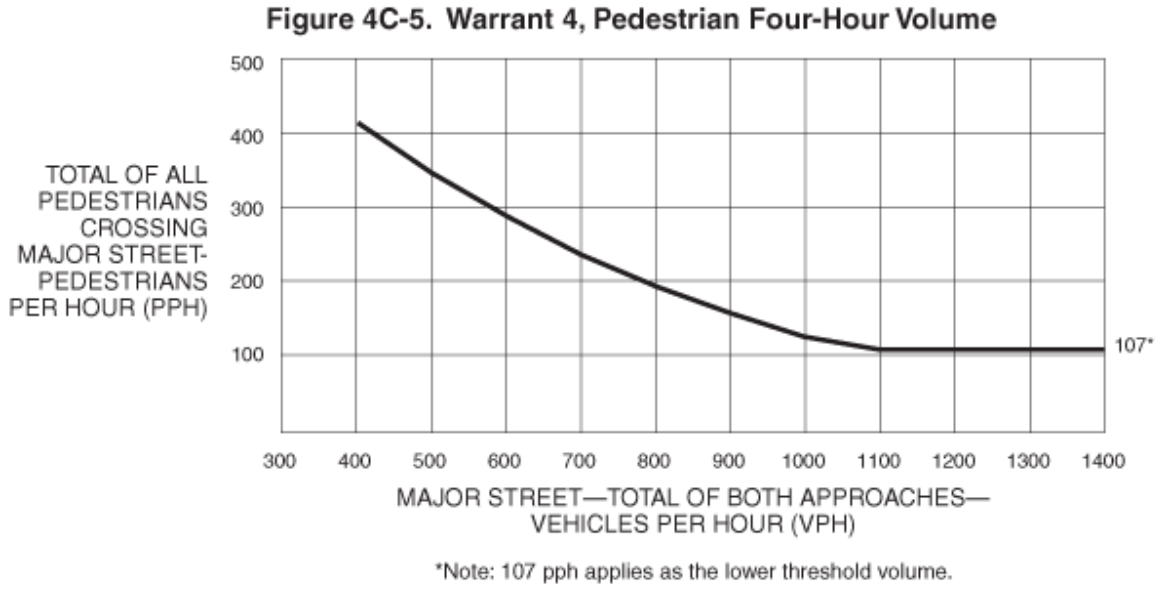


Figure 7. MUTCD Figure 4C-5 – Pedestrian Signal Warrant

At the Slater Avenue NE-132nd Avenue NE trail crossing, it is recommended to install a HAWK since the following MUTCD thresholds are met: traffic volumes exceed 1,470 peak hour trips, roadway speed is 35 mph, and a crossing width of approximately 60 feet with pedestrian volumes exceeding 20 pedestrians per hour (per MUTCD Figure 4F-1).

It is not recommended to install a RRFB as the traffic and pedestrian volumes exceed the thresholds for the HAWK. Per the MUTCD Figure 4C-5, a full pedestrian signal is not warranted with current volumes (trail use would need to exceed 107 users per hour for four hours of the day), but could be warranted in the future.

4.1.1.2 Alternative 1A - 1 Lane Northbound/2 Lane Southbound, Median

This alternative was selected as the preferred strategy to implement as soon as possible. It would construct a median refuge island and rechannelize Slater Avenue NE-132nd Avenue NE to include two southbound lanes and one northbound lane, as shown on Figure 8. The bicycle lanes on Slater Avenue NE-132nd Avenue NE would also be buffered and a signalized pedestrian crossing (compatible with a RRFB, HAWK, or full pedestrian signal) would be provided at the crossing. Given the traffic volumes and level of pedestrian and bicycles activity, it is recommended to install a HAWK.

Adding a signal at the pedestrian crossing would create a queue of vehicles at times but the queue is not expected to spillback to the NE 124th Street/Slater Avenue NE intersection regularly. The Synchro analysis indicates the typical northbound queue would be 260 feet while the distance between the intersections is about 300 feet.

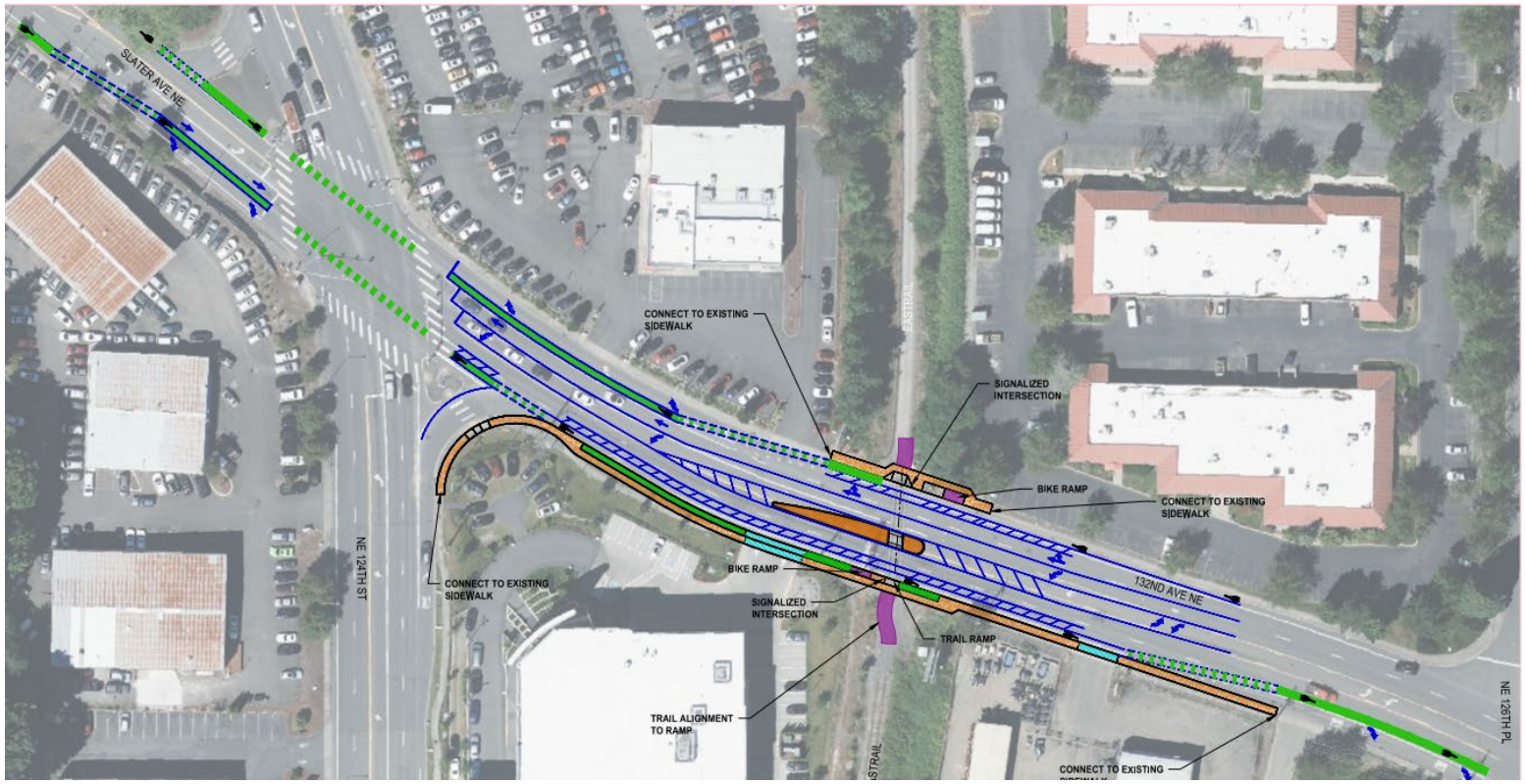


Figure 8. Alternative 1A

In the Synchro model, the pedestrian signal was modeled to behave like a HAWK signal and allowed more than one bicycle and pedestrian crossing phase to occur during the NE 124th Street/Slater Avenue NE signal cycle length.

It is recommended that the HAWK timing be coordinated with the NE 124th Street/Slater Avenue NE signal, such that the trail users are held at the curb when the southbound NE 124th Street/Slater Avenue NE signal is green. This is recommended as vehicles travelling southbound on Slater Avenue NE may be focused on the signal ahead, especially in congested conditions, and not be focused on the HAWK signal overhead. It is recommended that this condition be monitored once constructed, to optimize pedestrian safety, and reduce delays for pedestrians as much as feasible. It should be noted that an RRFB was not selected as RRFBs are not coordinated with adjacent signals, thus this is not an ideal location for an RRFB.

It should be noted that due to Synchro limitations, the following elements were coded in the model different than would occur in the field. These elements were modeled as such so that the analysis could report the typical queue that would occur when the HAWK was activated by a pedestrian or bicyclist, rather than the typical queue that occurs over the hour (which includes periods where there are no trail users present). To be able to report this case where a pedestrian or bicyclist is present, in the Synchro model the rate of bicyclist and pedestrian arrivals were maximized and reflect a volume higher than is forecasted. The Synchro model also did not assume the HAWK signal was coordinated with the NE 124th Street/Slater Avenue NE as the model reports individual intersection operations and was not used as a network analysis tool.

As shown in Table 3, the typical northbound queue at the HAWK signal is 170 to 260 feet which is less than the distance (approximately 300 feet) between NE 124th Street and the trail crossing. This means the northbound queue of traffic stopped at the HAWK when a bicyclist or pedestrian is present would not typically impact the NE 124th Street/Slater Avenue NE signal, with traffic volumes forecasted for year 2035. Existing traffic volumes are lower than year 2035, so these reported queues would be less for an existing condition. The southbound queues would be between 100 and 160 feet long, and would not impact the 132nd Avenue NE/NE 126th Place intersection.

The improvements associated with Alternative 1A were modeled in Vissim (as part of the Alternative 2 scenario described in section 4.1.2 below). The Vissim analysis was done to validate the results in Synchro. Synchro is not a network analysis tool and also does not model conditions well where queues are compounding. The analysist developed and calibrated an existing conditions AM and PM peak hour model which included the roadway between and including the NE 124th Street/Slater Avenue NE and 132nd Avenue NE/NE 124th Place intersections. The Alternative 1A analyses was completed with year 2035 volumes included the trail crossing with the HAWK signal. The Vissim model results were consistent with the Synchro analysis described above. Northbound queues that occurred when vehicles stopped at the HAWK signal cleared each cycle and did not impact the NE 124th Street/Slater Avenue NE intersection.

It should be noted that queues would exist frequently during the AM and PM peak hours on Slater Avenue NE-132nd Avenue NE in the southbound direction. This is a condition that exists today, and would worsen in the year 2035, spilling over the trail crossing frequently. Alternative 1A provides bicyclist and pedestrian priority and visibility at the crossing with a crosswalk, signage, and the HAWK signal, but does not improve the queue condition that is generated by the NE 124th Street/Slater Avenue NE signal.

Table 3. Year 2035 No Build and Alternative 1A Traffic Operations

Location	Movement	Year 2035 No Build Alternative		Year 2035 Alternative 1A	
		AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
132nd Ave NE/ NE 126th Pl (TWSC)[a]	Westbound LOS, v/c ratio	F 0.55	F 0.96	F 0.55	F 0.96
Slater Ave NE-132nd Ave NE/Trail Crossing (HAWK)	Northbound 50th percentile queue	Not Applicable	Not Applicable	170 feet	260 feet
	Southbound 50th percentile queue	Not Applicable	Not Applicable	100 feet	160 feet
NE 124th St/Slater Ave NE (Signal)	Overall LOS, v/c ratio	E 0.95	F 1.04	E 0.95	F 1.04
	Southbound Left-Turn LOS, v/c ratio	E 1.07	F 1.48	E 1.07	F 1.48
	Southbound 50th percentile queue	~400	~420	~400	~420

Synchro version 11; level of service (LOS) and volume to capacity (v/c) ratio are from Synchro report

a TWSC = two-way stop controlled b HAWK = high intensity activated crosswalk

4.1.1.3 Alternative 1B - 1 Lane Northbound/2 Lane Southbound, No Median

This alternative would rechannelize Slater Avenue NE-132nd Avenue NE to include one northbound lane and two southbound lanes (see Figure 9) similar to Alternative 1A, but with no median at the trail crossing. Alternative 1B would have a narrower crossing than 1A without the median, meaning the walk distance across Slater Avenue NE-132nd Avenue NE would be shorter. Reducing trail crossing distances on roadways is usually desirable to minimize the time bicyclists and pedestrians are exposed to traffic. However, with the existence of the southbound queue spilling back from the NE 124th Street/Slater Avenue NE intersection through the trail crossing, there would be issues with sight distance between northbound vehicles and eastbound bicyclists and pedestrians. The southbound queue could obscure visibility for trail users in the crossing. For this reason, this alternative includes a full pedestrian signal at the crossing. Vehicles would be required to stop with the red light if a bicyclist or pedestrian were in or approaching the crossing and would not require the vehicles to determine if they were present. However, as pedestrians and bicyclists may not be visible to northbound vehicles, there could be a risk of northbound vehicles violating the red light.

Northbound traffic queues at the trail crossing (with a full pedestrian signal) as shown in Table 4 are typically about 360 feet during the PM peak hour. This queue would extend to the NE 124th Street/Slater Avenue NE intersection and could potentially impact the intersection operations at times. The queues with a full pedestrian signal are longer than with a HAWK (Alternative 1A) as the vehicles are stopped longer with a full pedestrian signal (24 seconds) compared to a HAWK (some vehicles stop and proceed if a pedestrian or bicyclist has already cleared the vehicle travel lanes, and other vehicles will be delayed up to 20 seconds if a pedestrian or bicyclist is still approaching).

Alternative 1B was evaluated and the team determined it did not meet project goals. Without a median there would be sight distance issues between the trail users and northbound vehicles, as views from the northbound vehicles to the eastbound trail users would be obscured by the southbound queued traffic; and the full pedestrian signal results in queues which could potentially impact the NE 124th Street/Slater Avenue NE intersection.

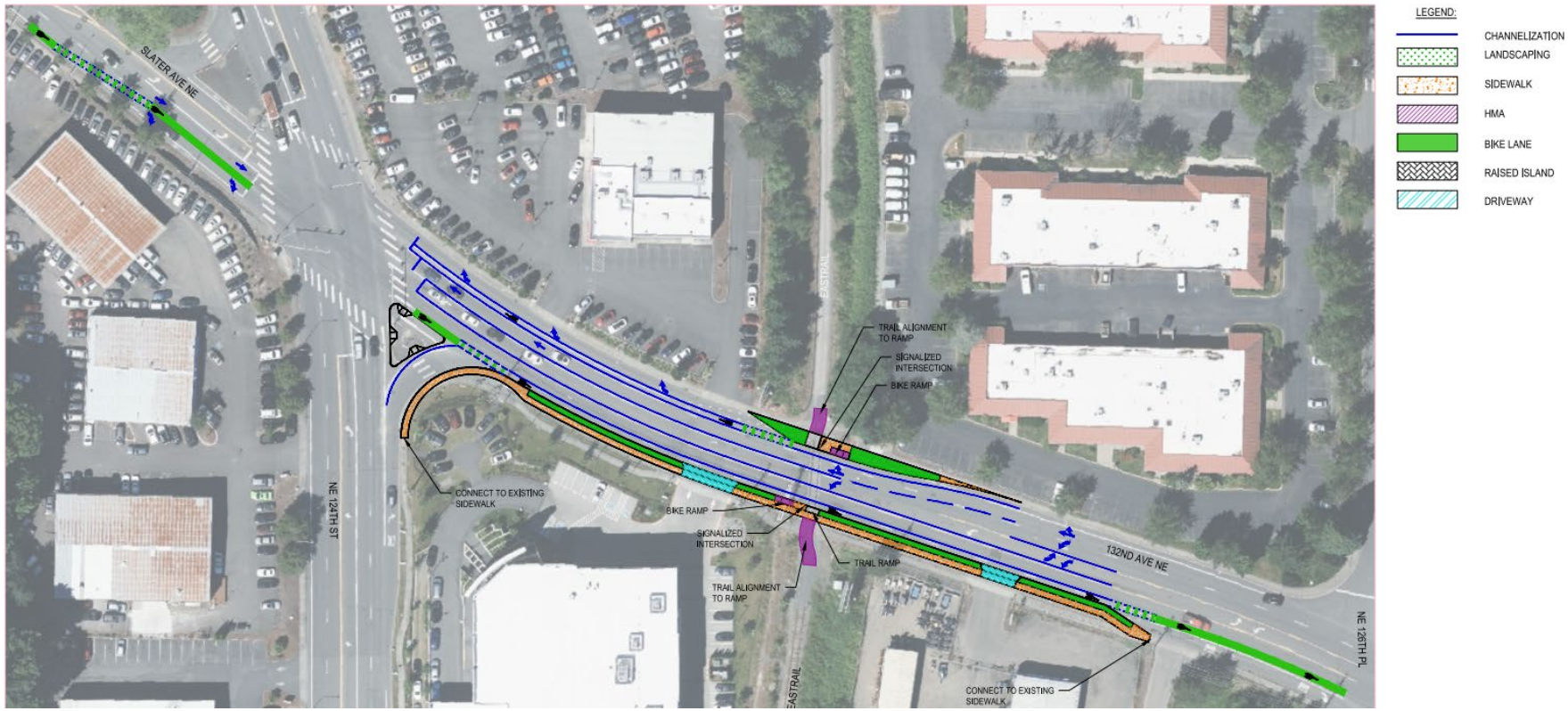


Figure 9. Alternative 1B

Table 4. Year 2035 No Build and Alternative 1B Traffic Operations

		Year 2035 No Build Alternative		Year 2035 Alternative 1B	
Location	**Movement**	**AM Peak Hour**	**PM Peak Hour**	**AM Peak Hour**	**PM Peak Hour**
132nd Ave NE/NE 126th Pl (TWSC)[a]	Overall LOS, v/c ratio	F 0.55	F 0.96	F 0.55	F 0.96
Slater Ave NE-132nd Ave NE/ Trail Crossing (HAWK)[b]	Northbound 50th percentile queue	Not Applicable	Not Applicable	210 feet	360 feet
	Southbound 50th percentile queue	Not Applicable	Not Applicable	130 feet	120 feet
NE 124th St/Slater Ave NE (Signal)	Overall LOS, v/c ratio	E 0.95	F 1.04	E 0.95	F 1.04
	Southbound left turn LOS, v/c ratio	E 1.07	F 1.48	E 1.07	F 1.48
	Southbound 50th percentile queue	~400 feet	~420 feet	~400 feet	~420 feet

Synchro version 11; level of service (LOS) and volume to capacity (v/c) are from Synchro report

a TWSC = two-way stop controlled b HAWK = high intensity activated crosswalk

4.1.1.4 Alternative 1C – 1 Lane Northbound/1 Lane Southbound, No Median

This alternative would rechannelize Slater Avenue NE-132nd Avenue NE to include one northbound lane and one southbound lane. A full pedestrian signal would be provided at the crossing. This alternative was developed to further reduce the width of the roadway at the trail crossing. However, the reduction in capacity for vehicles results in significant queues, and visibility issues between trail users and northbound vehicles as described in Alternative 1B.

Southbound queues at the trail crossing with Alternative 1C are the longest of the Alternative 1 options, as the southbound roadway is reduced to a single lane. Typical queues are estimated to be up to 370 feet.

As described in Alternative 1B above, northbound traffic queues at the trail crossing (with a full pedestrian signal) as shown in Table 5 are typically about 360 feet during the PM peak hour. This queue would extend to the NE 124th Street/Slater Avenue NE intersection and could potentially impact the intersection operations at times. The queues with a full pedestrian signal are longer than with a HAWK (Alternative 1A) as a vehicles are stopped longer with a full pedestrian signal (24 seconds) compared to a HAWK (some vehicles stop and proceed if a pedestrian or bicyclist has already cleared the vehicles travel lanes, and other vehicles will be delayed up to 20 seconds if a pedestrian or bicyclist is still approaching).

Design layouts were not produced for this alternative as it was evaluated and removed from consideration due to traffic operations issues, as the single lane southbound at the crossing would result in compounding queues that would likely impact NE 126th Place and spill further north. The alternative was also removed from further consideration through the tier 1 evaluation process for the same reasons as Alternative 1B. As described in section 6.1, without a median, there would be sight distance issues for trail users travelling eastbound and northbound vehicles, as views from the northbound vehicles to the eastbound trail users would be obscured by the southbound queued traffic. As pedestrians and bicyclists may not be visible to northbound vehicles, there could be a risk of northbound vehicles violating the red light.

Table 5. Year 2035 No Build and Alternative 1C Traffic Operations

		Year 2035 No Build Alternative		Year 2035 Alternative 1C	
Location	**Movement**	**AM Peak Hour**	**PM Peak Hour**	**AM Peak Hour**	**PM Peak Hour**
132nd Ave NE/ NE 126th Pl (TWSC)[a]	Overall LOS, v/c ratio	F 0.55	F 0.96	F 0.55	F 0.96
Slater Ave NE-132nd Ave NE / Trail Crossing (HAWK)[b]	Northbound 50th percentile queue	Not Applicable	Not Applicable	210 feet	360 feet
	Southbound 50th percentile queue	Not Applicable	Not Applicable	370 feet	310 feet
NE 124th St/Slater Ave NE (Signal)	Overall LOS, v/c ratio	E 0.95	F 1.04	E 0.95	F 1.04
	Southbound left turn LOS, v/c ratio	E 1.07	F 1.48	E 1.07	F 1.48
	Southbound 50th percentile queue	~400 feet	~420 feet	~400 feet	~420 feet

Synchro version 11; LOS and v/c are from Synchro report

a TWSC = two-way stop controlled b HAWK = high intensity activated crosswalk

4.1.2 Alternative 2 – Reduce Southbound Queues at Trail Crossing

This alternative could be constructed after Alternative 1A and would add capacity at the intersection of NE 124th Street/Slater Avenue NE to reduce southbound queuing that would spillback through the CKC trail crossing in the future. Alternative 2 is shown in Figure 10. The alternative includes a second southbound left turn lane, and converts the southbound right turn lane to a shared through-right turn lane. A second receiving lane would need to be constructed south of the intersection for the two southbound through lanes. The lane could drop a few hundred feet south of the intersection. Because the intersecting roads of NE 124th Street and 132nd Avenue NE do not intersect perpendicularly and are skewed, creating the two southbound left turns would require adjustments to the east leg of the intersection (NE 124th Street). As shown in Figure 10 below, the westbound stop bars are moved to the east, and additional width is provided on the eastbound departing lanes, to accommodate the southbound left turning radius.

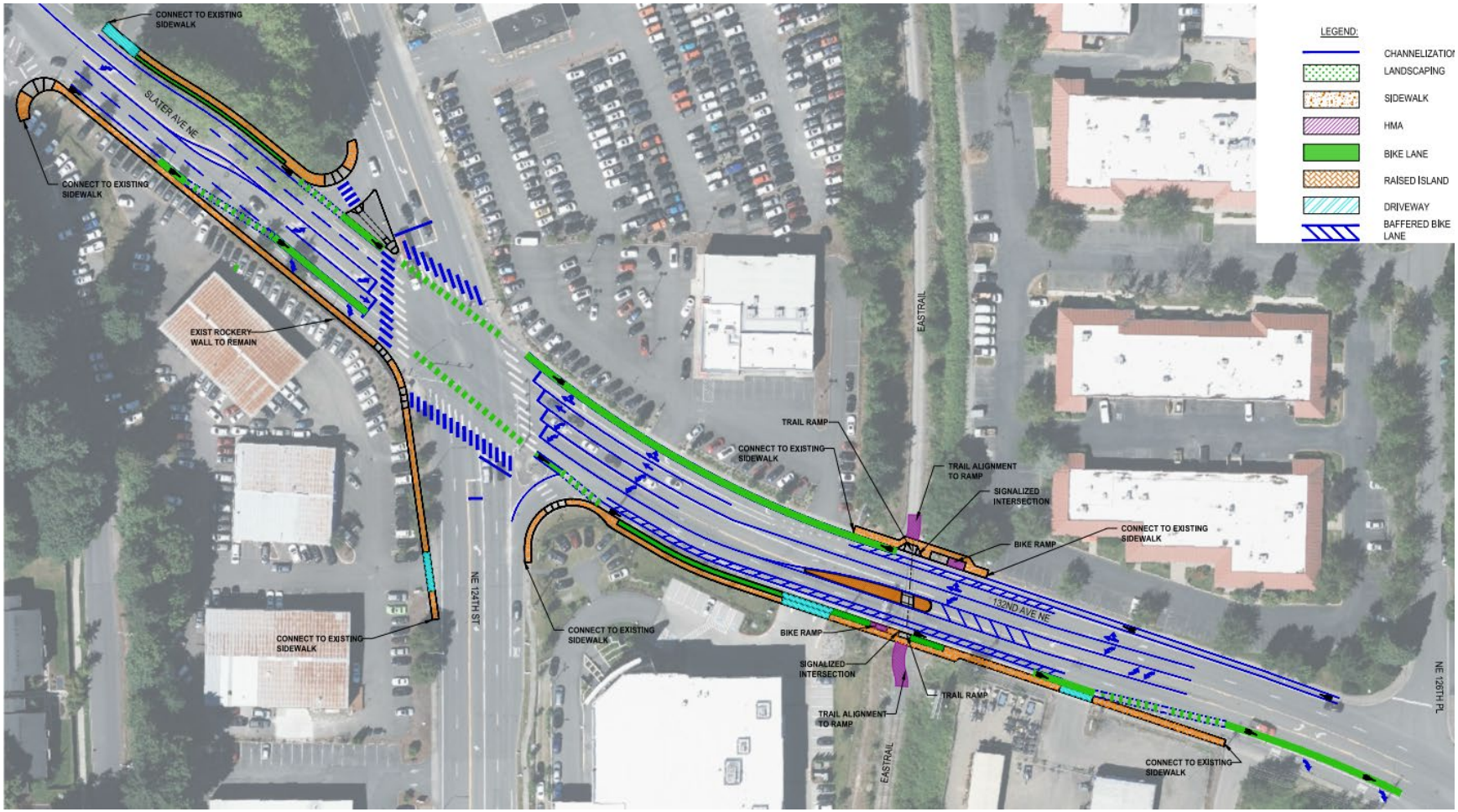


Figure 10. Alternative 2

The capacity improvements at NE 124th Street/Slater Avenue NE significantly improve the operations of the southbound movements. The southbound left turn v/c ratio is 1.48 in the No Build Alternative with a typical queue which would spill back past the trail crossing. Once a v/c ratio exceeds 1.0, there is more traffic approaching the signal than can be served in a cycle. This means traffic is not cleared after each signal cycle and queues compound. In this condition, Synchro is not able to calculate the typical queue and the data output appears with a "~" indicating the queue will be longer than reported. Therefore the 420-foot southbound queue reported in the No Build alternative would be much longer, and regularly queue across the trail crossing. With the capacity improvements included in Alternative 2, this southbound v/c ratio is reduced to less than 1.0 and the queue is 150 to 180 feet, which would no longer spill across the trail crossing.

It should be noted that the signal phasing and splits were not optimized with the capacity improvements. This is because the NE 124th Street corridor signals are all coordinated. If in the Synchro model the splits were allowed to be optimized, the east and westbound movements that are over capacity would likely absorb some of the benefit and reduce the benefit on the southbound approach. This would also result in the NE 124th Street corridor signals to no longer be coordinated. Table 6 below shows the results (LOS, v/c ratios, and queues) without any updates to signal splits. However if these capacity improvements were to be constructed, the City would likely re-time the NE 124th Street corridor signals and the benefit may be less than shown below.

Alternative 2 includes the same HAWK signal described under Alternative 1A above.

Alternative 2 was also modeled in the Vissim microsimulation tool. This analysis was done to validate the results in Synchro. Synchro is not a network analysis tool and also does not model conditions well where queues are compounding. The analysist developed and calibrated an existing conditions AM and PM peak hour model which included the roadway between and including the NE 124th Street/Slater Avenue NE and 132nd Avenue NE/NE 124th Place intersections. Alternative 2 was then modeled with year 2035 volumes and included the intersection capacity improvements at NE 124th Street/Slater Avenue, and the trail crossing with the HAWK signal. The Vissim model results were consistent with the Synchro analysis shown below. Northbound queues that occurred when vehicles stopped at the HAWK signal cleared each cycle and did not impact the NE 124th Street/Slater Avenue NE intersection, and the same reduction in the southbound queue approaching NE 124th Street/Slater Avenue NE were identified.

Table 6. Year 2035 No Build and Alternative 2 Traffic Operations

		Year 2035 No Build Alternative		Year 2035 Alternative 2	
Location	**Movement**	**AM Peak Hour**	**PM Peak Hour**	**AM Peak Hour**	**PM Peak Hour**
132nd Ave NE/ NE 126th Pl (TWSC)[a]	Overall LOS, v/c ratio	F 0.55	F 0.96	F 0.55	F 0.96
Slater Ave NE-132nd Ave NE/ Trail Crossing (HAWK)[b]	Northbound 50th percentile queue	Not Applicable	Not Applicable	170 feet	260 feet
	Southbound 50th percentile queue	Not Applicable	Not Applicable	100 feet	160 feet
NE 124th St/Slater Ave NE (Signal)	Overall LOS, v/c ratio	E 0.95	F 1.04	D 0.85	E 0.96
	Southbound left turn LOS, v/c ratio	E 1.07	F 1.48	D 0.82	F 0.87
	Southbound 50th percentile queue	~400 feet	~420 feet	180 feet	150 feet

Synchro version 11; level of service (LOS) and volume to capacity (v/c) ratio are from Synchro report

a TWSC = two-way stop controlled b HAWK = high intensity activated crosswalk

4.2 Grade Separated

Two grade separated alternatives were developed – a bridge alternative (Alternative 3) and a tunnel alternative (Alternative 4).

4.2.1 Alternative 3 – Bridge

The grade separated bridge option provides a non-motorized connection of the CKC/Eastrail trail over Slater Avenue NE-132nd Avenue NE without impacting traffic operations.

A bridge structure would consist of two 410 feet long approach ramps on retained earth fill embankments supported by Mechanically Stabilized Earth (MSE) retaining walls. The ramps would lead up to a 3-span steel undulating arch bridge comprised of two outer underslung arches each spanning 65 feet and a main span overhead arch spanning 105 feet over Slater Avenue NE-132nd Avenue NE. The proposed pathway would maintain a 14 foot clear width with a maximum five percent grade per Washington State Department of Transportation (WSDOT) Design Manual for Shared-Use Paths, which necessitates the long approach ramps. The existing at-grade trail will remain in its current alignment and will tie into the grade separated approach 500 feet away from the roadway. The at-grade trail is needed to provide maintenance vehicle access to the utilities in the corridor.

Stairs could be added on the north side of the overpass each side of Slater Avenue NE-132nd Avenue NE to provide a more direct connection with the bus stops, but would require some land acquisition for the west staircase.

Figures 11 through 14 depict the bridge and PSE alignments, as well as the proximity to the property line, in plan and profile views.

Figure 11. Alternative 3 – Bridge – Plan View

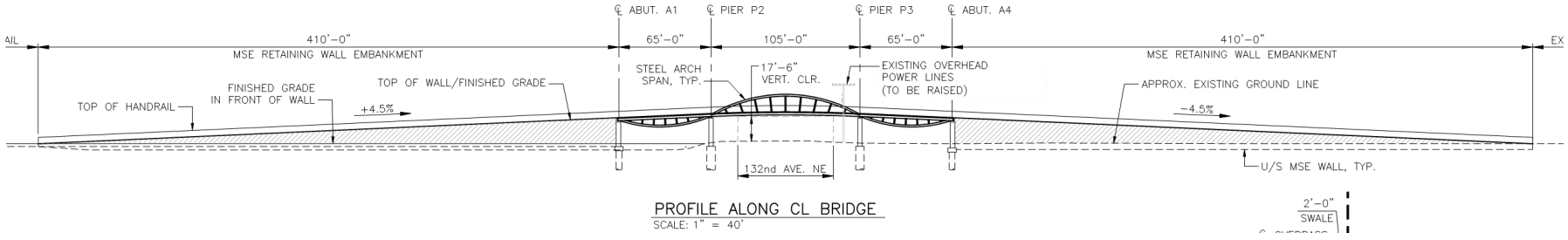


Figure 12. Alternative 3 – Bridge - Profile

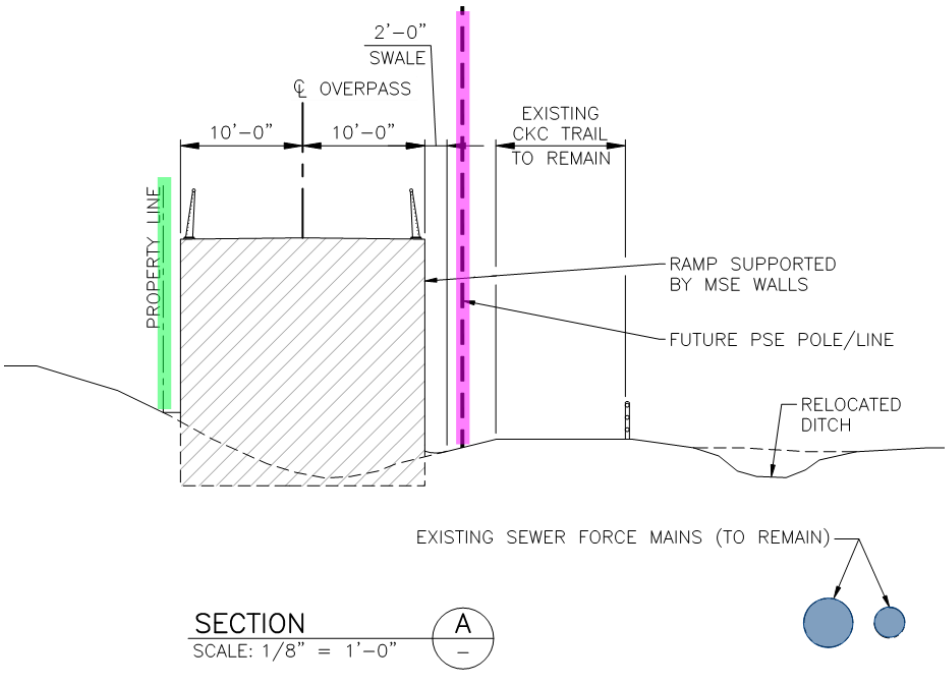


Figure 13. Alternative 3 – Bridge – Alignment Relative to Property Line and PSE

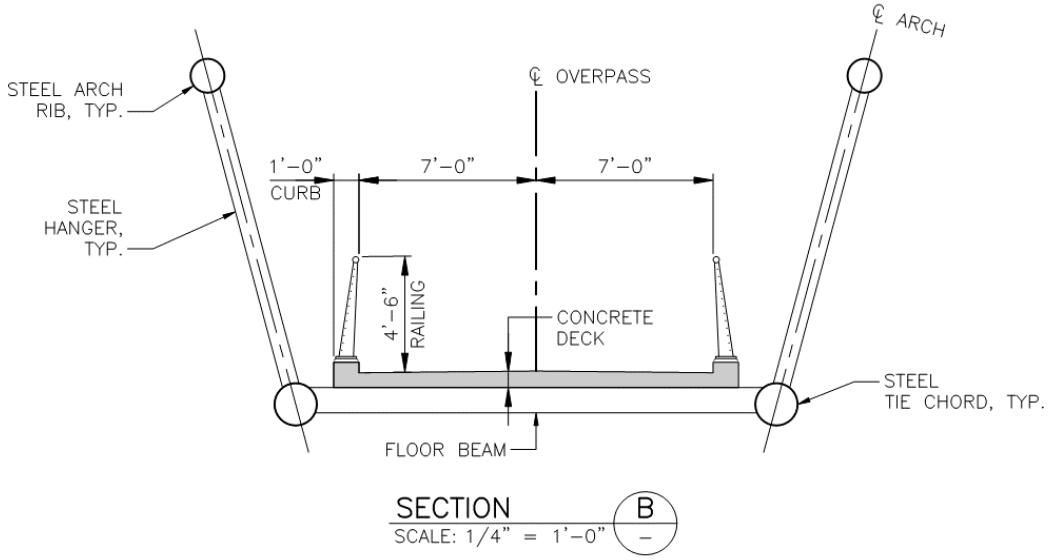


Figure 14. Alternative 3 – Bridge Detail

The alignment was chosen to accommodate the right-of-way, the permanent force main easement and the future PSE pole locations. These constraints are highlighted in the plan view above. The two existing underground sewer force mains, which are to remain in place, pushes the alignment of the grade separated structure to the north of the existing trail.

There is currently a drainage ditch along the north edge of the corridor which will need to be relocated for the proposed alignment. Since the site has been designated as an environmentally sensitive wetland,

relocating the ditch to the south side of the existing trail will require the project to fund off-site mitigation measures.

The future PSE power lines will run just north of the existing trail and south of the proposed structure. Accommodating the future PSE lines pushes the bridge ramps to sit near the north boundary of the CKC, which has a jog in the right-of-way west of Slater Avenue NE-132nd Avenue NE.

Existing overhead power lines running along the east side of Slater Avenue NE-132nd Avenue NE will need to be raised (or buried) to allow the bridge to pass below with sufficient vertical clearance from the lines. This will affect the height of four to five poles and may require coordination with the future PSE lines where they overlap, if the future lines do not provide adequate clearance.

Coordination with PSE concluded that they will be able to replace their guyed poles at 2/15, 2/16, and 2/17 with self-supporting cantilevered glulam poles. The glulam poles may need to be slightly shifted closer to the at-grade trail to provide additional clearance to the structure. Pole 2/14 would remain with guys and the approach ramp would be low enough at this point to pass under the guy wires.

Vertical MSE retaining walls were selected for the design as a cost-effective means of supporting the approaches while staying clear of ROW, the sewer easement, and the future PSE line. The lateral offset between the walls and sewer lines will not impose any surcharge to the pipes to avoid damaging the pipes. It is noted that the retaining wall aspect ratio may need a deviation from Federal Highway Administration (FHWA) given the trail width and max wall height. Also, there is limited width between the north face of wall and the ROW, which may need a maintenance agreement with the north property owner for inspections.

The proposed design closely matches Totem Lake Connector bridge, which is currently under construction approximately 0.6 miles South-West of the site. The similar design will allow for visual continuity and an esthetic repetition of structural forms (see Figure 15).

Figure 15. Rendering of Totem Lake Connector Bridge

4.2.2 Alternative 4 – Tunnel

The grade separated tunnel option provides a non-motorized connection of the CKC trail by passing under Slater Avenue NE-132nd Avenue NE. Similar to the bridge option, the tunnel design has several alignment constraints including the right of way limits, existing and future utilities, and considerations for wetlands. The tunnel design will also need accommodations for the high ground water elevation at the site.

Figures 16 through 19 depict the tunnel and PSE alignments, as well as the proximity to the property line, in plan and profile views.

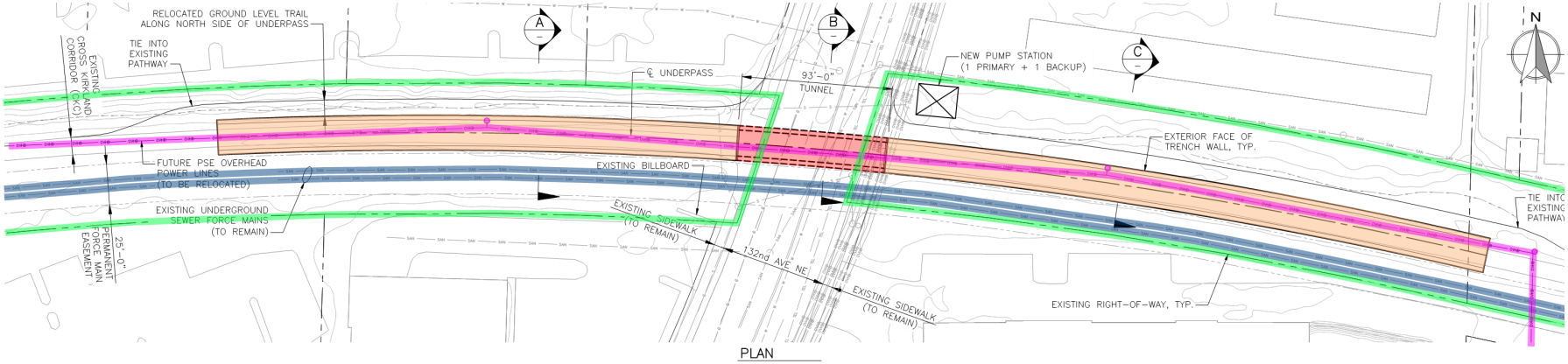


Figure 16. Alternative 4 – Tunnel – Plan View

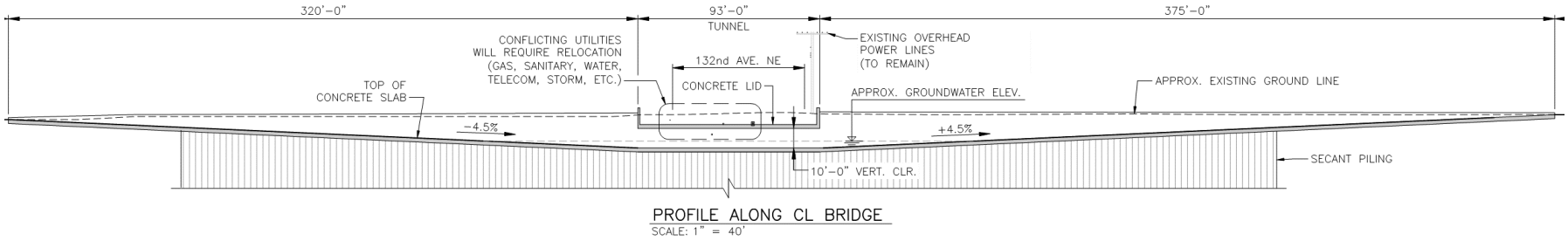


Figure 17. Alternative 4 – Tunnel – Profile

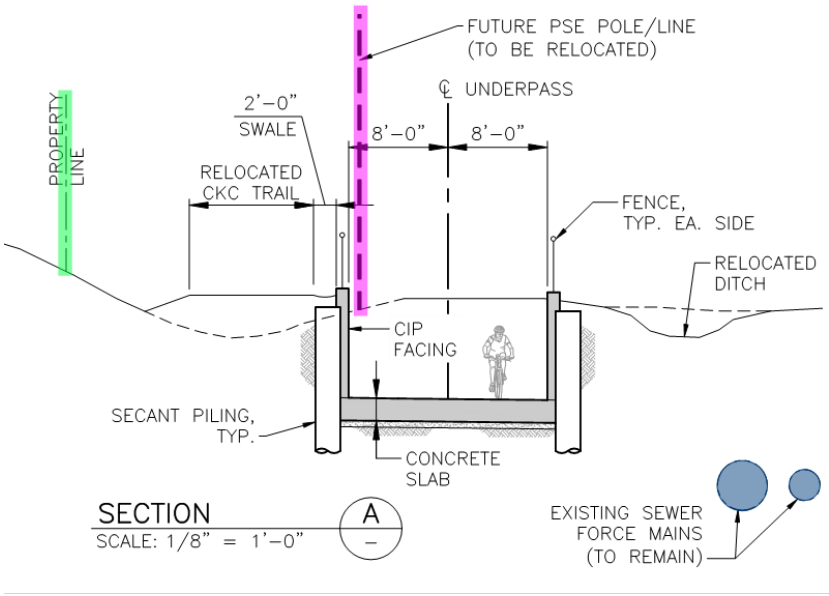


Figure 18. Alternative 4 – Tunnel – Alignment Relative to Property Line and PSE

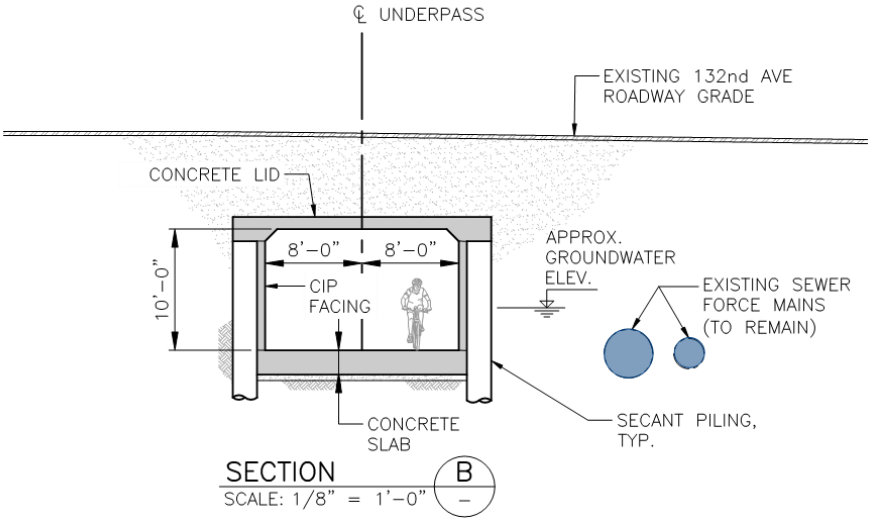


Figure 19. Alternative 4 – Tunnel Detail

The proposed grade-separated structure consists of secant pile walls and a cast-in-place bottom slab with a maximum grade of five percent per WSDOT Design Manual for Shared-Use Paths. The slope necessitates the 320 feet and 375 feet approaches at west and east sides of the tunnel, respectively. A precast or cast-in-place concrete lid is formed to complete the tunnel where it passes under Slater Avenue NE-132nd Avenue NE. The tunnel will have a clear height of 10 feet, and the pathway will maintain a clear width of 16 feet. A cast-in-place facia is proposed to line the inside face of the secant piles for an esthetic finish. A guardrail will be mounted to tops of the secant pile walls to provide fall protection. Similar designs are shown in the Figure 20 below.

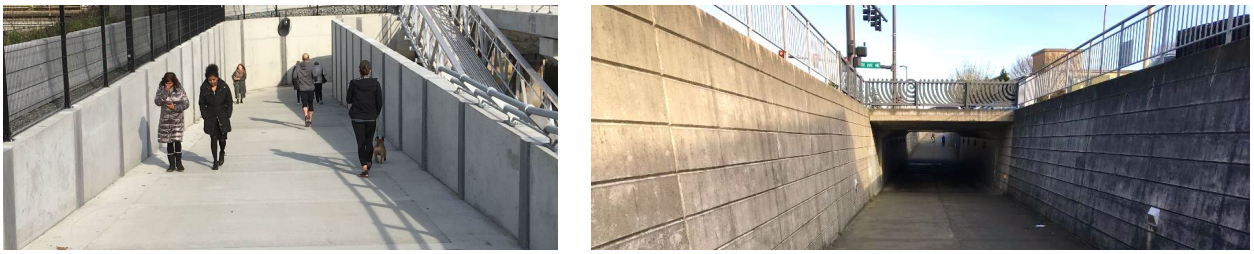


Figure 20. Comparable Grade Separated Tunnel Configurations

The structure is proposed to follow the alignment of the existing CKC trail to maintain a clear line of sight as users approach the tunnel for safety purposes. The at-grade trail will be relocated along the north edge of the structure.

The top elevation of the tunnel is proposed to be approximately 8 feet below the existing grade. Conflicting utilities which run under Slater Avenue NE-132nd Avenue NE will require relocating. The proposed alignment does not interface well with the future PSE power lines either, as two of the poles are planned above the north secant pile wall and will need to be relocated. The environmentally sensitive drainage ditch will also require relocating, resulting in the need for off-site mitigation measures.

Ground water elevation is high at the site location. The proposed secant piling system consists of a series of piles which cut into each other forming a continuous and water-tight retaining wall. Baker tanks will be used during construction to pump the water out from in front of the walls. Although costly, the additional benefits of the proposed retaining wall are that it does not require tie backs, which would encroach into neighboring properties, and it is watertight. Construction methods also offer less vibration than traditional pile driving, allowing a safer option near the existing sewer mains. Water stops will be cast into the edges of the slab and lid to avoid infill of ground water between the joints.

Since a portion of the water-tight box will be submerged below ground water elevation, the tunnel will have buoyancy and induce an upward force. The secant piles would need to be deep enough to resist the uplift.

The open aired trenched ramps will allow for rainwater to accumulate and run down to the tunnel. A permanent pump system will need to be installed and maintained throughout the tunnels service life to ensure the pathway does not flood. The pump station is proposed to be located east of 132nd Avenue NE in the north edge of the Eastrail corridor. There would be a primary and backup pump.

5. FEASIBILITY

To support the alternatives evaluation process, the rough order of magnitude (ROM) costs were developed, and the construction duration were identified. The following summarizes the findings for the four alternatives.

5.1 Methodology for Developing Costs

The soft costs consist of Engineering/Design, Construction management, Permitting, Taxes, and City / King County Staff Costs. The construction costs are built up using basic unit costs applied to major elements, including contingency and allowances. Unit costs are based on WSDOT BDM 2020 values (where information is available) and previous experience with costs for similar overpass and trench/tunnel structures. The values used reflect an efficient, constructable design with strong aesthetic merit. The ROM is for a roughly two percent design, so the values retain ambiguity on structural details, and precedes survey or geotechnical information. The Accuracy of the estimate for this feasibility study is -40 percent and +100 percent per WSDOT Estimating Guidelines, Table 4-1: Cost Estimating Matrix. It should be noted that the second quarter of 2022 has been a challenging time for accurate pricing due to state of inflation. As such, it is recommended that the project be re-estimated as construction approaches.

5.2 At-Grade (Alternatives 1A and 2)

Upon review of the three sub-alternatives (1A, 1B, and 1C), Alternative 1A was carried forward and included in the feasibility analysis. The reasons behind the decision to carry forward Alternative 1A is included in Section 6 of this report.

The project footprint was conceptually laid out on GIS and aerial basemapping, and rough quantities for cost estimation were developed. Given the conceptual nature of the project design, a 30 percent contingency factor was applied. Additional elements such as Engineering Design and Construction Management were calculated using guidance from the WSDOT Cost Estimating Manual.

The construction of the at-grade alternative would take place as a phased approach. Alternative 1A is considered the first phase. Actual construction sequencing would be determined by the Contractor building the work, as well as street closure limitations set by the City of Kirkland. It is likely the City will not allow for full-street closures, so all improvements would be constructed through several work zones to keep traffic open in all directions during construction. Often the Contractor does this by implementing half-street closures and/or a series of full-corner closures. For example the Contractor may begin by closing the northeast corner, including the northbound lanes, and shifting all traffic to the west to keep a minimum of one northbound lane and one southbound lane in each direction. Once the northeast corner is constructed, the contractor would shift traffic to the east and work along the west side, and so forth. The signal installation and turn on would take place as one of the final phases of work. With this scenario of half-street closures, it is anticipated that construction could take up to 6 to 9 months.

When funding allows, the second phase would be Alternative 2. Again, actual construction sequencing would be determined by the contractor building the work, as well as street closure limitations set by the City of Kirkland. It is again likely the City will not allow for full-street closures, so all improvements would be constructed through several work zones to keep traffic open in all directions during construction. The contractor would again do this by implementing half-street closures, and/or a series of full-corner

closures. For example the contractor may begin by closing the west side of the south leg, and shifting all traffic to the east to keep a minimum of one northbound lane and one southbound lane in each direction. Once the west side is constructed, the contractor would shift traffic to the west and work along the east side, and so forth. The signal installation and turn on would take place as one of the final phases of work. With this scenario of half-street closures, it is anticipated that construction could take 9 to 12 months.

Table 7. At-Grade Alternative Costs (in 2022 Dollars) and Construction Duration

	Construction Cost	Soft Costs1	Total Cost	Construction Duration
Alternative 1A	$2.0M	$1.3M	$3.3M	6-9 months
Alternative 2	$2.9M	$1.7M	$4.6M	9-12 months

1 Soft costs include engineering/design, construction management, permitting, taxes, and City/King County Staff costs

5.3 Grade Separated (Alternatives 3 and 4)

A ROM cost estimate was produced for the two grade separated crossing alternatives and are shown in Table 8.

Table 8. Grade Separated Alternative Costs (in 2022 Dollars)and Construction Duration

	Deck Clear Width	Construction Cost	Soft Costs[1]	Total Cost	Construction Duration
Alternative 3 (Bridge)	14 feet	$10.5M	$4.9M	$15.4M	15 months
Alternative 4 (Tunnel)	16 feet	$17.1M	$8.0M	$25.1M	15 months

1 Soft costs include engineering/design, construction management, permitting, taxes, and City/King County Staff costs

The entire duration of construction for both the bridge and tunnel options are anticipated to be approximately 15 months. There would be minimal impacts to the roadway during the construction of the bridge, with only a few night closures expected when the main spans are erected, and precast deck panels are placed. The construction of the tunnel, however, will require approximately 20 days of roadway closures, as well as additional night closures.

It is anticipated that the tunnel and trenches would be constructed in stages, working linearly from west to east (or vise-versa). The lengthy road closure will allow for the secant piles to be constructed across the roadway, the trench excavated, ground water pumped out, cast-in-place bottom slab poured, and precast panels placed to form a temporary road surface. Night closures will then allow for the temporary panels to be replaced with the permanent concrete lid option and road paving to be completed.

During construction, both of the grade separated alternatives will require closing the CKC/Eastrail corridor at the site, with a temporary detour option for trail users. The proposed detour would divert pedestrians and cyclists up 128th Lane NE, where the road curves to head east along NE 126th Place, and then north along 139th Avenue NE before turning back onto the trail where the road intersects with the Willows Road Connector and then onto the Eastrail corridor.

6. ALTERNATIVE EVALUATION

A two-tiered approach was used to identify alternatives which met the project goals. The first tier identified if there were elements of the alternative which significantly degraded traffic operations, did not provide an improved safety condition for trail users, or were not feasible to construct and maintain. The second tier evaluated the remaining alternatives against the identified criteria to determine if one or more alternatives met the project goals, and to provide data to support a recommendation or strategy for the City to implement.

6.1 Tier 1 Evaluation

The first step of the evaluation process was to evaluate if the alternatives would meet the project goals and be feasible to construct. Alternatives which were identified to have significant flaws, would not provide a safe crossing, or are not feasible to construct were removed from consideration.

Alternatives 1B and 1C did not move beyond the tier 1 evaluation because they created the potential for sight/visibility issues between northbound vehicles on Slater Avenue NE-132nd Avenue NE and eastbound trail users, as visibility of trail users could be blocked by the southbound queue during peak periods. As pedestrians and bicyclists may not be visible to northbound vehicles, there could be a risk of northbound vehicles violating the red light.

Alternative 4 did not move beyond the tier 1 evaluation because the tunnel would be below ground water level. This would require a pump, back up pump and electrical to prevent water from flooding the tunnel. This would add additional capital and operating costs to the project.

It should be noted that as the four alternatives (Alternatives 1A/B/C, 2, 3, and 4) were developed, there were several other strategies that were tested and it was found that those strategies did not result in a system that meets the project need or caused greater offsets (potential cost, impacts to businesses, and driveway access). For example revising the signal timing at NE 124th Street/Slater Avenue NE to reduce the southbound queues was considered but it was found that the all the approaches of the intersection are at or over capacity and this modification would have significant negative implications to the operations of the other movements.

6.2 Tier 2 Evaluation

The alternatives that were included in the second tier of analysis were scored on their performance on each of the evaluation criteria. The summary results are shown in Table 9. The full results of the analysis for all alternatives including a short description of the qualitative or quantitative data supporting the scoring are included in Appendix B.

The findings of the tier 2 evaluation are that there is an at-grade improvement (Alternative 1A) that can provide significant benefit to trail users (in terms of travel time, safety, visibility, intuitive travel routes). This alternative will provide direct connections to the existing bike lanes and sidewalks on Slater Avenue NE-132nd Avenue NE. The improvements associated with Alternative 1A however would not reduce the queue that exists on southbound Slater Avenue NE-132nd Avenue NE approaching the NE 124th Street/Slater Avenue NE intersection. If Alternative 1A were constructed, the design of the crossing should include elements such as a “do not block” area or other signage to keep the trail crossing area clear.

Alternative 1A can be built within the existing ROW and meet the project needs. In general, Alternative 1A performed higher on the project goals to Minimize Impacts and provide a Feasible Solution. Alternative 1A had minimal to no impacts to ROW, critical areas, drainage and groundwater, utilities, and Sound Transit easement rights. This alternative also had lower construction costs and construction duration (of 6 to 9 months) and would have minimal life cycle costs. This alternative can be funded and constructed sooner than the other alternatives (Alternatives 2 and 3) due to these factors.

Alternative 2 would be built as an addition to Alternative 1A, and would substantially improve traffic queue spillbacks through the trail crossing. However Alternative 2 would have more impacts to the built environment (impacts to ROW and drainage and groundwater due new impervious surface) as well as higher construction costs and a longer construction timeline (of 9 to 12 months).

Alternative 3 would provide complete separation of the trail from the roadway below. This is an advantage to “through” trail users. However trail users travelling between the trail and the local streets in this vicinity would have a less intuitive, less direct connection than would occur with Alternative 1A or Alternative 2. This alternative would have more impacts on the built environment (impacts to ROW, critical areas, drainage and groundwater, utilities, and Sound Transit easement rights). An additional risk is that the PSE alignment along the trail was determined to accommodate a bridge connection, however the bridge would be located tightly against the northern ROW edge. At this level of design, it is determined that this appears feasible, but this conflict is a risk going forward in further design, and it could be costly to move the PSE alignment further. The City and PSE are currently working to form an agreement that would require PSE to modify their poles (see Appendix C) in the event that the City decides to pursue a bridge in the future. Alternative 3 would also have higher construction costs and construction duration (at least 15 months) as well as more long-term maintenance costs.

Table 9. Evaluation Results

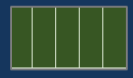
Goals and Evaluation Criteria	As Defined As	Legend: Lowest Performing  >>>  Highest Performing			
		Existing/No Build	At-Grade Alternatives: Alt 1A	At-Grade Alternatives: Alt 2	Alt 3 - Bridge
Goal: Improves Nonmotorized Connections					
Safety of crossings and connections.	Consistency with design standards				
	Consider queues and their impact to sight lines. potential for minimization of traffic conflicts				
Intuitiveness of crossings and connections	Qualitative evaluation of directness of connections to intersecting sidewalks and existing bike lanes				
	Qualitative evaluation of consistency of crossing concept with other (nearby) crossings in the CKC and Eastrail corridors				
User comfort	Does the crossing feel safe for the user, is it convenient?				
	Quantitative comparison of delay between alternatives (for E-W travel)				
	Quantitative comparison of crossing distance between alternatives (for E-W travel)				

Table 9. Evaluation Results (continued)

Goals and Evaluation Criteria	As Defined As	Legend: Lowest Performing  >>>  Highest Performing			
			At-Grade Alternatives		
		Existing/No Build	Alt 1A	Alt 2	Alt 3 - Bridge
Goal: Fits Context					
Aesthetics and scale relative to context of surroundings	Quality of integration with surrounding land uses				
	Connections accommodate access to adjacent businesses and the trail				
Goal: Minimizes Impacts					
Traffic impacts on study intersections and driveways	Changes to access including reducing some or all turn movements to and from businesses. Changes to study intersection operations as measured by intersection LOS and delay.				
Impacts to traffic safety	Potential conflicts between trail users and vehicles				
Impacts to right of way	Approximate ROW needed				
Impacts to critical areas	Approximate impact to wetlands and sensitive areas				
Impacts to drainage and groundwater	Affects drainage requirements				

Table 9. Evaluation Results (continued)

Goals and Evaluation Criteria	As Defined As	Legend: Lowest Performing  >>>  Highest Performing			
		Existing/No Build	At-Grade Alternatives		Alt 3 - Bridge
			Alt 1A	Alt 2	
Goal: Minimizes Impacts (Continued)					
Impacts to utilities	Potential conflicts to PSE alignment and other utilities				
Impact to ST easement rights	Impact to easement rights				
Goal: Feasible Solution					
Cost to construct	Quantitative comparison of alternatives				
Schedule to construct	Qualitative comparison durations and potential to close trail use				
Long-term maintenance and life cycle costs	Qualitative comparison of alternatives				

7. RECOMMENDATION

One near-term and two long-term alternatives were selected that best meet the purpose and need of the crossing. These three alternatives were selected because they performed relatively high in the evaluation process.

Alternative 1A would be an ideal near-term solution that could be implemented easier than the other alternatives. Alternative 1A would include an at-grade crossing with a narrowed crossing distance and a pedestrian signal (recommended installing a HAWK beacon). When the findings of the evaluation process were presented to City Council, they provided direction that Alternative 1A be implemented as soon as possible. This alternative will be added to the City's Capital Improvement Program (CIP) and City staff will work to fund and construct this improvement as quickly as is feasible.

Two long-term alternatives have been identified for consideration: Alternative 2, which would add capacity to the NE 124th Street/Slater Avenue NE intersection, and Alternative 3, which would construct a pedestrian bridge at the trail crossing. Only one of these alternatives would be constructed. The City will continue to monitor traffic and trail use to determine the best long-term solution for construction. Based on future traffic and trail use, a full pedestrian signal could be warranted for Alternative 2.

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Appendix A

Synchro Reports

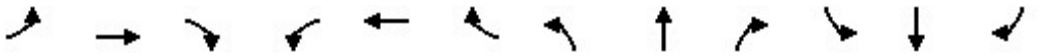
The following Synchro results are included in this appendix.

Scenario	Intersection
Existing, AM and PM Peak	• Slater Ave NE & NE 124th St • Slater Ave NE/132nd Ave NE & NE 126th Pl
Year 2035/No Build, AM and PM Peak	• Slater Ave NE & NE 124th St • Slater Ave NE/132nd Ave NE & NE 126th Pl
Year 2035/Alt 1A, AM and PM Peak	• Slater Ave NE & Eastrail Crossing *Report not included; Same as No Build –* • *Slater Ave NE & NE 124th St* • *Slater Ave NE/132nd Ave NE & NE 126th Pl*
Year 2035/Alt 1B, AM and PM Peak	• Slater Ave NE & Eastrail Crossing *Report not included; Same as No Build –* • *Slater Ave NE & NE 124th St* • *Slater Ave NE/132nd Ave NE & NE 126th Pl*
Year 2035/Alt 1C, AM and PM Peak	• Slater Ave NE & Eastrail Crossing *Report not included; Same as No Build –* • *Slater Ave NE & NE 124th St* • *Slater Ave NE/132nd Ave NE & NE 126th Pl*
Year 2035/Alt 2, AM and PM Peak	• Slater Ave NE & NE 124th St *Report not included; Same as Alt 1A –* • *Slater Ave NE & Eastrail Crossing* *Report not included; Same as No Build –* • *Slater Ave NE/132nd Ave NE & NE 126th Pl*

Existing and No Build

AM and PM Peak Hour

Synchro Reports



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	155	795	15	150	565	210	25	210	205	290	295	180
Future Volume (vph)	155	795	15	150	565	210	25	210	205	290	295	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	11	11	11	11	11	11	11
Grade (%)		-1%			-2%			-5%			0%	
Storage Length (ft)	250		80	440		200	0		0	350		0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor			0.98			0.98		0.99				0.99
Frt			0.850			0.850		0.926				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1744	3489	1561	1770	3422	1531	1703	3131	0	1678	1766	1501
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1744	3489	1522	1770	3422	1494	1703	3131	0	1678	1766	1482
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			179			233		168				200
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		421			1236			330			877	
Travel Time (s)		8.2			24.1			9.0			17.1	
Confl. Peds. (#/hr)			2			9			2			
Confl. Bikes (#/hr)						1			1			1
Peak Hour Factor	0.94	0.94	0.94	0.90	0.90	0.90	0.85	0.85	0.85	0.90	0.90	0.90
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	5%	5%	5%	4%	4%	4%
Adj. Flow (vph)	165	846	16	167	628	233	29	247	241	322	328	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	165	846	16	167	628	233	29	488	0	322	328	200
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane					Yes						Yes	
Headway Factor	0.99	0.99	0.99	0.99	1.03	1.03	1.01	1.01	1.01	1.04	1.04	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1	1	1	1	1	1	1		1	1	1
Detector Template			Right									
Leading Detector (ft)	65	50	20	40	30	0	85	40		60	50	40
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Size(ft)	65	50	20	40	30	0	85	40		60	50	40
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			6			2						8
Detector Phase	1	6	6	5	2	2	7	4		3	8	8
Switch Phase												
Minimum Initial (s)	6.0	15.0	15.0	6.0	15.0	15.0	6.0	10.0		6.0	10.0	10.0
Minimum Split (s)	12.5	36.5	36.5	12.5	39.5	39.5	12.5	39.5		12.5	36.5	36.5
Total Split (s)	20.0	49.0	49.0	20.0	49.0	49.0	15.0	41.0		30.0	56.0	56.0
Total Split (%)	14.3%	35.0%	35.0%	14.3%	35.0%	35.0%	10.7%	29.3%		21.4%	40.0%	40.0%
Maximum Green (s)	13.5	42.5	42.5	13.5	42.5	42.5	8.5	34.5		23.5	49.5	49.5
Yellow Time (s)	3.5	5.0	5.0	3.5	5.0	5.0	4.0	5.0		4.0	5.0	5.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	2.5	1.5		2.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5		6.5	6.5	6.5
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lead		Lag	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	4.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		23.0	23.0		26.0	26.0		26.0			23.0	23.0
Pedestrian Calls (#/hr)		2	2		9	9		2			0	0
Act Effct Green (s)	13.5	43.5	43.5	13.5	43.5	43.5	7.0	20.9		36.1	55.0	55.0
Actuated g/C Ratio	0.10	0.31	0.31	0.10	0.31	0.31	0.05	0.15		0.26	0.39	0.39
v/c Ratio	0.98	0.78	0.03	0.98	0.59	0.37	0.34	0.80		0.74	0.47	0.28
Control Delay	119.6	35.0	0.1	116.1	27.9	7.3	74.8	47.0		60.0	35.9	5.0
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	119.6	35.0	0.1	116.1	27.9	7.3	74.8	47.0		60.0	35.9	5.0
LOS	F	C	A	F	C	A	E	D		E	D	A
Approach Delay		48.0			37.5			48.6			37.8	
Approach LOS		D			D			D			D	

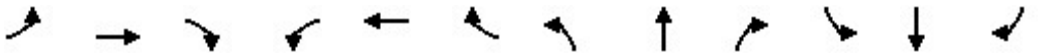
Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 18 (13%), Referenced to phase 2:WBT and 6:EBT, Start of 1st Green			
Natural Cycle: 125			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.98			
Intersection Signal Delay: 42.4		Intersection LOS: D	
Intersection Capacity Utilization 87.3%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 4: Slater Ave NE & NE 124th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	165	846	16	167	628	233	29	488	322	328	200
v/c Ratio	0.98	0.78	0.03	0.98	0.59	0.37	0.34	0.80	0.74	0.47	0.28
Control Delay	119.6	35.0	0.1	116.1	27.9	7.3	74.8	47.0	60.0	35.9	5.0
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	119.6	35.0	0.1	116.1	27.9	7.3	74.8	47.0	60.0	35.9	5.0
Queue Length 50th (ft)	158	361	0	162	261	59	26	154	268	235	0
Queue Length 95th (ft)	#314	432	0	#319	301	93	57	177	#520	335	54
Internal Link Dist (ft)		341			1156			250		797	
Turn Bay Length (ft)	250		80	440		200			350		
Base Capacity (vph)	168	1083	595	170	1062	624	103	898	433	693	703
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	0.98	0.78	0.03	0.98	0.59	0.37	0.28	0.54	0.74	0.47	0.28

Intersection Summary

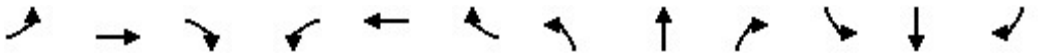
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	5	30	60	5	10	40	445	100	30	680	30
Future Volume (Veh/h)	5	5	30	60	5	10	40	445	100	30	680	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	33	65	5	11	43	484	109	33	739	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								877				
pX, platoon unblocked	0.91	0.91		0.91	0.91	0.91				0.91		
vC, conflicting volume	1405	1500	756	1427	1408	484	772			593		
vC1, stage 1 conf vol	822	822		570	570							
vC2, stage 2 conf vol	584	679		857	838							
vCu, unblocked vol	1395	1501	756	1419	1398	379	772			499		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	98	92	73	98	98	95			97		
cM capacity (veh/h)	285	282	408	238	282	605	843			965		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1
Volume Total	43	81	43	484	109	805
Volume Left	5	65	43	0	0	33
Volume Right	33	11	0	0	109	33
cSH	370	263	843	1700	1700	965
Volume to Capacity	0.12	0.31	0.05	0.28	0.06	0.03
Queue Length 95th (ft)	10	32	4	0	0	3
Control Delay (s)	16.0	24.7	9.5	0.0	0.0	0.9
Lane LOS	C	C	A			A
Approach Delay (s)	16.0	24.7	0.6			0.9
Approach LOS	C	C				

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	79.6%	ICU Level of Service	D	
Analysis Period (min)	15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	160	660	50	200	1000	295	35	280	240	250	270	200
Future Volume (vph)	160	660	50	200	1000	295	35	280	240	250	270	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	11	11	11	11	11	11	11
Grade (%)		-1%			-2%			-5%			0%	
Storage Length (ft)	250		80	440		200	0		0	350		0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Ped Bike Factor			0.97			0.98		0.99				0.98
Frt			0.850			0.850		0.931				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1744	3489	1561	1787	3455	1546	1736	3205	0	1711	1801	1531
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1744	3489	1519	1787	3455	1517	1736	3205	0	1711	1801	1507
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			179			195		147				211
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		421			1236			330			877	
Travel Time (s)		8.2			24.1			9.0			17.1	
Confl. Peds. (#/hr)			3			5			5			2
Confl. Bikes (#/hr)						1			1			1
Peak Hour Factor	0.93	0.93	0.93	0.95	0.95	0.95	0.87	0.87	0.87	0.95	0.95	0.95
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Adj. Flow (vph)	172	710	54	211	1053	311	40	322	276	263	284	211
Shared Lane Traffic (%)												
Lane Group Flow (vph)	172	710	54	211	1053	311	40	598	0	263	284	211
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane					Yes						Yes	
Headway Factor	0.99	0.99	0.99	0.99	1.03	1.03	1.01	1.01	1.01	1.04	1.04	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1	1	1	1	1	1	1		1	1	1
Detector Template			Right									
Leading Detector (ft)	65	50	20	40	30	0	85	40		60	50	40
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Size(ft)	65	50	20	40	30	0	85	40		60	50	40
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			6			2						8
Detector Phase	1	6	6	5	2	2	7	4		3	8	8
Switch Phase												
Minimum Initial (s)	6.0	15.0	15.0	6.0	15.0	15.0	6.0	10.0		6.0	10.0	10.0
Minimum Split (s)	12.5	36.5	36.5	12.5	39.5	39.5	12.5	39.5		12.5	36.5	36.5
Total Split (s)	24.0	53.0	53.0	24.0	53.0	53.0	21.0	41.0		22.0	42.0	42.0
Total Split (%)	17.1%	37.9%	37.9%	17.1%	37.9%	37.9%	15.0%	29.3%		15.7%	30.0%	30.0%
Maximum Green (s)	17.5	46.5	46.5	17.5	46.5	46.5	14.5	34.5		15.5	35.5	35.5
Yellow Time (s)	3.5	5.0	5.0	3.5	5.0	5.0	4.0	5.0		4.0	5.0	5.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	2.5	1.5		2.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5		6.5	6.5	6.5
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lead		Lag	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	4.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		23.0	23.0		26.0	26.0		26.0			23.0	23.0
Pedestrian Calls (#/hr)		3	3		5	5		5			2	2
Act Effct Green (s)	17.5	46.5	46.5	17.5	46.5	46.5	8.0	25.2		24.8	44.5	44.5
Actuated g/C Ratio	0.12	0.33	0.33	0.12	0.33	0.33	0.06	0.18		0.18	0.32	0.32
v/c Ratio	0.79	0.61	0.09	0.95	0.92	0.49	0.41	0.86		0.87	0.50	0.34
Control Delay	69.0	27.7	0.7	108.6	49.4	15.2	75.3	54.1		83.2	43.8	6.3
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	69.0	27.7	0.7	108.6	49.4	15.2	75.3	54.1		83.2	43.8	6.3
LOS	E	C	A	F	D	B	E	D		F	D	A
Approach Delay		33.7			50.6			55.5			47.0	
Approach LOS		C			D			E			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 5 (4%), Referenced to phase 2:WBT and 6:EBT, Start of 1st Green			
Natural Cycle: 135			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.95			
Intersection Signal Delay: 46.6		Intersection LOS: D	
Intersection Capacity Utilization 89.5%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 4: Slater Ave NE & NE 124th St

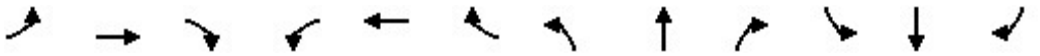
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	172	710	54	211	1053	311	40	598	263	284	211
v/c Ratio	0.79	0.61	0.09	0.95	0.92	0.49	0.41	0.86	0.87	0.50	0.34
Control Delay	69.0	27.7	0.7	108.6	49.4	15.2	75.3	54.1	83.2	43.8	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	69.0	27.7	0.7	108.6	49.4	15.2	75.3	54.1	83.2	43.8	6.3
Queue Length 50th (ft)	160	318	0	203	439	89	36	216	236	214	0
Queue Length 95th (ft)	#275	339	7	#359	#601	113	73	255	#480	321	62
Internal Link Dist (ft)		341			1156			250		797	
Turn Bay Length (ft)	250		80	440		200			350		
Base Capacity (vph)	218	1158	624	223	1147	634	179	900	302	572	623
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	0.79	0.61	0.09	0.95	0.92	0.49	0.22	0.66	0.87	0.50	0.34

Intersection Summary

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

18: Slater Ave NE/132nd Ave NE & NE 126th Pl/NE 126th Pl

HCM Unsignalized Intersection Capacity Analysis



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	5	45	105	5	40	30	660	60	5	570	35
Future Volume (Veh/h)	40	5	45	105	5	40	30	660	60	5	570	35
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	5	49	114	5	43	33	717	65	5	620	38
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								877				
pX, platoon unblocked	0.84	0.84		0.84	0.84	0.84				0.84		
vC, conflicting volume	1478	1497	639	1484	1451	717	658			782		
vC1, stage 1 conf vol	649	649		783	783							
vC2, stage 2 conf vol	828	848		700	668							
vCu, unblocked vol	1473	1496	639	1480	1442	570	658			647		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	83	98	90	56	98	90	96			99		
cM capacity (veh/h)	256	285	476	258	293	439	930			790		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1
Volume Total	97	162	33	717	65	663
Volume Left	43	114	33	0	0	5
Volume Right	49	43	0	0	65	38
cSH	336	290	930	1700	1700	790
Volume to Capacity	0.29	0.56	0.04	0.42	0.04	0.01
Queue Length 95th (ft)	29	79	3	0	0	0
Control Delay (s)	20.0	32.0	9.0	0.0	0.0	0.2
Lane LOS	C	D	A			A
Approach Delay (s)	20.0	32.0	0.4			0.2
Approach LOS	C	D				

Intersection Summary				
Average Delay	4.3			
Intersection Capacity Utilization	56.2%	ICU Level of Service	B	
Analysis Period (min)	15			

4: Slater Ave NE & NE 124th St

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	205	975	20	180	710	250	30	260	250	350	360	255
Future Volume (vph)	205	975	20	180	710	250	30	260	250	350	360	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	11	11	11	11	11	11	11
Grade (%)		-1%			-2%			-5%			0%	
Storage Length (ft)	250		80	440		200	0		0	350		0
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor			0.98			0.98			0.98			0.99
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1744	3489	1561	1770	3422	1531	1703	1793	1524	1678	1766	1501
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1744	3489	1522	1770	3422	1494	1703	1793	1501	1678	1766	1482
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			179			223			205			283
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		421			1236			330			877	
Travel Time (s)		8.2			24.1			9.0			17.1	
Confl. Peds. (#/hr)			2			9			2			
Confl. Bikes (#/hr)						1			1			1
Peak Hour Factor	0.94	0.94	0.94	0.90	0.90	0.90	0.85	0.85	0.85	0.90	0.90	0.90
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	5%	5%	5%	4%	4%	4%
Adj. Flow (vph)	218	1037	21	200	789	278	35	306	294	389	400	283
Shared Lane Traffic (%)												
Lane Group Flow (vph)	218	1037	21	200	789	278	35	306	294	389	400	283
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane					Yes						Yes	
Headway Factor	0.99	0.99	0.99	0.99	1.03	1.03	1.01	1.01	1.01	1.04	1.04	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1	1	1	1	1	1	1	1	1	1	1
Detector Template			Right						Right			
Leading Detector (ft)	65	50	20	40	30	0	85	40	20	60	50	40
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	65	50	20	40	30	0	85	40	20	60	50	40
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	

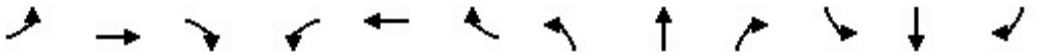
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			6			2			4			8
Detector Phase	1	6	6	5	2	2	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	6.0	15.0	15.0	6.0	15.0	15.0	6.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	12.5	36.5	36.5	12.5	39.5	39.5	12.5	39.5	39.5	12.5	36.5	36.5
Total Split (s)	20.0	49.0	49.0	20.0	49.0	49.0	15.0	41.0	41.0	30.0	56.0	56.0
Total Split (%)	14.3%	35.0%	35.0%	14.3%	35.0%	35.0%	10.7%	29.3%	29.3%	21.4%	40.0%	40.0%
Maximum Green (s)	13.5	42.5	42.5	13.5	42.5	42.5	8.5	34.5	34.5	23.5	49.5	49.5
Yellow Time (s)	3.5	5.0	5.0	3.5	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	2.5	1.5	1.5	2.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	4.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0
Flash Dont Walk (s)		23.0	23.0		26.0	26.0		26.0	26.0		23.0	23.0
Pedestrian Calls (#/hr)		2	2		9	9		2	2		0	0
Act Effct Green (s)	13.5	42.5	42.5	13.5	42.5	42.5	7.3	27.8	27.8	30.2	53.2	53.2
Actuated g/C Ratio	0.10	0.30	0.30	0.10	0.30	0.30	0.05	0.20	0.20	0.22	0.38	0.38
v/c Ratio	1.30	0.98	0.04	1.18	0.76	0.46	0.40	0.86	0.64	1.07	0.60	0.38
Control Delay	214.9	59.1	0.1	169.0	33.9	10.3	77.3	76.8	21.6	119.4	40.4	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	214.9	59.1	0.1	169.0	33.9	10.3	77.3	76.8	21.6	119.4	40.4	4.9
LOS	F	E	A	F	C	B	E	E	C	F	D	A
Approach Delay		84.7			50.1			51.2			59.7	
Approach LOS		F			D			D			E	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 18 (13%), Referenced to phase 2:WBT and 6:EBT, Start of 1st Green			
Natural Cycle: 145			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.30			
Intersection Signal Delay: 63.1		Intersection LOS: E	
Intersection Capacity Utilization 94.5%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 4: Slater Ave NE & NE 124th St

4: Slater Ave NE & NE 124th St

Queues

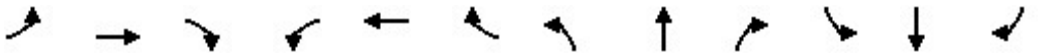


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	218	1037	21	200	789	278	35	306	294	389	400	283
v/c Ratio	1.30	0.98	0.04	1.18	0.76	0.46	0.40	0.86	0.64	1.07	0.60	0.38
Control Delay	214.9	59.1	0.1	169.0	33.9	10.3	77.3	76.8	21.6	119.4	40.4	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	214.9	59.1	0.1	169.0	33.9	10.3	77.3	76.8	21.6	119.4	40.4	4.9
Queue Length 50th (ft)	~260	458	0	~223	347	104	31	271	71	~399	299	0
Queue Length 95th (ft)	#432	#636	0	#391	430	140	65	338	141	#677	421	62
Internal Link Dist (ft)		341			1156			250			797	
Turn Bay Length (ft)	250		80	440		200				350		
Base Capacity (vph)	168	1059	586	170	1038	608	103	441	524	362	671	738
Starvation Cap Reductn	0	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	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.30	0.98	0.04	1.18	0.76	0.46	0.34	0.69	0.56	1.07	0.60	0.38

Intersection Summary

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

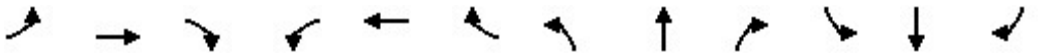
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	5	35	70	5	10	50	560	120	35	865	35
Future Volume (Veh/h)	5	5	35	70	5	10	50	560	120	35	865	35
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	38	76	5	11	54	609	130	38	940	38
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								877				
pX, platoon unblocked	0.87	0.87		0.87	0.87	0.87				0.87		
vC, conflicting volume	1766	1882	959	1792	1771	609	978			739		
vC1, stage 1 conf vol	1035	1035		717	717							
vC2, stage 2 conf vol	730	847		1076	1054							
vCu, unblocked vol	1805	1938	959	1836	1811	478	978			627		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	98	88	50	98	98	92			95		
cM capacity (veh/h)	207	210	312	151	203	512	706			832		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1
Volume Total	48	92	54	609	130	1016
Volume Left	5	76	54	0	0	38
Volume Right	38	11	0	0	130	38
cSH	282	167	706	1700	1700	832
Volume to Capacity	0.17	0.55	0.08	0.36	0.08	0.05
Queue Length 95th (ft)	15	71	6	0	0	4
Control Delay (s)	20.3	50.2	10.5	0.0	0.0	1.3
Lane LOS	C	F	B			A
Approach Delay (s)	20.3	50.2	0.7			1.3
Approach LOS	C	F				

Intersection Summary				
Average Delay	3.9			
Intersection Capacity Utilization	94.2%	ICU Level of Service	F	
Analysis Period (min)	15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	230	825	60	240	1220	355	40	345	290	300	330	255
Future Volume (vph)	230	825	60	240	1220	355	40	345	290	300	330	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	11	11	11	11	11	11	11
Grade (%)		-1%			-2%			-5%			0%	
Storage Length (ft)	250		80	440		200	0		0	350		0
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor			0.97			0.98			0.98			0.98
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1744	3489	1561	1787	3455	1546	1736	1828	1554	1711	1801	1531
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1744	3489	1519	1787	3455	1517	1736	1828	1524	1711	1801	1507
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			179			192			282			268
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		421			1236			330			877	
Travel Time (s)		8.2			24.1			9.0			17.1	
Confl. Peds. (#/hr)			3			5			5			2
Confl. Bikes (#/hr)						1			1			1
Peak Hour Factor	0.93	0.93	0.93	0.95	0.95	0.95	0.87	0.87	0.87	0.95	0.95	0.95
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Adj. Flow (vph)	247	887	65	253	1284	374	46	397	333	316	347	268
Shared Lane Traffic (%)												
Lane Group Flow (vph)	247	887	65	253	1284	374	46	397	333	316	347	268
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane					Yes						Yes	
Headway Factor	0.99	0.99	0.99	0.99	1.03	1.03	1.01	1.01	1.01	1.04	1.04	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1	1	1	1	1	1	1	1	1	1	1
Detector Template			Right						Right			
Leading Detector (ft)	65	50	20	40	30	0	85	40	20	60	50	40
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	65	50	20	40	30	0	85	40	20	60	50	40
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	

4: Slater Ave NE & NE 124th St

Lanes, Volumes, Timings

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			6			2			4			8
Detector Phase	1	6	6	5	2	2	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	6.0	15.0	15.0	6.0	15.0	15.0	6.0	10.0	10.0	6.0	10.0	10.0
Minimum Split (s)	12.5	36.5	36.5	12.5	39.5	39.5	12.5	39.5	39.5	12.5	36.5	36.5
Total Split (s)	24.0	53.0	53.0	24.0	53.0	53.0	21.0	41.0	41.0	22.0	42.0	42.0
Total Split (%)	17.1%	37.9%	37.9%	17.1%	37.9%	37.9%	15.0%	29.3%	29.3%	15.7%	30.0%	30.0%
Maximum Green (s)	17.5	46.5	46.5	17.5	46.5	46.5	14.5	34.5	34.5	15.5	35.5	35.5
Yellow Time (s)	3.5	5.0	5.0	3.5	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	2.5	1.5	1.5	2.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	4.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0
Flash Dont Walk (s)		23.0	23.0		26.0	26.0		26.0	26.0		23.0	23.0
Pedestrian Calls (#/hr)		3	3		5	5		5	5		2	2
Act Effct Green (s)	17.5	46.5	46.5	17.5	46.5	46.5	8.4	32.6	32.6	17.4	44.1	44.1
Actuated g/C Ratio	0.12	0.33	0.33	0.12	0.33	0.33	0.06	0.23	0.23	0.12	0.32	0.32
v/c Ratio	1.13	0.77	0.10	1.13	1.12	0.59	0.45	0.93	0.58	1.48	0.61	0.41
Control Delay	142.8	33.2	1.1	154.9	103.2	18.1	76.3	82.5	12.9	282.8	47.7	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	142.8	33.2	1.1	154.9	103.2	18.1	76.3	82.5	12.9	282.8	47.7	6.3
LOS	F	C	A	F	F	B	E	F	B	F	D	A
Approach Delay		54.0			93.4			52.3			115.6	
Approach LOS		D			F			D			F	

Intersection Summary

Area Type: Other

Cycle Length: 140

Actuated Cycle Length: 140

Offset: 5 (4%), Referenced to phase 2:WBT and 6:EBT, Start of 1st Green

Natural Cycle: 145

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.48

Intersection Signal Delay: 81.2 Intersection LOS: F

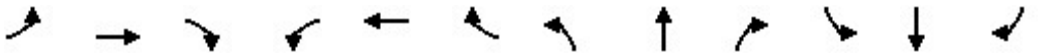
Intersection Capacity Utilization 104.3% ICU Level of Service G

Analysis Period (min) 15

Splits and Phases: 4: Slater Ave NE & NE 124th St

4: Slater Ave NE & NE 124th St

Queues



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	247	887	65	253	1284	374	46	397	333	316	347	268
v/c Ratio	1.13	0.77	0.10	1.13	1.12	0.59	0.45	0.93	0.58	1.48	0.61	0.41
Control Delay	142.8	33.2	1.1	154.9	103.2	18.1	76.3	82.5	12.9	282.8	47.7	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	142.8	33.2	1.1	154.9	103.2	18.1	76.3	82.5	12.9	282.8	47.7	6.3
Queue Length 50th (ft)	~262	419	0	~274	~717	109	41	351	37	~418	275	0
Queue Length 95th (ft)	#443	501	13	#449	#836	166	81	#500	118	#611	401	70
Internal Link Dist (ft)		341			1156			250			797	
Turn Bay Length (ft)	250		80	440		200				350		
Base Capacity (vph)	218	1158	624	223	1147	632	179	450	588	213	567	658
Starvation Cap Reductn	0	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	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.13	0.77	0.10	1.13	1.12	0.59	0.26	0.88	0.57	1.48	0.61	0.41

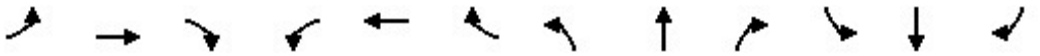
Intersection Summary

~ 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.

18: Slater Ave NE/132nd Ave NE & NE 126th Pl/NE 126th Pl

HCM Unsignalized Intersection Capacity Analysis



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	5	55	125	5	50	35	845	70	5	710	40
Future Volume (Veh/h)	50	5	55	125	5	50	35	845	70	5	710	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	5	60	136	5	54	38	918	76	5	772	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			TWLTL	
Median storage veh)								2			2	
Upstream signal (ft)								877				
pX, platoon unblocked	0.80	0.80		0.80	0.80	0.80				0.80		
vC, conflicting volume	1854	1874	794	1860	1819	918	815			994		
vC1, stage 1 conf vol	804	804		994	994							
vC2, stage 2 conf vol	1050	1070		866	825							
vCu, unblocked vol	1943	1967	794	1950	1899	772	815			867		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	68	98	85	23	98	83	95			99		
cM capacity (veh/h)	167	209	388	177	218	319	812			621		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1
Volume Total	119	195	38	918	76	820
Volume Left	54	136	38	0	0	5
Volume Right	60	54	0	0	76	43
cSH	237	203	812	1700	1700	621
Volume to Capacity	0.50	0.96	0.05	0.54	0.04	0.01
Queue Length 95th (ft)	64	201	4	0	0	1
Control Delay (s)	34.5	101.3	9.6	0.0	0.0	0.2
Lane LOS	D	F	A			A
Approach Delay (s)	34.5	101.3	0.4			0.2
Approach LOS	D	F				

Intersection Summary				
Average Delay	11.3			
Intersection Capacity Utilization	66.9%	ICU Level of Service	C	
Analysis Period (min)	15			

Alternatives 1 and 2

AM and PM Peak Hour

Synchro Reports

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	730	0	0	970	0
Future Volume (vph)	0	0	0	0	0	0	0	730	0	0	970	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	0	0	0	1863	0	0	3539	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	0	0	0	1863	0	0	3539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		196			202			402			476	
Travel Time (s)		3.8			3.9			7.8			9.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	793	0	0	1054	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	793	0	0	1054	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			8			8	
Two way Left Turn Lane											Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors								2			2	
Detector Template								Thru			Thru	
Leading Detector (ft)								100			100	
Trailing Detector (ft)								0			0	
Detector 1 Position(ft)								0			0	
Detector 1 Size(ft)								6			6	
Detector 1 Type								Cl+Ex			Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)								0.0			0.0	
Detector 1 Queue (s)								0.0			0.0	
Detector 1 Delay (s)								0.0			0.0	
Detector 2 Position(ft)								94			94	
Detector 2 Size(ft)								6			6	
Detector 2 Type								Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)								0.0			0.0	
Turn Type								NA			NA	
Protected Phases								4			8	
Permitted Phases												
Detector Phase								4			8	
Switch Phase												
Minimum Initial (s)								5.0			5.0	

Lane Group	Ø9	Ø13
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		
Turn Type		
Protected Phases	9	13
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)								30.0			30.0	
Total Split (s)								32.5			30.0	
Total Split (%)								64.4%			59.4%	
Maximum Green (s)								28.0			25.5	
Yellow Time (s)								3.5			3.5	
All-Red Time (s)								1.0			1.0	
Lost Time Adjust (s)								0.0			0.0	
Total Lost Time (s)								4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0			3.0	
Recall Mode								Min			Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)								37.7			36.7	
Actuated g/C Ratio								0.77			0.75	
v/c Ratio								0.55			0.40	
Control Delay								7.6			5.9	
Queue Delay								0.3			0.0	
Total Delay								7.9			5.9	
LOS								A			A	
Approach Delay								7.9			5.9	
Approach LOS								A			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 50.5			
Actuated Cycle Length: 48.8			
Natural Cycle: 55			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.55			
Intersection Signal Delay: 6.7		Intersection LOS: A	
Intersection Capacity Utilization 42.2%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 400: Slater Ave NE & Eastrail Crossing

Lane Group	Ø9	Ø13
Minimum Split (s)	17.5	20.5
Total Split (s)	17.5	20.5
Total Split (%)	35%	41%
Maximum Green (s)	13.0	16.0
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1.0	1.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Walk Time (s)	7.0	7.0
Flash Dont Walk (s)	6.0	9.0
Pedestrian Calls (#/hr)	60	60
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	NBT	SBT
Lane Group Flow (vph)	793	1054
v/c Ratio	0.55	0.40
Control Delay	7.6	5.9
Queue Delay	0.3	0.0
Total Delay	7.9	5.9
Queue Length 50th (ft)	169	104
Queue Length 95th (ft)	260	143
Internal Link Dist (ft)	322	396
Turn Bay Length (ft)		
Base Capacity (vph)	1391	2580
Starvation Cap Reductn	161	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.64	0.41

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	950	0	0	890	0
Future Volume (vph)	0	0	0	0	0	0	0	950	0	0	890	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	0	0	0	1863	0	0	3539	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	0	0	0	1863	0	0	3539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		209			160			407			470	
Travel Time (s)		4.1			3.1			7.9			9.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	1033	0	0	967	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	1033	0	0	967	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			8			8	
Two way Left Turn Lane											Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors								2			2	
Detector Template								Thru			Thru	
Leading Detector (ft)								100			100	
Trailing Detector (ft)								0			0	
Detector 1 Position(ft)								0			0	
Detector 1 Size(ft)								6			6	
Detector 1 Type								Cl+Ex			Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)								0.0			0.0	
Detector 1 Queue (s)								0.0			0.0	
Detector 1 Delay (s)								0.0			0.0	
Detector 2 Position(ft)								94			94	
Detector 2 Size(ft)								6			6	
Detector 2 Type								Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)								0.0			0.0	
Turn Type								NA			NA	
Protected Phases								4			8	
Permitted Phases												
Detector Phase								4			8	
Switch Phase												
Minimum Initial (s)								5.0			5.0	

Lane Group	Ø9	Ø13
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		
Turn Type		
Protected Phases	9	13
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)								30.0			30.0	
Total Split (s)								32.5			30.0	
Total Split (%)								64.4%			59.4%	
Maximum Green (s)								28.0			25.5	
Yellow Time (s)								3.5			3.5	
All-Red Time (s)								1.0			1.0	
Lost Time Adjust (s)								0.0			0.0	
Total Lost Time (s)								4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0			3.0	
Recall Mode								Min			Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)								45.9			41.8	
Actuated g/C Ratio								0.80			0.72	
v/c Ratio								0.70			0.38	
Control Delay								10.7			7.3	
Queue Delay								0.9			0.0	
Total Delay								11.6			7.3	
LOS								B			A	
Approach Delay								11.6			7.3	
Approach LOS								B			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 50.5			
Actuated Cycle Length: 57.7			
Natural Cycle: 60			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.70			
Intersection Signal Delay: 9.5		Intersection LOS: A	
Intersection Capacity Utilization 53.8%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 400: Slater Ave NE & Eastrail Crossing

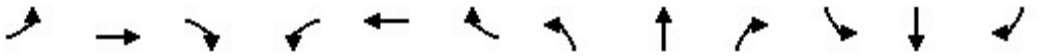
Lane Group	Ø9	Ø13
Minimum Split (s)	17.5	20.5
Total Split (s)	17.5	20.5
Total Split (%)	35%	41%
Maximum Green (s)	13.0	16.0
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1.0	1.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Walk Time (s)	7.0	7.0
Flash Dont Walk (s)	6.0	9.0
Pedestrian Calls (#/hr)	60	60
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	NBT	SBT
Lane Group Flow (vph)	1033	967
v/c Ratio	0.70	0.38
Control Delay	10.7	7.3
Queue Delay	0.9	0.0
Total Delay	11.6	7.3
Queue Length 50th (ft)	259	158
Queue Length 95th (ft)	#574	128
Internal Link Dist (ft)	327	390
Turn Bay Length (ft)		
Base Capacity (vph)	1483	2565
Starvation Cap Reductn	200	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.81	0.38

Intersection Summary

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



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	730	0	0	970	0
Future Volume (vph)	0	0	0	0	0	0	0	730	0	0	970	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	0	0	0	1863	0	0	3539	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	0	0	0	1863	0	0	3539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		196			202			402			476	
Travel Time (s)		3.8			3.9			7.8			9.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	793	0	0	1054	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	793	0	0	1054	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			8			8	
Two way Left Turn Lane											Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors								2			2	
Detector Template								Thru			Thru	
Leading Detector (ft)								100			100	
Trailing Detector (ft)								0			0	
Detector 1 Position(ft)								0			0	
Detector 1 Size(ft)								6			6	
Detector 1 Type								Cl+Ex			Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)								0.0			0.0	
Detector 1 Queue (s)								0.0			0.0	
Detector 1 Delay (s)								0.0			0.0	
Detector 2 Position(ft)								94			94	
Detector 2 Size(ft)								6			6	
Detector 2 Type								Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)								0.0			0.0	
Turn Type								NA			NA	
Protected Phases								4			8	
Permitted Phases												
Detector Phase								4			8	
Switch Phase												
Minimum Initial (s)								5.0			5.0	

Lane Group	Ø9	Ø13
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		
Turn Type		
Protected Phases	9	13
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)								30.0			30.0	
Total Split (s)								30.0			30.0	
Total Split (%)								56.1%			56.1%	
Maximum Green (s)								25.5			25.5	
Yellow Time (s)								3.5			3.5	
All-Red Time (s)								1.0			1.0	
Lost Time Adjust (s)								0.0			0.0	
Total Lost Time (s)								4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0			3.0	
Recall Mode								Min			Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)								40.8			40.5	
Actuated g/C Ratio								0.75			0.75	
v/c Ratio								0.56			0.40	
Control Delay								9.9			6.7	
Queue Delay								0.5			0.0	
Total Delay								10.4			6.7	
LOS								B			A	
Approach Delay								10.4			6.7	
Approach LOS								B			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 53.5			
Actuated Cycle Length: 54.1			
Natural Cycle: 60			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.56			
Intersection Signal Delay: 8.3		Intersection LOS: A	
Intersection Capacity Utilization 42.2%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 400: Slater Ave NE & Eastrail Crossing

Lane Group	Ø9	Ø13
Minimum Split (s)	23.5	23.5
Total Split (s)	23.5	23.5
Total Split (%)	44%	44%
Maximum Green (s)	19.0	19.0
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1.0	1.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Walk Time (s)	7.0	7.0
Flash Dont Walk (s)	12.0	12.0
Pedestrian Calls (#/hr)	60	60
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	NBT	SBT
Lane Group Flow (vph)	793	1054
v/c Ratio	0.56	0.40
Control Delay	9.9	6.7
Queue Delay	0.5	0.0
Total Delay	10.4	6.7
Queue Length 50th (ft)	211	131
Queue Length 95th (ft)	342	164
Internal Link Dist (ft)	322	396
Turn Bay Length (ft)		
Base Capacity (vph)	1406	2652
Starvation Cap Reductn	248	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.68	0.40

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	950	0	0	890	0
Future Volume (vph)	0	0	0	0	0	0	0	950	0	0	890	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	0	0	0	1863	0	0	3539	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	0	0	0	1863	0	0	3539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		209			160			407			470	
Travel Time (s)		4.1			3.1			7.9			9.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	1033	0	0	967	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	1033	0	0	967	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			8			8	
Two way Left Turn Lane											Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors								2			2	
Detector Template								Thru			Thru	
Leading Detector (ft)								100			100	
Trailing Detector (ft)								0			0	
Detector 1 Position(ft)								0			0	
Detector 1 Size(ft)								6			6	
Detector 1 Type								Cl+Ex			Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)								0.0			0.0	
Detector 1 Queue (s)								0.0			0.0	
Detector 1 Delay (s)								0.0			0.0	
Detector 2 Position(ft)								94			94	
Detector 2 Size(ft)								6			6	
Detector 2 Type								Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)								0.0			0.0	
Turn Type								NA			NA	
Protected Phases								4			8	
Permitted Phases												
Detector Phase								4			8	
Switch Phase												
Minimum Initial (s)								5.0			5.0	

Lane Group	Ø9	Ø13
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		
Turn Type		
Protected Phases	9	13
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)								30.0			30.0	
Total Split (s)								30.0			30.0	
Total Split (%)								56.1%			56.1%	
Maximum Green (s)								25.5			25.5	
Yellow Time (s)								3.5			3.5	
All-Red Time (s)								1.0			1.0	
Lost Time Adjust (s)								0.0			0.0	
Total Lost Time (s)								4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0			3.0	
Recall Mode								Min			Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)								44.6			43.9	
Actuated g/C Ratio								0.75			0.74	
v/c Ratio								0.73			0.37	
Control Delay								15.5			6.8	
Queue Delay								1.0			0.0	
Total Delay								16.5			6.8	
LOS								B			A	
Approach Delay								16.5			6.8	
Approach LOS								B			A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 53.5			
Actuated Cycle Length: 59.1			
Natural Cycle: 70			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 11.8		Intersection LOS: B	
Intersection Capacity Utilization 53.8%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 400: Slater Ave NE & Eastrail Crossing

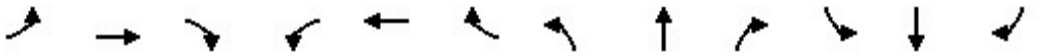
Lane Group	Ø9	Ø13
Minimum Split (s)	23.5	23.5
Total Split (s)	23.5	23.5
Total Split (%)	44%	44%
Maximum Green (s)	19.0	19.0
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1.0	1.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Walk Time (s)	7.0	7.0
Flash Dont Walk (s)	12.0	12.0
Pedestrian Calls (#/hr)	60	60
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	NBT	SBT
Lane Group Flow (vph)	1033	967
v/c Ratio	0.73	0.37
Control Delay	15.5	6.8
Queue Delay	1.0	0.0
Total Delay	16.5	6.8
Queue Length 50th (ft)	356	124
Queue Length 95th (ft)	#648	147
Internal Link Dist (ft)	327	390
Turn Bay Length (ft)		
Base Capacity (vph)	1406	2627
Starvation Cap Reductn	163	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.83	0.37

Intersection Summary

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



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	730	0	0	970	0
Future Volume (vph)	0	0	0	0	0	0	0	730	0	0	970	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	0	0	0	1863	0	0	1863	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	0	0	0	1863	0	0	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		196			202			402			476	
Travel Time (s)		3.8			3.9			7.8			9.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	793	0	0	1054	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	793	0	0	1054	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			8			8	
Two way Left Turn Lane											Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors								2			2	
Detector Template								Thru			Thru	
Leading Detector (ft)								100			100	
Trailing Detector (ft)								0			0	
Detector 1 Position(ft)								0			0	
Detector 1 Size(ft)								6			6	
Detector 1 Type								Cl+Ex			Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)								0.0			0.0	
Detector 1 Queue (s)								0.0			0.0	
Detector 1 Delay (s)								0.0			0.0	
Detector 2 Position(ft)								94			94	
Detector 2 Size(ft)								6			6	
Detector 2 Type								Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)								0.0			0.0	
Turn Type								NA			NA	
Protected Phases								4			8	
Permitted Phases												
Detector Phase								4			8	
Switch Phase												
Minimum Initial (s)								5.0			5.0	

Lane Group	Ø9	Ø13
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		
Turn Type		
Protected Phases	9	13
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)								30.0			30.0	
Total Split (s)								30.0			30.0	
Total Split (%)								56.1%			56.1%	
Maximum Green (s)								25.5			25.5	
Yellow Time (s)								3.5			3.5	
All-Red Time (s)								1.0			1.0	
Lost Time Adjust (s)								0.0			0.0	
Total Lost Time (s)								4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0			3.0	
Recall Mode								Min			Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)								44.6			44.6	
Actuated g/C Ratio								0.75			0.75	
v/c Ratio								0.56			0.75	
Control Delay								9.8			16.2	
Queue Delay								0.5			0.0	
Total Delay								10.3			16.2	
LOS								B			B	
Approach Delay								10.3			16.2	
Approach LOS								B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 53.5			
Actuated Cycle Length: 59.1			
Natural Cycle: 75			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 13.7		Intersection LOS: B	
Intersection Capacity Utilization 54.8%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 400: Slater Ave NE & Eastrail Crossing

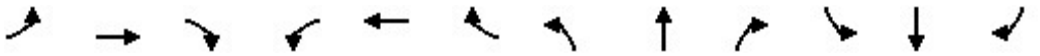
Lane Group	Ø9	Ø13
Minimum Split (s)	23.5	23.5
Total Split (s)	23.5	23.5
Total Split (%)	44%	44%
Maximum Green (s)	19.0	19.0
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1.0	1.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Walk Time (s)	7.0	7.0
Flash Dont Walk (s)	12.0	12.0
Pedestrian Calls (#/hr)	60	60
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	NBT	SBT
Lane Group Flow (vph)	793	1054
v/c Ratio	0.56	0.75
Control Delay	9.8	16.2
Queue Delay	0.5	0.0
Total Delay	10.3	16.2
Queue Length 50th (ft)	211	372
Queue Length 95th (ft)	342	#669
Internal Link Dist (ft)	322	396
Turn Bay Length (ft)		
Base Capacity (vph)	1406	1406
Starvation Cap Reductn	248	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.68	0.75

Intersection Summary

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



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	950	0	0	890	0
Future Volume (vph)	0	0	0	0	0	0	0	950	0	0	890	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	0	0	0	0	0	0	1863	0	0	1863	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	0	0	0	1863	0	0	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		209			160			407			470	
Travel Time (s)		4.1			3.1			7.9			9.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	1033	0	0	967	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	1033	0	0	967	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			8			8	
Two way Left Turn Lane											Yes	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors								2			2	
Detector Template								Thru			Thru	
Leading Detector (ft)								100			100	
Trailing Detector (ft)								0			0	
Detector 1 Position(ft)								0			0	
Detector 1 Size(ft)								6			6	
Detector 1 Type								Cl+Ex			Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)								0.0			0.0	
Detector 1 Queue (s)								0.0			0.0	
Detector 1 Delay (s)								0.0			0.0	
Detector 2 Position(ft)								94			94	
Detector 2 Size(ft)								6			6	
Detector 2 Type								Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)								0.0			0.0	
Turn Type								NA			NA	
Protected Phases								4			8	
Permitted Phases												
Detector Phase								4			8	
Switch Phase												
Minimum Initial (s)								5.0			5.0	

Lane Group	Ø9	Ø13
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		
Turn Type		
Protected Phases	9	13
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)								30.0			30.0	
Total Split (s)								30.0			30.0	
Total Split (%)								56.1%			56.1%	
Maximum Green (s)								25.5			25.5	
Yellow Time (s)								3.5			3.5	
All-Red Time (s)								1.0			1.0	
Lost Time Adjust (s)								0.0			0.0	
Total Lost Time (s)								4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)								3.0			3.0	
Recall Mode								Min			Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)								44.6			44.6	
Actuated g/C Ratio								0.75			0.75	
v/c Ratio								0.73			0.69	
Control Delay								15.5			13.5	
Queue Delay								1.0			0.0	
Total Delay								16.5			13.5	
LOS								B			B	
Approach Delay								16.5			13.5	
Approach LOS								B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 53.5			
Actuated Cycle Length: 59.1			
Natural Cycle: 70			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 15.1		Intersection LOS: B	
Intersection Capacity Utilization 53.8%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 400: Slater Ave NE & Eastrail Crossing

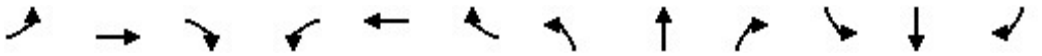
Lane Group	Ø9	Ø13
Minimum Split (s)	23.5	23.5
Total Split (s)	23.5	23.5
Total Split (%)	44%	44%
Maximum Green (s)	19.0	19.0
Yellow Time (s)	3.5	3.5
All-Red Time (s)	1.0	1.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Walk Time (s)	7.0	7.0
Flash Dont Walk (s)	12.0	12.0
Pedestrian Calls (#/hr)	60	60
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		

Intersection Summary

Lane Group	NBT	SBT
Lane Group Flow (vph)	1033	967
v/c Ratio	0.73	0.69
Control Delay	15.5	13.5
Queue Delay	1.0	0.0
Total Delay	16.5	13.5
Queue Length 50th (ft)	356	308
Queue Length 95th (ft)	#648	#586
Internal Link Dist (ft)	327	390
Turn Bay Length (ft)		
Base Capacity (vph)	1406	1406
Starvation Cap Reductn	163	0
Spillback Cap Reductn	0	0
Storage Cap Reductn	0	0
Reduced v/c Ratio	0.83	0.69

Intersection Summary

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



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	205	975	20	180	710	250	30	260	250	350	360	255
Future Volume (vph)	205	975	20	180	710	250	30	260	250	350	360	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	11	11	11	11	11	11	11
Grade (%)		-1%			-2%			-5%			0%	
Storage Length (ft)	250		80	440		200	0		0	200		200
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.97	0.95	0.95
Ped Bike Factor			0.99			0.96			0.98		0.99	
Frt			0.850			0.850			0.850		0.938	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1744	3489	1561	1770	3422	1531	1703	1793	1524	3255	3131	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1744	3489	1538	1770	3422	1470	1703	1793	1501	3255	3131	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			179			223			205		141	
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		421			1236			330			402	
Travel Time (s)		8.2			24.1			9.0			7.8	
Confl. Peds. (#/hr)			2			9			2			
Confl. Bikes (#/hr)						1			1			1
Peak Hour Factor	0.94	0.94	0.94	0.90	0.90	0.90	0.85	0.85	0.85	0.90	0.90	0.90
Heavy Vehicles (%)	4%	4%	4%	3%	3%	3%	5%	5%	5%	4%	4%	4%
Adj. Flow (vph)	218	1037	21	200	789	278	35	306	294	389	400	283
Shared Lane Traffic (%)												
Lane Group Flow (vph)	218	1037	21	200	789	278	35	306	294	389	683	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			22			22	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane					Yes							
Headway Factor	0.99	0.99	0.99	0.99	1.03	1.03	1.01	1.01	1.01	1.04	1.04	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1	1	1	1	1	1	1	1	1	1	
Detector Template			Right						Right			
Leading Detector (ft)	65	50	20	40	30	0	85	40	20	60	50	
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	65	50	20	40	30	0	85	40	20	60	50	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			6			2			4			
Detector Phase	1	6	6	5	2	2	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	6.0	15.0	15.0	6.0	15.0	15.0	6.0	10.0	10.0	6.0	10.0	
Minimum Split (s)	12.5	36.5	36.5	12.5	39.5	39.5	12.5	39.5	39.5	12.5	36.5	
Total Split (s)	20.0	49.0	49.0	20.0	49.0	49.0	15.0	41.0	41.0	30.0	56.0	
Total Split (%)	14.3%	35.0%	35.0%	14.3%	35.0%	35.0%	10.7%	29.3%	29.3%	21.4%	40.0%	
Maximum Green (s)	13.5	42.5	42.5	13.5	42.5	42.5	8.5	34.5	34.5	23.5	49.5	
Yellow Time (s)	3.5	5.0	5.0	3.5	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	2.5	1.5	1.5	2.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	4.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		23.0	23.0		26.0	26.0		26.0	26.0		23.0	
Pedestrian Calls (#/hr)		2	2		9	9		2	2		0	
Act Effct Green (s)	13.5	52.3	52.3	13.5	52.3	52.3	7.3	27.8	27.8	20.4	43.4	
Actuated g/C Ratio	0.10	0.37	0.37	0.10	0.37	0.37	0.05	0.20	0.20	0.15	0.31	
v/c Ratio	1.30	0.80	0.03	1.18	0.62	0.40	0.40	0.86	0.64	0.82	0.64	
Control Delay	214.9	34.2	0.1	169.0	24.2	7.4	77.3	76.8	21.6	72.4	35.1	
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	214.9	34.2	0.1	169.0	24.2	7.4	77.3	76.8	21.6	72.4	36.2	
LOS	F	C	A	F	C	A	E	E	C	E	D	
Approach Delay		64.5			43.4			51.2			49.3	
Approach LOS		E			D			D			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 18 (13%), Referenced to phase 2:WBT and 6:EBT, Start of 1st Green			
Natural Cycle: 125			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.30			
Intersection Signal Delay: 52.4		Intersection LOS: D	
Intersection Capacity Utilization 85.1%		ICU Level of Service E	
Analysis Period (min) 15			

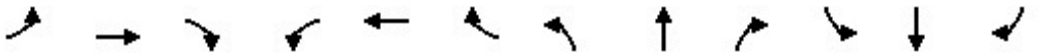
Splits and Phases: 4: Slater Ave NE & NE 124th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	218	1037	21	200	789	278	35	306	294	389	683
v/c Ratio	1.30	0.80	0.03	1.18	0.62	0.40	0.40	0.86	0.64	0.82	0.64
Control Delay	214.9	34.2	0.1	169.0	24.2	7.4	77.3	76.8	21.6	72.4	35.1
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	214.9	34.2	0.1	169.0	24.2	7.4	77.3	76.8	21.6	72.4	36.2
Queue Length 50th (ft)	~260	441	0	~223	308	61	31	271	71	178	228
Queue Length 95th (ft)	#432	#636	0	#391	430	142	65	338	141	232	275
Internal Link Dist (ft)		341			1156			250			322
Turn Bay Length (ft)	250		80	440		200				200	
Base Capacity (vph)	168	1303	686	170	1278	689	103	441	524	546	1198
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	286
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	1.30	0.80	0.03	1.18	0.62	0.40	0.34	0.69	0.56	0.71	0.75

Intersection Summary

~ 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.



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	230	825	60	240	1220	355	40	345	290	300	330	255
Future Volume (vph)	230	825	60	240	1220	355	40	345	290	300	330	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	11	11	11	11	11	11	11	11
Grade (%)		-1%			-2%			-5%			0%	
Storage Length (ft)	250		80	440		200	0		0	200		200
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.97	0.95	0.95
Ped Bike Factor			0.98			0.97			0.98		0.99	
Frt			0.850			0.850			0.850		0.935	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1744	3489	1561	1787	3455	1546	1736	1828	1554	3319	3177	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1744	3489	1535	1787	3455	1497	1736	1828	1524	3319	3177	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			179			192			282		134	
Link Speed (mph)		35			35			25			35	
Link Distance (ft)		421			1236			330			407	
Travel Time (s)		8.2			24.1			9.0			7.9	
Confl. Peds. (#/hr)			3			5			5			2
Confl. Bikes (#/hr)						1			1			1
Peak Hour Factor	0.93	0.93	0.93	0.95	0.95	0.95	0.87	0.87	0.87	0.95	0.95	0.95
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Adj. Flow (vph)	247	887	65	253	1284	374	46	397	333	316	347	268
Shared Lane Traffic (%)												
Lane Group Flow (vph)	247	887	65	253	1284	374	46	397	333	316	615	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			22			22	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane					Yes							
Headway Factor	0.99	0.99	0.99	0.99	1.03	1.03	1.01	1.01	1.01	1.04	1.04	1.04
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1	1	1	1	1	1	1	1	1	1	
Detector Template			Right						Right			
Leading Detector (ft)	65	50	20	40	30	0	85	40	20	60	50	
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	65	50	20	40	30	0	85	40	20	60	50	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	1	6		5	2		7	4		3	8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			6			2			4			
Detector Phase	1	6	6	5	2	2	7	4	4	3	8	
Switch Phase												
Minimum Initial (s)	6.0	15.0	15.0	6.0	15.0	15.0	6.0	10.0	10.0	6.0	10.0	
Minimum Split (s)	12.5	36.5	36.5	12.5	39.5	39.5	12.5	39.5	39.5	12.5	36.5	
Total Split (s)	24.0	53.0	53.0	24.0	53.0	53.0	21.0	41.0	41.0	22.0	42.0	
Total Split (%)	17.1%	37.9%	37.9%	17.1%	37.9%	37.9%	15.0%	29.3%	29.3%	15.7%	30.0%	
Maximum Green (s)	17.5	46.5	46.5	17.5	46.5	46.5	14.5	34.5	34.5	15.5	35.5	
Yellow Time (s)	3.5	5.0	5.0	3.5	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
All-Red Time (s)	3.0	1.5	1.5	3.0	1.5	1.5	2.5	1.5	1.5	2.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	4.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		23.0	23.0		26.0	26.0		26.0	26.0		23.0	
Pedestrian Calls (#/hr)		3	3		5	5		5	5		2	
Act Effct Green (s)	17.5	46.5	46.5	19.6	48.6	48.6	8.4	32.6	32.6	15.3	42.0	
Actuated g/C Ratio	0.12	0.33	0.33	0.14	0.35	0.35	0.06	0.23	0.23	0.11	0.30	
v/c Ratio	1.13	0.77	0.10	1.01	1.07	0.58	0.45	0.93	0.58	0.87	0.59	
Control Delay	142.8	33.2	1.1	119.4	84.6	17.6	76.3	82.5	12.9	85.0	35.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	
Total Delay	142.8	33.2	1.1	119.4	84.6	17.6	76.3	82.5	12.9	85.0	36.1	
LOS	F	C	A	F	F	B	E	F	B	F	D	
Approach Delay		54.0			76.1			52.3			52.7	
Approach LOS		D			E			D			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 5 (4%), Referenced to phase 2:WBT and 6:EBT, Start of 1st Green			
Natural Cycle: 145			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.13			
Intersection Signal Delay: 62.2		Intersection LOS: E	
Intersection Capacity Utilization 96.3%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 4: Slater Ave NE & NE 124th St

4: Slater Ave NE & NE 124th St

Queues

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	247	887	65	253	1284	374	46	397	333	316	615
v/c Ratio	1.13	0.77	0.10	1.01	1.07	0.58	0.45	0.93	0.58	0.87	0.59
Control Delay	142.8	33.2	1.1	119.4	84.6	17.6	76.3	82.5	12.9	85.0	35.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Total Delay	142.8	33.2	1.1	119.4	84.6	17.6	76.3	82.5	12.9	85.0	36.1
Queue Length 50th (ft)	~262	419	0	~274	~717	109	41	351	37	148	197
Queue Length 95th (ft)	#443	501	13	#449	#836	166	81	#500	118	#228	272
Internal Link Dist (ft)		341			1156			250			327
Turn Bay Length (ft)	250		80	440		200				200	
Base Capacity (vph)	218	1158	629	250	1199	645	179	450	588	372	1046
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	202
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	1.13	0.77	0.10	1.01	1.07	0.58	0.26	0.88	0.57	0.85	0.73

Intersection Summary

~ 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.

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Appendix B

Evaluation Results

Legend

Lowest Performing  >>>  Highest Performing

Evaluation Results

Goals and Evaluation Criteria	As defined by	Existing / No Build		At-Grade Alternatives				Grade-Separated Alternatives			
				Reduce CKC Crossing Width		Minimize Queues through CKC Crossing		Alt 3 Bridge		Alt 4 Tunnel	
				Alt 1A 2 Lanes SB / 1 Lane NB (median)		Alt 2 (Alt 1A + Add SB L, SB T)					
Goal: Improves Nonmotorized Connections											
Safety of crossings and connections.	Consistency with design standards		Design consistent with standards.		Design consistent with standards.		Design consistent with standards.		Design consistent with standards.		Design consistent with standards.
	Consider queues and their impact to sight lines, potential for minimization of traffic conflicts		Assumes compliance and that all trail users travel to the 124th/Slater intersection to cross Slater-132nd. Rating adjusted to reflect the free WB R at 124th/Slater		Median allows for visibility between northbound vehicles and eastbound trail users.		Includes benefits described under Alt 1A. Capacity improvements would mitigate/remove the southbound queues approaching 124th/Slater through the year 2035.		Separated from traffic		Separated from traffic
Intuitiveness of crossings and connections	Qualitative evaluation of directness of connections to intersecting sidewalks and existing bike lanes		Crossing is out of direction.		Design consistent with standards.. Routes are direct.		Design consistent with standards.. Routes are direct.		Design consistent with standards.. Routes are clear but indirect for N-S bike/peds that would have to backtrack to use the bridge or tunnel.		Design consistent with standards.. Routes are clear but indirect for N-S bike/peds that would have to backtrack to use the bridge or tunnel.
	Qualitative evaluation of consistency of crossing concept with other (nearby) crossings in the CKC and Eastrail corridors		Crossing is out of direction.		HAWK is consistent with other trail crossings.		HAWK is consistent with other trail crossings.		Consistent with Totem Lake bridge.		Inconsistent with other crossings.
User comfort	Does the crossing feel safe, are there clear sight lines for the user, is it convenient?		Intersection and sidewalks are lit, clear sight lines. Crossing is not convenient and risks trail users crossing the 5lanes of traffic. Rating adjusted to reflect the free WB R at 124/Slater.		Crossing is direct. Sight lines are clear. However the crossing still navigates the southbound queue.		Same as Alt 1A. Crossing is direct. Sight lines are clear. Pedestrians at the NE 124th St/Slater Ave NE signal would have a longer crossing on north leg, however is a lower volume pedestrian use than the projected trail crossing.		Clear visibility, no vehicle interactions.		Design can mitigate many tunnel issues (no dark corners, maintain clear sight lines) however a tunnel would rate lower than the other alts considered.
	Quantitative comparison of delay between alternatives (for E-W travel)		5 minutes		0.9 minutes (HAWK coordinated with NE 124th St/Slater Ave NE signal)		0.9 minutes (HAWK coordinated with NE 124th St/Slater Ave NE signal)		0.4 minutes		0.4 minutes
	Quantitative comparison of crossing distance between alternatives (for E-W travel)		830 feet walking distance with 150 feet through an intersection		~60 feet		Same as Alt 1A. ~60 feet		0 feet (separated from traffic)		0 feet (separated from traffic)
Goal: Fits Context											
Aesthetics and scale relative to context of surroundings	Quality of integration with surrounding land uses		Trail is not a priority in the current environment.		Access to the N-S bike lanes and sidewalks is provided in vicinity of trail crossing.		Same as Alt 1A		Assumes bridge designed to compliment surrounding context.		Tunnel would not have an affect to the aesthetics as it is generally not visible.
	Connections accommodate access to adjacent businesses and the trail		Trail is not a priority in the current environment.		Access to the N-S bike lanes and sidewalks is provided in vicinity of trail crossing.		Same as Alt 1A		Creates a new barrier; access to trail for N-S bike or peds requires longer distance to reach crossing.		Creates a new barrier; access to trail for N-S bike or peds requires longer distance to reach crossing.

Legend

Lowest Performing >>> Highest Performing

Evaluation Results

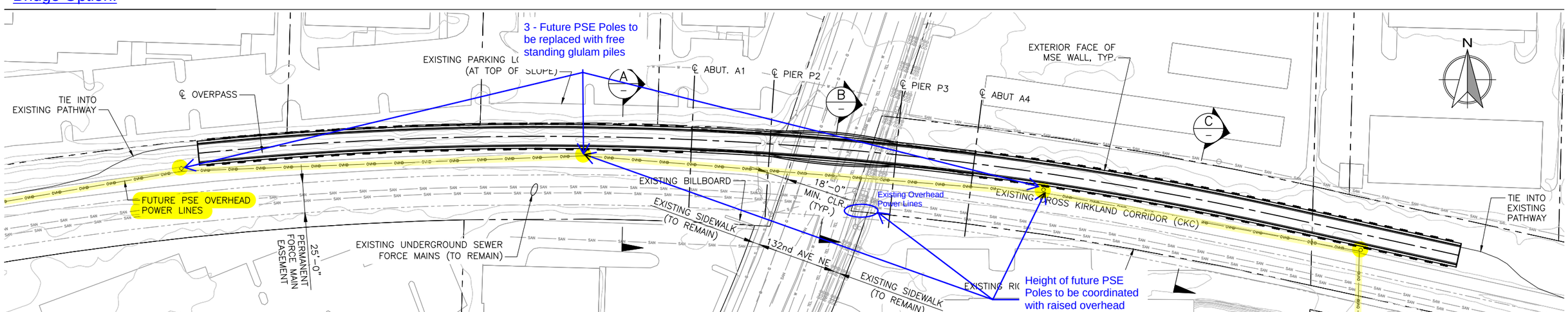
Goals and Evaluation Criteria	As defined by	Existing / No Build		At-Grade Alternatives				Grade-Separated Alternatives			
				Reduce CKC Crossing Width		Minimize Queues through CKC Crossing		Alt 3 Bridge		Alt 4 Tunnel	
				Alt 1A 2 Lanes SB / 1 Lane NB (median)		Alt 2 (Alt 1A + Add SB L, SB T)					
Goal: Minimized Impacts											
Traffic impacts on study intersections and driveways	Changes to access including reducing some or all turn movements to and from businesses. Changes to study intersection operations as measured by intersection LOS and delay.		No impact to driveways. Queues in this scenario considered a baseline condition.		Converts driveways at the car dealerships to right in/right out. If traffic volumes return to pre-covid levels, peak hour queues would likely extend to 132nd/126th with the reduced storage available.		Significant improvements to southbound operations with capacity improvements from year of construction past year 2035.		Same as No Build.		Same as No Build.
Impacts to traffic safety	Potential conflicts between trail users and vehicles		Scenario is considered the baseline condition. Trail users may avoid the 830' out of way travel and cross unprotected in the vicinity of the trail.		Safety improved by removing the free WB R at 124th-Slater. Adequate sight distance to HAWK.		Similar to Alt 1A.		Removes all potential conflicts between trail users and vehicles.		Removes all potential conflicts between trail users and vehicles.
Impacts to right of way	Approximate ROW needed		Scenario is considered the baseline condition. No ROW impacts.		No additional ROW impacts.		ROW impacts at the 124th/Slater intersection.		Potential ROW impacts to share corridor with PSE		Potential ROW impacts to share corridor with PSE
Impacts to critical areas	Approximate impact to wetlands and sensitive areas		Scenario is considered the baseline condition. No ROW impacts.		No additional impacts.		Impacts to SW quadrant of 124th/Slater intersection (likely no wetlands but significant trees)		Potential wetland impacts to share corridor with PSE		Potential wetland impacts to share corridor with PSE
Impacts to drainage and groundwater	Affects drainage requirements		Scenario is considered the baseline condition. No impacts.		No additional impacts.		Adds impervious area.		Adds impervious area.		Adds impervious area. (Pumping associated with the tunnel is covered under maintenance below).
Impacts to utilities	Potential conflicts to PSE alignment and other utilities		Scenario is considered the baseline condition. No impacts.		No additional impacts.		Requires traffic signal poles and controller at Slater/132nd to be moved.		PSE pole alignment is an issue to the north. Included in cost element.		Avoids underground utilities. Similar to Alt 3, may impact PSE alignment.
Impact to ST easement rights	Impact to easement rights		Scenario is considered the baseline condition. No impacts.		No additional impacts.		Same as Alt 1A.		Potential issue in coordinating with PSE alignment.		Potential issue in coordinating with PSE alignment.
Goal: Feasible Solution											
Cost to construct	Quantitative comparison of alternatives		No cost		$3.2M		$7.6M ($3.2M with Alt 1A, + $4.4M Add SB L, SB T)		$15.4M		$25.2M
Schedule to construct	Qualitative comparison durations and potential to close trail use		No duration		Approx. 6 months of construction		Approx. 9 months of construction		Approx. 16 months of construction		Approx. 18 months of construction
Long-term maintenance and life cycle costs	Qualitative comparison of alternatives		Existing signal and minor sidewalk maintenance		New signal and minor sidewalk and median maintenance		New signal and minor sidewalk and median maintenance		Structures require regular inspection. Rating reflects complications associated with structure compared to signals.		Need a pump, back up pump, and power, as tunnel is below ground water level.

Appendix C

PSE Pole Alignment and
Alternative 3 Bridge Layout

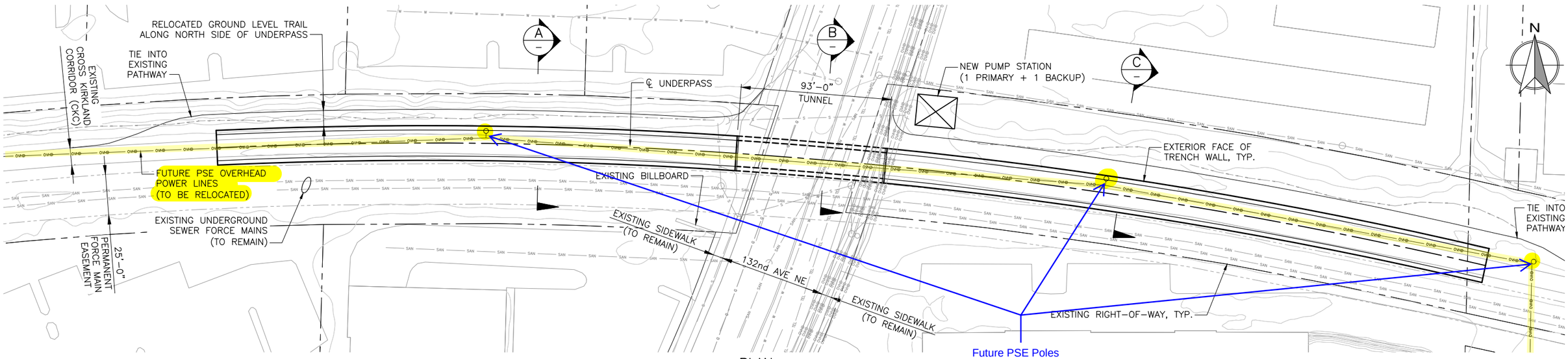
PSE Modifications

Bridge Option:



PLAN
SCALE: 1" = 40'

Tunnel Option:



PLAN
SCALE: 1" = 40'

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