

MEMORANDUM

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| Date: | February 8, 2011 | TG: | 10222.00 |
| To: | Gary Prince – King County Metro Paul Stewart – City of Kirkland | | |
| From: | Mike Swenson and Stefanie Herzstein – Transpo Group | | |
| cc: | Kurt Gahnberg – Transpo Group | | |
| Subject: | South Kirkland Park-and-Ride Transit Oriented Development Traffic and Parking Assessment | | |

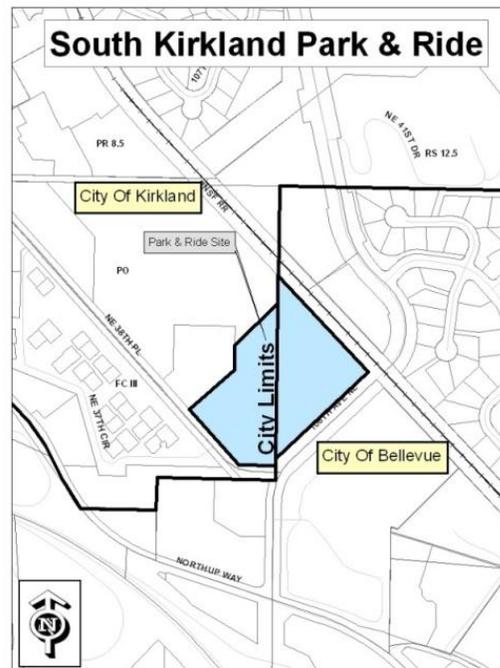
This memorandum provides information to help inform the City's on-going efforts to consider amendments to the Zoning and Municipal Codes. These would ultimately include new transit oriented development (TOD) standards, design guidelines and/or regulations, and related code amendments to implement existing Comprehensive Plan policies. While this assessment is approached in a conservative manner consistent with SEPA traffic studies, the actual SEPA review would occur at a later stage in the process. The work to-date has been coordinated with City of Kirkland, City of Bellevue, and King County Metro staff.

TOD/Park and Ride Development Assumptions

The South Kirkland Park-and-Ride is located on the northwest corner of the 108th Avenue NE/38th Place NE intersection, at the southern boundary of the City of Kirkland. The park-and-ride lot contains approximately 600 designated parking stalls. King County currently owns and operates the seven acre park-and-ride. Approximately half of the seven acre park-and-ride is located within the City of Kirkland, while the remainder is located in the City of Bellevue.

The TOD project is anticipated to include up to 250¹ multi-family units, 12,500 square-feet of commercial use, and 250 additional park-and-ride stalls for a total of 853 park-and-ride stalls.

For the purpose of this assessment it is assumed that approximately 20 to 50 percent of the multi-family units are anticipated to be affordable housing. Parking for the multi-family units and commercial use would be provided by additional stalls dedicated to the TOD project as well as through shared parking with the park-and-ride facility. Access to the site is assumed to continue via the two existing full access driveways along 38th Place NE and 108th Avenue NE.



¹ The final residential unit count will be determined through King County's Request for Proposal (RFP) process.

Executive Summary

- **Benefits of TOD** – The development of TOD typically results in improved mobility by locating housing near transit services, reducing vehicle miles travelled for the region due to higher transit use, and improving air quality by reducing trip-making and trip lengths.
- **Benefits of the Park-and-Ride** – Provision of additional spaces within the park-and-ride will contribute to reducing regional vehicle demand for trips downstream of the park-and-ride by converting auto trips to transit trips and reduce off-site parking related to users parking along the transit routes.
- **Localized Impacts** – There is no significant change to off-site intersection operations anticipated to occur with development of the TOD and park-and-ride expansion, and mitigation is not likely to be triggered based on the current City standards.
- **Access Improvements** – A combination of providing additional capacity such as signalization at the 108th Avenue NE/NE 38th Place intersection and implementation of turn restrictions at the 108th Avenue NE may be required. The extent of these improvements are contingent on the final development plan and anticipated trip generation.
- **Parking Requirements** - When defining the required parking supply for the project, we recommend a baseline assumption of 1.08 stalls per unit, consistent with the Redmond data, with provisions to adjust the required parking supply to account for reductions due to senior and affordable housing components, as well as the ability to share parking with the park-and-ride facility. If overflow from the TOD is anticipated, the current utilization of the Park-and-Ride facility should be observed and the ability for shared parking confirmed.

Project Approach

The proposed TOD project and increase in park-and-ride parking supply represents one element of the region's future transportation strategy to make more efficient use of limited resources. While the technical analysis that follows is largely focused on the *localized* transportation impacts that could occur, the TOD proposal can be viewed in the larger context of smart growth planning.

TOD Housing Development Considerations

While the analysis that is contained herein presents a conservative picture of the nature of potential localized impacts of added housing on the site, there is a substantial amount of research that has been published regarding the potential benefits of TOD projects. These benefits include (but are not limited to):

- **Increase Mobility** – Improved mobility options within congested areas occurs when housing development is located proximate to regional transit service. The South Kirkland Park-and-Ride facility provides transit service to the entire region, and a quick connection to the regional employment centers of Seattle and Bellevue.
- **Reduce Vehicle Miles Traveled (VMT)** – A critical metric for many Transportation Management Programs for employment facilities focuses on reducing overall VMT. This can occur through reduced trip generation, as well as through shortening of vehicle trips.
- **Improved Air Quality** – Linking housing development with access to transit would result in reduced emissions through both reduced trip-making (vehicle trip generation)

and reduced trip lengths when housing is located within the urbanized area instead of suburban or rural locations.

- **Provide Affordable Housing Opportunities/Reduced Auto Demand** – Not only does a TOD project such as this contribute to the supply of affordable housing, but also its location adjacent to park-and-ride/transit facilities reinforces the opportunity to reside in such housing without the need for an automobile. This results in a significant reduction in both vehicle trip generation and the parking supply needed to directly serve the housing.

The regional benefits to TOD projects can be significant, although there is often some increase in localized impacts in the immediate vicinity of the TOD project. The detailed analysis that follows is largely focused on helping to understand the localized impacts of the TOD component and the increased size of the park and ride facility. However, a TOD should also be considered in the context of the overall regional smart growth strategies.

Park-and-Ride Considerations

Similar to the discussion above regarding the TOD component of the proposal, the proposed increase in parking associated with the park-and-ride facility could accommodate additional and future travel demand that would otherwise be making an auto trip, and would serve those parking and accessing the transit system at other locations due to the high utilization currently experienced at the South Kirkland Park-and-Ride. In all cases, since the proposal is simply to increase the supply of parking, no new regional travel demand would occur as a result of the increased parking, it would simply accommodate demand already on the system, effectively diverting trips from other routes. The majority of these regional trips would be attracted from SR 520 and I-405. A lesser proportion would be diverted from local streets near or adjacent to the site, such as Lake Washington Boulevard, 108th Avenue NE, and Northup Way. These travel patterns to the park-and-ride facility would result in the following impacts and benefits:

- **Reduced Regional Auto Demand** – Increasing the transit share of regional travel marginally (i.e., by auto trips being converted to park-and-ride users) improves the travel environment for all remaining travel modes on the system, including single occupant autos and high occupancy vehicles (HOV), especially for that portion of the regional trip “downstream” from the park-and-ride facility (i.e. to the west on SR 520).
- **Minor Increases in Local Access Traffic** – As traffic from other routes is reoriented to the park-and-ride facility, minor increases in local access traffic would occur.
- **Reduced Off-Site Parking** – While the level of current off-site parking is unknown, there have been comments from the community that such parking occurs as a result of the parking supply limitations of the existing park-and-ride. Increasing the on-site parking supply would reduce the demand for transit access parking that occurs elsewhere along transit routes serving the park-and-ride.

Overall, the combined development of proposed TOD (with an affordable housing component) and the increase in parking supply of park-and-ride facility would:

- Further King County/Metro’s and the City’s goals to facilitate smart growth through encouraging development with reduced trip making characteristics
- Result in localized impacts associated with vehicle access that would be addressed in more detail at the project proposal/SEPA evaluation stage of the development process.

The remainder of the technical review is primarily focused on understanding the likely level of local impacts and how those impacts should inform zoning requirements. As mentioned above, the

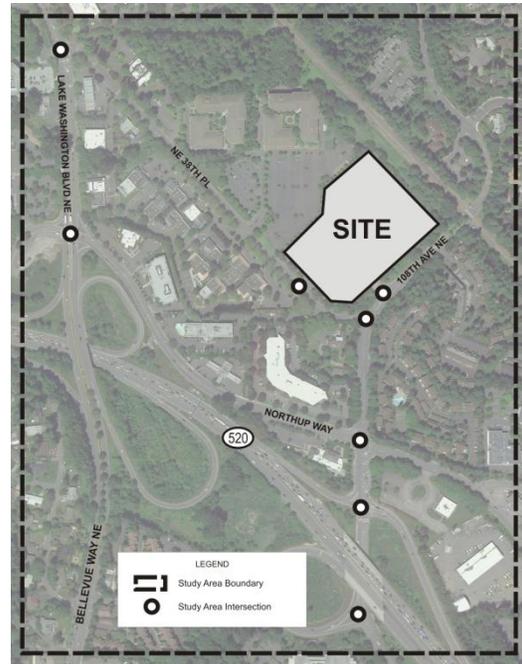
detailed project-specific SEPA evaluation, including the City of Kirkland transportation concurrency review, would be conducted as part of a separate review process.

Local Traffic Impacts

This section describes the potential traffic volume and intersection operation impacts associated with a potential project (inclusive of the TOD and increase in park-and-ride stalls). The evaluation focuses on the weekday PM peak hour (of the adjacent street system) consistent with the City of Kirkland requirements and the final traffic analysis conducted by Washington State Department of Transportation (WSDOT) as part of their coordination on SR 520 with the City of Bellevue.

The year 2030 was selected for analysis of the impacts of the long term affects of the proposed rezone because it is consistent with the horizon year for the regional transportation modeling that supports the SR 520 improvements (tolling, etc.); thus, the analysis gives decision makers the best sense of how the proposal will integrate with the long term transportation vision. SEPA review and concurrency analysis will occur at a later stage, and be based on the City of Kirkland TIA procedures.

The scope of this study includes an evaluation of a number of key intersections along Bellevue Way and Lake Washington Boulevard as illustrated on the map located to the right. Several of the study area intersections are under the City of Bellevue jurisdiction.



Trip Generation

The potential project has two primary components: residential/retail mixed-use and the park-and-ride expansion. The following provides a summary of the assumptions made in regards to the development of trip generation estimates for the project.

TOD Component. As identified in multiple research studies, TOD housing projects have a lower vehicle trip generation rates when compared to stand alone residential projects due to the location of the projects near transit service. Research has shown that TOD housing results in up to 50 percent fewer trips than non-TOD housing due to residents using transit rather than personal vehicles^{2,3}. There is also a component of affordable housing to be included in the TOD project. Studies show that auto ownership for affordable housing residents (i.e., lower incomes) is less⁴. To account for the affordable housing as well as the transit oriented nature of the residential component, the trip rates published in the ITE Trip Generation Manual, 8th Edition, were reduced by 40 percent. The detailed calculations are shown in Table 1.

Due to the presence of the retail use, there is also an element of trip internalization between uses that needs to be considered. Internal trips that would occur within the site between the apartment

² *Transit Cooperative Research Program (TCRP) Report 128 Effects of TOD on Housing, Parking, and Travel*, G.B. Arrington and Robert Cervero, Federal Transit Administration, Transportation Research Board, Washington D.C., 2008.

³ *New Transit Cooperative Research Program Research Confirms Transit-Oriented Developments Produce Fewer Auto Trips*, G.B. Arrington and Kimi Iboshi Sloop, ITE Journal, June 2009.

⁴ National Household Travel Survey, 2009.

and retail and park-and-ride and retail uses were estimated for purposes of developing overall off-site trip generation. An internal trip reduction of approximately 4 percent or 13 trips was calculated using the ITE *Trip Generation Handbook*, 2nd Edition. In addition to internalization of the residential /retail trips, a portion of the retail trips are typically assumed to be pass-by trips i.e., trips already on the adjacent roadway system that would travel to and from the retail. Based on the ITE *Trip Generation Handbook*, 34 percent of the retail trips were assumed to be pass-by.

Park-and-Ride Facility. As discussed in the introduction to this memorandum, park-and-ride lots are not anticipated to generate new traffic on a regional scale. The purpose of a park-and-ride is to attract existing traffic in the area, concentrate it at one location, and transfer people to transit. As a result, there would be some localized impact in the immediate vicinity of the project, and an overall benefit to the region’s transportation system. With the tolling of SR 520 scheduled to begin spring 2011, park-and-ride demand is expected to increase. To evaluate the potential impacts of the park-and-ride component of the project, it was assumed that 50 percent of the park-and-ride trips would be diverted from an existing route in the immediate vicinity while the remaining 50 percent would be a “new trip” within the limits of the study area.

Traffic counts were conducted at the park-and-ride driveways on December 15, 2010 from 4:00 to 6:00 p.m. to develop an existing trip rate per stall for the South Kirkland Park-and-Ride during the weekday PM peak hour of the adjacent street network. Although the parking lot is typically fully occupied during the day, the weekday peak hour represents when traffic volumes to and from the driveway and on the surrounding roadway system would be highest. Attachment A provides the park-and-ride traffic counts. This data showed that for the existing 603 stall park-and-ride there was a total of 303 vehicle trips (inbound and outbound) during the weekday PM peak hour of the adjacent street or 0.50 trips per stall (see Attachment A).

Table 1 provides a summary of the trip generation estimated for the TOD project. Detailed trip generation calculations are provided in Attachment B. As shown in the table, the potential TOD and park-and-ride project would generate 194 net new weekday PM peak hour trips.

Table 1. Estimated Weekday PM Peak Hour Trip Generation for the TOD and Park-and-Ride

| Land Use | Size | Rate ¹ | PM Peak Hour Trips | | |
|-------------------------------------------|---------------------------------------------------------|-------------------|--------------------|------------|------------|
| | | | Inbound | Outbound | Total |
| Apartment (#220) | 250 units | 0.62 | 101 | 54 | 155 |
| | <i>Transit/Affordable Housing Reduction³</i> | | -39 | -21 | -60 |
| Retail (#820) | 12,500 square-feet | 3.73 | 23 | 24 | 47 |
| | <i>Internal Trip Reduction²</i> | | -7 | -6 | -13 |
| | <i>Pass-by Trip Reduction⁴</i> | | -7 | -7 | -14 |
| Park-and-Ride | 250 stalls | 0.50 | 34 | 91 | 125 |
| | <i>Diverted Trip Reduction⁵</i> | | 0 | -46 | -46 |
| Total Trips | | | 158 | 169 | 327 |
| Trip Reductions (Diverted/Pass-by) | | | 53 | 80 | 133 |
| Net New Trips | | | 105 | 89 | 194 |

Source: Transpo Group, 2011.

1. Trip generation rate based on ITE *Trip Generation*, 8th Edition regression equation for apartment land use #220, average trip rate for shopping center (retail) land use #820, and traffic counts conducted at the South Kirkland park-and-ride on December 15, 2010 for the park-and-ride use.
2. Internal trips calculated using ITE *Trip Generation Handbook*, 2nd Edition assuming internal trips only between apartment and retail and retail and park-and-ride. The ITE office data was used for the park-and-ride internal trip rates.
3. Based the Transit Cooperative Research Program (TCRP) Report 128 (2008), *New Transit Cooperative Research Program Research Confirms Transit-Oriented Developments Produce Fewer Auto Trips*, ITE Journal, (June 2009), and National Household Travel Survey (2009), a 40 percent reduction was taken to account for residents using transit rather than driving personal vehicles.
4. Pass-by rate (34 percent) is based on ITE *Trip Generation Handbook*, 2nd Edition for shopping center land use.
5. Fifty percent of the park-and-ride peak direction trips are assumed to be diverted.

Trip Distribution and Assignment

The project-related trips were assigned to the roadway network based on existing travel patterns and the Bellevue Kirkland Redmond (BKR) travel demand model. Given the differences in the travel behaviors for the TOD (apartments and retail) and park-and-ride components, a separate distribution was determined for each. Attachments C and D display the distribution for the TOD and park-and-ride. Traffic was assigned to the study area based on the travel patterns as shown on Attachments E and F.

2030 Traffic Volume Forecasts

Forecast Methodology. Baseline 2030 traffic volumes for the weekday PM peak hour were provided by WSDOT and are based on the BKR travel demand model and work completed as part of the coordination with Bellevue on the SR 520 project. For locations not included in the SR 520 evaluation, an annual growth rate of two percent per year was applied to the existing traffic volumes based the forecasted growth from the travel demand model. This growth rate is conservative when considering a 20year forecast, but it is inclusive of general background growth as well as changes in travel patterns that may result from the SR 520 project. As mentioned, 2030 was selected as the analysis year to assure consistency with the long term regional planning and anticipated improvements to SR 520. Project-specific SEPA analysis and concurrency review at a later stage. Attachment A includes the existing weekday PM peak hour intersection turning movement counts for the site access locations and the 108th Avenue NE/NE 38th Place intersection. Attachment G shows the baseline 2030 traffic volumes for the study area. Project traffic volumes were added to the future baseline traffic volumes to develop the 2030 with-project traffic forecasts. Attachment H shows the weekday PM peak hour traffic volumes at the study intersections.

Proportionate Share. Table 2 summarizes the anticipated total intersection traffic with the project as well as the percent of future with-project volume attributable to the proposed project during the weekday PM peak hour. As shown in the table, the TOD and park-and-ride would increase traffic locally along 108th Avenue NE, NE 38th Place, and Northup Way. However, traffic would decrease along Lake Washington Boulevard in the vicinity of the SR 520 interchange since the additional park-and-ride stalls would attract users that may have otherwise travelled to and from Seattle via SR 520.

Table 2. Future 2030 Weekday PM Peak Hour Traffic Volume Impact at Study Intersections

| Intersection ¹ | With-Project Traffic Volume | TOD/Park-and-Ride Traffic ¹ | Percent TOD Impact |
|----------------------------------------------------------|-----------------------------|----------------------------------------|--------------------|
| 1. Lake Washington Boulevard/NE 38th Place | 3,278 | 18 | 0.5% |
| 2. Lake Washington Boulevard/Northup Way/NE Points Drive | 5,023 | -7 | -0.1% |
| 3. Lake Washington Boulevard/SR 520 WB On-Ramp | 4,002 | -8 | -0.2% |
| 4. Lake Washington Boulevard/SR 520 EB Off-Ramp | 3,590 | -20 | -0.6% |
| 5. NE 38th Place/South Access Park-and-Ride | 805 | 60 | 7.5% |
| 6. 108th Avenue NE/East Access Park-and-Ride | 2,041 | 171 | 8.4% |
| 7. 108th Avenue NE/NE 38th Place | 2,334 | 134 | 5.7% |
| 8. 108th Avenue NE/Northup Way | 4,797 | 127 | 2.6% |
| 9. 108th Avenue NE/SR 520 WB On-Ramp | 2,928 | 98 | 3.3% |
| 10. 108th Avenue NE/SR 520 Transit-HOV Ramp/WB Off-Ramp | 3,754 | 94 | 2.5% |
| 11. 108th Avenue NE/SR 520 EB Off-Ramp | 3,075 | 65 | 2.1% |

Source: Transpo Group, 2010.

Notes: EB = eastbound and WB = westbound

1. Negative traffic volume and percent impact due to park-and-ride trips being diverted from SR 520 to the park-and-ride and using transit to travel rather than SR 520.

In addition to the intersection impacts shown in Table 2, impacts on key corridors include:

- **Lake Washington Boulevard.** North of NE 38th Place, the TOD/Park-and-Ride expansion traffic is anticipated to constitute approximately 0.6% of the project 2030 volumes.
- **108th Avenue NE.** North of the South Kirkland Park-and-Ride Driveway, the TOD/Park-and-Ride expansion traffic is anticipated to constitute approximately 2.8% of the project 2030 volumes.

The amount of TOD/Park-and-Ride expansion traffic volumes anticipated along Lake Washington Boulevard and 108th Avenue NE are within the range of day-to-day traffic fluctuations.

Traffic Operations Impacts

Methodology. Traffic operational analysis was conducted for 2030 traffic forecasts at the study intersections defined for this analysis. The City of Kirkland's adopted intersection LOS standard is LOS D. Based on the City's *Traffic Impact Analysis Guidelines* (February 2004), they generally define a SEPA impact requiring mitigation at a signalized location where the project's proportional share of daily intersection traffic related to the capacity of the intersection represents⁵:

- More than 15 percent at intersections operating at LOS E
- More than 5 percent at intersections operating at LOS F

Although this analysis is not being prepared for SEPA purposes, review of the City's thresholds is reasonable criteria to apply. The Lake Washington Boulevard/NE 38th Place intersection is the only signalized study intersection located in the City of Kirkland. The City of Bellevue does not have an adopted intersection LOS standard; however, LOS D/E are generally considered acceptable.

Results. The results of the with-project analysis were compared to the 2030 baseline conditions to identify long range localized traffic impacts associated with the proposal. The analysis assumes that by 2030 WSDOT completes improvements at the SR 520 interchanges as well as tolling of SR 520. Table 3 summarizes the future with and without-project LOS for the weekday PM peak hour. Detailed LOS worksheets are included in Attachment I.

⁵ See Table 1 of the City of Kirkland *Traffic Impact Analysis Guidelines*, Revised February 2004.

Table 3. Future 2030 Weekday PM Peak Hour LOS Summary

| Intersection | Baseline | | | With-Project | | |
|----------------------------------------------------------|------------------|--------------------|-------------------------------------|--------------|-------|-----------|
| | LOS ¹ | Delay ² | V/C ³ or WM ⁴ | LOS | Delay | V/C or WM |
| 1. Lake Washington Boulevard/NE 38th Place | F | >120 | 1.36 | F | >120 | 1.36 |
| 2. Lake Washington Boulevard/Northup Way/NE Points Drive | E | 59 | 1.00 | E | 59 | 1.00 |
| 3. Lake Washington Boulevard/SR 520 WB On-Ramp | B | 12 | 0.77 | B | 12 | 0.78 |
| 4. Lake Washington Boulevard/SR 520 EB Off-Ramp | C | 21 | 0.59 | C | 21 | 0.58 |
| 5. NE 38th Place/South Access Park-and-Ride | B | 12 | SB | B | 13 | SB |
| 6. 108th Avenue NE/East Access Park-and-Ride | E | 35 | EB | F | 76 | EB |
| 7. 108th Avenue NE/NE 38th Place | F | >120 | EBL | F | >120 | EBL |
| 8. 108th Avenue NE/Northup Way | E | 64 | 0.97 | E | 70 | 1.00 |
| 10. 108th Avenue NE/SR 520 Transit-HOV Ramp/WB Off-Ramp | D | 49 | 0.92 | D | 51 | 0.93 |
| 11. 108th Avenue NE/SR 520 EB Off-Ramp | B | 16 | 0.69 | B | 16 | 0.69 |

1. Level of service, based on 2000 Highway Capacity Manual methodology.

2. Average delay in seconds per vehicle.

3. Volume-to-capacity ratio reported for signalized intersections.

4. Worst movement reported for unsignalized intersections where, SB = southbound approach, EB = eastbound approach, and EBL = eastbound left-turn movement.

As shown in the table, several intersections are forecast to operate at LOS E/F in the future with or without the proposed project.

The **108th Avenue NE intersections with the park-and-ride access and NE 38th Place** are anticipated to operate poorly due to the increase in vehicles to and from the site as well as the anticipated growth along the 108th Avenue NE corridor. In order to enhance access to and from the TOD and park-and-ride, intersection improvements would be needed at these locations. Potential improvements to these locations would include:

- **Access Restrictions at the 108th Avenue NE Driveway:** Depending on the final project level of development and future traffic growth, the 108th Avenue NE driveway would likely need to have some access restrictions. The actual restriction should be determined in conjunction with the on-site design to ensure circulation is adequate for transit and general purpose vehicles. Examples of potential restrictions include right-in/right-out only or right-in/right-out/left-in only access.
- **NE 38th Place Main Access:** Given the restricted access along 108th Avenue NE, the majority of the traffic would use this driveway. The site should be configured to allow for approximately 100-feet of storage on the outbound approach and to direct users to this location.
- **Enhanced Traffic Control at 108th Avenue NE/NE 38th Place Intersection:** Traffic control improvements should be implemented to add capacity to NE 38th Place such as installation of a traffic signal or similar traffic control measures.

Lake Washington Boulevard/NE 38th Place. This intersection is anticipated to operate at LOS F during the PM peak hour, with or without the proposed project. Based on the City of Kirkland proportional share calculation worksheet, the TOD and park-and-ride proportional share at the Lake Washington Boulevard/NE 38th Place intersection is approximately 1.70 percent. Based on the City of Kirkland's criteria, this would not be considered a significant impact in terms of the SEPA thresholds.

Lake Washington Boulevard/Northup Way. This intersection is anticipated to operate at LOS E during the weekday PM peak hour by 2030 with or without the project. The park-and-ride and TOD

project would increase the total intersection volume at this location by less than one percent (see Table 2). This intersection would continue operating at LOS E, which is within the acceptable LOS D/E range typically used by the City of Bellevue.

108th Avenue NE/Northup Way. This intersection would operate at LOS E during the weekday PM peak hour by 2030 with or without the project. The park-and-ride and TOD project would increase the total intersection volume at this location by less than three percent (see Table 2). This intersection would continue operating at LOS E, which is within the acceptable LOS D/E range typically used by the City of Bellevue.

The suggested improvements have the potential to alter the circulation patterns internal to the site; therefore, these improvements should be reassessed during the SEPA review at the time a detailed plan is developed and a project moves forward. In general, the analysis shows that some form of turn restrictions would be necessary at the 108th driveway and capacity improvements would be needed at the 108th Avenue NE/NE 38th Place intersection to accommodate future traffic levels associated with the project and potential shifts in traffic due to the turn restrictions on 108th Avenue NE.

Parking Guidelines

The purpose of this parking discussion is to provide information around the anticipated parking demand in order to develop zoning regulations for the project. Currently no specific project has been identified and as such no defined parking supply established. Parking demand for TOD projects can be influenced by several key factors such as the mix of affordable housing and provision of a senior housing component.

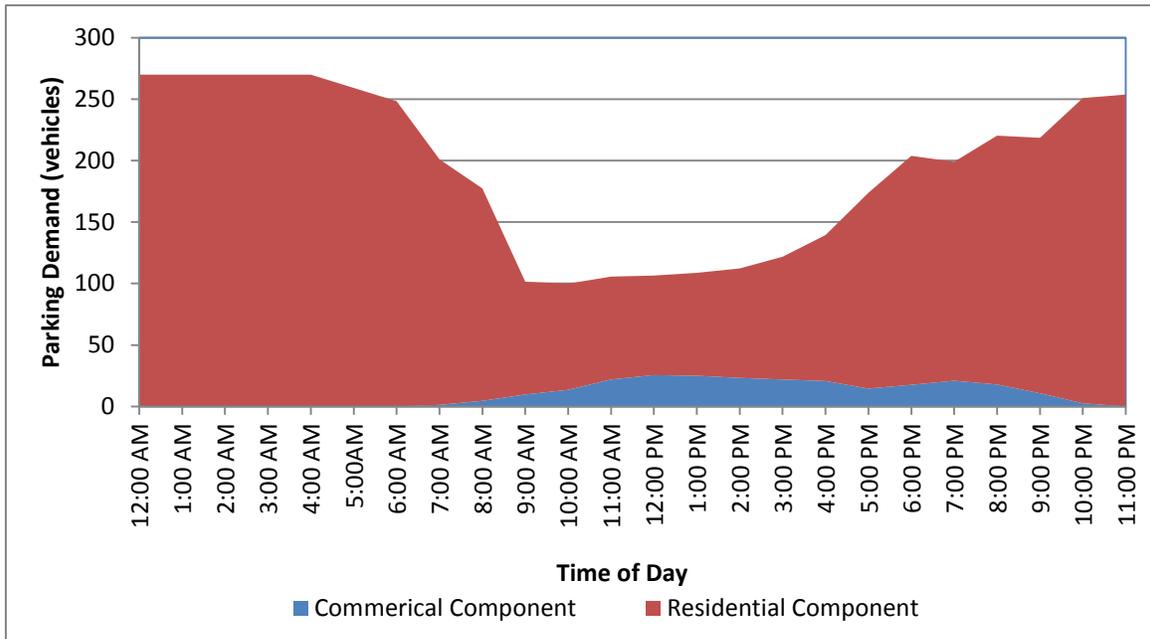
Data collected locally at four sites in the Redmond Urban Center, with market rate residential units, shows a parking demand range of 1.01 to 1.12 vehicles per unit⁶. Provision of affordable and/or senior housing would impact the parking demand significantly.

To understand the potential parking demand of the TOD component, this analysis assumed a peak demand rate of 1.08 vehicles per unit for the residential component, which represents the weighted average of the Redmond data. This does not take into consideration of factors discussed previously regarding affordable and senior housing. Parking demand for the retail component was calculated based on the average rate provided in the ITE *Parking Generation*, 4th Edition. It anticipated the retail uses would be geared towards users of the park-and-ride facility as well as the residential component; however, at this time only a 20 percent reduction in retail parking demand has been assumed. In addition, TOD development in suburban areas is shown to be less than projected by ITE *Parking Generation*, 4th Edition. These assumptions should be further refined when a development plan and potential uses are defined.

Based on the size of the TOD and the parking rates described above, Figure 1 shows the 24-hour parking demand profiles for the retail and residential components of the TOD project. Time of day distribution is also based on ITE.

⁶ *Assessing Multifamily Residential Parking Demand and Transit Service*, ITE Journal, December 2010,

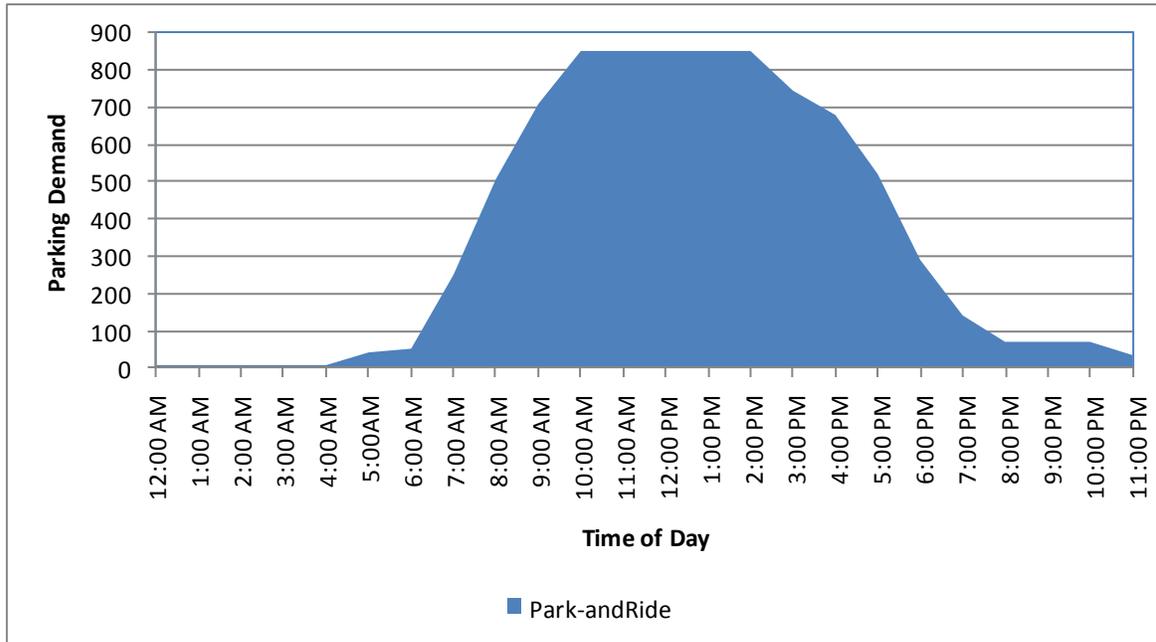
Figure 1. TOD Component Weekday Parking Demand Curve



Initial plans call for approximately one stall per unit or 250 stalls dedicated to the TOD portion (250 residential units/ 12,500 square-feet of retail) of the project, but this could change with the final development plans. As shown in the figure, assuming a supply of 250 stalls, the peak parking demands for the TOD component could exceed the dedicated parking between 6:00 p.m. and 7:00 a.m. by approximately 20 vehicles. This coincides with the low utilization periods of the park-and-ride lot. As discussed above, the rate used to calculate residential parking demand is based on market rate housing; therefore, this overflow from the TOD component would be less based on adjustments to the peak demand to account for the affordable and/or senior housing.

Figure 2 provides an estimated parking demand curve for the park-and-ride based on data collected at the South Kirkland Park-and-Ride during the peak periods (morning and evening) and an assumed 100 percent occupancy during the peak periods. As discussed previously, the total parking supply for the park-and-ride would be approximately 850 spaces with the project. The graph shows that during the fringes of the peak period (i.e., prior to 7:00 a.m. and after 6:00 p.m.), more than adequate capacity would exist to accommodate any overflow from the TOD components, even assuming the upper end of the demand curve and only 200 stalls of dedicated TOD parking provided.

Figure 2. Figure 2. Park-and-Ride Weekday Demand Curve



Conclusions

A review of the potential local traffic impacts showed that relative to forecasted conditions without the project, no significant change to off-site intersection operations would occur with development of the TOD and park-and-ride expansion. For those intersections where forecasted operations are projected to be LOS E/LOS F, mitigation would not likely be triggered based on current City of Kirkland and City of Bellevue standards.

Improvements are recommended at the 108th Avenue NE/NE 38th Place intersection and the 108th Avenue NE site access. These improvements include a combination of providing additional capacity such as signalization at the 108th Avenue NE/NE 38th Place intersection and implementation of turn restrictions at the 108th Avenue NE access. Several options exist for capacity improvements and turn restrictions, and it is recommended that this be revisited when a defined site plan is available such that any changes to the on-site circulation patterns can be considered in the final recommendation. The effect of these recommendations would be to reduce potential congestion along 108th Avenue NE near the access as well as a shift in traffic to NE 38th Place, and accommodating increased side street demand by improving the 108th Avenue NE/NE 38th Place intersection.

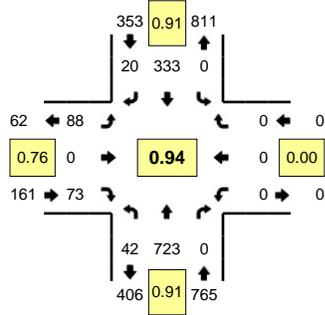
An analysis of the parking demand was conducted for the TOD component and park-and-ride. Due to the nature of the TOD projects, it is desirable to have shared parking between the uses. Any overflow from the TOD would be accommodated in the vacant stalls in the park-and-ride lot that exist during non-peak times. The analysis showed that even with an average peak parking demand of 1.08 vehicles per unit for the residential uses, a peak demand for shared parking would not exceed 20 spaces. This can easily be met by the available parking at the park-and-ride lot.

When defining the required parking supply for the project, we recommend a baseline assumption of 1.08 stalls per unit, consistent with the Redmond data, with provisions to adjust the required parking supply to account for reductions due to senior and affordable housing components, as well as the ability to share parking with the park-and-ride facility. If overflow from the TOD is anticipated, the current utilization of the Park-and-Ride facility should be observed and the ability for shared parking confirmed.

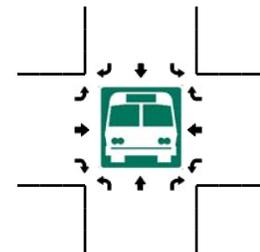
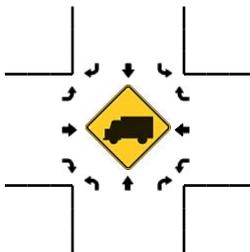
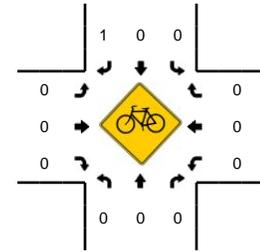
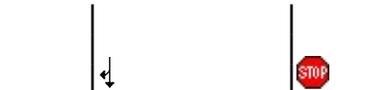
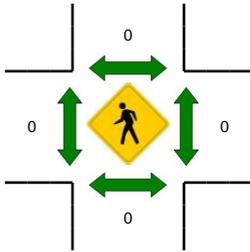
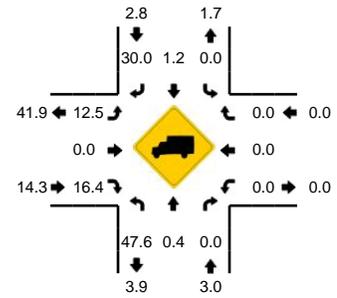
Attachment A: Traffic Counts and Existing
Park-and-Ride Trip Generation

LOCATION: 108th -- Park-n-Ride
CITY/STATE: Kirkland, WA

QC JOB #: 10565001
DATE: 12/15/2010



Peak-Hour: 4:30 PM -- 5:30 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

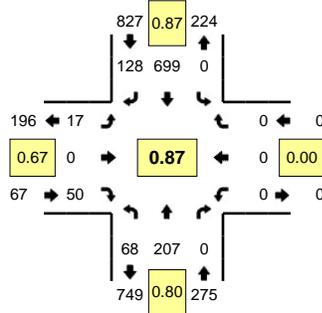


| 5-Min Count Period Beginning At | 108th (Northbound) | | | | 108th (Southbound) | | | | Park-n-Ride (Eastbound) | | | | Park-n-Ride (Westbound) | | | | Total | Hourly Totals |
|---------------------------------|--------------------|------|-------|---|--------------------|------|-------|---|-------------------------|------|-------|---|-------------------------|------|-------|---|-------|---------------|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 4:00 PM | 3 | 46 | 0 | 0 | 0 | 17 | 2 | 0 | 5 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 79 | |
| 4:05 PM | 1 | 43 | 0 | 0 | 0 | 42 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 93 | |
| 4:10 PM | 3 | 65 | 0 | 0 | 0 | 26 | 1 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 99 | |
| 4:15 PM | 0 | 53 | 0 | 0 | 0 | 23 | 0 | 0 | 4 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 85 | |
| 4:20 PM | 5 | 51 | 0 | 0 | 0 | 27 | 2 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 91 | |
| 4:25 PM | 1 | 50 | 0 | 0 | 0 | 27 | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 83 | |
| 4:30 PM | 7 | 56 | 0 | 0 | 0 | 24 | 1 | 0 | 8 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 105 | |
| 4:35 PM | 3 | 68 | 0 | 0 | 0 | 32 | 2 | 0 | 10 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 127 | |
| 4:40 PM | 5 | 63 | 0 | 0 | 0 | 23 | 1 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 102 | |
| 4:45 PM | 4 | 61 | 0 | 0 | 0 | 28 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 98 | |
| 4:50 PM | 5 | 52 | 0 | 0 | 0 | 26 | 3 | 0 | 6 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 97 | |
| 4:55 PM | 3 | 48 | 0 | 0 | 0 | 24 | 1 | 0 | 15 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 97 | 1156 |
| 5:00 PM | 5 | 69 | 0 | 0 | 0 | 27 | 1 | 0 | 7 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 119 | 1196 |
| 5:05 PM | 1 | 46 | 0 | 0 | 0 | 30 | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 83 | 1186 |
| 5:10 PM | 0 | 72 | 0 | 0 | 0 | 30 | 1 | 0 | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 112 | 1199 |
| 5:15 PM | 5 | 59 | 0 | 0 | 0 | 23 | 2 | 0 | 14 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 110 | 1224 |
| 5:20 PM | 3 | 64 | 0 | 0 | 0 | 24 | 5 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 107 | 1240 |
| 5:25 PM | 1 | 65 | 0 | 0 | 0 | 42 | 1 | 0 | 6 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 122 | 1279 |
| 5:30 PM | 1 | 62 | 0 | 0 | 0 | 21 | 1 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 93 | 1267 |
| 5:35 PM | 9 | 64 | 0 | 0 | 0 | 24 | 2 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 104 | 1244 |
| 5:40 PM | 3 | 71 | 0 | 0 | 0 | 28 | 2 | 0 | 5 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 120 | 1262 |
| 5:45 PM | 4 | 65 | 0 | 0 | 0 | 17 | 3 | 0 | 11 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 108 | 1272 |
| 5:50 PM | 2 | 54 | 0 | 0 | 0 | 25 | 3 | 0 | 9 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 102 | 1277 |
| 5:55 PM | 4 | 57 | 0 | 0 | 0 | 20 | 0 | 0 | 8 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 99 | 1279 |
| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total | |
| All Vehicles | 36 | 752 | 0 | 0 | 0 | 356 | 32 | 0 | 108 | 0 | 72 | 0 | 0 | 0 | 0 | 0 | 1356 | |
| Heavy Trucks | 12 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 16 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 52 | |
| Pedestrians | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Bicycles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Railroad | | | | | | | | | | | | | | | | | | |
| Stopped Buses | | | | | | | | | | | | | | | | | | |

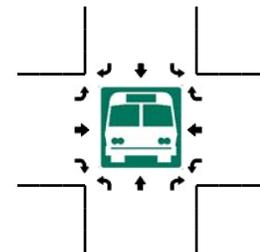
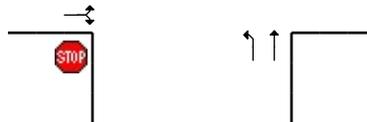
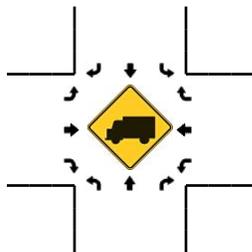
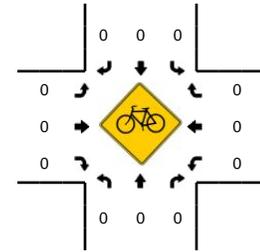
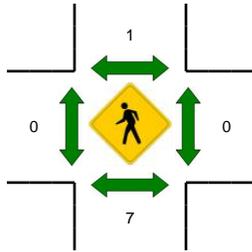
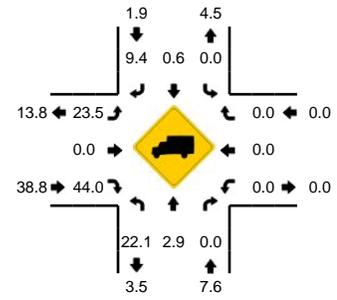
Comments:

LOCATION: 108th -- Park-n-Ride
CITY/STATE: Kirkland, WA

QC JOB #: 10565002
DATE: 12/15/2010



Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 8:00 AM -- 8:15 AM

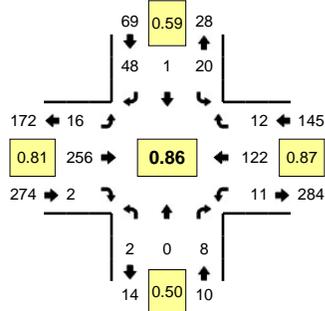


| 5-Min Count Period Beginning At | 108th (Northbound) | | | | 108th (Southbound) | | | | Park-n-Ride (Eastbound) | | | | Park-n-Ride (Westbound) | | | | Total | Hourly Totals |
|---------------------------------|--------------------|------|-------|---|--------------------|------|-------|---|-------------------------|------|-------|---|-------------------------|------|-------|---|-------|---------------|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 7:00 AM | 5 | 12 | 0 | 0 | 0 | 33 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 55 | 398 |
| 7:05 AM | 3 | 11 | 0 | 0 | 0 | 39 | 14 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 71 | 449 |
| 7:10 AM | 6 | 16 | 0 | 0 | 0 | 33 | 7 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 65 | 495 |
| 7:15 AM | 8 | 10 | 0 | 0 | 0 | 38 | 11 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 72 | 543 |
| 7:20 AM | 8 | 12 | 0 | 0 | 0 | 40 | 7 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 72 | 582 |
| 7:25 AM | 6 | 13 | 0 | 0 | 0 | 50 | 8 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 81 | 645 |
| 7:30 AM | 10 | 9 | 0 | 0 | 0 | 49 | 9 | 0 | 4 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 87 | 705 |
| 7:35 AM | 6 | 20 | 0 | 0 | 0 | 69 | 10 | 0 | 3 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 116 | 793 |
| 7:40 AM | 11 | 14 | 0 | 0 | 0 | 46 | 10 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 85 | 846 |
| 7:45 AM | 4 | 11 | 0 | 0 | 0 | 57 | 16 | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 94 | 909 |
| 7:50 AM | 5 | 8 | 0 | 0 | 0 | 50 | 16 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 83 | 941 |
| 7:55 AM | 8 | 15 | 0 | 0 | 0 | 58 | 6 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 91 | 972 |
| 8:00 AM | 3 | 27 | 0 | 0 | 0 | 63 | 14 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 110 | 1027 |
| 8:05 AM | 3 | 29 | 0 | 0 | 0 | 76 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 116 | 1072 |
| 8:10 AM | 1 | 23 | 0 | 0 | 0 | 74 | 7 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 109 | 1116 |
| 8:15 AM | 9 | 21 | 0 | 0 | 0 | 61 | 14 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 110 | 1154 |
| 8:20 AM | 1 | 17 | 0 | 0 | 0 | 47 | 11 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 79 | 1161 |
| 8:25 AM | 7 | 13 | 0 | 0 | 0 | 49 | 10 | 0 | 2 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 89 | 1169 |
| 8:30 AM | 5 | 15 | 0 | 0 | 0 | 34 | 5 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 61 | 1143 |
| 8:35 AM | 3 | 9 | 0 | 0 | 0 | 60 | 11 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 86 | 1113 |
| 8:40 AM | 1 | 13 | 0 | 0 | 0 | 63 | 6 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 86 | 1114 |
| 8:45 AM | 6 | 19 | 0 | 0 | 0 | 51 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 81 | 1101 |
| 8:50 AM | 4 | 15 | 0 | 0 | 0 | 57 | 8 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 87 | 1105 |
| 8:55 AM | 3 | 16 | 0 | 0 | 0 | 43 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 65 | 1079 |
| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total | |
| All Vehicles | 28 | 316 | 0 | 0 | 0 | 852 | 104 | 0 | 12 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 1340 | |
| Heavy Trucks | 20 | 12 | 0 | 0 | 0 | 8 | 8 | 0 | 8 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 76 | |
| Pedestrians | | 4 | | | | 0 | | | | 0 | | | | 0 | | | 4 | |
| Bicycles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Railroad | | | | | | | | | | | | | | | | | | |
| Stopped Buses | | | | | | | | | | | | | | | | | | |

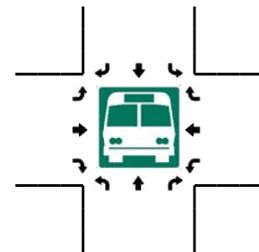
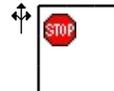
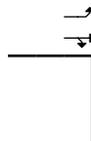
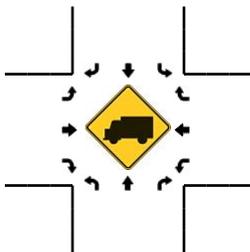
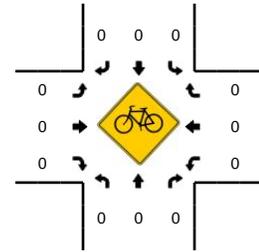
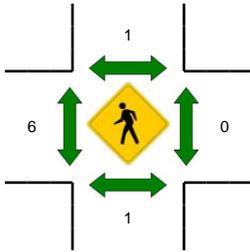
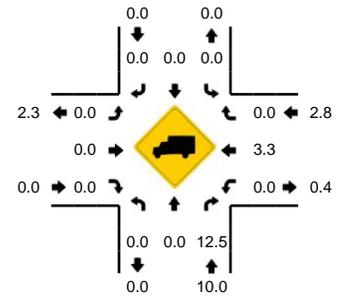
Comments:

LOCATION: Park-n-Ride -- 38th
CITY/STATE: Kirkland, WA

QC JOB #: 10565003
DATE: 12/15/2010



Peak-Hour: 4:55 PM -- 5:55 PM
Peak 15-Min: 5:05 PM -- 5:20 PM

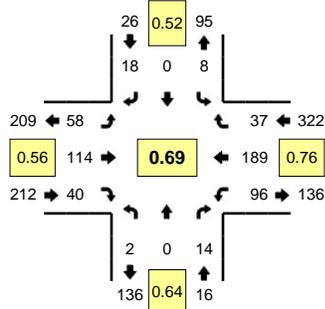


| 5-Min Count Period Beginning At | Park-n-Ride (Northbound) | | | | Park-n-Ride (Southbound) | | | | 38th (Eastbound) | | | | 38th (Westbound) | | | | Total | Hourly Totals |
|---------------------------------|--------------------------|------|-------|---|--------------------------|------|-------|---|------------------|------|-------|---|------------------|------|-------|---|-------|---------------|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 4:00 PM | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 20 | 0 | 0 | 1 | 14 | 1 | 0 | 39 | |
| 4:05 PM | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 29 | 0 | 0 | 3 | 12 | 3 | 0 | 50 | |
| 4:10 PM | 1 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 24 | 2 | 0 | 2 | 11 | 0 | 0 | 44 | |
| 4:15 PM | 0 | 0 | 2 | 0 | 1 | 0 | 4 | 0 | 0 | 20 | 1 | 0 | 2 | 8 | 0 | 0 | 38 | |
| 4:20 PM | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 14 | 0 | 0 | 2 | 14 | 1 | 0 | 35 | |
| 4:25 PM | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 12 | 0 | 0 | 31 | |
| 4:30 PM | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 14 | 1 | 0 | 1 | 9 | 1 | 0 | 29 | |
| 4:35 PM | 0 | 0 | 1 | 0 | 1 | 0 | 10 | 0 | 1 | 26 | 0 | 0 | 1 | 8 | 0 | 0 | 48 | |
| 4:40 PM | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 14 | 1 | 0 | 0 | 8 | 0 | 0 | 26 | |
| 4:45 PM | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 1 | 0 | 0 | 10 | 1 | 0 | 34 | |
| 4:50 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 22 | 0 | 0 | 0 | 15 | 1 | 0 | 40 | |
| 4:55 PM | 0 | 0 | 1 | 0 | 4 | 0 | 5 | 0 | 1 | 21 | 0 | 0 | 1 | 7 | 0 | 0 | 40 | 454 |
| 5:00 PM | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 3 | 26 | 0 | 0 | 0 | 6 | 1 | 0 | 40 | 455 |
| 5:05 PM | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 30 | 0 | 0 | 1 | 9 | 1 | 0 | 48 | 453 |
| 5:10 PM | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 2 | 27 | 0 | 0 | 1 | 15 | 0 | 0 | 50 | 459 |
| 5:15 PM | 0 | 0 | 1 | 0 | 2 | 0 | 6 | 0 | 1 | 21 | 0 | 0 | 1 | 12 | 2 | 0 | 46 | 467 |
| 5:20 PM | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 19 | 1 | 0 | 0 | 10 | 0 | 0 | 36 | 468 |
| 5:25 PM | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 5 | 20 | 0 | 0 | 2 | 12 | 1 | 0 | 43 | 480 |
| 5:30 PM | 1 | 0 | 3 | 0 | 2 | 0 | 4 | 0 | 1 | 20 | 1 | 0 | 0 | 11 | 0 | 0 | 43 | 494 |
| 5:35 PM | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 2 | 11 | 2 | 0 | 32 | 478 |
| 5:40 PM | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 19 | 0 | 0 | 1 | 15 | 2 | 0 | 40 | 492 |
| 5:45 PM | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 2 | 22 | 0 | 0 | 1 | 6 | 1 | 0 | 39 | 497 |
| 5:50 PM | 0 | 0 | 0 | 0 | 4 | 0 | 8 | 0 | 1 | 17 | 0 | 0 | 1 | 8 | 2 | 0 | 41 | 498 |
| 5:55 PM | 0 | 0 | 0 | 0 | 4 | 0 | 9 | 0 | 2 | 12 | 0 | 0 | 0 | 9 | 0 | 0 | 36 | 494 |
| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total | |
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| All Vehicles | 0 | 0 | 4 | 0 | 16 | 0 | 64 | 0 | 12 | 312 | 0 | 0 | 12 | 144 | 12 | 0 | 576 | |
| Heavy Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 | |
| Pedestrians | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Bicycles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Railroad | | | | | | | | | | | | | | | | | | |
| Stopped Buses | | | | | | | | | | | | | | | | | | |

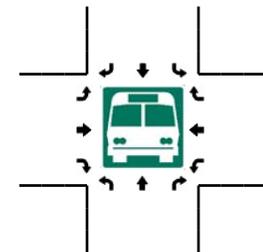
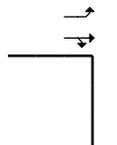
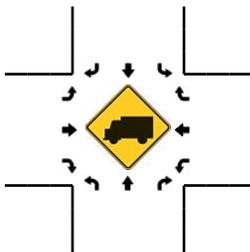
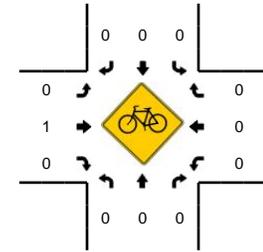
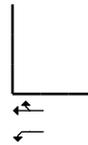
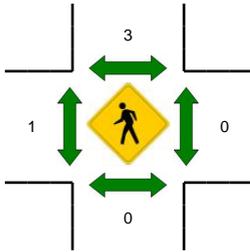
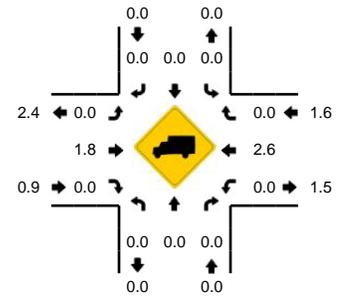
Comments:

LOCATION: Park-n-Ride -- 38th
CITY/STATE: Kirkland, WA

QC JOB #: 10565004
DATE: 12/15/2010



Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 7:45 AM -- 8:00 AM



| 5-Min Count Period Beginning At | Park-n-Ride (Northbound) | | | | Park-n-Ride (Southbound) | | | | 38th (Eastbound) | | | | 38th (Westbound) | | | | Total | Hourly Totals |
|---------------------------------|--------------------------|------|-------|---|--------------------------|------|-------|---|------------------|------|-------|---|------------------|------|-------|---|-------|---------------|
| | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | Left | Thru | Right | U | | |
| 6:50 AM | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 1 | 9 | 3 | 0 | 18 | |
| 6:55 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 2 | 0 | 4 | 14 | 0 | 0 | 34 | 172 |
| 7:00 AM | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 4 | 2 | 0 | 0 | 1 | 17 | 1 | 0 | 28 | 192 |
| 7:05 AM | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 5 | 0 | 0 | 3 | 14 | 3 | 0 | 29 | 214 |
| 7:10 AM | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 5 | 2 | 1 | 0 | 0 | 5 | 4 | 0 | 20 | 227 |
| 7:15 AM | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 1 | 0 | 0 | 0 | 11 | 1 | 0 | 20 | 234 |
| 7:20 AM | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 6 | 0 | 0 | 2 | 12 | 2 | 0 | 26 | 246 |
| 7:25 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 0 | 5 | 14 | 6 | 0 | 32 | 264 |
| 7:30 AM | 0 | 0 | 3 | 0 | 1 | 0 | 2 | 0 | 12 | 5 | 4 | 0 | 6 | 12 | 1 | 0 | 46 | 293 |
| 7:35 AM | 0 | 0 | 2 | 0 | 2 | 0 | 6 | 0 | 6 | 3 | 2 | 0 | 6 | 17 | 4 | 0 | 48 | 322 |
| 7:40 AM | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 11 | 4 | 0 | 13 | 15 | 1 | 0 | 50 | 359 |
| 7:45 AM | 1 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 3 | 14 | 13 | 0 | 15 | 10 | 4 | 0 | 64 | 415 |
| 7:50 AM | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 17 | 5 | 0 | 15 | 15 | 1 | 0 | 61 | 458 |
| 7:55 AM | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 5 | 27 | 4 | 0 | 21 | 20 | 4 | 0 | 85 | 509 |
| 8:00 AM | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 5 | 14 | 5 | 0 | 9 | 18 | 3 | 0 | 57 | 538 |
| 8:05 AM | 1 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 6 | 5 | 0 | 0 | 3 | 22 | 4 | 0 | 45 | 554 |
| 8:10 AM | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 3 | 4 | 1 | 0 | 0 | 17 | 6 | 0 | 34 | 568 |
| 8:15 AM | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 1 | 17 | 1 | 0 | 28 | 576 |
| 8:20 AM | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 4 | 0 | 0 | 0 | 15 | 2 | 0 | 25 | 575 |
| 8:25 AM | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 1 | 16 | 2 | 0 | 29 | 572 |
| 8:30 AM | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 3 | 2 | 0 | 0 | 8 | 0 | 0 | 16 | 542 |
| 8:35 AM | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 20 | 1 | 0 | 29 | 523 |
| 8:40 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 1 | 17 | 0 | 0 | 25 | 498 |
| 8:45 AM | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 4 | 0 | 0 | 1 | 12 | 2 | 0 | 22 | 456 |
| Peak 15-Min Flowrates | Northbound | | | | Southbound | | | | Eastbound | | | | Westbound | | | | Total | |
| All Vehicles | 4 | 0 | 16 | 0 | 4 | 0 | 16 | 0 | 60 | 232 | 88 | 0 | 204 | 180 | 36 | 0 | 840 | |
| Heavy Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 | |
| Pedestrians | | | | | 4 | | | | 0 | | | | 0 | | | | 4 | |
| Bicycles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Railroad | | | | | | | | | | | | | | | | | | |
| Stopped Buses | | | | | | | | | | | | | | | | | | |

Comments:

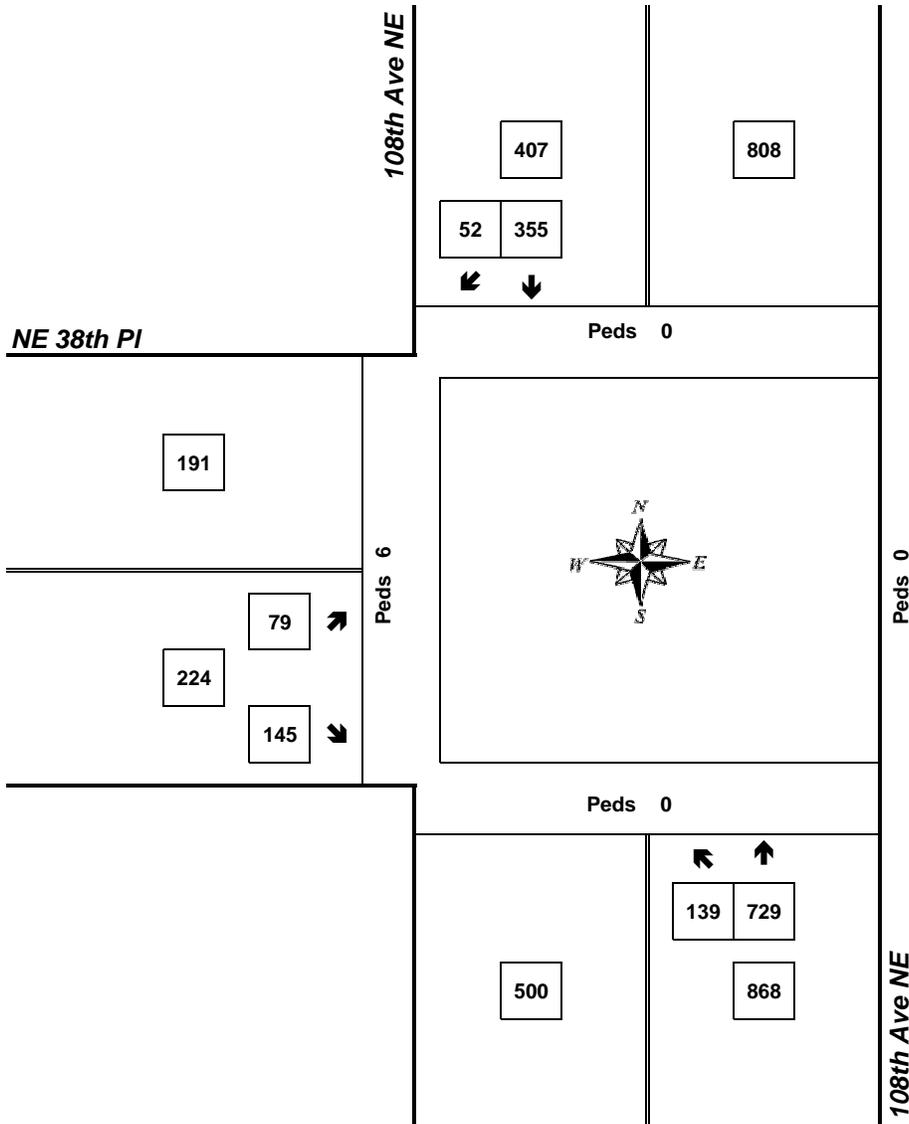
Peak Hour Summary



Mark Skaggs
(206) 251-0300

108th Ave NE & NE 38th PI

5:00 PM to 6:00 PM
Thursday, January 20, 2011



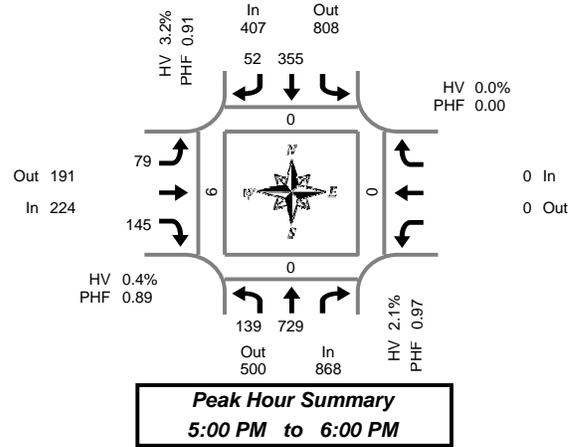
| Approach | PHF | HV% | Volume |
|---------------------|-------------|-------------|--------------|
| EB | 0.89 | 0.4% | 224 |
| WB | 0.00 | 0.0% | 0 |
| NB | 0.97 | 2.1% | 868 |
| SB | 0.91 | 3.2% | 407 |
| Intersection | 0.95 | 2.1% | 1,499 |

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary



Mark Skaggs
(206) 251-0300



108th Ave NE & NE 38th PI

Thursday, January 20, 2011
4:00 PM to 6:00 PM

15-Minute Interval Summary

4:00 PM to 6:00 PM

| Interval Start Time | Northbound 108th Ave NE | | | Southbound 108th Ave NE | | | Eastbound NE 38th PI | | | Westbound NE 38th PI | | | Interval Total | Pedestrians Crosswalk | | | | |
|---------------------|-------------------------|-------|----|-------------------------|----|----|----------------------|-----|----|----------------------|-----|-------|----------------|-----------------------|-------|-------|------|------|
| | L | T | HV | T | R | HV | L | R | HV | In | Out | Total | | PHF | North | South | East | West |
| 4:00 PM | 21 | 127 | 6 | 91 | 4 | 3 | 20 | 47 | 0 | | | | | 310 | 0 | 0 | 0 | 2 |
| 4:15 PM | 22 | 151 | 5 | 75 | 9 | 7 | 16 | 30 | 0 | | | | | 303 | 0 | 0 | 0 | 3 |
| 4:30 PM | 30 | 149 | 5 | 91 | 9 | 2 | 19 | 46 | 1 | | | | | 344 | 0 | 0 | 0 | 1 |
| 4:45 PM | 21 | 174 | 5 | 75 | 8 | 3 | 10 | 50 | 0 | | | | | 338 | 0 | 0 | 0 | 1 |
| 5:00 PM | 32 | 180 | 4 | 87 | 9 | 3 | 24 | 26 | 0 | | | | | 358 | 0 | 0 | 0 | 1 |
| 5:15 PM | 47 | 177 | 7 | 90 | 16 | 4 | 18 | 45 | 1 | | | | | 393 | 0 | 0 | 0 | 1 |
| 5:30 PM | 30 | 187 | 4 | 98 | 14 | 4 | 17 | 37 | 0 | | | | | 383 | 0 | 0 | 0 | 2 |
| 5:45 PM | 30 | 185 | 3 | 80 | 13 | 2 | 20 | 37 | 0 | | | | | 365 | 0 | 0 | 0 | 2 |
| Total Survey | 233 | 1,330 | 39 | 687 | 82 | 28 | 144 | 318 | 2 | | | | | 2,794 | 0 | 0 | 0 | 13 |

Peak Hour Summary

5:00 PM to 6:00 PM

| By Approach | Northbound 108th Ave NE | | | | Southbound 108th Ave NE | | | | Eastbound NE 38th PI | | | | Westbound NE 38th PI | | | | Total | Pedestrians Crosswalk | | | |
|-------------|-------------------------|-----|-------|----|-------------------------|-----|-------|----|----------------------|-----|-------|----|----------------------|-----|-------|-----|-------|-----------------------|-------|------|------|
| | In | Out | Total | HV | In | Out | Total | HV | In | Out | Total | HV | In | Out | Total | PHF | | North | South | East | West |
| Volume | 868 | 500 | 1,368 | 18 | 407 | 808 | 1,215 | 13 | 224 | 191 | 415 | 1 | 0 | 0 | 0 | | 1,499 | 0 | 0 | 0 | 6 |
| %HV | 2.1% | | | | 3.2% | | | | 0.4% | | | | 0.0% | | | | 2.1% | | | | |
| PHF | 0.97 | | | | 0.91 | | | | 0.89 | | | | 0.00 | | | | 0.95 | | | | |

| By Movement | Northbound 108th Ave NE | | | Southbound 108th Ave NE | | | Eastbound NE 38th PI | | | Westbound NE 38th PI | | | Total |
|-------------|-------------------------|------|-------|-------------------------|------|-------|----------------------|------|-------|----------------------|-----|-------|-------|
| | L | T | Total | T | R | Total | L | R | Total | In | Out | Total | |
| Volume | 139 | 729 | 868 | 355 | 52 | 407 | 79 | 145 | 224 | | | 0 | 1,499 |
| PHF | 0.74 | 0.97 | 0.97 | 0.91 | 0.81 | 0.91 | 0.82 | 0.81 | 0.89 | | | 0.00 | 0.95 |

Rolling Hour Summary

4:00 PM to 6:00 PM

| Interval Start Time | Northbound 108th Ave NE | | | Southbound 108th Ave NE | | | Eastbound NE 38th PI | | | Westbound NE 38th PI | | | Interval Total | Pedestrians Crosswalk | | | |
|---------------------|-------------------------|-----|----|-------------------------|----|----|----------------------|-----|----|----------------------|-----|-------|----------------|-----------------------|-------|-------|------|
| | L | T | HV | T | R | HV | L | R | HV | In | Out | Total | | PHF | North | South | East |
| 4:00 PM | 94 | 601 | 21 | 332 | 30 | 15 | 65 | 173 | 1 | | | | 1,295 | 0 | 0 | 0 | 7 |
| 4:15 PM | 105 | 654 | 19 | 328 | 35 | 15 | 69 | 152 | 1 | | | | 1,343 | 0 | 0 | 0 | 6 |
| 4:30 PM | 130 | 680 | 21 | 343 | 42 | 12 | 71 | 167 | 2 | | | | 1,433 | 0 | 0 | 0 | 4 |
| 4:45 PM | 130 | 718 | 20 | 350 | 47 | 14 | 69 | 158 | 1 | | | | 1,472 | 0 | 0 | 0 | 5 |
| 5:00 PM | 139 | 729 | 18 | 355 | 52 | 13 | 79 | 145 | 1 | | | | 1,499 | 0 | 0 | 0 | 6 |

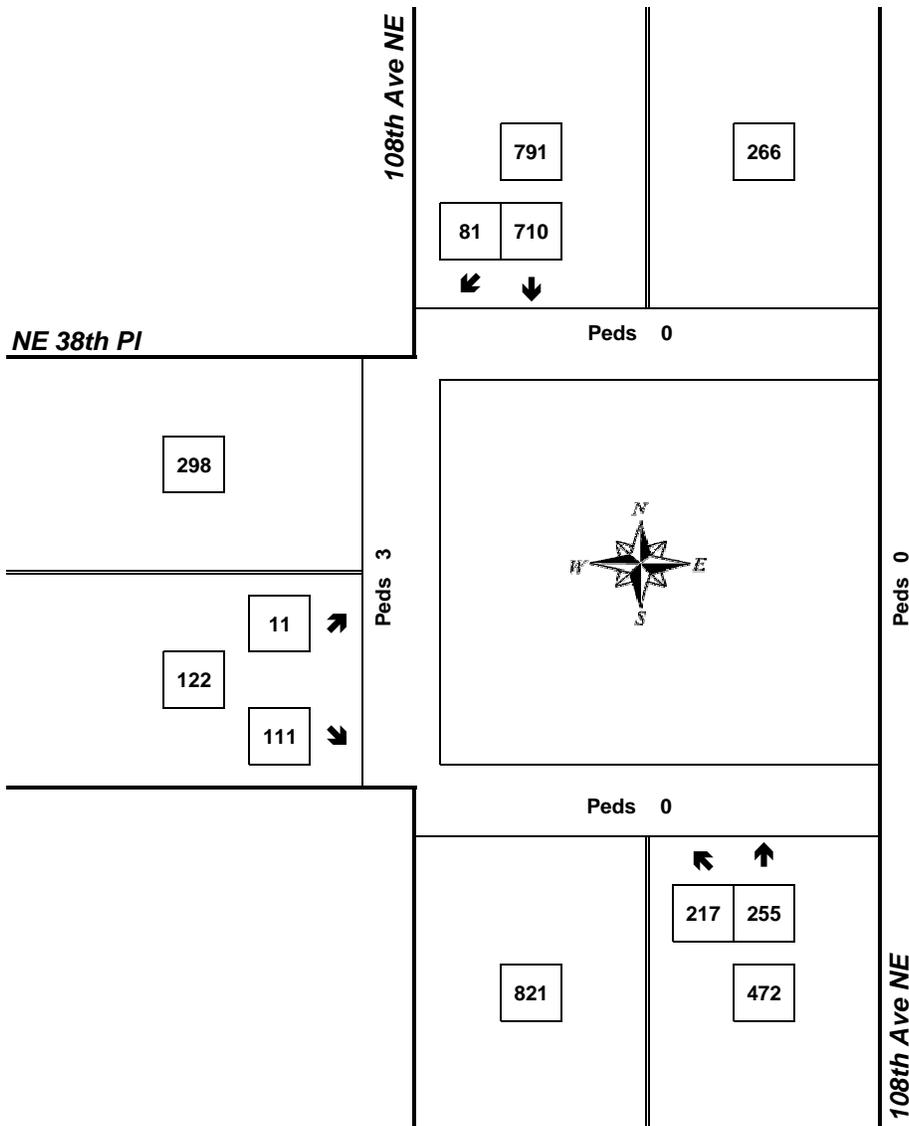
Peak Hour Summary



Mark Skaggs
(206) 251-0300

108th Ave NE & NE 38th PI

7:30 AM to 8:30 AM
Thursday, January 20, 2011



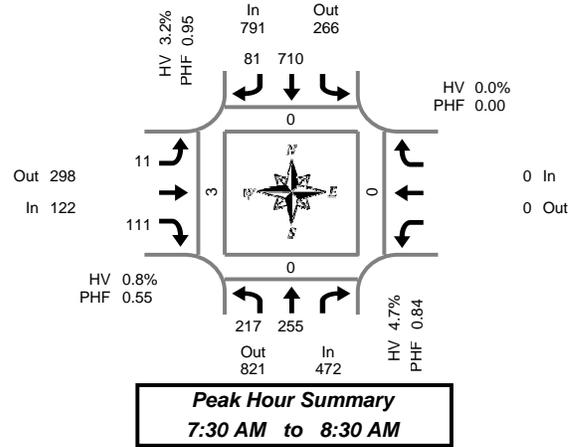
| Approach | PHF | HV% | Volume |
|---------------------|-------------|-------------|--------------|
| EB | 0.55 | 0.8% | 122 |
| WB | 0.00 | 0.0% | 0 |
| NB | 0.84 | 4.7% | 472 |
| SB | 0.95 | 3.2% | 791 |
| Intersection | 0.86 | 3.5% | 1,385 |

Count Period: 7:00 AM to 9:00 AM

Total Vehicle Summary



Mark Skaggs
(206) 251-0300



108th Ave NE & NE 38th PI

Thursday, January 20, 2011
7:00 AM to 9:00 AM

15-Minute Interval Summary

7:00 AM to 9:00 AM

| Interval Start Time | Northbound 108th Ave NE | | | Southbound 108th Ave NE | | | Eastbound NE 38th PI | | | Westbound NE 38th PI | | | Interval Total | Pedestrians Crosswalk | | | |
|---------------------|-------------------------|-----|----|-------------------------|-----|----|----------------------|--|-----|----------------------|----|-----|----------------|-----------------------|-------|-------|------|
| | L | T | HV | T | R | HV | L | | R | HV | In | Out | | Total | North | South | East |
| 7:00 AM | 29 | 39 | 6 | 86 | 11 | 10 | 1 | | 10 | 0 | | | 176 | 0 | 0 | 0 | 0 |
| 7:15 AM | 48 | 51 | 2 | 104 | 11 | 3 | 1 | | 15 | 0 | | | 230 | 0 | 0 | 0 | 0 |
| 7:30 AM | 50 | 70 | 10 | 169 | 18 | 9 | 4 | | 24 | 1 | | | 335 | 0 | 0 | 0 | 0 |
| 7:45 AM | 73 | 67 | 3 | 181 | 27 | 5 | 2 | | 53 | 0 | | | 403 | 0 | 0 | 0 | 0 |
| 8:00 AM | 46 | 68 | 7 | 187 | 22 | 8 | 3 | | 23 | 0 | | | 349 | 0 | 0 | 0 | 2 |
| 8:15 AM | 48 | 50 | 2 | 173 | 14 | 3 | 2 | | 11 | 0 | | | 298 | 0 | 0 | 0 | 1 |
| 8:30 AM | 36 | 47 | 4 | 156 | 19 | 6 | 3 | | 16 | 0 | | | 277 | 0 | 0 | 0 | 2 |
| 8:45 AM | 54 | 60 | 6 | 126 | 15 | 5 | 5 | | 16 | 0 | | | 276 | 0 | 0 | 0 | 2 |
| Total Survey | 384 | 452 | 40 | 1,182 | 137 | 49 | 21 | | 168 | 1 | | | 2,344 | 0 | 0 | 0 | 7 |

Peak Hour Summary

7:30 AM to 8:30 AM

| By Approach | Northbound 108th Ave NE | | | | Southbound 108th Ave NE | | | | Eastbound NE 38th PI | | | | Westbound NE 38th PI | | | Total | Pedestrians Crosswalk | | | |
|-------------|-------------------------|-----|-------|----|-------------------------|-----|-------|----|----------------------|-----|-------|----|----------------------|-----|-------|-------|-----------------------|-------|------|------|
| | In | Out | Total | HV | In | Out | Total | HV | In | Out | Total | HV | In | Out | Total | | North | South | East | West |
| Volume | 472 | 821 | 1,293 | 22 | 791 | 266 | 1,057 | 25 | 122 | 298 | 420 | 1 | 0 | 0 | 0 | 1,385 | 0 | 0 | 0 | 3 |
| %HV | 4.7% | | | | 3.2% | | | | 0.8% | | | | 0.0% | | | 3.5% | | | | |
| PHF | 0.84 | | | | 0.95 | | | | 0.55 | | | | 0.00 | | | 0.86 | | | | |

| By Movement | Northbound 108th Ave NE | | | Southbound 108th Ave NE | | | Eastbound NE 38th PI | | | Westbound NE 38th PI | | | Total | |
|-------------|-------------------------|------|-------|-------------------------|------|-------|----------------------|--|------|----------------------|----|-----|-------|-------|
| | L | T | Total | T | R | Total | L | | R | Total | In | Out | | Total |
| Volume | 217 | 255 | 472 | 710 | 81 | 791 | 11 | | 111 | 122 | | | 0 | 1,385 |
| PHF | 0.74 | 0.91 | 0.84 | 0.95 | 0.75 | 0.95 | 0.69 | | 0.52 | 0.55 | | | 0.00 | 0.86 |

Rolling Hour Summary

7:00 AM to 9:00 AM

| Interval Start Time | Northbound 108th Ave NE | | | Southbound 108th Ave NE | | | Eastbound NE 38th PI | | | Westbound NE 38th PI | | | Interval Total | Pedestrians Crosswalk | | | |
|---------------------|-------------------------|-----|----|-------------------------|----|----|----------------------|--|-----|----------------------|----|-----|----------------|-----------------------|-------|-------|------|
| | L | T | HV | T | R | HV | L | | R | HV | In | Out | | Total | North | South | East |
| 7:00 AM | 200 | 227 | 21 | 540 | 67 | 27 | 8 | | 102 | 1 | | | 1,144 | 0 | 0 | 0 | 0 |
| 7:15 AM | 217 | 256 | 22 | 641 | 78 | 25 | 10 | | 115 | 1 | | | 1,317 | 0 | 0 | 0 | 2 |
| 7:30 AM | 217 | 255 | 22 | 710 | 81 | 25 | 11 | | 111 | 1 | | | 1,385 | 0 | 0 | 0 | 3 |
| 7:45 AM | 203 | 232 | 16 | 697 | 82 | 22 | 10 | | 103 | 0 | | | 1,327 | 0 | 0 | 0 | 5 |
| 8:00 AM | 184 | 225 | 19 | 642 | 70 | 22 | 13 | | 66 | 0 | | | 1,200 | 0 | 0 | 0 | 7 |

Existing Park-and-Ride Peak Hour Trip Generation

| Existing | Size | | Trips | | | Distribution | | Trip |
|-------------------------------------------------------------------------|------------|-------------|-------|-----|-------|--------------|-----|------|
| | 603 spaces | | In | Out | Total | In | Out | Rate |
| <i>Peak Hour of the Park-and-Ride</i> | | | | | | | | |
| AM Peak Hour | | | 301 | 88 | 389 | 77% | 23% | 0.65 |
| PM Peak Hour | | | 90 | 232 | 322 | 28% | 72% | 0.53 |
| <i>Peak Hour of the Adjacent Street</i> | | | | | | | | |
| AM Peak Hour | | | 285 | 93 | 378 | 73% | 27% | 0.63 |
| PM Peak Hour | | | 87 | 216 | 303 | 27% | 73% | 0.50 |
| <i>Difference Between Park-and-Ride and Adjacent Street Peak</i> | | | | | | | | |
| AM Peak Hour | | | 16 | -5 | 11 | | | |
| PM Peak Hour | | | 3 | 16 | 19 | | | |
| <i>Comparison to ITE</i> | | | | | | | | |
| | | Rate | | | | | | |
| AM Peak Hour | 0.76 | Equation | 371 | 87 | 458 | 81% | 19% | |
| PM Peak Hour | 0.62 | Equation | 86 | 288 | 374 | 23% | 77% | |

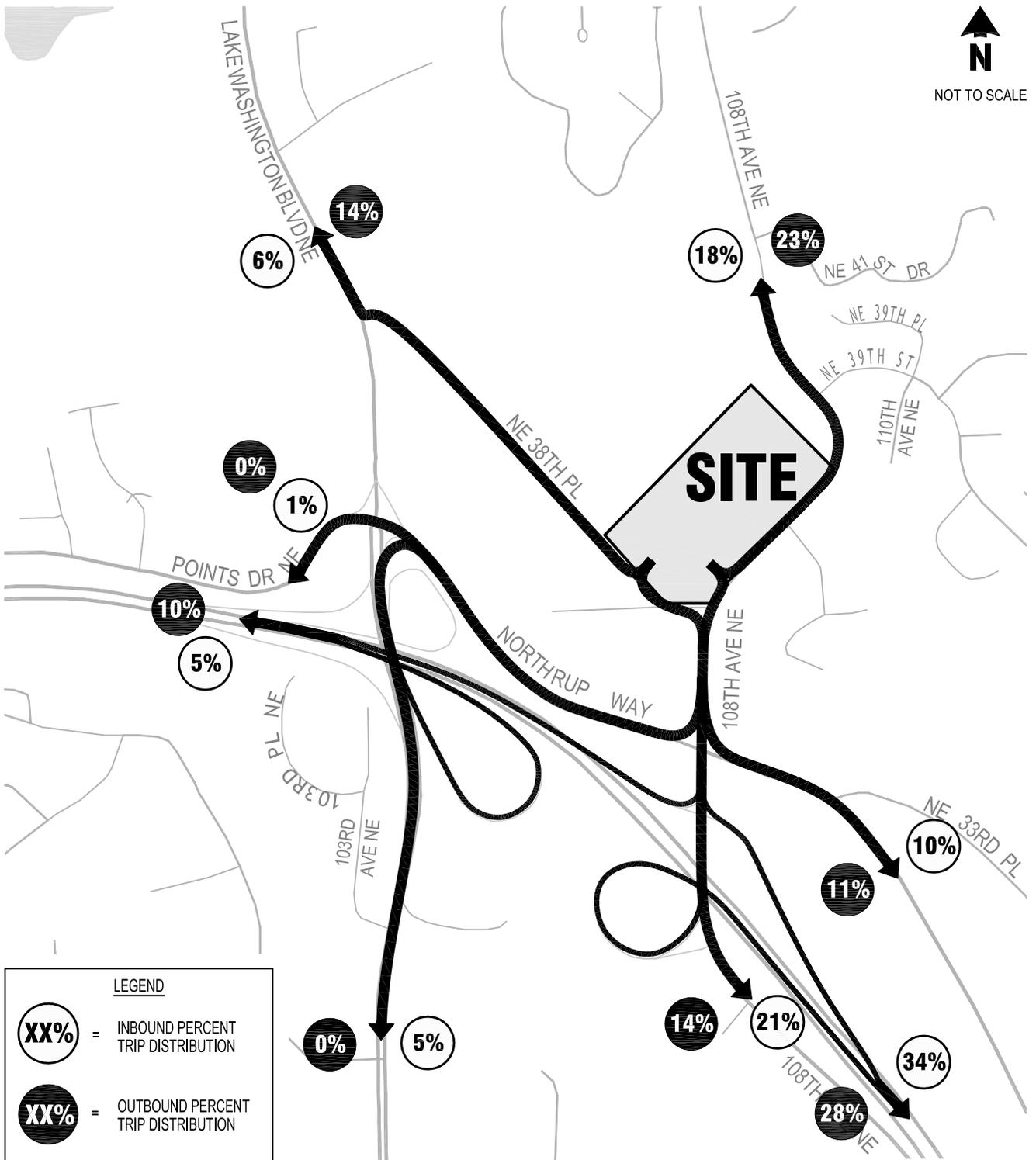
Attachment B: TOD Trip Generation
Calculations

South Kirkland Park & Ride Trip Generation Summary

PM Peak Hour

| Land Use | Size | Units | Rate ¹ | | Total Trips | % IN | Total Trips | | Internal Trips ² | | External Trips | | Transit/Affordable Reduction ³ | | | Diverted/Pass-by Rate ^{4,5} | | Net New Trips | | |
|------------------|--------|--------|-------------------|------|-------------|------|-------------|-----|-----------------------------|-----|----------------|-----|-------------------------------------------|----|-----|--------------------------------------|-------|---------------|-----------|------------|
| | | | EQN | AVG | | | In | Out | In | Out | In | Out | Rate | In | Out | Rate | Trips | In | Out | Total |
| Apartment (#220) | 250 | units | EQN | 0.62 | 155 | 65% | 101 | 54 | 3 | 2 | 98 | 52 | 0.40 | 39 | 21 | - | - | 59 | 31 | 90 |
| Retail (#820) | 12,500 | sf | AVG | 3.73 | 47 | 49% | 23 | 24 | 3 | 4 | 20 | 20 | - | - | - | 0.34 | 14 | 13 | 13 | 26 |
| Park-and-Ride | 250 | spaces | Ex. Count | 0.50 | 125 | 27% | 34 | 91 | 1 | 0 | 33 | 91 | - | - | - | 0.50 | 46 | 33 | 45 | 78 |
| | | | | | | | | | | | | | | | | | | 105 | 89 | 194 |

1. Trip generation rate based on ITE Trip Generation, 8th Edition regression equation for apartment land use #220, average trip rate for shopping center (retail) land use #820, and traffic counts conducted at the South Kirkland park-and-ride on December 15, 2010 for the park-and-ride use.
2. Internal trips calculated using ITE *Trip Generation Handbook*, 2nd Edition assuming internal trips only between apartment and retail and retail and park-and-ride. The ITE office data was used for the park-and-ride internal trip rates.
3. Based the Transit Cooperative Research Program (TCRP) Report 128 (2008), *New Transit Cooperative Research Program Research Confirms Transit-Oriented Developments Produce Fewer Auto Trips*, ITE Journal, (June 2009), and National Household Travel Survey (2009), a 40 percent reduction was taken to account for residents using transit rather than driving personal vehicles.
4. The pass-by rate 34 percent based on ITE Trip Generation Handbook, 2nd Edition for shopping center land use.
5. Fifty percent of the peak direction trips for the park-and-ride are assumed to be diverted.



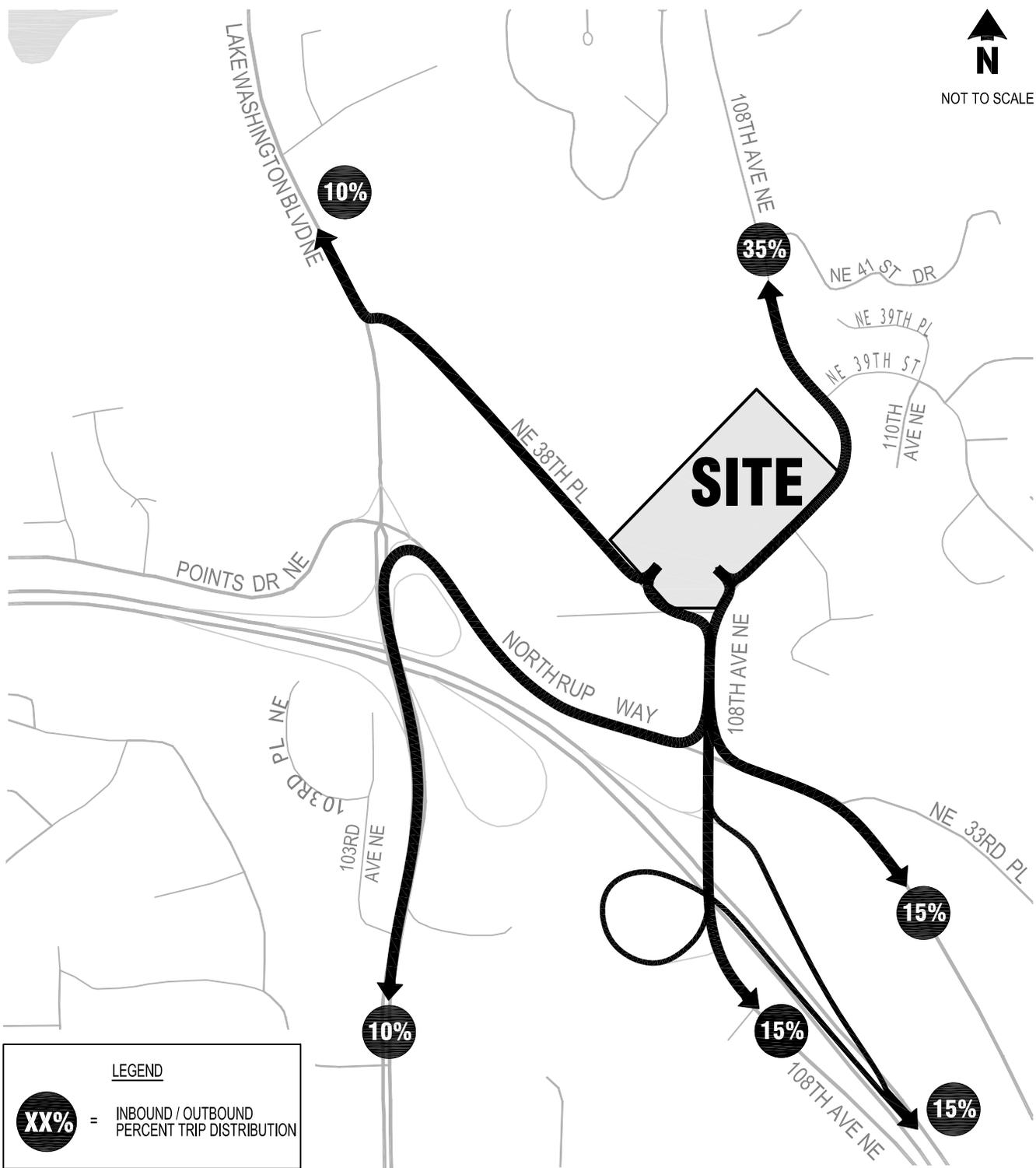
Inbound/Outbound Trip Distribution for TOD Component

ATTACHMENT

South Kirkland Park-and-Ride Rezone Transportation Assessment



C



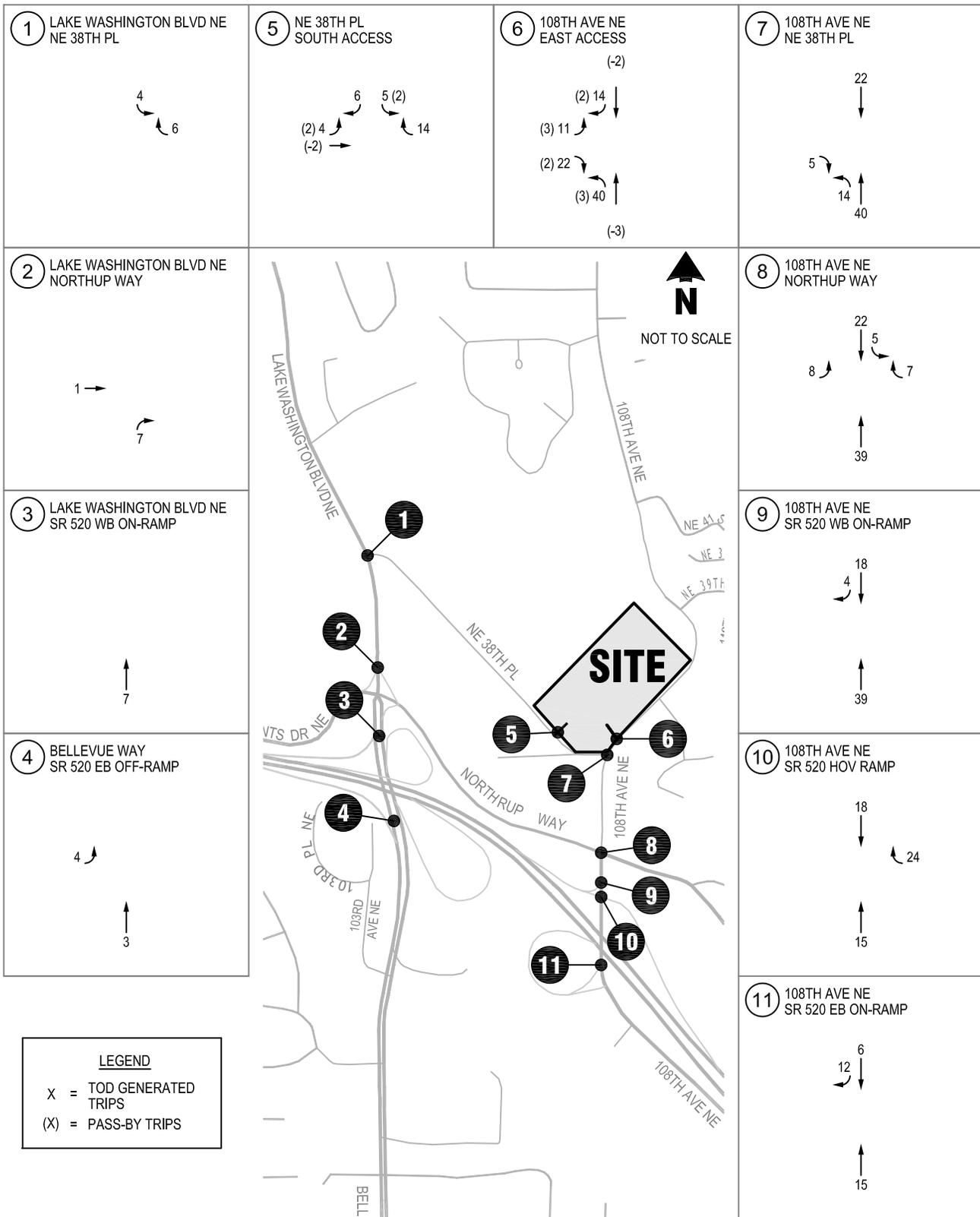
Inbound/Outbound Trip Distribution for Park & Ride Component

ATTACHMENT

South Kirkland Park-and-Ride Rezone Transportation Assessment



D



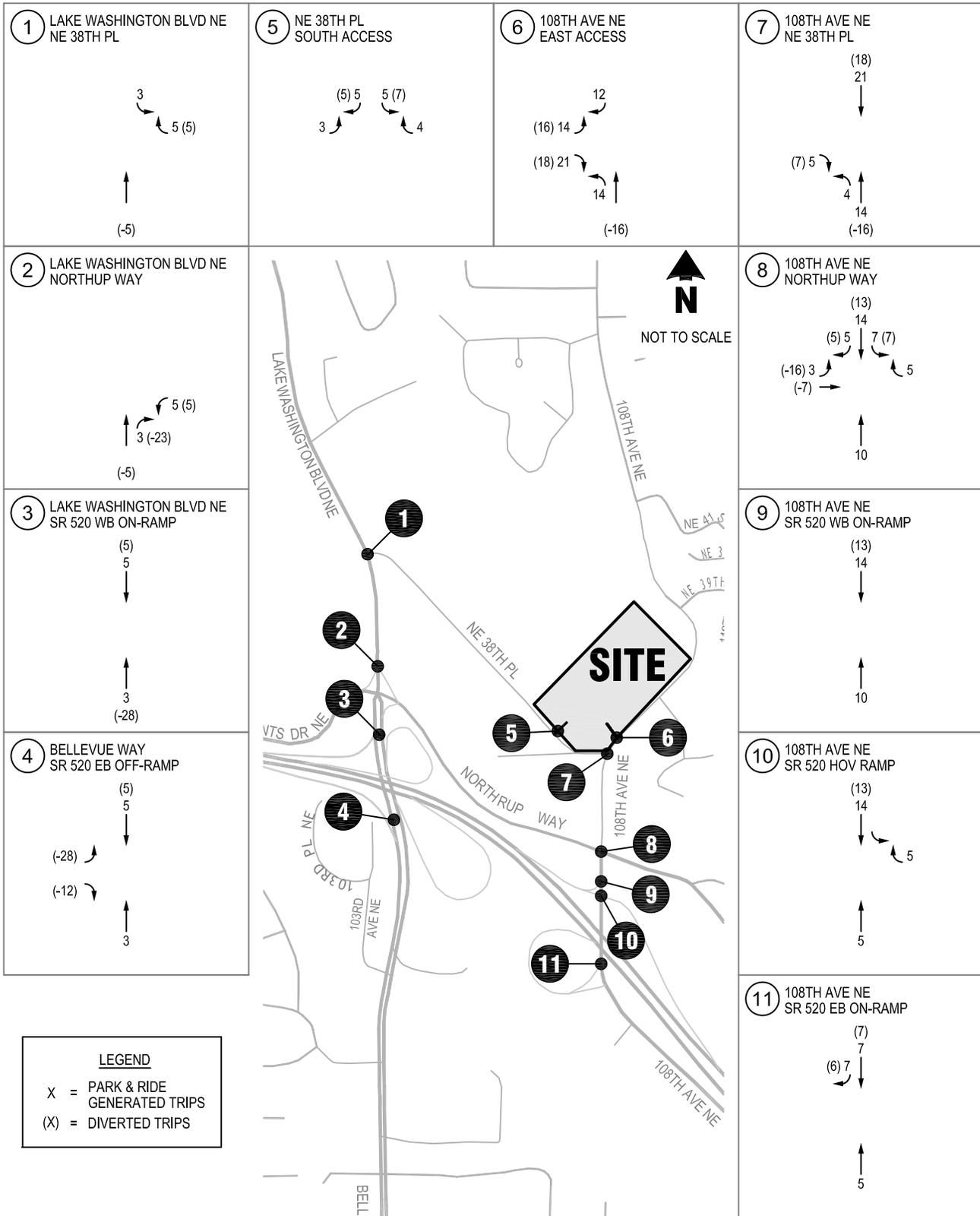
2030 PM Peak Hour Trip Assignment for TOD Component

ATTACHMENT

South Kirkland Park-and-Ride Rezone Transportation Assessment



E

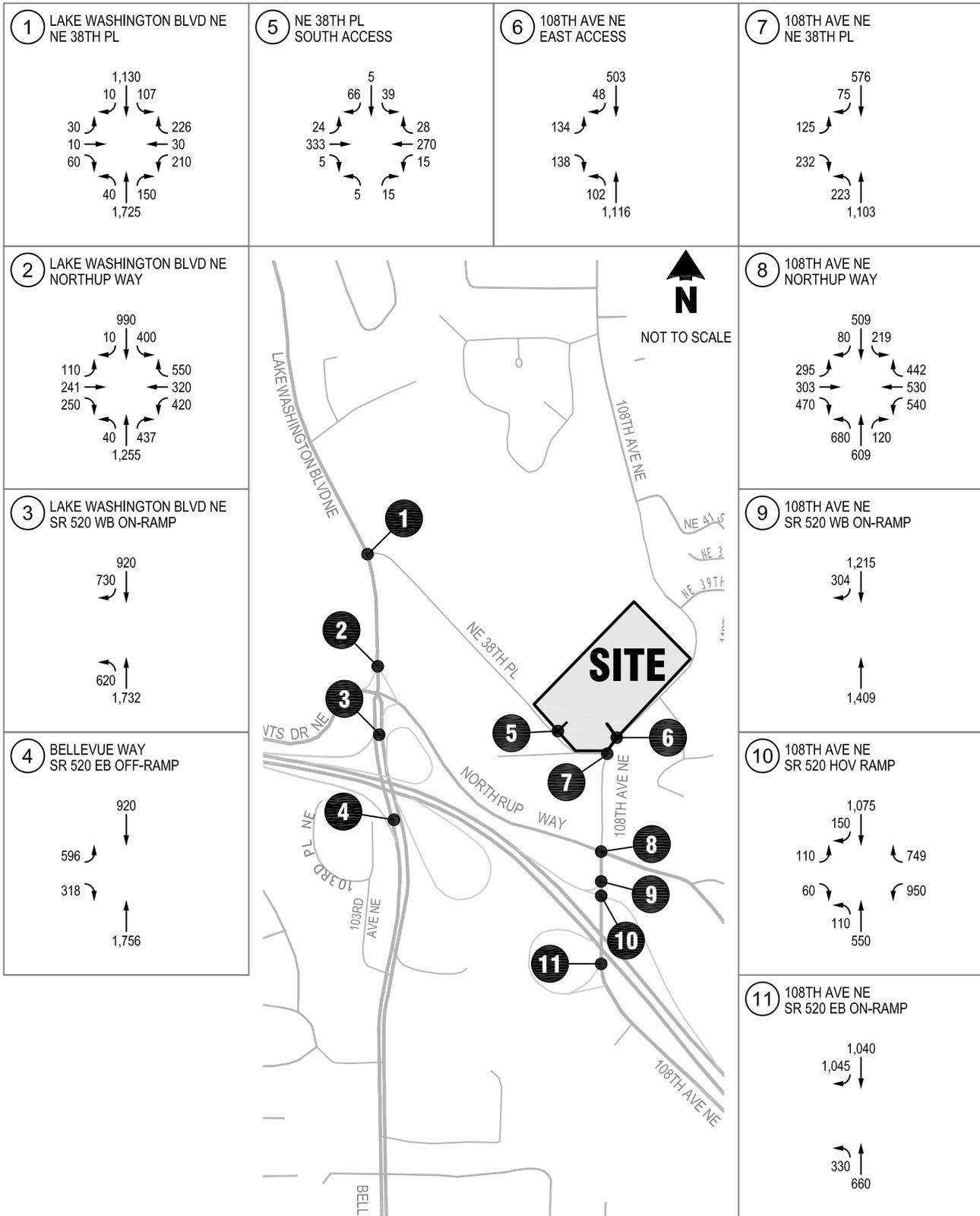


2030 PM Peak Hour Trip Assignment for Park & Ride Component ATTACHMENT

South Kirkland Park-and-Ride Rezone Transportation Assessment



F



2030 With-Project PM Peak Hour Traffic Volumes

ATTACHMENT

South Kirkland Park-and-Ride Rezone Transportation Assesment

M:\10\10222 South Kirkland Park and Ride TOD\Graphics\CAD\10222_Graphic01 <2030 With Project> robertm 01/31/11 16:44



Attachment I: LOS Worksheets

HCM Signalized Intersection Capacity Analysis
1: NE 38th Pl. & Lk. Wash Blvd

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|------|--------|------|-------|----------------------|------|------|-------|------|-------|------|------|
| Lane Configurations | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ |
| Volume (vph) | 30 | 10 | 60 | 210 | 30 | 210 | 40 | 1730 | 150 | 100 | 1130 | 10 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | -2% | | | 2% | | | | -2% |
| Total Lost time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | | 4.0 | 5.0 | 5.0 | 4.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.87 | | 1.00 | 0.87 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1625 | | 1787 | 1635 | | 1752 | 1844 | 1542 | 1787 | 3570 | |
| Flt Permitted | 0.26 | 1.00 | | 0.71 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 476 | 1625 | | 1334 | 1635 | | 1752 | 1844 | 1542 | 1787 | 3570 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 32 | 11 | 63 | 221 | 32 | 221 | 42 | 1821 | 158 | 105 | 1189 | 11 |
| RTOR Reduction (vph) | 0 | 52 | 0 | 0 | 73 | 0 | 0 | 0 | 27 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 32 | 22 | 0 | 221 | 180 | 0 | 42 | 1821 | 131 | 105 | 1200 | 0 |
| Bus Blockages (#/hr) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 |
| Turn Type | Perm | | | Perm | | | Prot | | Perm | Prot | | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | | | 2 | | | |
| Actuated Green, G (s) | 22.0 | 22.0 | | 22.0 | 22.0 | | 5.9 | 87.2 | 87.2 | 6.8 | 88.1 | |
| Effective Green, g (s) | 22.0 | 22.0 | | 22.0 | 22.0 | | 5.9 | 87.2 | 87.2 | 6.8 | 88.1 | |
| Actuated g/C Ratio | 0.17 | 0.17 | | 0.17 | 0.17 | | 0.05 | 0.67 | 0.67 | 0.05 | 0.68 | |
| Clearance Time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | | 4.0 | 5.0 | 5.0 | 4.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 81 | 275 | | 226 | 277 | | 80 | 1237 | 1034 | 93 | 2419 | |
| v/s Ratio Prot | | 0.01 | | | 0.11 | | 0.02 | c0.99 | | c0.06 | 0.34 | |
| v/s Ratio Perm | 0.07 | | | c0.17 | | | | | 0.08 | | | |
| v/c Ratio | 0.40 | 0.08 | | 0.98 | 0.65 | | 0.52 | 1.47 | 0.13 | 1.13 | 0.50 | |
| Uniform Delay, d1 | 48.1 | 45.5 | | 53.8 | 50.4 | | 60.7 | 21.4 | 7.7 | 61.6 | 10.2 | |
| Progression Factor | 1.00 | 1.00 | | 1.03 | 1.05 | | 1.05 | 1.02 | 0.23 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.2 | 0.0 | | 50.8 | 3.6 | | 1.0 | 214.1 | 0.1 | 132.4 | 0.7 | |
| Delay (s) | 49.2 | 45.5 | | 106.3 | 56.5 | | 64.9 | 235.8 | 1.9 | 194.0 | 10.9 | |
| Level of Service | D | D | | F | E | | E | F | A | F | B | |
| Approach Delay (s) | | 46.6 | | | 79.7 | | | 214.0 | | | 25.6 | |
| Approach LOS | | D | | | E | | | F | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM Average Control Delay | | 130.2 | | | | | | | | F | | |
| HCM Volume to Capacity ratio | | 1.36 | | | | | | | | | | |
| Actuated Cycle Length (s) | | 130.0 | | | Sum of lost time (s) | | | 14.0 | | | | |
| Intersection Capacity Utilization | | 123.1% | | | ICU Level of Service | | | H | | | | |
| Analysis Period (min) | | 15 | | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
2: NE Points Dr & Lake Washington Boulevard

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|------|-------|-------|-------|----------------------|-------|------|-------|-------|-------|------|------|
| Lane Configurations | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ |
| Volume (vph) | 110 | 240 | 250 | 410 | 320 | 550 | 40 | 1260 | 450 | 400 | 990 | 10 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 12 | 11 | 11 | 12 | 12 | 11 | 11 | 13 |
| Grade (%) | | 0% | | | 0% | | | -5% | | | 0% | |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1805 | 1900 | 1615 | 3351 | 1881 | 1546 | 1788 | 3700 | 1655 | 1711 | 3421 | 1636 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 1900 | 1615 | 3351 | 1881 | 1546 | 1788 | 3700 | 1655 | 1711 | 3421 | 1636 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 116 | 253 | 263 | 432 | 337 | 579 | 42 | 1326 | 474 | 421 | 1042 | 11 |
| RTOR Reduction (vph) | 0 | 0 | 41 | 0 | 0 | 22 | 0 | 0 | 22 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 116 | 253 | 222 | 432 | 337 | 557 | 42 | 1326 | 452 | 421 | 1042 | 10 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 1% | 1% | 0% | 0% | 0% | 2% | 2% | 2% |
| Turn Type | Prot | | pt+ov | Prot | | pt+ov | Prot | | pt+ov | Prot | | Prot |
| Protected Phases | 3 | 8 | 8.5 | 7 | 4 | 4.1 | 5 | 2 | 2.7 | 1 | 6 | 6 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 11.3 | 14.0 | 40.3 | 25.4 | 28.1 | 58.1 | 21.3 | 45.6 | 76.0 | 25.0 | 49.3 | 49.3 |
| Effective Green, g (s) | 11.3 | 14.0 | 40.3 | 25.4 | 28.1 | 58.1 | 21.3 | 45.6 | 76.0 | 25.0 | 49.3 | 49.3 |
| Actuated g/C Ratio | 0.09 | 0.11 | 0.31 | 0.20 | 0.22 | 0.45 | 0.16 | 0.35 | 0.58 | 0.19 | 0.38 | 0.38 |
| Clearance Time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 157 | 205 | 501 | 655 | 407 | 691 | 293 | 1298 | 968 | 329 | 1297 | 620 |
| v/s Ratio Prot | 0.06 | c0.13 | 0.14 | c0.13 | c0.18 | 0.36 | 0.02 | c0.36 | 0.27 | c0.25 | 0.30 | 0.01 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.74 | 1.23 | 0.44 | 0.66 | 0.83 | 0.81 | 0.14 | 1.02 | 0.47 | 1.28 | 0.80 | 0.02 |
| Uniform Delay, d1 | 57.9 | 58.0 | 35.9 | 48.3 | 48.6 | 31.1 | 46.5 | 42.2 | 15.4 | 52.5 | 36.0 | 25.2 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.58 | 0.48 | 0.40 | 0.87 | 0.85 | 0.85 | 0.95 | 0.82 | 0.76 |
| Incremental Delay, d2 | 16.5 | 140.2 | 0.6 | 0.5 | 3.8 | 1.9 | 0.1 | 29.0 | 0.1 | 144.2 | 4.5 | 0.0 |
| Delay (s) | 74.5 | 198.2 | 36.5 | 28.5 | 27.2 | 14.3 | 40.4 | 64.9 | 13.3 | 194.3 | 33.9 | 19.2 |
| Level of Service | E | F | D | C | C | B | D | E | B | F | C | B |
| Approach Delay (s) | | 108.2 | | | 22.1 | | | 51.0 | | | 79.6 | |
| Approach LOS | | F | | | C | | | D | | | E | |
| Intersection Summary | | | | | | | | | | | | |
| HCM Average Control Delay | | 58.4 | | | | | | | | E | | |
| HCM Volume to Capacity ratio | | 1.00 | | | | | | | | | | |
| Actuated Cycle Length (s) | | 130.0 | | | Sum of lost time (s) | | | 15.0 | | | | |
| Intersection Capacity Utilization | | 98.0% | | | ICU Level of Service | | | F | | | | |
| Analysis Period (min) | | 15 | | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
3: WB On-Ramp & Lake Washington Boulevard

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|------------------------|------|------|-------|-------|-------|-------|
| Lane Configurations | | | ↖↗ | ↖↗ | ↖↗ | ↖↗ |
| Volume (vph) | 0 | 0 | 620 | 1750 | 910 | 730 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | -3% | | | -8% | 6% | |
| Total Lost time (s) | | | 5.0 | 5.0 | 5.0 | 4.0 |
| Lane Util. Factor | | | 0.97 | 0.95 | 0.91 | 0.91 |
| Fr | | | 1.00 | 1.00 | 0.94 | 0.85 |
| Flt Protected | | | 0.95 | 1.00 | 1.00 | 1.00 |
| Satd. Flow (prot) | | | 3570 | 3681 | 3082 | 1398 |
| Flt Permitted | | | 0.95 | 1.00 | 1.00 | 1.00 |
| Satd. Flow (perm) | | | 3570 | 3681 | 3082 | 1398 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 653 | 1842 | 958 | 768 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 10 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 653 | 1842 | 1639 | 77 |
| Turn Type | | | Prot | | | Free |
| Protected Phases | | | 5 | 2 | 6 | |
| Permitted Phases | | | | | | Free |
| Actuated Green, G (s) | | | 27.7 | 130.0 | 92.3 | 130.0 |
| Effective Green, g (s) | | | 27.7 | 130.0 | 92.3 | 130.0 |
| Actuated g/C Ratio | | | 0.21 | 1.00 | 0.71 | 1.00 |
| Clearance Time (s) | | | 5.0 | 5.0 | 5.0 | |
| Vehicle Extension (s) | | | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | | 761 | 3681 | 2188 | 1398 |
| v/s Ratio Prot | | | c0.18 | 0.50 | c0.53 | |
| v/s Ratio Perm | | | | | | 0.06 |
| v/c Ratio | | | 0.86 | 0.50 | 0.75 | 0.06 |
| Uniform Delay, d1 | | | 49.3 | 0.0 | 11.7 | 0.0 |
| Progression Factor | | | 0.81 | 1.00 | 0.68 | 1.00 |
| Incremental Delay, d2 | | | 8.1 | 0.4 | 1.9 | 0.1 |
| Delay (s) | | | 48.2 | 0.4 | 9.9 | 0.1 |
| Level of Service | | | D | A | A | A |
| Approach Delay (s) | 0.0 | | | 12.9 | 9.4 | |
| Approach LOS | A | | | B | A | |

| Intersection Summary | | | |
|-----------------------------------|-------|----------------------|------|
| HCM Average Control Delay | 11.5 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 99.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: EB Off-Ramp & Bellevue Way NE

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|------------------------|-------|------|------|-------|------|------|
| Lane Configurations | ↖↗ | ↖↗ | | ↖↗ | ↖↗ | |
| Volume (vph) | 620 | 330 | 0 | 1750 | 910 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | -2% | | | -6% | 5% | |
| Total Lost time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.91 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpfb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Fr | 1.00 | 0.85 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1599 | | 5238 | 3451 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1599 | | 5238 | 3451 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 653 | 347 | 0 | 1842 | 958 | 0 |
| RTOR Reduction (vph) | 0 | 80 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 653 | 267 | 0 | 1842 | 958 | 0 |
| Confl. Peds. (#/hr) | | | 20 | | | 20 |
| Turn Type | | | Perm | | | |
| Protected Phases | 4 | | | 2 | 6 | |
| Permitted Phases | | 4 | | | | |
| Actuated Green, G (s) | 29.5 | 29.5 | | 90.5 | 90.5 | |
| Effective Green, g (s) | 29.5 | 29.5 | | 90.5 | 90.5 | |
| Actuated g/C Ratio | 0.23 | 0.23 | | 0.70 | 0.70 | |
| Clearance Time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 787 | 363 | | 3646 | 2402 | |
| v/s Ratio Prot | c0.19 | | | c0.35 | 0.28 | |
| v/s Ratio Perm | | 0.17 | | | | |
| v/c Ratio | 0.83 | 0.74 | | 0.51 | 0.40 | |
| Uniform Delay, d1 | 47.9 | 46.6 | | 9.3 | 8.3 | |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.02 | |
| Incremental Delay, d2 | 6.9 | 6.6 | | 0.5 | 0.3 | |
| Delay (s) | 54.8 | 53.2 | | 9.8 | 8.8 | |
| Level of Service | D | D | | A | A | |
| Approach Delay (s) | 54.2 | | | 9.8 | 8.8 | |
| Approach LOS | D | | | A | A | |

| Intersection Summary | | | |
|-----------------------------------|-------|----------------------|------|
| HCM Average Control Delay | 21.2 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 99.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
5: NE 38th Place & South Access

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------------|-------------|-------------|-------------|----------------------|-------------|------|------|------|------|------|------|
| Lane Configurations | ↔ | ↔ | | ↔ | ↔ | | | ↕ | | | ↕ | |
| Volume (veh/h) | 15 | 335 | 5 | 10 | 270 | 15 | 5 | 0 | 15 | 20 | 5 | 50 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| Hourly flow rate (vph) | 17 | 390 | 6 | 12 | 314 | 17 | 6 | 0 | 17 | 23 | 6 | 58 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | TWLT | | | TWLT | | | | | | | |
| Median storage (veh) | | 2 | | | 2 | | | | | | | |
| Upstream signal (ft) | | 985 | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 331 | | | 395 | | | 826 | 782 | 392 | 788 | 776 | 323 |
| vC1, stage 1 conf vol | | | | | | | 427 | 427 | | 346 | 346 | |
| vC2, stage 2 conf vol | | | | | | | 398 | 355 | | 442 | 430 | |
| vCu, unblocked vol | 331 | | | 395 | | | 826 | 782 | 392 | 788 | 776 | 323 |
| tC, single (s) | 4.2 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | 6.1 | 5.5 | | 6.1 | 5.5 | |
| tF (s) | 2.3 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 99 | | | 99 | 100 | 97 | 95 | 99 | 92 |
| cM capacity (veh/h) | 1164 | | | 1163 | | | 456 | 487 | 656 | 484 | 489 | 716 |
| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 | | | | | | |
| Volume Total | 17 | 395 | 12 | 331 | 23 | 87 | | | | | | |
| Volume Left | 17 | 0 | 12 | 0 | 6 | 23 | | | | | | |
| Volume Right | 0 | 6 | 0 | 17 | 17 | 58 | | | | | | |
| cSH | 1164 | 1700 | 1163 | 1700 | 591 | 618 | | | | | | |
| Volume to Capacity | 0.01 | 0.23 | 0.01 | 0.19 | 0.04 | 0.14 | | | | | | |
| Queue Length 95th (ft) | 1 | 0 | 1 | 0 | 3 | 12 | | | | | | |
| Control Delay (s) | 8.1 | 0.0 | 8.1 | 0.0 | 11.3 | 11.8 | | | | | | |
| Lane LOS | A | | A | | B | B | | | | | | |
| Approach Delay (s) | 0.3 | | 0.3 | | 11.3 | 11.8 | | | | | | |
| Approach LOS | | | | | B | B | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| Average Delay | | | 1.8 | | | | | | | | | |
| Intersection Capacity Utilization | | | 30.7% | | ICU Level of Service | A | | | | | | |
| Analysis Period (min) | | | 15 | | | | | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: East Access & 108th Avenue NE

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------------|-------------|-------------|-------------|----------------------|------|
| Lane Configurations | ↔ | ↔ | ↔ | ↕ | ↕ | |
| Volume (veh/h) | 90 | 75 | 45 | 1135 | 505 | 20 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 96 | 80 | 48 | 1207 | 537 | 21 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | TWLT | |
| Median storage (veh) | | | | | 2 | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1851 | 548 | 559 | | | |
| vC1, stage 1 conf vol | 548 | | | | | |
| vC2, stage 2 conf vol | 1303 | | | | | |
| vCu, unblocked vol | 1851 | 548 | 559 | | | |
| tC, single (s) | 6.5 | 6.3 | 4.1 | | | |
| tC, 2 stage (s) | 5.5 | | | | | |
| tF (s) | 3.6 | 3.4 | 2.2 | | | |
| p0 queue free % | 55 | 84 | 95 | | | |
| cM capacity (veh/h) | 212 | 514 | 1007 | | | |
| Direction, Lane # | EB 1 | EB 2 | NB 1 | NB 2 | SB 1 | |
| Volume Total | 96 | 80 | 48 | 1207 | 559 | |
| Volume Left | 96 | 0 | 48 | 0 | 0 | |
| Volume Right | 0 | 80 | 0 | 0 | 21 | |
| cSH | 212 | 514 | 1007 | 1700 | 1700 | |
| Volume to Capacity | 0.45 | 0.16 | 0.05 | 0.71 | 0.33 | |
| Queue Length 95th (ft) | 54 | 14 | 4 | 0 | 0 | |
| Control Delay (s) | 35.3 | 13.3 | 8.8 | 0.0 | 0.0 | |
| Lane LOS | E | B | A | | | |
| Approach Delay (s) | 25.3 | | 0.3 | | 0.0 | |
| Approach LOS | D | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 2.4 | | | |
| Intersection Capacity Utilization | | | 71.4% | | ICU Level of Service | C |
| Analysis Period (min) | | | 15 | | | |

HCM Unsignalized Intersection Capacity Analysis
7: NE 38th Place & 108th Avenue NE

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------------|-------------|-------------|----------------------|-------------|------|
| Lane Configurations | ↔ | ↔ | ↔ | ↕ | ↕ | ↔ |
| Volume (veh/h) | 125 | 215 | 205 | 1065 | 515 | 75 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 132 | 226 | 216 | 1121 | 542 | 79 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | None | | |
| Median storage (veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 2134 | 582 | 621 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 2134 | 582 | 621 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 0 | 56 | 78 | | | |
| cM capacity (veh/h) | 43 | 517 | 960 | | | |
| Direction, Lane # | EB 1 | EB 2 | NB 1 | NB 2 | SB 1 | |
| Volume Total | 132 | 226 | 216 | 1121 | 621 | |
| Volume Left | 132 | 0 | 216 | 0 | 0 | |
| Volume Right | 0 | 226 | 0 | 0 | 79 | |
| cSH | 43 | 517 | 960 | 1700 | 1700 | |
| Volume to Capacity | 3.09 | 0.44 | 0.22 | 0.66 | 0.37 | |
| Queue Length 95th (ft) | Err | 55 | 22 | 0 | 0 | |
| Control Delay (s) | Err | 17.3 | 9.8 | 0.0 | 0.0 | |
| Lane LOS | F | C | A | | | |
| Approach Delay (s) | 3687.0 | | 1.6 | | 0.0 | |
| Approach LOS | F | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 570.7 | | | |
| Intersection Capacity Utilization | | | 69.6% | ICU Level of Service | C | |
| Analysis Period (min) | | | | | | 15 |

HCM Signalized Intersection Capacity Analysis
8: Northrup Way & 108th Avenue NE

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|-------|-------|----------------------|------|-------|------|------|-------|-------|------|
| Lane Configurations | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ |
| Volume (vph) | 300 | 310 | 470 | 540 | 530 | 430 | 680 | 560 | 120 | 200 | 460 | 70 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | | | 0% | | | 0% | | | 1% | | | -6% |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Fipb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 0.97 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1863 | 1559 | 3467 | 3265 | | 3416 | 3397 | | 1823 | 3573 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1863 | 1559 | 3467 | 3265 | | 3416 | 3397 | | 1823 | 3573 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 316 | 326 | 495 | 568 | 558 | 453 | 716 | 589 | 126 | 211 | 484 | 74 |
| RTOR Reduction (vph) | 0 | 0 | 13 | 0 | 112 | 0 | 0 | 14 | 0 | 0 | 9 | 0 |
| Lane Group Flow (vph) | 316 | 326 | 482 | 568 | 899 | 0 | 716 | 701 | 0 | 211 | 549 | 0 |
| Confl. Peds. (#/hr) | 10 | | 10 | 10 | | 10 | | | 10 | 10 | | |
| Heavy Vehicles (%) | 2% | 2% | 2% | 1% | 1% | | 2% | 2% | | 2% | 2% | 2% |
| Turn Type | Prot | | pm+ov | Prot | | | Split | | | Split | | |
| Protected Phases | 1 | 6 | 4 | 5 | 2 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 6 | | | | | | | | | |
| Actuated Green, G (s) | 24.1 | 27.6 | 55.6 | 32.3 | 35.8 | | 28.0 | 28.0 | | 22.1 | 22.1 | |
| Effective Green, g (s) | 24.1 | 27.6 | 55.6 | 32.3 | 35.8 | | 28.0 | 28.0 | | 22.1 | 22.1 | |
| Actuated g/C Ratio | 0.19 | 0.21 | 0.43 | 0.25 | 0.28 | | 0.22 | 0.22 | | 0.17 | 0.17 | |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 328 | 396 | 667 | 861 | 899 | | 736 | 732 | | 310 | 607 | |
| v/s Ratio Prot | c0.18 | 0.18 | 0.16 | 0.16 | c0.28 | | c0.21 | 0.21 | | 0.12 | c0.15 | |
| v/s Ratio Perm | | | 0.15 | | | | | | | | | |
| v/c Ratio | 0.96 | 0.82 | 0.72 | 0.66 | 1.00 | | 0.97 | 0.96 | | 0.68 | 0.90 | |
| Uniform Delay, d1 | 52.5 | 48.9 | 30.8 | 43.9 | 47.1 | | 50.6 | 50.4 | | 50.6 | 52.9 | |
| Progression Factor | 0.81 | 0.78 | 1.22 | 1.00 | 1.00 | | 1.05 | 1.05 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 20.5 | 6.7 | 1.1 | 1.4 | 29.9 | | 22.7 | 19.5 | | 4.8 | 16.6 | |
| Delay (s) | 63.0 | 44.6 | 38.7 | 45.3 | 77.0 | | 76.0 | 72.7 | | 55.5 | 69.5 | |
| Level of Service | E | D | D | D | E | | E | E | | E | E | |
| Approach Delay (s) | 47.2 | | | | 65.6 | | 74.3 | | | 65.6 | | |
| Approach LOS | D | | | | E | | E | | | E | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM Average Control Delay | | | | 63.9 | HCM Level of Service | | | E | | | | |
| HCM Volume to Capacity ratio | 0.97 | | | | | | | | | | | |
| Actuated Cycle Length (s) | | | | 130.0 | Sum of lost time (s) | | | 20.0 | | | | |
| Intersection Capacity Utilization | | | | 96.5% | ICU Level of Service | | | F | | | | |
| Analysis Period (min) | 15 | | | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

HCM Unsignalized Intersection Capacity Analysis
9: WB On-Ramp & 108th Avenue NE

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------------|-------------|-------------|----------------------|-------------|-------------|
| Lane Configurations | | | | ↑↑↑ | ↑↑ | ↑ |
| Volume (veh/h) | 0 | 0 | 0 | 1360 | 1170 | 300 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | -1% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 0 | 0 | 0 | 1432 | 1232 | 316 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage (veh) | | | | | | |
| Upstream signal (ft) | | | | 159 | 266 | |
| pX, platoon unblocked | 0.87 | 0.87 | 0.87 | | | |
| vC, conflicting volume | 1709 | 616 | 1232 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1521 | 269 | 975 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 100 | 100 | | | |
| cM capacity (veh/h) | 95 | 636 | 614 | | | |
| Direction, Lane # | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
| Volume Total | 477 | 477 | 477 | 616 | 616 | 316 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 316 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.28 | 0.28 | 0.28 | 0.36 | 0.36 | 0.19 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | | | | | | |
| Approach Delay (s) | 0.0 | | | 0.0 | | |
| Approach LOS | | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.0 | | | | | |
| Intersection Capacity Utilization | 35.7% | | | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | | | |

HCM Signalized Intersection Capacity Analysis
10: Transit and HOV Ramp & 108th Avenue NE

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|--------|----------------------|------|------|-------|------|------|------|------|-------|
| Lane Configurations | ↔ | | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | | | ↔ | ↔ |
| Volume (vph) | 110 | 0 | 60 | 950 | 0 | 720 | 110 | 530 | 0 | 0 | 1030 | 150 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 14 |
| Grade (%) | | | 0% | | | 2% | | | | | | -2% |
| Total Lost time (s) | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | 5.0 |
| Lane Util. Factor | 1.00 | | 1.00 | 0.97 | 0.95 | 0.95 | 1.00 | 1.00 | | | | 0.95 |
| Frbp, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 |
| Frlp, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 0.85 | 0.85 | 1.00 | 1.00 | | | | 0.98 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 |
| Satd. Flow (prot) | 1805 | | 1615 | 3432 | 1504 | 1504 | 1769 | 1862 | | | | 3506 |
| Flt Permitted | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 |
| Satd. Flow (perm) | 1805 | | 1615 | 3432 | 1504 | 1504 | 1769 | 1862 | | | | 3506 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 116 | 0 | 63 | 1000 | 0 | 758 | 116 | 558 | 0 | 0 | 1084 | 158 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 175 | 175 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 116 | 0 | 63 | 1000 | 204 | 204 | 116 | 558 | 0 | 0 | 1242 | 0 |
| Confl. Peds. (#/hr) | | | | | | | | | 20 | 20 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 1% | 1% | 1% | 1% | | | 2% | 2% |
| Turn Type | Prot | | custom | Split | | Prot | Prot | | | | | |
| Protected Phases | 3 | | 35 | 4 | 4 | 4 | 5 | 2 | | | | 6 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 9.6 | | 27.0 | 36.4 | 36.4 | 36.4 | 12.4 | 69.0 | | | | 51.6 |
| Effective Green, g (s) | 9.6 | | 27.0 | 36.4 | 36.4 | 36.4 | 12.4 | 69.0 | | | | 51.6 |
| Actuated g/C Ratio | 0.07 | | 0.21 | 0.28 | 0.28 | 0.28 | 0.10 | 0.53 | | | | 0.40 |
| Clearance Time (s) | 5.0 | | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | 5.0 |
| Vehicle Extension (s) | 2.0 | | | 3.0 | 3.0 | 3.0 | 2.0 | 2.0 | | | | 2.0 |
| Lane Grp Cap (vph) | 133 | | 335 | 961 | 421 | 421 | 169 | 988 | | | | 1392 |
| v/s Ratio Prot | c0.06 | | 0.04 | c0.29 | 0.14 | 0.14 | c0.07 | 0.30 | | | | c0.35 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.87 | | 0.19 | 1.04 | 0.48 | 0.48 | 0.69 | 0.56 | | | | 0.89 |
| Uniform Delay, d1 | 59.6 | | 42.5 | 46.8 | 39.0 | 39.0 | 56.9 | 20.4 | | | | 36.6 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 0.68 |
| Incremental Delay, d2 | 41.2 | | 0.1 | 40.1 | 0.9 | 0.9 | 8.5 | 2.2 | | | | 6.2 |
| Delay (s) | 100.8 | | 42.6 | 86.9 | 39.9 | 39.9 | 65.4 | 22.7 | | | | 31.2 |
| Level of Service | F | | D | F | D | D | E | C | | | | C |
| Approach Delay (s) | | 80.3 | | | 66.6 | | | 30.0 | | | | 31.2 |
| Approach LOS | | F | | | E | | | C | | | | C |
| Intersection Summary | | | | | | | | | | | | |
| HCM Average Control Delay | 49.4 | | | HCM Level of Service | | | | D | | | | |
| HCM Volume to Capacity ratio | 0.92 | | | | | | | | | | | |
| Actuated Cycle Length (s) | 130.0 | | | Sum of lost time (s) | | | | 20.0 | | | | |
| Intersection Capacity Utilization | 78.9% | | | ICU Level of Service | | | | D | | | | |
| Analysis Period (min) | 15 | | | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
11: EB On-Ramp & 108th Avenue NE

South Kirkland Park & Ride Rezone
Baseline 2030 PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|------------------------|------|------|-------|-------|-------|------|
| Lane Configurations | | | ↘ | ↗ | ↗ | ↘ |
| Volume (vph) | 0 | 0 | 330 | 640 | 1020 | 1020 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 14 | 12 | 12 | 15 |
| Grade (%) | 2% | | | -6% | 6% | |
| Total Lost time (s) | | | 5.0 | 5.0 | 5.0 | 5.0 |
| Lane Util. Factor | | | 1.00 | 1.00 | 0.91 | 0.91 |
| Frb, ped/bikes | | | 1.00 | 1.00 | 1.00 | 1.00 |
| Fpb, ped/bikes | | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 1.00 | 1.00 | 0.96 | 0.85 |
| Flt Protected | | | 0.95 | 1.00 | 1.00 | 1.00 |
| Satd. Flow (prot) | | | 1983 | 1957 | 3216 | 1568 |
| Flt Permitted | | | 0.95 | 1.00 | 1.00 | 1.00 |
| Satd. Flow (perm) | | | 1983 | 1957 | 3216 | 1568 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 347 | 674 | 1074 | 1074 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 347 | 674 | 1482 | 666 |
| Confl. Peds. (#/hr) | | 50 | | | | |
| Heavy Vehicles (%) | 2% | 2% | 0% | 0% | 0% | 0% |
| Turn Type | | | Prot | | Prot | |
| Protected Phases | | | 5 | 2 | 6 | 6 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | 26.8 | 130.0 | 93.2 | 93.2 |
| Effective Green, g (s) | | | 26.8 | 130.0 | 93.2 | 93.2 |
| Actuated g/C Ratio | | | 0.21 | 1.00 | 0.72 | 0.72 |
| Clearance Time (s) | | | 5.0 | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | | | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | | 409 | 1957 | 2306 | 1124 |
| v/s Ratio Prot | | | c0.17 | 0.34 | c0.46 | 0.42 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | 0.85 | 0.34 | 0.64 | 0.59 |
| Uniform Delay, d1 | | | 49.6 | 0.0 | 9.7 | 9.1 |
| Progression Factor | | | 1.00 | 1.00 | 1.15 | 2.16 |
| Incremental Delay, d2 | | | 14.5 | 0.5 | 0.1 | 1.6 |
| Delay (s) | | | 64.1 | 0.5 | 11.2 | 21.1 |
| Level of Service | | | E | A | B | C |
| Approach Delay (s) | 0.0 | | | 22.1 | 14.3 | |
| Approach LOS | A | | | C | B | |

| Intersection Summary | | | |
|-----------------------------------|-------|----------------------|------|
| HCM Average Control Delay | 16.8 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.69 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 80.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

HCM Signalized Intersection Capacity Analysis
1: NE 38th Pl. & Lk. Wash Blvd

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|------|--------|------|-------|----------------------|------|------|-------|------|-------|------|------|
| Lane Configurations | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ |
| Volume (vph) | 30 | 10 | 60 | 210 | 30 | 226 | 40 | 1725 | 150 | 107 | 1130 | 10 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | | 0% | | | -2% | | | 2% | | | | -2% |
| Total Lost time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | | 4.0 | 5.0 | 5.0 | 4.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | |
| Frt | 1.00 | 0.87 | | 1.00 | 0.87 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1625 | | 1787 | 1633 | | 1752 | 1844 | 1542 | 1787 | 3570 | |
| Flt Permitted | 0.21 | 1.00 | | 0.71 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | |
| Satd. Flow (perm) | 399 | 1625 | | 1334 | 1633 | | 1752 | 1844 | 1542 | 1787 | 3570 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 32 | 11 | 63 | 221 | 32 | 238 | 42 | 1816 | 158 | 113 | 1189 | 11 |
| RTOR Reduction (vph) | 0 | 52 | 0 | 0 | 74 | 0 | 0 | 0 | 27 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 32 | 22 | 0 | 221 | 196 | 0 | 42 | 1816 | 131 | 113 | 1200 | 0 |
| Bus Blockages (#/hr) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 |
| Turn Type | Perm | | | Perm | | | Prot | | Perm | Prot | | |
| Protected Phases | | 4 | | | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | | 8 | | | | | 2 | | | |
| Actuated Green, G (s) | 22.0 | 22.0 | | 22.0 | 22.0 | | 5.9 | 87.2 | 87.2 | 6.8 | 88.1 | |
| Effective Green, g (s) | 22.0 | 22.0 | | 22.0 | 22.0 | | 5.9 | 87.2 | 87.2 | 6.8 | 88.1 | |
| Actuated g/C Ratio | 0.17 | 0.17 | | 0.17 | 0.17 | | 0.05 | 0.67 | 0.67 | 0.05 | 0.68 | |
| Clearance Time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | | 4.0 | 5.0 | 5.0 | 4.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 68 | 275 | | 226 | 276 | | 80 | 1237 | 1034 | 93 | 2419 | |
| v/s Ratio Prot | | 0.01 | | | 0.12 | | 0.02 | c0.98 | | c0.06 | 0.34 | |
| v/s Ratio Perm | 0.08 | | | c0.17 | | | | | 0.08 | | | |
| v/c Ratio | 0.47 | 0.08 | | 0.98 | 0.71 | | 0.52 | 1.47 | 0.13 | 1.22 | 0.50 | |
| Uniform Delay, d1 | 48.7 | 45.5 | | 53.8 | 51.0 | | 60.7 | 21.4 | 7.7 | 61.6 | 10.2 | |
| Progression Factor | 1.00 | 1.00 | | 1.04 | 1.06 | | 1.05 | 1.02 | 0.23 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.9 | 0.0 | | 50.6 | 6.5 | | 1.0 | 212.3 | 0.1 | 162.1 | 0.7 | |
| Delay (s) | 50.6 | 45.5 | | 106.4 | 60.3 | | 65.0 | 234.0 | 1.9 | 223.7 | 10.9 | |
| Level of Service | D | D | | F | E | | E | F | A | F | B | |
| Approach Delay (s) | | 47.1 | | | 81.1 | | | 212.3 | | | 29.2 | |
| Approach LOS | | D | | | F | | | F | | | C | |
| Intersection Summary | | | | | | | | | | | | |
| HCM Average Control Delay | | 130.2 | | | | | | | | F | | |
| HCM Volume to Capacity ratio | | 1.36 | | | | | | | | | | |
| Actuated Cycle Length (s) | | 130.0 | | | Sum of lost time (s) | | | 14.0 | | | | |
| Intersection Capacity Utilization | | 123.8% | | | ICU Level of Service | | | | | H | | |
| Analysis Period (min) | | 15 | | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
2: NE Points Dr & Lake Washington Boulevard

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|------|-------|-------|-------|----------------------|-------|------|-------|-------|-------|------|------|
| Lane Configurations | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ |
| Volume (vph) | 110 | 241 | 250 | 420 | 320 | 550 | 40 | 1255 | 437 | 400 | 990 | 10 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 11 | 12 | 11 | 11 | 12 | 12 | 11 | 11 | 13 |
| Grade (%) | | 0% | | | 0% | | | -5% | | | 0% | |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1805 | 1900 | 1615 | 3351 | 1881 | 1546 | 1788 | 3700 | 1655 | 1711 | 3421 | 1636 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1805 | 1900 | 1615 | 3351 | 1881 | 1546 | 1788 | 3700 | 1655 | 1711 | 3421 | 1636 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 116 | 254 | 263 | 442 | 337 | 579 | 42 | 1321 | 460 | 421 | 1042 | 11 |
| RTOR Reduction (vph) | 0 | 0 | 41 | 0 | 0 | 23 | 0 | 0 | 22 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 116 | 254 | 222 | 442 | 337 | 556 | 42 | 1321 | 438 | 421 | 1042 | 10 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 1% | 1% | 0% | 0% | 0% | 2% | 2% | 2% |
| Turn Type | Prot | | pt+ov | Prot | | pt+ov | Prot | | pt+ov | Prot | | Prot |
| Protected Phases | 3 | 8 | 8.5 | 7 | 4 | 4.1 | 5 | 2 | 2.7 | 1 | 6 | 6 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 11.3 | 14.0 | 40.3 | 25.4 | 28.1 | 58.1 | 21.3 | 45.6 | 76.0 | 25.0 | 49.3 | 49.3 |
| Effective Green, g (s) | 11.3 | 14.0 | 40.3 | 25.4 | 28.1 | 58.1 | 21.3 | 45.6 | 76.0 | 25.0 | 49.3 | 49.3 |
| Actuated g/C Ratio | 0.09 | 0.11 | 0.31 | 0.20 | 0.22 | 0.45 | 0.16 | 0.35 | 0.58 | 0.19 | 0.38 | 0.38 |
| Clearance Time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 3.0 | | 2.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 157 | 205 | 501 | 655 | 407 | 691 | 293 | 1298 | 968 | 329 | 1297 | 620 |
| v/s Ratio Prot | 0.06 | c0.13 | 0.14 | c0.13 | c0.18 | 0.36 | 0.02 | c0.36 | 0.26 | c0.25 | 0.30 | 0.01 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.74 | 1.24 | 0.44 | 0.67 | 0.83 | 0.81 | 0.14 | 1.02 | 0.45 | 1.28 | 0.80 | 0.02 |
| Uniform Delay, d1 | 57.9 | 58.0 | 35.9 | 48.5 | 48.6 | 31.1 | 46.5 | 42.2 | 15.2 | 52.5 | 36.0 | 25.2 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 0.59 | 0.49 | 0.41 | 0.88 | 0.85 | 0.84 | 0.95 | 0.82 | 0.76 |
| Incremental Delay, d2 | 16.5 | 142.0 | 0.6 | 0.5 | 3.5 | 1.7 | 0.1 | 28.0 | 0.1 | 144.2 | 4.5 | 0.0 |
| Delay (s) | 74.5 | 200.0 | 36.5 | 29.0 | 27.2 | 14.3 | 41.0 | 63.7 | 12.9 | 194.3 | 34.0 | 19.2 |
| Level of Service | E | F | D | C | C | B | D | E | B | F | C | B |
| Approach Delay (s) | | 109.1 | | | 22.3 | | | 50.4 | | | 79.6 | |
| Approach LOS | | F | | | C | | | D | | | E | |
| Intersection Summary | | | | | | | | | | | | |
| HCM Average Control Delay | | | 58.3 | | | | | | | E | | |
| HCM Volume to Capacity ratio | | | 1.00 | | | | | | | | | |
| Actuated Cycle Length (s) | | 130.0 | | | Sum of lost time (s) | | | 15.0 | | | | |
| Intersection Capacity Utilization | | 98.2% | | | ICU Level of Service | | | | | F | | |
| Analysis Period (min) | | 15 | | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
3: WB On-Ramp & Lake Washington Boulevard

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|-------|-------|----------------------|-------|
| Lane Configurations | | | ↔↔ | ↕↕ | ↔↔ | ↕ |
| Volume (vph) | 0 | 0 | 620 | 1732 | 920 | 730 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | -3% | | | -8% | 6% | |
| Total Lost time (s) | | | 5.0 | 5.0 | 5.0 | 4.0 |
| Lane Util. Factor | | | 0.97 | 0.95 | 0.91 | 0.91 |
| Fr't | | | 1.00 | 1.00 | 0.94 | 0.85 |
| Flt Protected | | | 0.95 | 1.00 | 1.00 | 1.00 |
| Satd. Flow (prot) | | | 3570 | 3681 | 3083 | 1398 |
| Flt Permitted | | | 0.95 | 1.00 | 1.00 | 1.00 |
| Satd. Flow (perm) | | | 3570 | 3681 | 3083 | 1398 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 653 | 1823 | 968 | 768 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 10 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 653 | 1823 | 1649 | 77 |
| Turn Type | | | Prot | | Free | |
| Protected Phases | | | 5 | 2 | 6 | |
| Permitted Phases | | | | | Free | |
| Actuated Green, G (s) | | | 27.7 | 130.0 | 92.3 | 130.0 |
| Effective Green, g (s) | | | 27.7 | 130.0 | 92.3 | 130.0 |
| Actuated g/C Ratio | | | 0.21 | 1.00 | 0.71 | 1.00 |
| Clearance Time (s) | | | 5.0 | 5.0 | 5.0 | |
| Vehicle Extension (s) | | | 2.0 | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | | | 761 | 3681 | 2189 | 1398 |
| v/s Ratio Prot | | | c0.18 | 0.50 | c0.53 | |
| v/s Ratio Perm | | | | | 0.06 | |
| v/c Ratio | | | 0.86 | 0.50 | 0.75 | 0.06 |
| Uniform Delay, d1 | | | 49.3 | 0.0 | 11.8 | 0.0 |
| Progression Factor | | | 0.83 | 1.00 | 0.68 | 1.00 |
| Incremental Delay, d2 | | | 8.1 | 0.4 | 1.9 | 0.1 |
| Delay (s) | | | 49.2 | 0.4 | 9.9 | 0.1 |
| Level of Service | | | D | A | A | A |
| Approach Delay (s) | 0.0 | | | 13.3 | 9.5 | |
| Approach LOS | A | | | B | A | |
| Intersection Summary | | | | | | |
| HCM Average Control Delay | | | 11.7 | | HCM Level of Service | B |
| HCM Volume to Capacity ratio | | | 0.78 | | | |
| Actuated Cycle Length (s) | | | 130.0 | | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | | | 99.3% | | ICU Level of Service | F |
| Analysis Period (min) | | | 15 | | | |

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
4: EB Off-Ramp & Bellevue Way NE

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|------|------|------|-------|------|----------------------|
| Lane Configurations | ↔↔ | ↕ | | ↕↕↕ | ↕↕ | |
| Volume (vph) | 596 | 318 | 0 | 1756 | 920 | 0 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Grade (%) | -2% | | | -6% | 5% | |
| Total Lost time (s) | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 0.97 | 1.00 | | 0.91 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Fr't | 1.00 | 0.85 | | 1.00 | 1.00 | |
| Flt Protected | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (prot) | 3467 | 1599 | | 5238 | 3451 | |
| Flt Permitted | 0.95 | 1.00 | | 1.00 | 1.00 | |
| Satd. Flow (perm) | 3467 | 1599 | | 5238 | 3451 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 627 | 335 | 0 | 1848 | 968 | 0 |
| RTOR Reduction (vph) | 0 | 79 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 627 | 256 | 0 | 1848 | 968 | 0 |
| Confl. Peds. (#/hr) | | | | 20 | | 20 |
| Turn Type | | | | Perm | | |
| Protected Phases | | | | 4 | 2 | 6 |
| Permitted Phases | | | | 4 | | |
| Actuated Green, G (s) | | | | 28.5 | 28.5 | 91.5 |
| Effective Green, g (s) | | | | 28.5 | 28.5 | 91.5 |
| Actuated g/C Ratio | | | | 0.22 | 0.22 | 0.70 |
| Clearance Time (s) | | | | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | | | | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | | | 760 | 351 | 3687 |
| v/s Ratio Prot | | | | c0.18 | | c0.35 |
| v/s Ratio Perm | | | | | 0.16 | |
| v/c Ratio | | | | 0.82 | 0.73 | 0.50 |
| Uniform Delay, d1 | | | | 48.4 | 47.2 | 8.8 |
| Progression Factor | | | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | | | 6.9 | 6.3 | 0.5 |
| Delay (s) | | | | 55.3 | 53.5 | 9.3 |
| Level of Service | | | | E | D | A |
| Approach Delay (s) | | | | 54.7 | | 9.3 |
| Approach LOS | | | | D | | A |
| Intersection Summary | | | | | | |
| HCM Average Control Delay | | | | 20.5 | | HCM Level of Service |
| HCM Volume to Capacity ratio | | | | 0.58 | | C |
| Actuated Cycle Length (s) | | | | 130.0 | | Sum of lost time (s) |
| Intersection Capacity Utilization | | | | 99.3% | | ICU Level of Service |
| Analysis Period (min) | | | | 15 | | F |

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
5: NE 38th Place & South Access

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR | | | | | | |
|-----------------------------------|-------------|-------------|-------------|----------------------|-------------|-------------|------|------|------|------|------|------|-----|--|-----|--|-----|--|
| Lane Configurations | ↔ | ↔ | | ↔ | ↔ | | | ↕ | | | ↕ | | | | | | | |
| Volume (veh/h) | 24 | 333 | 5 | 15 | 270 | 28 | 5 | 0 | 15 | 39 | 5 | 66 | | | | | | |
| Sign Control | Free | | | Free | | | Stop | | | Stop | | | | | | | | |
| Grade | 0% | | | 0% | | | 0% | | | 0% | | | | | | | | |
| Peak Hour Factor | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | | | | | | |
| Hourly flow rate (vph) | 28 | 387 | 6 | 17 | 314 | 33 | 6 | 0 | 17 | 45 | 6 | 77 | | | | | | |
| 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) | 985 | | | | | | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | | | | | | | |
| vC, conflicting volume | 347 | | | 393 | | | 874 | | 827 | | 390 | | 826 | | 814 | | 330 | |
| vC1, stage 1 conf vol | | | | | | | 446 | | 446 | | 365 | | 365 | | | | | |
| vC2, stage 2 conf vol | | | | | | | 428 | | 381 | | 460 | | 449 | | | | | |
| vCu, unblocked vol | 347 | | | 393 | | | 874 | | 827 | | 390 | | 826 | | 814 | | 330 | |
| tC, single (s) | 4.2 | | | 4.1 | | | 7.1 | | 6.5 | | 6.2 | | 7.1 | | 6.5 | | 6.2 | |
| tC, 2 stage (s) | | | | | | | 6.1 | | 5.5 | | 6.1 | | 5.5 | | | | | |
| tF (s) | 2.3 | | | 2.2 | | | 3.5 | | 4.0 | | 3.3 | | 3.5 | | 4.0 | | 3.3 | |
| p0 queue free % | 98 | | | 99 | | | 99 | | 100 | | 97 | | 90 | | 99 | | 89 | |
| cM capacity (veh/h) | 1149 | | | 1166 | | | 421 | | 465 | | 658 | | 463 | | 469 | | 709 | |
| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 | | | | | | | | | | | | |
| Volume Total | 28 | 393 | 17 | 347 | 23 | 128 | | | | | | | | | | | | |
| Volume Left | 28 | 0 | 17 | 0 | 6 | 45 | | | | | | | | | | | | |
| Volume Right | 0 | 6 | 0 | 33 | 17 | 77 | | | | | | | | | | | | |
| cSH | 1149 | 1700 | 1166 | 1700 | 577 | 585 | | | | | | | | | | | | |
| Volume to Capacity | 0.02 | 0.23 | 0.01 | 0.20 | 0.04 | 0.22 | | | | | | | | | | | | |
| Queue Length 95th (ft) | 2 | 0 | 1 | 0 | 3 | 21 | | | | | | | | | | | | |
| Control Delay (s) | 8.2 | 0.0 | 8.1 | 0.0 | 11.5 | 12.9 | | | | | | | | | | | | |
| Lane LOS | A | | A | | B | B | | | | | | | | | | | | |
| Approach Delay (s) | 0.5 | | 0.4 | | 11.5 | | 12.9 | | | | | | | | | | | |
| Approach LOS | | | | | B | | B | | | | | | | | | | | |
| Intersection Summary | | | | | | | | | | | | | | | | | | |
| Average Delay | 2.4 | | | | | | | | | | | | | | | | | |
| Intersection Capacity Utilization | 36.6% | | | ICU Level of Service | | | A | | | | | | | | | | | |
| Analysis Period (min) | 15 | | | | | | | | | | | | | | | | | |

HCM Unsignalized Intersection Capacity Analysis
6: East Access & 108th Avenue NE

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------------|-------------|----------------------|-------------|-------------|------|
| Lane Configurations | ↔ | ↔ | ↔ | ↕ | ↕ | |
| Volume (veh/h) | 134 | 138 | 102 | 1116 | 503 | 48 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 143 | 147 | 109 | 1187 | 535 | 51 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None TWLTL | | |
| Median storage (veh) | | | | 2 | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1965 | | 561 | | 586 | |
| vC1, stage 1 conf vol | 561 | | | | | |
| vC2, stage 2 conf vol | 1404 | | | | | |
| vCu, unblocked vol | 1965 | | 561 | | 586 | |
| tC, single (s) | 6.5 | | 6.3 | | 4.1 | |
| tC, 2 stage (s) | 5.5 | | | | | |
| tF (s) | 3.6 | | 3.4 | | 2.2 | |
| p0 queue free % | 20 | | 71 | | 89 | |
| cM capacity (veh/h) | 179 | | 505 | | 984 | |
| Direction, Lane # | EB 1 | EB 2 | NB 1 | NB 2 | SB 1 | |
| Volume Total | 143 | 147 | 109 | 1187 | 586 | |
| Volume Left | 143 | 0 | 109 | 0 | 0 | |
| Volume Right | 0 | 147 | 0 | 0 | 51 | |
| cSH | 179 | 505 | 984 | 1700 | 1700 | |
| Volume to Capacity | 0.80 | 0.29 | 0.11 | 0.70 | 0.34 | |
| Queue Length 95th (ft) | 135 | 30 | 9 | 0 | 0 | |
| Control Delay (s) | 76.2 | 15.0 | 9.1 | 0.0 | 0.0 | |
| Lane LOS | F | C | A | | | |
| Approach Delay (s) | 45.2 | | 0.8 | | 0.0 | |
| Approach LOS | E | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 6.5 | | | | | |
| Intersection Capacity Utilization | 72.8% | | ICU Level of Service | | C | |
| Analysis Period (min) | 15 | | | | | |

HCM Unsignalized Intersection Capacity Analysis
7: NE 38th Place & 108th Avenue NE

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-----------------------------------------------------|-------------|-------------|-------------|------------------------|------|
| Lane Configurations | [Diagram: EBL, EBR, NBL, NBT, SBT, SBR with arrows] | | | | | |
| Volume (veh/h) | 125 | 232 | 223 | 1103 | 576 | 75 |
| Sign Control | Stop | | Free | | Free | |
| Grade | 0% | | 0% | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 132 | 244 | 235 | 1161 | 606 | 79 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | None | |
| Median storage (veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 2276 | 646 | 685 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 2276 | 646 | 685 | | | |
| tC, single (s) | 6.4 | 6.2 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 0 | 49 | 74 | | | |
| cM capacity (veh/h) | 33 | 475 | 908 | | | |
| Direction, Lane # | EB 1 | EB 2 | NB 1 | NB 2 | SB 1 | |
| Volume Total | 132 | 244 | 235 | 1161 | 685 | |
| Volume Left | 132 | 0 | 235 | 0 | 0 | |
| Volume Right | 0 | 244 | 0 | 0 | 79 | |
| cSH | 33 | 475 | 908 | 1700 | 1700 | |
| Volume to Capacity | 3.97 | 0.51 | 0.26 | 0.68 | 0.40 | |
| Queue Length 95th (ft) | Err | 72 | 26 | 0 | 0 | |
| Control Delay (s) | Err | 20.3 | 10.3 | 0.0 | 0.0 | |
| Lane LOS | F | C | B | | | |
| Approach Delay (s) | 3514.2 | | 1.7 | | 0.0 | |
| Approach LOS | F | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | | | 538.5 | | | |
| Intersection Capacity Utilization | | | 71.6% | | ICU Level of Service C | |
| Analysis Period (min) | 15 | | | | | |

HCM Signalized Intersection Capacity Analysis
8: Northrup Way & 108th Avenue NE

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-----------------------------------------------------------------------------------|------|-------|------|----------------------|------|------|-------|------|-------|-------|------|
| Lane Configurations | [Diagram: EBL, EBT, EBR, WBL, WBT, WBR, NBL, NBT, NBR, SBL, SBT, SBR with arrows] | | | | | | | | | | | |
| Volume (vph) | 295 | 303 | 470 | 540 | 530 | 442 | 680 | 609 | 120 | 219 | 509 | 80 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| Grade (%) | 0% | | | | | | 1% | | | -6% | | |
| Total Lost time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.97 | 0.95 | | 0.97 | 0.95 | | 1.00 | 0.95 | |
| Frbp, ped/bikes | 1.00 | 1.00 | 0.98 | 1.00 | 0.98 | | 1.00 | 0.99 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.93 | | 1.00 | 0.98 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1770 | 1863 | 1559 | 3467 | 3260 | | 3416 | 3405 | | 1823 | 3571 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (perm) | 1770 | 1863 | 1559 | 3467 | 3260 | | 3416 | 3405 | | 1823 | 3571 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 311 | 319 | 495 | 568 | 558 | 465 | 716 | 641 | 126 | 231 | 536 | 84 |
| RTOR Reduction (vph) | 0 | 0 | 11 | 0 | 116 | 0 | 0 | 13 | 0 | 0 | 10 | 0 |
| Lane Group Flow (vph) | 311 | 319 | 484 | 568 | 907 | 0 | 716 | 754 | 0 | 231 | 610 | 0 |
| Conf. Peds. (#/hr) | 10 | | 10 | 10 | | 10 | | | 10 | 10 | | |
| Heavy Vehicles (%) | 2% | 2% | 2% | 1% | 1% | | 2% | 2% | | 2% | 2% | 2% |
| Turn Type | Prot | | pm+ov | | | Prot | | Split | | Split | | |
| Protected Phases | 1 | 6 | 4 | 5 | 2 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | 6 | | | | | | | | | | | |
| Actuated Green, G (s) | 23.8 | 26.5 | 54.5 | 32.5 | 35.2 | | 28.0 | 28.0 | | 23.0 | 23.0 | |
| Effective Green, g (s) | 23.8 | 26.5 | 54.5 | 32.5 | 35.2 | | 28.0 | 28.0 | | 23.0 | 23.0 | |
| Actuated g/C Ratio | 0.18 | 0.20 | 0.42 | 0.25 | 0.27 | | 0.22 | 0.22 | | 0.18 | 0.18 | |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lane Grp Cap (vph) | 324 | 380 | 654 | 867 | 883 | | 736 | 733 | | 323 | 632 | |
| v/s Ratio Prot | c0.18 | 0.17 | 0.16 | 0.16 | c0.28 | | 0.21 | c0.22 | | 0.13 | c0.17 | |
| v/s Ratio Perm | 0.15 | | | | | | | | | | | |
| v/c Ratio | 0.96 | 0.84 | 0.74 | 0.66 | 1.03 | | 0.97 | 1.03 | | 0.72 | 0.97 | |
| Uniform Delay, d1 | 52.6 | 49.7 | 31.8 | 43.7 | 47.4 | | 50.6 | 51.0 | | 50.4 | 53.1 | |
| Progression Factor | 0.81 | 0.77 | 1.25 | 1.00 | 1.00 | | 1.08 | 1.08 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 19.7 | 7.7 | 1.4 | 1.4 | 37.4 | | 22.2 | 36.6 | | 6.1 | 27.0 | |
| Delay (s) | 62.1 | 45.8 | 41.2 | 45.1 | 84.8 | | 76.7 | 91.5 | | 56.6 | 80.1 | |
| Level of Service | E | D | D | D | F | | E | F | | E | F | |
| Approach Delay (s) | 48.3 | | | | 70.6 | | 84.4 | | | | 73.7 | |
| Approach LOS | D | | | | E | | F | | | | E | |
| Intersection Summary | | | | | | | | | | | | |
| HCM Average Control Delay | | | 70.2 | | HCM Level of Service | | E | | | | | |
| HCM Volume to Capacity ratio | 1.00 | | | | | | | | | | | |
| Actuated Cycle Length (s) | 130.0 | | | | | | | | | | | |
| Sum of lost time (s) | 20.0 | | | | | | | | | | | |
| Intersection Capacity Utilization | | | 98.3% | | ICU Level of Service | | F | | | | | |
| Analysis Period (min) | 15 | | | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

HCM Unsignalized Intersection Capacity Analysis
9: WB On-Ramp & 108th Avenue NE

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|-----------------------------------|-------------|-------------|-------------|------------------------|-------------|-------------|
| Lane Configurations | | | | ↑↑↑ | ↑↑ | ↑ |
| Volume (veh/h) | 0 | 0 | 0 | 1409 | 1215 | 304 |
| Sign Control | Stop | | | Free | Free | |
| Grade | 0% | | | 0% | -1% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 0 | 0 | 0 | 1483 | 1279 | 320 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | None | None | |
| Median storage (veh) | | | | | | |
| Upstream signal (ft) | | | | 159 | 266 | |
| pX, platoon unblocked | 0.85 | 0.85 | 0.85 | | | |
| vC, conflicting volume | 1773 | 639 | 1279 | | | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1563 | 235 | 984 | | | |
| tC, single (s) | 6.8 | 6.9 | 4.1 | | | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | 2.2 | | | |
| p0 queue free % | 100 | 100 | 100 | | | |
| cM capacity (veh/h) | 87 | 654 | 595 | | | |
| Direction, Lane # | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
| Volume Total | 494 | 494 | 494 | 639 | 639 | 320 |
| Volume Left | 0 | 0 | 0 | 0 | 0 | 0 |
| Volume Right | 0 | 0 | 0 | 0 | 0 | 320 |
| cSH | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| Volume to Capacity | 0.29 | 0.29 | 0.29 | 0.38 | 0.38 | 0.19 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 0 | 0 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Lane LOS | | | | | | |
| Approach Delay (s) | 0.0 | | | 0.0 | | |
| Approach LOS | | | | | | |
| Intersection Summary | | | | | | |
| Average Delay | 0.0 | | | | | |
| Intersection Capacity Utilization | 36.9% | | | ICU Level of Service A | | |
| Analysis Period (min) | 15 | | | | | |

HCM Signalized Intersection Capacity Analysis
10: Transit and HOV Ramp & 108th Avenue NE

South Kirkland Park & Ride Rezone
With-Project 2030 PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|-----------------------------------|-------|------|--------|------------------------|------|------|-------|------|------|------|------|-------|
| Lane Configurations | ↔ | | ↔ | ↔ | ↔ | ↔ | ↔ | ↔ | | | ↔ | ↔ |
| Volume (vph) | 110 | 0 | 60 | 950 | 0 | 749 | 110 | 550 | 0 | 0 | 1075 | 150 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 14 |
| Grade (%) | | | 0% | | | 2% | | | 2% | | | -2% |
| Total Lost time (s) | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | 5.0 |
| Lane Util. Factor | 1.00 | | 1.00 | 0.97 | 0.95 | 0.95 | 1.00 | 1.00 | | | | 0.95 |
| Frbp, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 |
| Frlp, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 0.85 | 0.85 | 1.00 | 1.00 | | | | 0.98 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 |
| Satd. Flow (prot) | 1805 | | 1615 | 3432 | 1504 | 1504 | 1769 | 1862 | | | | 3509 |
| Flt Permitted | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | | 1.00 |
| Satd. Flow (perm) | 1805 | | 1615 | 3432 | 1504 | 1504 | 1769 | 1862 | | | | 3509 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 116 | 0 | 63 | 1000 | 0 | 788 | 116 | 579 | 0 | 0 | 1132 | 158 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 168 | 168 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 116 | 0 | 63 | 1000 | 226 | 226 | 116 | 579 | 0 | 0 | 1290 | 0 |
| Conf. Peds. (#/hr) | | | | | | | | | 20 | 20 | | |
| Heavy Vehicles (%) | 0% | 0% | 0% | 1% | 1% | 1% | 1% | 1% | 1% | 2% | 2% | 2% |
| Turn Type | Prot | | custom | Split | | Prot | Prot | | | | | |
| Protected Phases | 3 | | 35 | 4 | 4 | 4 | 5 | 2 | | | | 6 |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | 9.3 | | 26.1 | 36.1 | 36.1 | 36.1 | 11.8 | 69.6 | | | | 52.8 |
| Effective Green, g (s) | 9.3 | | 26.1 | 36.1 | 36.1 | 36.1 | 11.8 | 69.6 | | | | 52.8 |
| Actuated g/C Ratio | 0.07 | | 0.20 | 0.28 | 0.28 | 0.28 | 0.09 | 0.54 | | | | 0.41 |
| Clearance Time (s) | 5.0 | | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | | 5.0 |
| Vehicle Extension (s) | 2.0 | | | 3.0 | 3.0 | 3.0 | 2.0 | 2.0 | | | | 2.0 |
| Lane Grp Cap (vph) | 129 | | 324 | 953 | 418 | 418 | 161 | 997 | | | | 1425 |
| v/s Ratio Prot | c0.06 | | 0.04 | c0.29 | 0.15 | 0.15 | c0.07 | 0.31 | | | | c0.37 |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | 0.90 | | 0.19 | 1.05 | 0.54 | 0.54 | 0.72 | 0.58 | | | | 0.91 |
| Uniform Delay, d1 | 59.9 | | 43.2 | 47.0 | 39.9 | 39.9 | 57.5 | 20.4 | | | | 36.3 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | 0.71 |
| Incremental Delay, d2 | 48.3 | | 0.1 | 43.0 | 1.4 | 1.4 | 12.0 | 2.4 | | | | 6.3 |
| Delay (s) | 108.2 | | 43.3 | 89.9 | 41.4 | 41.4 | 69.5 | 22.7 | | | | 32.2 |
| Level of Service | F | | D | F | D | D | E | C | | | | C |
| Approach Delay (s) | | 85.4 | | | | 68.5 | | 30.5 | | | | 32.2 |
| Approach LOS | | F | | | | E | | C | | | | C |
| Intersection Summary | | | | | | | | | | | | |
| HCM Average Control Delay | 50.7 | | | HCM Level of Service D | | | | | | | | |
| HCM Volume to Capacity ratio | 0.93 | | | | | | | | | | | |
| Actuated Cycle Length (s) | 130.0 | | | Sum of lost time (s) | | | 20.0 | | | | | |
| Intersection Capacity Utilization | 80.2% | | | ICU Level of Service D | | | | | | | | |
| Analysis Period (min) | 15 | | | | | | | | | | | |
| c Critical Lane Group | | | | | | | | | | | | |

HCM Signalized Intersection Capacity Analysis
 11: EB On-Ramp & 108th Avenue NE

South Kirkland Park & Ride Rezone
 With-Project 2030 PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|------------------------|------|------|-------|-------|-------|------|
| Lane Configurations | | | ↘ | ↑ | ↑↘ | ↑ |
| Volume (vph) | 0 | 0 | 330 | 660 | 1040 | 1045 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 12 | 14 | 12 | 12 | 15 |
| Grade (%) | 2% | | | -6% | 6% | |
| Total Lost time (s) | | | 5.0 | 5.0 | 5.0 | 5.0 |
| Lane Util. Factor | | | 1.00 | 1.00 | 0.91 | 0.91 |
| Frb, ped/bikes | | | 1.00 | 1.00 | 1.00 | 1.00 |
| Fpb, ped/bikes | | | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 1.00 | 1.00 | 0.96 | 0.85 |
| Flt Protected | | | 0.95 | 1.00 | 1.00 | 1.00 |
| Satd. Flow (prot) | | | 1983 | 1957 | 3213 | 1568 |
| Flt Permitted | | | 0.95 | 1.00 | 1.00 | 1.00 |
| Satd. Flow (perm) | | | 1983 | 1957 | 3213 | 1568 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 0 | 0 | 347 | 695 | 1095 | 1100 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 0 | 347 | 695 | 1524 | 671 |
| Confl. Peds. (#/hr) | | 50 | | | | |
| Heavy Vehicles (%) | 2% | 2% | 0% | 0% | 0% | 0% |
| Turn Type | | | Prot | | Prot | |
| Protected Phases | | | 5 | 2 | 6 | 6 |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | | | 26.8 | 130.0 | 93.2 | 93.2 |
| Effective Green, g (s) | | | 26.8 | 130.0 | 93.2 | 93.2 |
| Actuated g/C Ratio | | | 0.21 | 1.00 | 0.72 | 0.72 |
| Clearance Time (s) | | | 5.0 | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | | | 2.0 | 2.0 | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | | 409 | 1957 | 2303 | 1124 |
| v/s Ratio Prot | | | c0.17 | 0.36 | c0.47 | 0.43 |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | | | 0.85 | 0.36 | 0.66 | 0.60 |
| Uniform Delay, d1 | | | 49.6 | 0.0 | 9.9 | 9.1 |
| Progression Factor | | | 1.00 | 1.00 | 1.22 | 2.01 |
| Incremental Delay, d2 | | | 14.5 | 0.5 | 0.1 | 1.5 |
| Delay (s) | | | 64.1 | 0.5 | 12.2 | 19.8 |
| Level of Service | | | E | A | B | B |
| Approach Delay (s) | 0.0 | | | 21.7 | 14.5 | |
| Approach LOS | A | | | C | B | |

| Intersection Summary | | | |
|-----------------------------------|-------|----------------------|------|
| HCM Average Control Delay | 16.8 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 130.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 81.3% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |