

KPG Traffic Analysis for Mercer Island I-90 Access Options

Nov 7, 2016



Introductory Statement

On August 5, 2016, the City received a changed decision by the Federal Highway Administration (FHWA) regarding Mercer Island access to I-90 via the Island Crest Way Westbound HOV ramp. (see August 5, 2016 FHWA Letter at: www.mercergov.org/files/2016-08-05_FHWA_Letter_to_City_and_WSDOT.pdf)

The City immediately commissioned KPG to analyze the worst case impacts on local Mercer Island traffic based on the FHWA decision when the center roadway closes in June 2017 and when East Link becomes operational after 2023. This is new data because the scenario created by the FHWA decision was not previously envisioned by any of the parties.

The attached *KPG Traffic Analysis for Mercer Island I-90 Access Options* provides a traffic analysis that evaluates impacts to the Mercer Island streets, intersections and I-90 ramps once the I-90 center roadway is closed and includes the restriction of Mercer Island SOVs from using the future R8A Lanes and Island Crest Way westbound HOV on-ramp.

KPG was not commissioned to develop or analyze mitigations to local traffic impacts at this time, and was not asked to analyze impacts on I-90. As was reported at the November 7, 2016 Mercer Island City Council meeting, the impacts are significant, and were not covered in the East Link Light Rail FEIS because, again, this scenario was not envisioned.

The results of the KPG traffic analyses and the evaluation of the I-90 Access Alternatives will be used by Mercer Island in the continued negotiations with Sound Transit, WSDOT and FHWA to achieve the mobility goals of Mercer Island residents.

(See I-90 Access Alternatives at: www.mercergov.org/files/MI_I-90_AccessAlternatives_7Nov2016.pdf)

Technical Memorandum

To: Pam Bissonnette, City of Mercer Island
From: Michael Lapham and John Davies, KPG
Date: November 3, 2016
Re: Traffic Analysis for Mercer Island I-90 Access Options

KPG recently assisted the City of Mercer Island to update the Transportation Element of the Comprehensive Plan. The Transportation Element update analyzed traffic operations for 2014 existing conditions and 2035 future conditions during both the AM and PM peak hours.

Next June (2017), the East Link Project is scheduled to close the I-90 reversible center roadway to begin construction on the light rail line. To replace the loss of the I-90 center roadway, the I-90 mainline between Mercer Island and Seattle will be restriped from 3-lanes to 4-lanes in each direction. These new I-90 lanes are referred to as R8A lanes. The traffic analysis for the East Link Project assumed that the R8A lanes would be designated as HOV lanes and that single occupancy vehicles (SOVs) traveling to or from Mercer Island would be allowed to use these lanes.

Recently, the Federal Highway Administration (FHWA) informed the City of Mercer Island about the potential restriction of Mercer Island SOVs from the I-90 R8A lanes. This may also lead to the restriction of SOVs from using the Island Crest Way on-ramp to westbound I-90 because it would connect to a HOV lane. The potential SOV restriction at the Island Crest Way westbound on-ramp would result in traffic being diverted to other I-90 on-ramps. This diversion would increase traffic volumes on Mercer Island local streets and negatively impact traffic operations in and around the Town Center.

This technical memo focuses on the traffic impacts to Mercer Island streets and intersections from the potential SOV restriction at the Island Crest Way westbound on-ramp and does not address the traffic operations of the I-90 mainline. The analysis evaluates 2017 conditions during construction and 2035 conditions after the completion of the light rail line and the new R8A lanes.

Changes to I-90 Ramps with Closure of the Center Roadway

The I-90 center roadway will be closed in 2017 with the start of light rail construction. The closure of the I-90 center roadway will result in the following changes to Mercer Island's access to and from I-90.

- The reversible ramp at 77th Avenue SE to/from the I-90 center roadway will be closed.
- The Island Crest Way westbound on-ramp to the center roadway will be closed and the on-ramp connecting to the I-90 mainline will be restriped to connect with the R8A lanes.
- The 76th Avenue SE on-ramp to westbound I-90 will be widened to include a metered general-purpose lane and a HOV bypass lane.
- The Island Crest Way eastbound off-ramp from the I-90 center roadway will be relocated to serve the new I-90 R8A lanes.

A map at the end of the memo shows the ramp changes that will occur with the closure of the I-90 center roadway.

Potential Restrictions of Mercer Island SOVs from I-90 R8A lanes and Island Crest Way Westbound On-Ramp

The traffic analyses for both the East Link Project *Final I-90 Interchange Justification Report* (IJR) and *Final Environmental Impact Statement* (EIS) assumed that Mercer Island SOVs would be allowed to use the new R8A lanes between Mercer Island and Seattle. This assumption and traffic analysis were also used to identify the traffic impacts and corresponding mitigation for Mercer Island local streets. The proposed mitigation is described on pages 3-99 and 3-100 of the EIS. The EIS states that with these mitigation improvements the AM and PM peak hour intersection operations would be the same or better than no-build conditions.

In an August 5, 2016 letter, the FHWA states that Mercer Island SOVs may be restricted from using the future I-90 R8A lanes between Seattle and Mercer Island, because the current plan is for the R8A lanes to be designated as HOV lanes. The letter also states that SOVs may be restricted from using the Island Crest Way westbound on-ramp. This on-ramp connects to the left side of the I-90 mainline. These potential restrictions of SOVs from the R8A lanes and westbound on-ramp were not part of the East Link FEIS analysis.

Reductions to Westbound I-90 On-Ramp Capacity for the Town Center and Island Crest Way

Traffic volumes onto westbound I-90 are highest during the morning commute. Currently, during the morning commute, the Town Center and Island Crest Way have SOV access onto westbound I-90 from three on-ramps at 76th Avenue SE, 77th Avenue SE and Island Crest Way. These three westbound SOV on-ramps would be reduced to a single on-ramp at 76th Avenue SE with the closure of the I-90 center roadway and the potential restriction of SOV access to the Island Crest Way on-ramp. With these two ramp changes, the 76th Avenue SE on-ramp would carry almost 1,200 vehicles during the AM peak hour.

The 76th Avenue SE on-ramp would not be able to support this level of traffic and would result in extensive queuing, travel delays and potential for traffic to divert to other westbound on-ramps such as West Mercer Way. The additional traffic diverting to the 76th Avenue SE westbound on-ramp would likely warrant a new traffic signal at the 76th Avenue SE/N Mercer Way intersection; however, a signal would not address the queues that would back up from the ramp meter through the intersection. Traffic simulation analysis indicates that vehicle queues from the ramp meter would extend east to the N Mercer Street/77th Avenue SE intersection and south to the SE 24th Street/76th Avenue SE intersection, negatively impacting downtown traffic circulation during the AM commute.

On Mercer Island, the AM peak hour of traffic typically occurs between 7:30 AM and 8:30 AM. The 76th Avenue SE on-ramp is also expected to be over capacity during the 30 minutes before and after the peak hour. These shoulder periods carry more than 80 percent of the AM peak hour volumes.

Currently, the 76th Avenue SE westbound on-ramp carries 180 vehicles during the AM peak hour. The number of additional westbound vehicles that would be diverted to the 76th Avenue SE on-ramp include the following:

- 420 vehicles from the reversible ramp at 77th Avenue SE to the I-90 center roadway.
- 530 SOVs from the Island Crest Way on-ramp that accesses the I-90 center roadway.
- 60 SOVs from the Island Crest Way on-ramp that accesses the I-90 outer roadway.

The AM peak hour analysis includes a reduction of 80 vehicles that reflect non-Mercer Island vehicles that currently exit westbound I-90 at either East Mercer Way or Island Crest Way and travel on local streets to access the westbound center roadway at the 77th Avenue SE on-ramp.

During the PM peak hour, the restriction of SOVs from the Island Crest Way westbound on-ramp would cause approximately 200 vehicles to divert primarily to the 76th Avenue SE on-ramp. This would increase the 76th Avenue SE on-ramp volume to approximately 800 vehicles during the PM peak hour.

The Island Crest Way interchange with I-90 was constructed consistent with WSDOT design guidelines that recommend providing on- and off-ramps for all four directions of travel at a single location. This maximizes efficiency, consolidates the impacts of the high traffic volumes accessing the freeway to a single location, and meets driver's expectations of exiting the freeway at one location and returning to the same location. The WSDOT Design Manual, Interchange Design Chapter 1360.02 states "provide complete ramp facilities for all directions of travel whenever possible". The potential SOV restriction at the Island Crest Way westbound on-ramp would require drivers to travel a half mile to access on the on-ramp at 76th Avenue SE.

Impacts to Local Streets

Island Crest Way is a Principal Arterial and carries 23,000 vehicles per day approaching I-90. Mercer Island's transportation system is based on Island Crest Way forming the primary north-south transportation spine providing access between I-90 and the southern three-quarters of the island. Currently, vehicles traveling between Island Crest Way and Seattle have direct access to westbound I-90 via a tunnel. The SOV restriction would require westbound SOVs on Island Crest Way to exit the high speed arterial and drive an additional half mile on local streets to reach the 76th Avenue SE on-ramp. The majority of the vehicles are expected to travel on either North Mercer Way or the Town Center streets.

The added traffic volumes would increase the potential for pedestrian-vehicle conflicts in the Town Center, particularly at pedestrian crossings near the future light rail station, Park and Ride and parking garage.

Transit operations would be impacted by increased volumes on N Mercer Way. With the 2017 closure of the I-90 center roadway, buses are expected to use the 76th Avenue SE on-ramp for westbound travel from Mercer Island. The additional congestion may cause delays to transit operations, even with the planned transit/HOV by-pass lane on the westbound on-ramp. With the opening of the Mercer Island light rail station, King County Metro and Sound Transit are planning to terminate many of the east side bus routes at Mercer Island. A roundabout is proposed at the N Mercer Way/77th Avenue SE intersection to facilitate the return trip of buses back to the east side. The increased traffic on N Mercer Way from the Island Crest Way SOV on-ramp restriction would negatively affect the operation of the roundabout, resulting in impacts to transit operations and overall traffic flow in the area.

Intersection Operations

Level of service (LOS) is a measurement of the quality of traffic flow or traffic congestion. Intersection LOS is defined by the seconds of delay experienced by vehicles traveling through the intersection. The intersection delay takes into account the delay caused by the traffic signals, vehicle queues and delays from turning movements that block through traffic. The intersection LOS grading ranges from A to F, with LOS A assigned when minimal delays are present and LOS F when lengthy delays occur. The table below shows the LOS criteria for signalized and unsignalized intersections.

Level of Service Criteria for Signalized and Unsignalized Intersections

Level of Service	Signalized Average Delay per Vehicle (seconds)	Unsignalized Average Delay per Vehicle (seconds)
A	0 to 10	0 to 10
B	10 to 20	10 to 15
C	20 to 35	15 to 25
D	35 to 55	25 to 35
E	55 to 80	35 to 50
F	> 80	> 50

Source: 2010 Highway Capacity Manual

The traffic analysis evaluates 2014 existing conditions, 2017 conditions during construction, and 2035 conditions with the completion of the East Link Project. The attached tables compare the traffic conditions with and without SOV access to the Island Crest Way westbound on-ramp. The tables list the AM and PM peak hour LOS for 12 key intersections affected by the potential SOV restriction.

The City of Mercer Island LOS standard for intersections in and nearby the Town Center is LOS C, except for WSDOT-controlled intersections where WSDOT allows a LOS E standard.

2017 Operations

The 2017 analysis evaluates conditions when the I-90 center roadway is closed for construction of the light rail. The City of Mercer Island has not received plans from Sound Transit to implement the traffic mitigation improvements proposed in the East Link FEIS that are not required to be completed until 2023, therefore these improvements are not included in the 2017 analysis.

The potential SOV restriction at the Island Crest Way westbound on-ramp would increase traffic along N Mercer Way and Town Center streets as the majority of vehicles are expected to divert to the 76th Avenue SE on-ramp. The higher traffic volumes will increase vehicle delays and lead to longer queues at intersections. Three intersections are forecasted to fall below the adopted LOS standard. The I-90 westbound on-ramp/76th Avenue SE intersection is forecasted to operate at LOS F. Vehicle queues from the 76th Avenue SE westbound on-ramp, are expected to adversely impact the operation of the nearby intersections at SE 24th Street/76th Avenue SE and N Mercer Way/77th Avenue SE. Traffic simulation indicates that these two intersections would fall below the City's LOS standard.

2035 Operations

The 2035 analysis represents conditions with the completion of the light rail and includes the mitigation improvements identified in the East Link EIS. The proposed East Link mitigation for Mercer Island includes revised westbound channelization at the I-90 westbound on-ramp/76th Avenue SE intersection and three new signals at the intersections of N Mercer Way/77th Avenue SE, I-90 eastbound off-ramp/77th Avenue SE, and SE 27th Street/80th Avenue SE. The 2035 traffic levels includes traffic growth from new development, the new light rail station, and the bus intercept strategy. The potential restriction of SOV traffic from the Island Crest Way westbound on-ramp would divert traffic to N Mercer Way and Town Center streets, increasing delays and vehicle queues at intersections and freeway on-ramps.

Even with the East Link EIS mitigation measures in place, the additional traffic from the Island Crest Way SOV restriction would result in six intersections operating below the LOS standard either in the AM or PM peak hours. A map showing the six intersections is included at the end of the memo. Three of these intersections, I-90 westbound on-ramp/76th Avenue SE, I-90 westbound off-ramp/Island Crest Way and SE 28th St/80th Avenue SE are forecasted to operate at LOS F. Three additional intersections, at SE 24th Street/76th Avenue SE and N Mercer Way/77th Avenue SE and SE 28th Street/Island Crest Way, are forecasted to operate below the City's LOS standard.

The increase in traffic volumes would cause traffic delays not just to vehicles destined for I-90, but would be experienced by all vehicles traveling in the Town Center and along N Mercer Way. This would impact Town Center commercial and residential traffic, vehicles traveling to the Park and Ride, and bus operations serving the light rail station.

Access to North Mercer Island Neighborhoods

SE 26th Street, 81st Avenue SE and 76th Avenue SE are the primary connections between the north Mercer Island neighborhoods and the Town Center, Park and Ride, and access to I-90. The potential SOV restriction at the Island Crest Way on-ramp would substantially increase traffic volumes along N Mercer Way at these three intersections. The higher traffic volumes would cause increased delays, queues and blocking issues. As described in the previous section, the two intersections at I-90 westbound on-ramp/N Mercer Way/76th Avenue SE and I-90 westbound off-ramp/N Mercer Way/Island Crest Way are forecasted to not meet the LOS E standard. The analysis results also indicate that westbound queues from the N Mercer Way/80th Avenue SE signalized intersection would likely block turning movements at the nearby N Mercer Way/81st Avenue SE intersection.

Travel Time Analysis

The potential restriction of the Island Crest Way westbound on-ramp to only HOV traffic would increase travel times for vehicles traveling to westbound I-90. During the AM peak hour, the majority of the 590 vehicles from Island Crest Way would divert to N Mercer Way and Town Center streets to access westbound I-90 at 76th Avenue SE. Without additional improvements, congestion and queuing would increase the 2017 and 2035 AM peak hour travel times for SOV traffic between Island Crest Way and westbound I-90 by more than 5 minutes. The traffic simulation modeling showed extensive queuing along N Mercer Way, with backups continuing onto Island Crest Way and into the Town Center.

Conclusions

The closure of the I-90 center roadway and the potential SOV restriction at the Island Crest Way westbound on-ramp are scheduled to occur in June of 2017. The traffic mitigation improvements proposed in the East Link FEIS assumed the continued use of the Island Crest Way westbound on-ramp for both SOV and HOV traffic. The City of Mercer Island has not received plans to implement the mitigation improvements and these improvements are not expected to be in place when the center roadway is closed.

The potential restriction of SOV traffic from the Island Crest Way westbound on-ramp would create significant impacts to the Mercer Island local streets and Town Center that were not identified in the East Link FEIS. This SOV on-ramp restriction would cause the majority of westbound traffic to divert to the on-ramp at 76th Avenue SE, increasing traffic volumes and delays on N Mercer Way and Town Center streets. These added traffic volumes would also increase the potential for pedestrian-vehicle conflicts in the Town Center and impact bus operations around the light rail station.

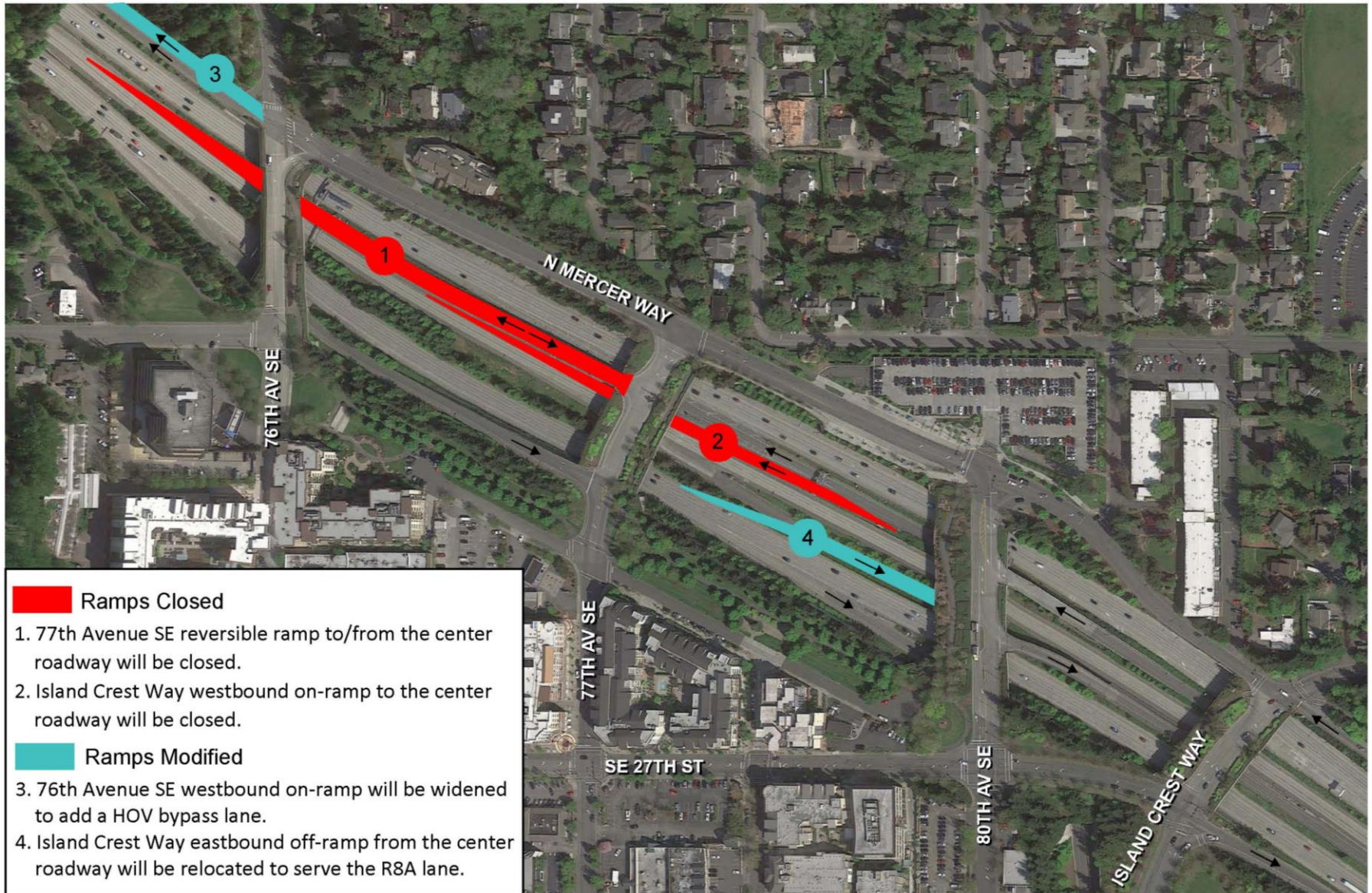
The SOV restriction at the Island Crest Way westbound on-ramp is forecast to result in six intersections operating below the adopted LOS standard during either the AM or PM peak hours.

- I-90 westbound on-ramp/76th Avenue SE
- SE 24th Street/76th Avenue SE
- N Mercer Way/77th Avenue SE
- SE 28th Street/80th Avenue SE
- I-90 westbound off-ramp/Island Crest Way
- SE 28th Street/Island Crest Way

These changes to intersection operations should also be reviewed for consistency with air quality standards.

In addition to intersection impacts, the SOV restriction at the Island Crest Way on-ramp would reduce the number of westbound SOV on-ramps serving the Town Center and Island Crest Way from 3 to 1 during the morning commute. The 76th Avenue SE on-ramp would not be able to support the expected increase in traffic volumes and would result in extensive queuing, affecting nearby intersections and traffic circulation.

Ramp Changes with the Closure of the I-90 Center Roadway



Intersections that would not meet the LOS Standard with SOV Restriction at the Island Crest Way Westbound On-Ramp



2017 AM Peak Hour Intersection LOS for With and Without SOV Access to the Island Crest Way Westbound On-Ramp

	Intersection	Traffic Control	LOS Standard	2014 Existing Conditions	2017 With SOV Access to ICW Westbound On-Ramp	2017 Without SOV Access to ICW Westbound On-Ramp
1	I-90 Westbound On-Ramp/76th Ave SE	All-way stop	E	B	C	F
2	SE 24th Street/76th Ave SE	All-way stop	C	A	B	C*
3	N Mercer Way/77th Ave SE	North leg stop	C	C	C	E
4	I-90 Eastbound Off-Ramp/77th Ave SE	West leg stop	E	B	B	B
5	SE 27th Street/77th Ave SE	Signal	C	B	B	B
6	SE 27th Street/78th Ave SE	Signal	C	A	A	A
7	N Mercer Way/80th Ave SE (Park and Ride)	Signal	E	B	B	C
8	SE 27th Street/80th Ave SE	All-way stop	C	B	B	C
9	SE 28th Street/80th Ave SE	All-way stop	C	B	B	B
10	I-90 Westbound Off-Ramp/Island Crest Way	Signal	E	C	C	E
11	I-90 Eastbound On-Ramp/Island Crest Way	Signal	E	C	C	C
12	SE 28th St/Island Crest Way	Signal	C	B	B	B

Note: 2010 Highway Capacity Manual Level of Service methodology. For 2-way stop-controlled intersections, delay reported for the worst stop-controlled approach.


*Traffic simulation indicates that vehicle queuing from the 76th Avenue SE westbound on-ramp would cause the intersection to fall below the LOS standard.

Shading indicates that intersection does not meet LOS standard.

2017 PM Peak Hour Intersection LOS for With and Without SOV Access to the Island Crest Way Westbound On-Ramp

	Intersection	Traffic Control	LOS Standard	2014 Existing Conditions	2017 With SOV Access to ICW Westbound On-Ramp	2017 Without SOV Access to ICW Westbound On-Ramp
1	I-90 Westbound On-Ramp/76th Ave SE	All-way stop	E	C	C	D
2	SE 24th Street/76th Ave SE	All-way stop	C	B	B	B
3	N Mercer Way/77th Ave SE	North leg stop	C	D	D	D
4	I-90 Eastbound Off-Ramp/77th Ave SE	West leg stop	E	B	B	B
5	SE 27th Street/77th Ave SE	Signal	C	B	B	B
6	SE 27th Street/78th Ave SE	Signal	C	A	A	A
7	N Mercer Way/80th Ave SE (Park and Ride)	Signal	E	C	C	C
8	SE 27th Street/80th Ave SE	All-way stop	C	B	B	C
9	SE 28th Street/80th Ave SE	All-way stop	C	C	C	C
10	I-90 Westbound Off-Ramp/Island Crest Way	Signal	E	D	D	E
11	I-90 Eastbound On-Ramp/Island Crest Way	Signal	E	C	C	C
12	SE 28th St/Island Crest Way	Signal	C	C	C	C

Note: 2010 Highway Capacity Manual Level of Service methodology. For 2-way stop-controlled intersections, delay reported for the worst stop-controlled approach.

 Shading indicates that intersection does not meet LOS standard.

2035 AM Peak Hour Intersection LOS for With and Without SOV Access to the Island Crest Way Westbound On-Ramp

	Intersection	Traffic Control	LOS Standard	2014 Existing Conditions	2035 With SOV Access to ICW Westbound On-Ramp	2035 Without SOV Access to ICW Westbound On-Ramp
1	I-90 Westbound On-Ramp/76th Ave SE	All-way stop^	E	B	C	F
2	SE 24th Street/76th Ave SE	All-way stop	C	A	B	C*
3	N Mercer Way/77th Ave SE	North leg stop/ Roundabout^	C	C	A	C*
4	I-90 Eastbound Off-Ramp/77th Ave SE	West leg stop/Signal^	E	B	B	B
5	SE 27th Street/77th Ave SE	Signal	C	B	C	C
6	SE 27th Street/78th Ave SE	Signal	C	A	B	B
7	N Mercer Way/80th Ave SE (Park and Ride)	Signal	E	B	B	D
8	SE 27th Street/80th Ave SE	All-way stop/Signal^	C	B	B	B
9	SE 28th Street/80th Ave SE	All-way stop	C	B	C	C
10	I-90 Westbound Off-Ramp/Island Crest Way	Signal	E	C	D	F
11	I-90 Eastbound On-Ramp/Island Crest Way	Signal	E	C	C	D
12	SE 28th St/Island Crest Way	Signal	C	B	B	D

Note: 2010 Highway Capacity Manual Level of Service methodology. For 2-way stop-controlled intersections, delay reported for the worst stop-controlled approach.

^Includes mitigation improvements identified in the East Link EIS.

*Traffic simulation indicates that vehicle queuing from the 76th Avenue SE westbound on-ramp would cause the intersection to fall below the LOS standard.

 Shading indicates that intersection does not meet LOS standard.

2035 PM Peak Hour Intersection LOS for With and Without SOV Access to the Island Crest Way Westbound On-Ramp

	Intersection	Traffic Control	LOS Standard	2014 Existing Conditions	2035 With SOV Access to ICW Westbound On-Ramp	2035 Without SOV Access to ICW Westbound On-Ramp
1	I-90 Westbound On-Ramp/76th Ave SE	All-way stop^	E	C	E	E
2	SE 24th Street/76th Ave SE	All-way stop	C	B	C	C
3	N Mercer Way/77th Ave SE	North leg stop/ Roundabout^	C	E	B	C
4	I-90 Eastbound Off-Ramp/77th Ave SE	West leg stop/ Signal^	E	B	A	A
5	SE 27th Street/77th Ave SE	Signal	C	B	C	C
6	SE 27th Street/78th Ave SE	Signal	C	A	B	B
7	N Mercer Way/80th Ave SE (Park and Ride)	Signal	E	C	C	C
8	SE 27th Street/80th Ave SE	All-way stop/Signal^	C	C	B	B
9	SE 28th Street/80th Ave SE	All-way stop	C	C	F	F
10	I-90 Westbound Off-Ramp/Island Crest Way	Signal	E	D	E	F
11	I-90 Eastbound On-Ramp/Island Crest Way	Signal	E	C	C	D
12	SE 28th St/Island Crest Way	Signal	C	C	C	D

Note: 2010 Highway Capacity Manual Level of Service methodology. For 2-way stop-controlled intersections, delay reported for the worst stop-controlled approach.

^Includes mitigation improvements identified in the East Link EIS.

 Shading indicates that intersection does not meet LOS standard.