Sound Transit East Link:
Bus/LRT System Integration Study

Prepared For:

Sound Transit
King County Metro
Mercer Island
WSDOT

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Appendix

1. Introduction

The East Link Bus/LRT System Integration study developed and evaluated scenarios of an integrated King County Metro (Metro) and Sound Transit (ST) bus system with Sound Transit's East Link LRT system at the Mercer Island Station. The objective of this effort is to identify opportunities when East Link service is operating that modify the transit service along I-90 to ensure long-term reliability and an opportunity increase transit service within the corridor. This report provides an overview of the potential changes to the transit operations associated with the bus/LRT integration, a description of the bus/LRT integration scenarios, a list of evaluation criteria associated with transportation level of service and potential impacts to the environment, and the findings.

Previous work related to transit operations along I-90 and Mercer Island was completed as part of Sound Transit's *East Link Project Final Environmental Impact Statement* (East Link FEIS). For the purposes of this study, the East Link FEIS preferred alternative will represent the baseline future condition. All of the findings associated with the bus/LRT integration scenarios are compared back to this baseline future condition.

As part of this study, conceptual plans were developed for each of the scenarios. In addition, several other concepts that were considered but not analyzed or evaluated are also presented in this study. It is expected that the results of this study will provide the agencies an opportunity to identify a preferred facility and operating plan that could be refined. Through the East Link's outreach program, the public will have an opportunity to comment in July 2014.

2. Bus/LRT System Integration Operations

2.1. Transit Operations Background

Integrating the transit routes along I-90 with the East Link LRT system will occur by creating a transit hub on Mercer Island that allows bus riders to transfer to the East Link LRT system and vice-versa. Inherent to this integration is that bus routes traveling on I-90 to and from the eastside communities would terminate at the Mercer Island Station and not continue west into downtown Seattle. Therefore the intent of the bus/LRT integration is to optimize and integrate the light rail and bus operations between Seattle and the communities east of Lake Washington.

Under the East Link FEIS preferred alternative, eastbound routes traveling along I-90 would use downtown Seattle surface streets and access I-90 via the I-90 D2 roadway. Westbound routes would not have access to the I-90 D2 roadway and use the I-90 general purpose lanes and ramps. Compared to the East Link FEIS, all I-90 bus routes that are under consideration in the bus/LRT systems integration scenarios would stop at Mercer Island. Metro routes that will be affected include 210, 212, 214, 215, 216, 218, and 219. Each of those routes would either be deleted, re-rerouted to other eastside communities or modified to terminate at Mercer Island so riders can transfer to the regional LRT system.

The most critical operations of the East Link bus/LRT integration occur for routes in the westbound direction during the AM peak period and routes traveling in the eastbound direction during the PM peak period. The AM peak period occurs from approximately 6:00

AM to 9:00 AM in the morning and the PM peak occurs from approximately 3:30 PM to 6:30 PM in the afternoon. Depending on the peak period there are different considerations for bus operations. In the PM peak period, a key consideration is to facilitate an easy transfer from LRT to routes ready for pick-up while in the AM peak period, bus riders need to be dropped-off prior to an arriving LRT train. In all of the scenarios, East Link trains would operate with an 8-minute headway during the peak periods.

With all of the proposed bus/LRT system integration scenarios, I-90 bus routes serving Mercer Island would use the 80th Avenue HOV ramps. While in each scenario routes would have a different routing scheme and bus stop/layover locations, routes would travel only on 80th Avenue SE, SE 27th Street, 77th Avenue SE, and North Mercer Way.

The bus routing schemes are further described in the Scenario Description section. Additional information on the conceptual bus service and frequencies used in this study is located in Appendix D which includes a white paper prepared by King County Metro in November, 2013.

2.2. Study Assumptions

2.2.1. Study Area

The geographic focus of this study is on Mercer Island in the vicinity of the proposed East Link LRT station. To capture the effects of the bus/LRT integration on Mercer Island the extents of the study area are based on the bus operating concepts presented in the King County white paper included in Appendix D. Therefore, the study area is bound by North Mercer Way, SE 27th Street, 77th Avenue SE, and 80th Avenue SE. Within this study area, eight intersections were analyzed and are listed below and identified in Figure 1:

- 80th Avenue SE/North Mercer Way
- 80th Avenue SE/I-90 WB HOV off-ramp
- 80th Avenue SE/I-90 EB HOV on-ramp
- 80th Avenue SE/SE 27th Street
- 77th Avenue SE/North Mercer Way
- 77th Avenue SE/I-90 EB off-ramp
- 77th Avenue SE/Sunset Way
- 77th Avenue SE/SE 27th Street

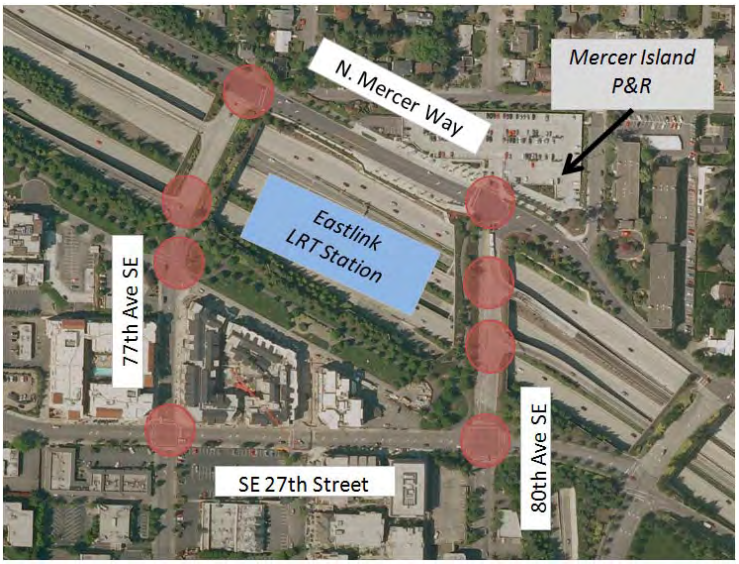


Figure 1. East Link Bus/LRT System Integration Study Area & Intersections

While some evaluation measures provide information beyond the Mercer Island study area (such as ridership and travel times) no further analysis of I-90 conditions beyond what was documented in the East Link FEIS was conducted for this study as no additional impacts are expected along the I-90 corridor.

2.2.2. Analysis Year and Periods

Consistent with the East Link FEIS, the scenarios were evaluated in the 2030 year and include information for the AM and PM peak periods, where appropriate.

2.2.3. Traffic Analysis and Ridership Forecasting

The traffic analysis and ridership forecasting is based on the models that were developed for the East Link FEIS. The traffic analysis and transit ridership forecasts were updated based on the FEIS estimates and preliminary transit integration plan that was developed as part of the King County Metro white paper.

2.2.4. Bus Service Analysis

Bus service schedules and routing were based on the conceptual transit integration plan from the East Link FEIS (included in the appendices in the Transportation Technical Report) and King County's white paper. The routes provided in Table 1 summarize the bus service assumptions depending on the condition.

Table 1. I-90 Bus Service Summary

Route	Existing	East Link FEIS[1]	Bus/LRT Systems Integration Service[2]
111	I-90 Only	I-90 Only	Rerouted to Downtown Bellevue
114	I-90 Only	I-90 Only	Rerouted to Downtown Bellevue
201	I-90 w/stops on Mercer Island	I-90 w/stops on Mercer Island	I-90 w/stops on Mercer Island
202	Mercer Island Only	Deleted	Deleted
203	Mercer Island Only	I-90 w/stops on Mercer Island	Mercer Island Only

Table 1. I-90 Bus Service Summary

Route	Existing	East Link FEIS[1]	Bus/LRT Systems Integration Service[2]
204	Mercer Island Only	I-90 w/stops on Mercer Island	Mercer Island Only
205	Mercer Island/I-90	Mercer Island/I-90	Deleted
210	I-90 Only	I-90 Only	Deleted
211	I-90 w/stops on Mercer Island	Deleted	Deleted
212	I-90 Only	I-90 Only	I-90 Routes to serve Eastgate
213	I-90 w/stops on Mercer Island	I-90 w/stops on Mercer Island	Mercer Island Only
214	I-90 Only	I-90 Only	I-90 w/Mercer Island Truncation
215	I-90 Only	Deleted	I-90 w/Mercer Island Truncation
216	I-90 w/stops on Mercer Island	I-90 w/stops on Mercer Island	replaced by 219
217	I-90 Only	Deleted	Deleted
218	I-90 Only	I-90 Only	I-90 w/Mercer Island Truncation
219	I-90 Only	I-90 Only	I-90 w/Mercer Island Truncation
550	I-90 w/stops on Mercer Island	replaced by LRT	replaced by LRT
554	I-90 w/stops on Mercer Island	I-90 w/stops on Mercer Island	Rerouted to Downtown Bellevue

Black shading represents a change from existing condtions

[1] Routes modified based on the East Link FEIS Conceptual Bus Integration Plan

[2] Routes modified based on *Mercer Island Bus Route Truncation with East Link* white paper

For bus stop and layover sizing a range of spaces is provided in this report. The lower range represents the approximate number of buses that can be accommodated with fully independent operations and the upper number represents the approximate number of buses that can be accommodated with dependent operations. Each bus space has been assumed to accommodate an articulated bus.

3. Scenario Descriptions

Four scenarios were developed and evaluated as part of this study. Each of these scenarios is based on concepts discussed between the affected agencies: Sound Transit, King County Metro, City of Mercer Island and WSDOT. A description of each scenario is provided in this section and conceptual design drawings are provided in Appendix A. Potential roadway improvements, bus routing schemes and bus stop and layover locations are indicated on these drawings.

3.1. Scenario 1: East Link FEIS (Baseline)

Scenario 1 represents the preferred alternative from the East Link FEIS document. It serves as the baseline and provides a comparison point for the other scenarios. A conceptual layout of Scenario 1 is included in Figure 2.

Road Network and Intersections

Scenario 1 includes all network and roadway assumptions within the Mercer Island study area that are documented in the East Link FEIS. The main network differences that are present in this scenario over existing conditions include the closures of the I-90 center

roadway and the 77th Avenue ramp to vehicle traffic and permitting left turns from the westbound 80th Avenue off-ramp. Scenario 1 includes signal mitigation at the 77th Avenue/North Mercer Way and 80th Avenue/27th Street intersections. Both of those intersections are analyzed as traffic signals for this study.

Bus Service

Bus service for Scenario 1 is based on the East Link FEIS conceptual integration plan. Key bus routes serving Mercer Island with this scenario include Metro route 216 and ST route 554. In addition, five Metro bus routes, 201, 203, 204, and 213 are also operating as routes exclusively on Mercer Island.

As part of this scenario, Sound Transit route 554 would be modified and truncate at Mercer Island and loop around the station area via 80th Avenue, 27th Street, 77th Avenue, and North Mercer Way in a clockwise direction and return to I-90 traveling Eastbound. Metro route 216 would remain unchanged from today and continue to use 80th Avenue and North Mercer Way in the westbound direction and 77th Avenue, North Mercer Way, and 80th Avenue in the eastbound direction to access bus pick-up and drop-off locations. In addition to the bus routes that serve Mercer Island, several Metro bus routes would travel on I-90 to and from downtown Seattle, but do not stop at Mercer Island. Those include Metro routes 111, 114, 210, 212, 214, 218, and 219.

A summary of the 2030 peak hour bus volumes and routes serving I-90 and Mercer Island are included in Appendix B.1.

Bus Stop and Layover Locations

With Scenario 1, a combined bus drop-off/pick-up stop will be located on the north side of North Mercer Way just to the west of 80th Avenue. This stop is expected to accommodate up to two articulated buses and will serve westbound routes from I-90 as well as the local Mercer Island bus routes.

In the eastbound direction, one combined bus drop-off/pick-up area will be located on the south side of North Mercer Way to the west of 80th Avenue and one combined bus drop-off/pick-up area will be located on the west side of 80th Avenue to the south of North Mercer Way. Both of the eastbound stop areas are expected to accommodate up to two articulated buses each.

In addition, bus layover space will be included along the east side of 77th Avenue and along the south side of North Mercer Way, to the east of 77th Avenue. The layover areas are expected to accommodate up to six articulated buses during layover times.

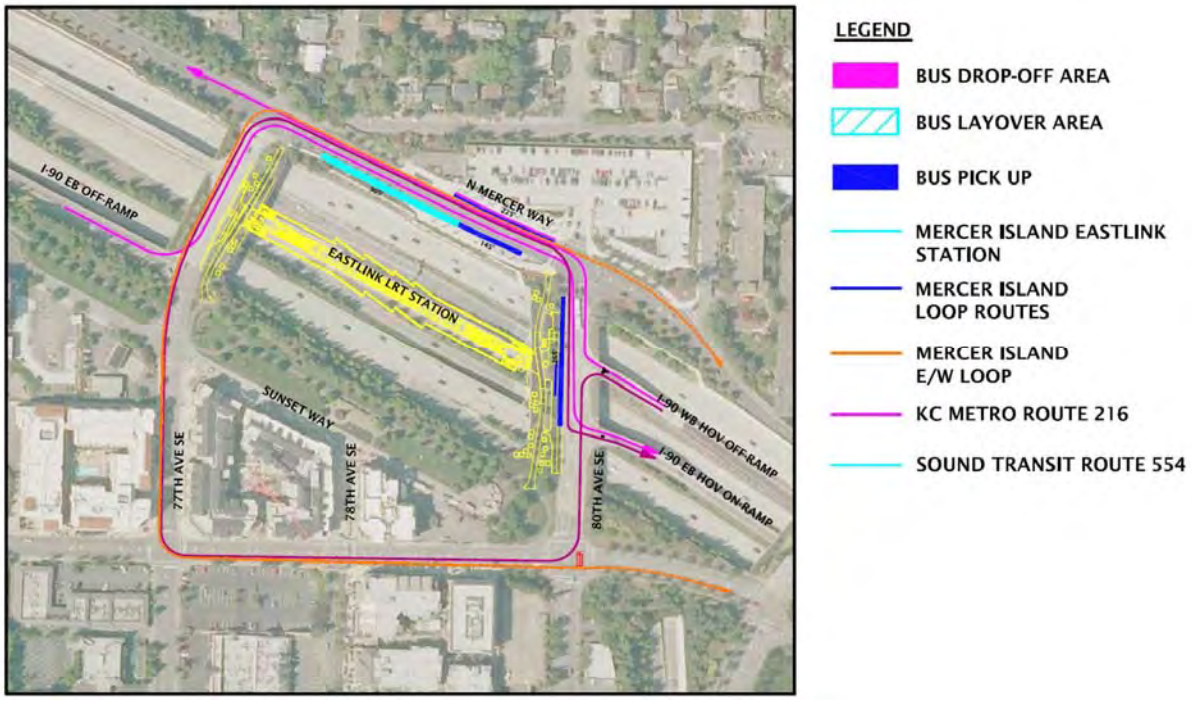


Figure 2. Scenario 1: East Link FEIS Concept

3.2. Scenario 2: Clockwise Bus Operations

Scenario 2 represents a bus operating scheme that operates in a clockwise direction from the westbound 80th Avenue HOV off-ramp to the 80th Avenue HOV on-ramp. A conceptual layout of Scenario 2 is included in Figure 3.

Road Network and Intersections

Scenario 2 includes all network and roadway assumptions within the Mercer Island study area that are documented in the East Link FEIS (Scenario 1).

Bus Service

Bus service for Scenario 2 is based on the conceptual integration plan that was developed by King County Metro and was included in the *Mercer Island Bus Route Truncation with East Link* white paper. As part of the system integration study developed by Metro, a total of five Metro bus routes would serve Mercer Island, one Metro bus route (204) circulating on Mercer Island, and four Metro bus routes, 214, 215, 218 and 219, serving Mercer Island and other east side communities; such as; Eastgate, Issaquah, Issaquah-Highlands, Sammamish and North Bend. Metro bus routes 111 and 114 would be re-structured to service downtown Bellevue.

Under Scenario 2, Metro routes 214, 215, 218, and 219 stop at Mercer Island and on 80th Avenue, 27th Street, 77th Avenue, and North Mercer Way in a clockwise direction to access the station's bus pick-up and drop-off locations. The local bus route that serves Mercer Island (204) would operate in a counter-clockwise direction.

In general, the four Metro routes stopping at Mercer Island would have increased frequencies based on low-end volume estimates in the *Mercer Island Bus Route Truncation*

with East Link white paper. A summary of the bus peak hour bus frequencies and volumes for Scenario 2 are included in Appendix B.1.

Bus Stop and Layover Locations

Under Scenario 2, a combined bus drop-off/pick-up stop will be located on the north side of North Mercer Way just to the west of 80th Avenue. This stop is expected to accommodate up to two articulated buses and will likely serve local Mercer Island bus routes.

For bus routes to and from the eastside, a bus drop-off area will be located on the west side of 80th Avenue to the north of 27th Street to allow for the drop off and transfer of passengers to the LRT station. This drop-off bus stop area will be able to accommodate up to two articulated buses. A bus pick-up area will be located on the south side of North Mercer Way between 77th Avenue and 80th Avenue to allow for the pick-up of passengers transferring from the LRT station. This pick-up bus stop area will be able to accommodate up to four articulated buses.

Potential layover space will be included along the north side of Sunset Way between 78th Avenue and 77th Avenue and along the east side of 77th Avenue between Sunset Way and North Mercer Way. The layover areas are expected to accommodate up to four routes.

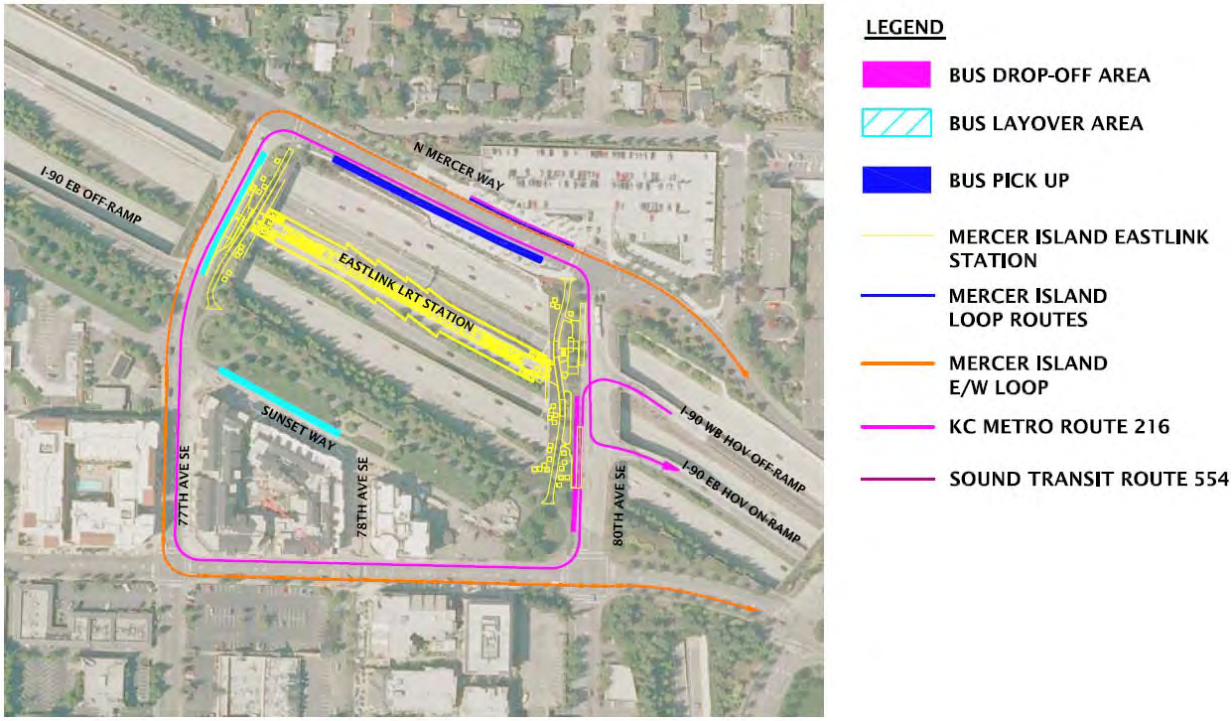


Figure 3. Scenario 2: Clockwise Operations Concept

3.3. Scenario 3: Counter-Clockwise Bus Operations: Sunset Way Roundabout

Scenario 3 represents a bus operating scheme that operates in a counter-clockwise direction from the westbound 80th Avenue HOV off-ramp to the 80th Avenue HOV on-ramp. A conceptual layout of Scenario 3 is included in Figure 4.

Road Network and Intersections

Scenario 3 includes network and roadway assumptions within the Mercer Island study area that are documented in the East Link FEIS (Scenario 1) with the exception of the intersections of 77th Avenue/Sunset Way and 77th Avenue/I-90 off-ramp. With Scenario 3, a roundabout is proposed that combines those two intersections into one roundabout near the existing 77th Avenue/Sunset Way intersection.

Bus Service

Bus service for Scenario 3 is based on the conceptual integration plan that was developed by KCM and documented in the *Mercer Island Bus Route Truncation with East Link* white paper. Similar to Scenario 2, a total of eight Metro routes would serve Mercer Island, four local routes and four routes originating or destined for communities on the east side.

Under Scenario 3, Metro routes 214, 215, 218, and 219 stop at Mercer Island and utilize 80th Avenue, North Mercer Way, and 77th Avenue in a counter-clockwise pattern. Under this operating plan, buses will use the proposed 77th Avenue/Sunset Way roundabout to turn around and proceed back along 77th Avenue, North Mercer Way, and 80th Avenue and access I-90 via the HOV on-ramp. By having bus routes turnaround at 77th Avenue/Sunset Way, buses will not travel on 27th Street and through the Mercer Island town center. In general, the four Metro routes stopping at Mercer Island would have increased frequencies.

Local bus routes in Scenario 3 that serve Mercer Island (routes 201, 203, 204, and 213) will continue to follow a similar route that they use today. A summary of the bus peak hour bus frequencies and volumes for Scenario 3 are included in Appendix B.1.

Bus Stop and Layover Locations

Under Scenario 3, a combined bus drop-off/pick-up stop will be located on the north side of North Mercer Way just to the west of 80th Avenue. This stop is expected to accommodate up to two articulated buses and could serve local Mercer Island bus routes as well as some routes from I-90.

For bus routes to and from the eastside, a combined pick-up/drop-off bus stop area will be located on the east side of 77th Avenue to the north of Sunset Way to allow for the drop off and transfer of passengers to the LRT station. This drop-off bus stop area will be able to accommodate up to two articulated buses.

A pick-up bus stop area will be located on the west side of 80th Avenue south of North Mercer Way to allow for the pick-up of passengers transferring from the LRT station. This pick-up bus stop area will be able to accommodate up to two articulated buses.

As part of Scenario 3, bus layover space will be included along the south side of North Mercer Way between 77th Avenue and 80th Avenue. The layover areas are expected to accommodate up to four routes during layover times and could also be used for pick-up area, if necessary.

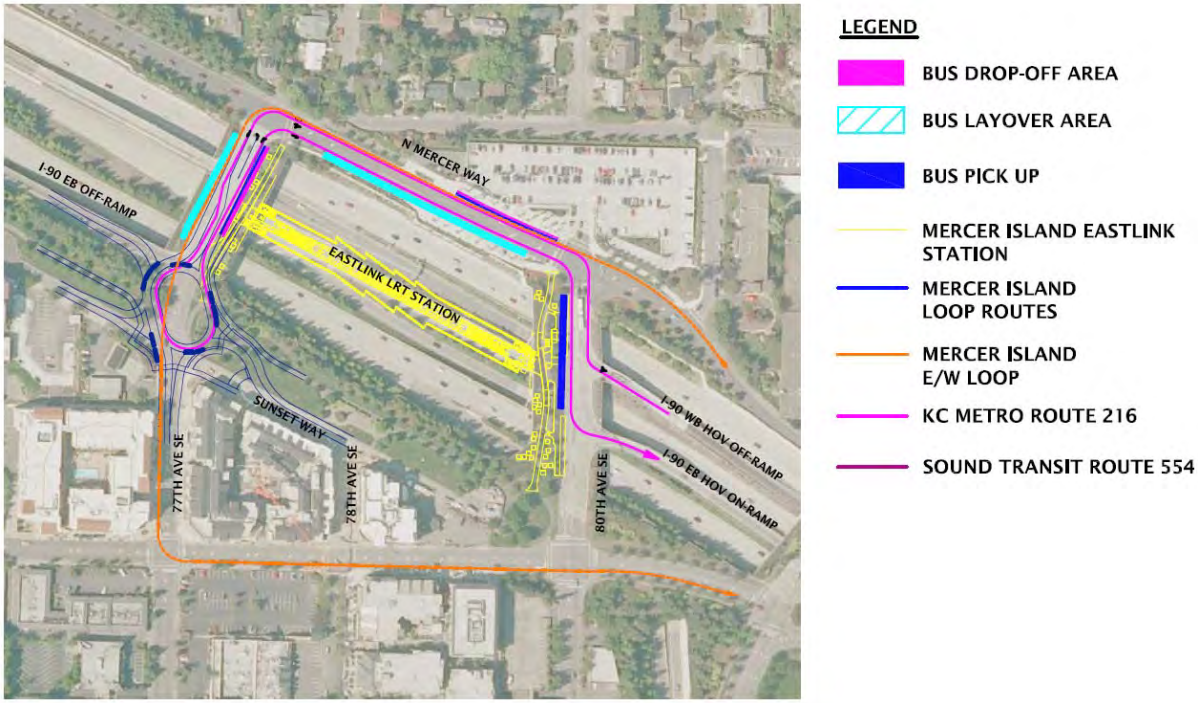


Figure 4. Scenario 3: Counter-clockwise with Sunset Roundabout Concept

3.4. Scenario 4: Counter-Clockwise Bus Operations: N. Mercer Way Roundabout

Scenario 4 represents a bus operating scheme that operates in a counter-clockwise direction from the westbound 80th Avenue HOV off-ramp to the 80th Avenue HOV on-ramp. A conceptual layout of Scenario 4 is included in Figure 5.

Road Network and Intersections

Scenario 4 includes network and roadway assumptions within the Mercer Island study area that are documented in the East Link FEIS (Scenario 1) with the exception of the intersection of 77th Avenue/North Mercer Way where a roundabout is proposed.

Bus Service

Bus service for Scenario 4 is based on the conceptual integration plan that was developed by KCM and documented in the *Mercer Island Bus Route Truncation with East Link* white paper. Similar to Scenario 2, a total of eight Metro routes would serve Mercer Island, four local routes and four routes originating or destined for communities on the east side.

Under Scenario 4, Metro routes 214, 215, 218, and 219 stop at Mercer Island and utilize 80th Avenue and North Mercer Way in a counter-clockwise pattern. Under this operating plan, bus routes will turnaround at the proposed 77th Avenue/North Mercer Way roundabout and proceed back along North Mercer Way and 80th Avenue and access I-90 via the HOV on-ramp. By having bus routes turnaround at 77th Avenue/North Mercer Way, routes will not travel on 27th Street and through the Mercer Island town center. In general, the four Metro routes stopping at Mercer Island would have increased frequencies.

Local bus routes in Scenario 3 that serve Mercer Island (routes 201, 203, 204, and 213) will continue to follow a similar route that they use today. A summary of the bus peak hour bus frequencies and volumes for Scenario 4 are included in Appendix B.1.

Bus Stop and Layover Locations

Under Scenario 4, a combined bus drop-off/pick-up stop will be located on the north side of North Mercer Way just to the west of 80th Avenue. This stop is expected to accommodate up to two articulated buses and will likely serve routes terminating at Mercer Island from the eastside from I-90 as well as local Mercer Island bus routes. Passengers at this stop that are transferring to/from LRT would cross North Mercer Way.

A bus pick-up area will be located on the south side of North Mercer Way to the west of 80th Avenue and a bus pick-up area will also be located on the west side of 80th Avenue to the south of North Mercer Way. Both of the eastbound stop areas are expected to accommodate up to two buses each.

Bus layover space would be along the south side of North Mercer Way between 77th Avenue and 80th Avenue and along the north side of Mercer Way, east of 77th Avenue. The combined layover areas are expected to accommodate up to three articulated buses.

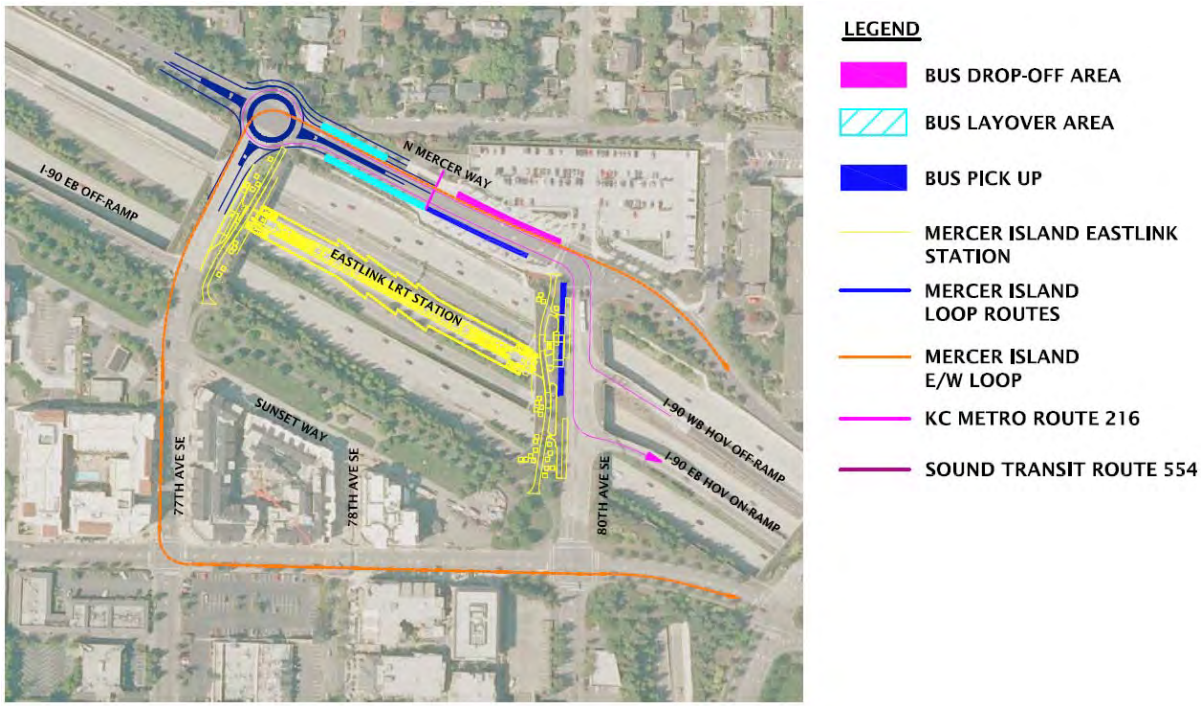


Figure 5. Scenario 4: Counter-clockwise with N. Mercer Way Roundabout Concept

4. Scenarios Evaluation

4.1. Overview of Evaluation Process

An evaluation framework was developed to compare each scenario. The four criteria that were evaluated are listed below:

- Environmental
- Transportation/Traffic
- Design Considerations
- Transit Operations

For each key criterion, several measures were created to assess each of the scenarios. A description of each criterion as well as definitions for each measure is described in this section.

Environmental

The environmental criterion is used to assess air and noise impacts, property acquisitions, section 4f requirements, and historical resources (i.e. buildings).

Air Impacts **-** Identify the number of intersections that would operate at LOS D or worse.

Noise Impacts **-** Identify the number of receivers impacted before mitigation, if applicable.

Acquisitions **-** Identify the number of residential properties displaced.

Section 4f/Parks **-** Identify the potential for impacts to Section 4(f) properties (i.e. parks)

Historic Resources **-** Identify the number of NRHP eligible buildings affected.

Transportation/Traffic

The Transportation/traffic impacts criterion is used to assess transportation conditions within the City of Mercer Island. Measures used within the Transportation/traffic impacts evaluation include bus activity and intersection level-of-service.

Bus Activity **-** Identify the number of buses that would travel on Mercer Island streets surrounding the LRT station.

Intersection Level-of-Service **-** Identify the intersection LOS at key Mercer Island intersections in the study area. If applicable, potential mitigation strategies will be identified.

Design Considerations

The design considerations criterion is used to assess the design of the intersections and transit facilities for each scenario. Measures developed under design considerations include right-of-way, design standards, bus stops and layover space, and costs.

Right-of-Way **-** Calculate the roadway right-of-way (in square feet) that would need to be acquired.

Design Standards **-** Identify if the scenario would meet WSDOT limited access guidelines and/or other jurisdictional roadway design guidelines.

Bus Stops and Layover Space **-** Identify the number of buses that can be accommodated at each bus stop area and bus layover area. This measure will indicate a range for the number of buses that can use each stop area or layover area.

Capital Costs **–** Develop a conceptual planning-level cost associated with the construction of each scenario.

Transit Operations

The transit operations criterion assesses transit operations and ridership characteristics for each scenario. Measures developed under transit operations include transit ridership, transit travel times, bus and LRT proximity, and pedestrian crossing locations.

Transit Ridership **–** Year 2035 forecast of the transit (bus and rail) ridership along I-90 at the floating bridge (west of Mercer Island) and East Channel (east of Mercer Island). This forecast is for year 2035 to reflect the most recent land use release by PSRC.

Year 2030 Transit Riders Travel Time - Calculate a transit rider's travel time between the Eastgate P&R and the University Street Station area. The travel times produced for this measure are based on the I-90 freeway analysis documented in the East Link FEIS. A figure representing the travel time path is included in Appendix B.

Bus and LRT Proximity - Calculate the distance and time for a transit rider to walk between their bus stop on Mercer Island and the Mercer Island Station LRT platforms

I-90 Bus Route Rider Crossing Volume **-** Estimate the number of bus riders that would cross a street to access the Mercer Island LRT station area for bus routes using I-90.

4.2. Evaluation Findings

As part of the evaluation process, each scenario was compared to one another for the four key criteria discussed in the previous section. The sections below provide a summary of the findings for each key criterion. Supporting analysis documents and the complete table for the evaluation process are referenced in the sections and are provided in Appendix B.

Environmental

The environmental criteria primarily measures impacts within the study area related to air quality, noise, acquisitions, Section 4(f)/parks, and historic resources. An overall summary of the environmental evaluation is provided in Table 2.

Table 2 Preliminary Environmental Impacts Evaluation Criteria

Measure	Scenario 1: Baseline (FEIS)	Scenario 2: Clockwise Bus Operations	Scenario 3: Counter-Clockwise Sunset Roundabout	Scenario 4: Counter-Clockwise N. Mercer Roundabout
Air	No impacts	No impacts	No impacts	No impacts
Noise	No Impacts	No Impacts	No Impacts	No Impacts
Acquisitions	No impacts	No impacts	No impacts	2 Single Family Residences

Table 2 Preliminary Environmental Impacts Evaluation Criteria

Measure	Scenario 1: Baseline (FEIS)	Scenario 2: Clockwise Bus Operations	Scenario 3: Counter-Clockwise Sunset Roundabout	Scenario 4: Counter-Clockwise N. Mercer Roundabout
Section 4f/Parks	No impacts	No impacts	0.6 acre	No impacts
Historical	None	None	None	None anticipated, must be confirmed with DAHP

Air Quality:

Under Scenario 1, 80th Ave SE and the I-90 HOV off ramp would operate at LOS D, and the same intersection would operate at LOS E for scenarios 2, 3 and 4. However, because this intersection is not signalized, a hotspot analysis is not needed. No adverse impacts to air quality are expected.

Noise:

All four scenarios would require a Federal Transit Administration (FTA) noise analysis because of the changes in bus layover locations and changes in bus volumes. Potential for new buses traffic levels exceeding local noise ordinances, based on Washington Administrative Code (WAC), was also evaluated.

Scenarios 1, 2 and 3 do not require a Federal Highway Administration (FHWA) noise analysis because they would not shift a roadway closer to any sensitive receptors. Scenario 4 would require a FHWA noise analysis because the proposed roundabout would shift travel lanes closer to residences on the north side of North Mercer Way. In addition, construction of the roundabout would remove existing residences that serve as barriers to roadway noise for the residences behind them.

These analyses were completed and no impacts were identified. Under the FTA evaluation, none of the 7 modeled receivers would experience noise levels that exceed the FTA criteria. Under the WAC evaluation, no locations exceeded local noise ordinance requirements. Under the FHWA evaluation, two of the four locations modeled experienced a decrease in noise levels, one experienced no change and one experienced a 1 dBA increase. All locations remained below the FHWA criteria.

Acquisitions:

Scenarios 1 and 2 would not require acquisition of any private or public property. Scenario 3 would use WSDOT right-of-way. Scenario 4 would require partial or full acquisition of two single-family residences for construction of a roundabout at 77th Avenue and North Mercer Way. These residences may need to be displaced and would require relocation.

Section 4(f)/Parks:

Scenarios 1, 2 and 4 would not affect any parks or Section 4(f) resources. Scenario 3 would directly impact the Mercer Island Lid Sculpture Garden. The Mercer Island Lid Sculpture Garden was determined to be a Section 4(f) resource during the EIS process, through

consultation with the City of Mercer Island. This park is primarily open space with public art sculptures, and the I-90 trail runs through it west to east.

Scenario 3 would directly impact approximately 0.6 acre of this park, displacing some existing sculptures. There would be approximately 0.3 acre available in the roundabout and approximately 0.1 acre on the south side of Sunset Way for relocation of displaced sculptures, and the trail that currently runs through this area would be maintained. It is expected this would qualify as a de minimis impact, which would be dependent on concurrence from the City of Mercer Island. Temporary closure of part of this park would occur, and the trail would be temporarily detoured during the construction period.

Historic Resources:

The two residences displaced by Scenario 3 are more than 50 years old, as are two of the residences directly behind them. The two homes displaced would be directly impacted, and the two behind them could be indirectly impacted by the change in setting. All four were evaluated to determine if they are eligible for listing on the National Register of Historic Places, which would trigger compliance with Section 106 of the National Historic Preservation Act. Based on a preliminary assessment by CH2M HILL's architectural historian, none of these homes is potentially eligible. If this scenario is selected, then Sound Transit would request concurrence from the state Department of Archaeology and Historic Preservation.

Transportation/Traffic

Transportation/traffic criteria measured the amount of total bus activity that occurs near the Mercer Island station as well as on specific streets and the intersection level-of-service (LOS) at the study intersections. The summary of the Transportation/Traffic evaluation is provided in Table 3.

Table 3. Transportation/Traffic Evaluation Criteria

Measure	Exisiting Conditions	Scenario 1: Baseline (FEIS)	Scenario 2: Clockwise Bus Operations	Scenario 3: Counter-Clockwise Sunset Roundabout	Scenario 4: Counter-Clockwise N. Mercer Roundabout
Bus Activity on Mercer Island	AM peak hour: 33 buses PM peak hour: 31 buses Daily: 350 buses	AM peak hour: 18 buses PM peak hour: 19 buses Daily: 200 buses	AM peak hour: 45 buses PM peak hour: 45 buses Daily: 340 buses	AM peak hour: 45 buses PM peak hour: 45 buses Daily: 340 buses	AM peak hour: 45 buses PM peak hour: 45 buses Daily: 340 buses
Intersection LOS	AM Peak Hour: - 7 intersections better than LOS C - 1 Mercer Island int. at LOS worse than D PM Peak Hour: - 7 intersections better than LOS C - 1 Mercer Island int. at LOS worse than D	AM Peak Hour: - All 8 study int. operate better than LOS C PM Peak Hour: - 7 intersections better than LOS C - 1 WSDOT int. at LOS D - All intersections meet standards	AM Peak Hour: - All 8 study int. operate better than LOS C PM Peak Hour: - 7 Intersections better than LOS C - 1 WSDOT Int. at LOS E - All intersections meet standards	AM Peak Hour: - All 8 study int. operate better than LOS C PM Peak Hour: - 7 Intersections better than LOS C - 1 WSDOT Int. at LOS E - All intersections meet standards	AM Peak Hour: - All 8 study int. operate better than LOS C PM Peak Hour: - 7 Intersections better than LOS C - 1 WSDOT Int. at LOS E - All intersections meet standards

Mercer Island Station Bus Activity

Currently there are approximately 63 buses on I-90 during the peak hour in the peak direction and approximately 500 daily buses on I-90. Over half of these buses, approximately 33 in the peak hour and 350 of the daily buses, stop on Mercer Island within the study area.

In the future condition under Scenario 1: Baseline East Link FEIS, the bus activity on I-90 will consist of approximately 48 buses during the peak hour and 350 daily buses. Approximately 18 of the peak hour buses and 200 of the daily buses would stop on Mercer Island within the study area. Fewer routes are expected to stop on Mercer Island in Scenario 1 than in the existing conditions as KCM and Sound Transit would eliminate bus routes or change the bus route's service area.

In Scenarios 2 through 4 there would be a similar number of buses traveling on Mercer Island. Each of these scenarios will utilize the system integration study operating plan that is described in the KCM white paper. In each of these scenarios, the bus activity on I-90 will consist of approximately 45 buses during the peak hour and 340 daily buses. All of these buses would access Mercer Island as the routes would stop at this station and riders would transfer between LRT. Compared to existing conditions, this is slightly more buses during the peak hour but overall is a similar amount of buses over the day.

A summary table of total bus activity by route and peak hour is provided in Appendix B.1.

While not included in Table 3, bus volumes were developed for each street within the study area. This includes the following four segments:

- 80th Avenue SE between North Mercer Way and 27th Street,
- 27th Street between 77th Avenue and 80th Avenue,
- 77th Avenue between 27th Street and North Mercer Way, and
- North Mercer Way between 77th Avenue and 80th Avenue.

Under current conditions, most bus routes traveling on Mercer Island streets use 80th Avenue SE and North Mercer Way. These roadway segments carry more than 60 buses during the peak hour. The 27th Street and 77th Avenue segments carry fewer vehicles since they are not the main routes for bus routes serving regional trips.

With Scenario 1, there would be fewer than 20 buses during the peak hour on any of the streets in the study area. This scenario experiences the lowest number of buses when compared to the other scenarios as many routes would not stop on Mercer Island.

In Scenario 2, all of the study area streets carry approximately 40-45 buses during the peak hour. This scenario experiences a consistent bus volume on each of the streets as the majority of bus routes that stop on Mercer Island utilize a clockwise routing scheme that uses each study area street. This amount of bus activity is less than the existing conditions on 80th Avenue SE and North Mercer Way but more on 27th Street and 77th Avenue SE.

In Scenario 3, most bus routes on Mercer Island would use 80th Avenue, North Mercer Way, and 77th Avenue. Each of those roadways is expected to carry a volume of 80 buses in the

peak hour. 27th Street is expected to carry less than 10 buses during the peak hour. 80th Avenue, North Mercer Way, and 77th Avenue experience higher bus volumes because they represent the turnaround route that bus routes from/to I-90 would use.

In Scenario 4, most bus routes on Mercer Island would use 80th Avenue and North Mercer Way. Each of those roadways is expected to carry a volume of about 80 buses in the peak hour. 27th Street and 77th Avenue are both expected to carry less than 10 buses during the peak hour. 80th Avenue and North Mercer Way experience higher bus volumes because they represent the turnaround route that the bus routes from/to I-90 would use.

Table 4 provides a summary of the peak hour bus volumes for key Mercer Island roadway segments.

Table 4. Peak Hour Bus Volumes on Mercer Island

Street	Existing Conditions	Scenario 1	Scenario 2	Scenario 3	Scenario 4
		East Link FEIS	Clockwise Bus Operations	Counter-Clockwise: Sunset Roundabout	Counter-Clockwise: North Mercer Roundabout
80th Avenue	63	9	41	77	77
27th Street	2	15	45	9	9
77th Avenue	27	10	45	81	9
North Mercer Way	66	16	45	81	81

Notes:
- Peak hour bus volumes are based on the worst operating peak hour condition during the day

Intersection Level-of-Service

An intersection LOS analysis was prepared for the study area intersections listed in section 2.2. A LOS standard of LOS 'C' or better was used for all intersections within the City of Mercer Island and a LOS standard of LOS 'E' or better was used for WSDOT intersections.

Under all of the scenarios, each intersection meets the LOS standards for their jurisdiction. This assumes the 77th Avenue/North Mercer Way and 80th Avenue/27th Street intersection mitigation documented in the East Link FEIS. All intersections operations are expected to be similar between the scenarios. The only intersection that is expected to see a change in LOS when compared to Scenario 1 is the intersection of the 80th Avenue/I-90 westbound HOV off-ramp, which drops from an LOS 'D' to an LOS 'E' for Scenarios 2 through 4. This is due to the increase in bus volume on and off Mercer Island.

Although mobility standards on Mercer Island are met, potential signal design considerations could include modifying the signals to include transit signal priority and/or provide a traffic signal at the 80th Avenue and the I-90 ramp interchange to reduce bus delay and improve service to the station. These signal design considerations were not included in the intersection analysis but could be considered as the design advances.

A summary table of the intersection level-of-service analysis results is provided in Appendix B.2.

Design Considerations

The design considerations criterion considers key design elements for each scenario. This included limited access and design guidance, right-of-way impacts, capital costs, and the quantity of bus spaces. An overall summary of the Design Considerations evaluation is provided in Table 5.

Design Standards

Design standards were considered for two different elements; if the concept meets WSDOT limited access and relevant agency design guidelines. Scenarios 1 and 2 both meet all limited access guidelines set forth by WSDOT. Scenarios 3 and 4 will both require that the limited access be adjusted per WSDOT design criteria due to the construction of roundabouts along 77th Avenue SE at either Sunset Way or North Mercer Way. Based on the conceptual design, no known deviations from agency design guidelines have been identified.

Right-of-Way

For Scenarios 1 and 2, no right-of-way will be taken since the existing roadways will be utilized for both scenarios. No right-of-way impacts are expected for either of these scenarios.

For Scenario 3, approximately 17,700 square of right-of-way will need to be acquired in the proximity of the existing 77th Avenue/Sunset Way intersection to acquire the necessary land to construct the proposed roundabout.

For Scenario 4, approximately 900 square of right-of-way from the acquired parcels north of North Mercer Way near the 77th Avenue intersection will be needed to construct the proposed roundabout

Capital Costs

Capital costs include roadway and utility modification, traffic signal installation, environmental mitigation, hazardous material removal cost, demolition cost, and professional services in addition to right-of-way costs.

For Scenario 1, the estimated capital costs associated with transit stop improvements and construction is estimated to be between $5.0-$6.0 million dollars.

Total capital costs associated with Scenario 2 are expected to be between $6.0-$7.0 million dollars.

For Scenario 3, an order of magnitude construction cost range of $13.0 -$18.0 million dollars is estimated. A large portion of the costs associated with this scenario include the right-of-way required to construct the roundabout at 77th Avenue/Sunset Way.

For Scenario 4, a capital cost range of $8.0 -$11.0 million dollars is estimated. A large portion of the costs associated with this scenario include the right-of-way required to construct the roundabout at 77th Avenue/North Mercer Way.

A summary of the capital cost calculations are provided in Appendix B.3.

Number of Bus Spaces at Stop/Layover Areas

The number of bus spaces, drop-off, pick-up and layover, was calculated for each scenario. The number of bus spaces per stop or layover area was calculated based on the linear feet proposed as part of design. These are indicated in the conceptual design drawings located in Appendix A.

Based on bus space information provided by KCM, a low and high estimate of the number of bus spaces that could be accommodated with each scenario is provided. These estimates assumed an initial bus entering a stop requires 145 feet of linear bus stop length. Each additional bus, if it is dependent adds 65 feet of stop distance while a bus requiring full independence adds 120 feet of stop distance. The low bus space value indicated in Table 4 represents the number of buses that would be accommodated with full independence and the high bus space number value represents the number of buses that would be accommodated with dependent operations.

Based on the calculations described above, Scenario 1 provides 1-2 articulated bus spaces that can be used for picking up or dropping off passengers, 3-5 articulated bus spaces that can be used for drop-off only, and an additional 4-7 articulated bus spaces at layover areas.

Scenario 2 provides 1-2 bus spaces that can be used for picking up or dropping off passengers, 2-3 articulated bus spaces that can be used for pick-up only, 4-7 articulated bus spaces that can be used for drop-off only, and an additional 4-7 articulated bus spaces at layover areas. The layover space in Scenario 2 is sufficient to meet the requirement of 5-7 layover articulated bus spaces that was documented in the Metro white paper that discussed bus operations on Mercer Island.

Scenario 3 provides 3-5 bus articulated bus spaces that can be used for picking up or dropping off passengers, 1-2 articulated bus spaces that can be used for pick-up only, and an additional 5-9 articulated bus spaces at layover areas. The layover space in Scenario 3 is sufficient to meet the requirement of 5-7 layover articulated bus spaces that was documented in the Metro white paper that discussed bus operations on Mercer Island.

Scenario 4 provides 1-2 articulated bus spaces that can be used for picking up or dropping off passengers, 3-5 articulated bus spaces that can be used for pick-up only, and an additional 3-4 articulated bus spaces at layover areas. The layover space in Scenario 4 is not sufficient to meet the requirement of 5-7 layover articulated bus spaces that was documented in the Metro white paper that discussed bus operations on Mercer Island.

Table 5. Design Criteria Evaluation Criteria

Measure	Scenario 1: Baseline (FEIS)	Scenario 2: Clockwise Bus Operations	Scenario 3: Counter-Clockwise Sunset Roundabout	Scenario 4: Counter-Clockwise North Mercer Roundabout
Design Standards: WSDOT Limited Access	No change to WSDOT limited access	No change to WSDOT limited access	Existing limited access will be adjusted per WSDOT design criteria	Existing limited access will be adjusted per WSDOT design criteria
Design Standards: Agency Roadway Guidelines	Met WSDOT Design Guideline except the left-turn pocket on 80th to EB I-90 which matches existing conditions	Met WSDOT Design Guideline except the left-turn pocket on 80th to EB I-90 which matches existing conditions	Met WSDOT Design Guideline except the left-turn pocket on 80th to EB I-90 which matches existing conditions	Met WSDOT Design Guideline except the left-turn pocket on 80th to EB I-90 which matches existing conditions
Right-of-way Taken	0 Square Feet	0 Square Feet	17,700 Square Feet	900 Square Feet
Capital Costs	$5.0 to $6.0 million	$6.0 to $7.0 million	$13.0 to $18.0 million	$8.0 to 11.0 million
# of Bus Spaces[1]	Pick-up/drop-off: 1-2 spaces Drop-off: 3-5 spaces Layover: 4-7 spaces	Pick-up/drop-off: 1-2 spaces Pick-up: 2-3 spaces Drop-off: 4-7 spaces Layover: 4-7 spaces	Pick-up/drop-off: 3-5 spaces Pick-up: 1-2 spaces Layover: 5-9 spaces	Pick-up/drop-off: 1-2 spaces Pick-up: 3-5 spaces Layover: 3-4 spaces

Notes:

1 - The number of spaces is stated as a range. The lower range represents the approximate number of bus spaces that can be accommodated with fully independent bus operations and the upper number represents the approximate number of bus spaces that can be accommodated with dependent bus operations. Each bus space is designed to accommodate an articulated bus.

Transit Operations

The transit operations criterion considers how the scenarios affect transit ridership and transit passenger travel times, the proximity of bus stops to the LRT station, including an estimate of number of street crossings between a bus and LRT transfer. The evaluation summary of the Transit Operations criteria is provided in Table 6.

Table 6. Transit Operations Impacts Evaluation Criteria

Measure	Scenario 1: Baseline (FEIS)	Scenario 2: Clockwise Bus Operations	Scenario 3: Counter-Clockwise Sunset Roundabout	Scenario 4: Counter-Clockwise N. Mercer Roundabout
Transit Ridership[1]:	I-90 Floating Bridge Eastbound: 7,750 Westbound: 6,000 **Total: 13,750** East Channel Bridge: Eastbound: 7,350 Westbound: 5,800 **Total: 13,150**	I-90 Floating Bridge Eastbound: 7,650 Westbound: 6,250 **Total: 13,900** East Channel Bridge: Eastbound: 7,350 Westbound: 6,250 **Total: 13,600**	I-90 Floating Bridge Eastbound: 7,650 Westbound: 6,250 **Total: 13,900** East Channel Bridge: Eastbound: 7,350 Westbound: 6,250 **Total: 13,600**	I-90 Floating Bridge Eastbound: 7,650 Westbound: 6,250 **Total: 13,900** East Channel Bridge: Eastbound: 7,350 Westbound: 6,250 **Total: 13,600**
Year 2030 Transit Riders Travel Time[2]	AM Peak Hour/WB: 24.1 Minutes PM Peak Hour/EB: 22.6 Minutes	AM Peak Hour/WB: 23.4 Minutes PM Peak Hour/EB: 19.5 Minutes	AM Peak Hour/WB: 23.8 Minutes PM Peak Hour/EB: 19.4 Minutes	AM Peak Hour/WB: 24.4 Minutes PM Peak Hour/EB: 19.5 Minutes
Bus Stop and LRT Station Proximity	Walk time: 1.0 - 1.9 Minutes Walk Distance 250 - 450 feet	Walk time: 1.0 - 1.9 Minutes Walk Distance 250 - 450 feet	Walk time: 1.0 - 1.9 Minutes Walk Distance 250 - 450 feet	Walk time: 1.0 - 2.6 Minutes Walk Distance 250 - 500 feet
I-90 Bus Route Rider Crossing Volume	250 pedestrians	0 pedestrians	0 pedestrians	1300 pedestrians

Notes:
1 - Transit ridership provided in this table represents the 3-hour PM peak period. The AM peak period is the same total number of transit riders, but occurs in the opposite directions.
2 - Measured between Eastgate P&R and the University Street Station

Transit Ridership

The year 2035 transit ridership forecasts were developed using Sound Transit's ridership model. For each scenario, the transit ridership was forecasted at two screenlines; 1) the I-90 floating bridge, and 2) the I-90 East Channel bridge located to the east of Mercer Island. Each of the transit forecasts provided both bus and LRT ridership estimates.

Scenario 1 transit ridership was based on forecasts provided in the East Link FEIS. Scenarios 2, 3, and 4 all utilized updated forecasts with the bus/LRT systems integration operating plan (with bus routes stopping at Mercer Island).

In Scenario 1, an estimated 13,750 transit riders would cross the I-90 bridge and 13,150 transit riders would cross the East Channel bridge during the 3-hour peak period. In

Scenarios, 2, 3 and 4, an estimated 13,900 transit riders would cross the I-90 bridge and 13,600 transit riders would cross the East Channel bridge during the 3-hour peak period.

The results of the transit ridership forecasts indicate that integrating the bus and LRT operations at Mercer Island would have little to no effect on the transit ridership across I-90 and results between any of the scenarios are similar.

Under the bus/LRT system integration operating plan, Metro routes 214, 215, 218, and 219 are expected to have sufficient capacity to accommodate the ridership demand Metro route 214 is expected to utilize 25% of its 2035 capacity, Metro route 215 is expected to utilize 66% of its 2035 capacity, and the combine capacity to the Issaquah Highland Park and Ride (Metro routes 218 and 219) is expected to utilize 87% of its 2035 capacity using the low integration plan estimate outlined in Metro's white paper. In addition, the East Link LRT system is expected to operate at 45-55% of its capacity in the peak hour in the peak direction by year 2035.

A summary table of total transit ridership by mode and a summary of bus capacities are provided in Appendix B.4 and B.5.

Regional Transit Riders Travel Time

A transit passengers travel time between the Eastgate Park and Ride and University Station in downtown Seattle was calculated for each scenario. Year 2030 travel times were based on information provided within the East Link FEIS, the East Link D2 roadway study (joint study between King County Metro and Sound Transit), and from the analysis that was conducted as part of this study. Travel times were reported for both the AM and PM peak direction, which is the westbound direction in the AM peak and the eastbound direction in the PM peak.

Year 2030 travel times for Scenario 1 during the AM westbound peak direction between Eastgate and University Station are expected to be 24.1 minutes and during the PM eastbound peak direction are 22.6 minutes. For Scenario 2, the AM westbound travel time is reduced to 23.4 minutes and the PM eastbound travel time is reduced to 19.5 minutes. For Scenario 3, the AM westbound travel time is 23.8 minutes and had similar travel time as Scenario 2 for the PM eastbound travel time, 19.4 minutes. For Scenario 4, the AM westbound travel time is 24.4 minutes and had the same travel time as Scenario 2 for the PM eastbound travel time, 19.5 minutes.

Overall, a transit rider in Scenarios 2 through 4 would experience up to 1.5 minutes of travel time savings in the AM peak period and up to 4 minutes of travel time savings in the PM peak period. Even though a bus-rail transfer is required at Mercer Island in Scenarios 2 through 4, the travel time savings by using LRT between Mercer Island and the University Station more than accounted for the slower travel times associated with routes in Scenario 1 travelling on surface streets in downtown Seattle.

Although mobility standards on Mercer Island, potential signal and design considerations could include modifying the signals to include transit signal priority and/or provide a traffic signal at the 80th Avenue and the I-90 ramp interchange to reduce bus delay and improve service to the station. These design considerations were not included in this travel time analysis but could be considered as the design advances.

A summary table of the transit rider travel times is provided in Appendix B.6.

Bus Stop and LRT Station Proximity

Pedestrian access and transfers between bus and LRT were assessed by calculating the walk distances and times between each bus stop (pick-up or drop-off) location and the LRT Station platform area. Since all of the scenarios generally have stops in the same or similar locations, no noticeable differences are found between the four scenarios.

For scenarios 1-3, the walk distance between the bus stops and LRT station platform area ranged between 250-450 feet. The corresponding walk time ranged between 1.0-1.9 minutes. Under scenario 4, the walk distance between the bus stops and LRT station platform area ranged between 250-500 feet. The corresponding walk time ranged between 1.0-2.6 minutes. The longer walk time for scenario 4 is due to pedestrians crossing N. Mercer Way and having to wait at the traffic signal.

This assessment did not include the layover areas as those are not active stops used by transit riders. A summary of the bus stop and LRT station walk distances and walk times are provided in Appendix B.7.

Additional Pedestrian Crossings from Bus/LRT Transfers

In order to assess the pedestrian's exposure to vehicle conflicts and pedestrian capacities, the number of pedestrian crossing a street due to the bus/LRT transfer were calculated for each scenario. A high number of pedestrian crossings could indicate a need for improvements at those locations.

For the purposes of this task, estimating pedestrians that would already cross North Mercer Way to/from the park-and-ride or riders transferring from a local Mercer Island bus route (stops on the north side of North Mercer Way) are not included since those pedestrians occur in every scenario. Only the pedestrians associated with a bus/LRT transfer from an I-90 route were included in this assessment.

For Scenario 1, it was determined that approximately 250 pedestrians in the peak hour would cross North Mercer Way between the I-90 bus routes stops and the LRT station. The majority of those passengers would be transferring from either Metro route 216 or ST route 554.

For Scenarios 2 and 3, it was determined that no pedestrians to/from an I-90 bus route would cross a Mercer Island public roadway to access LRT. The bus stop locations for I-90 bus routes are located on the same side of the street as the Mercer Island station plaza areas.

For Scenario 4, approximately 1,300 pedestrians in the peak hour would be required to cross North Mercer Way between the I-90 bus route stops and the LRT station. In this scenario, all transit riders transferring from a bus to an LRT in the AM peak period would be dropped off on the north side of North Mercer Way and thus would be required to cross North Mercer Way at the 80th Avenue intersection.

With such a high number of pedestrians present, potential improvements that could be considered to increase safety and capacity include creating a pedestrian "scramble" phase at North Mercer Way/80th Avenue intersection or provide wider crosswalk and larger waiting areas at the intersection corners to accommodate pedestrian's bunching and waiting for a walk signal.

5. Other Concepts Considered

In addition to the four scenarios that were evaluated as part of this study, several other concepts were discussed between the agencies. The sections below describe some of the other concepts that were considered, but not evaluated, as part of the East Link Bus/LRT Integration Study.

5.1. 80th Avenue Transit Center

The concept of a transit center located to the west of 80th Avenue between North Mercer Way and 27th Street was considered. The concept includes the creation of transit stops and layover space along 80th Avenue that is currently a roadway crossing connecting North Mercer island with the Town Center as well as designated park space.

The original 80th Avenue transit center concept outlined by King County Metro included right-turn only access to eastbound I-90 and right-turn only access from westbound I-90 and would also eliminate northbound and southbound through traffic along 80th Avenue. Because of potential concerns the City of Mercer Island, WSDOT and FHWA would have regarding the traffic volume impacts at this overcrossing as well as nearby intersections and freeway ramps associated with this concept, a modified version of this concept was developed to determine the footprint of the transit center, the number of bus bays that could be accommodated and any potential impacts to the signals at North Mercer Way and 27th Street.

With the revised concept, routes would utilize the 80th Avenue transit center from the westbound I-90 off-ramp to 80th Avenue by turning north on 80th Avenue and making a u-turn at the North Mercer Way intersection into the transit center. Bus routes would then have two lanes to drop-off and pick-up passengers as well as layover. After picking up passengers from the LRT station, buses would then proceed southbound through the transit center and make a u-turn to northbound 80th Avenue at the intersection of 27th Street. After making the u-turn, buses would then proceed eastbound to I-90 using the HOV on-ramp. Figure 6 shows a conceptual depiction of how the transit center operations could function.

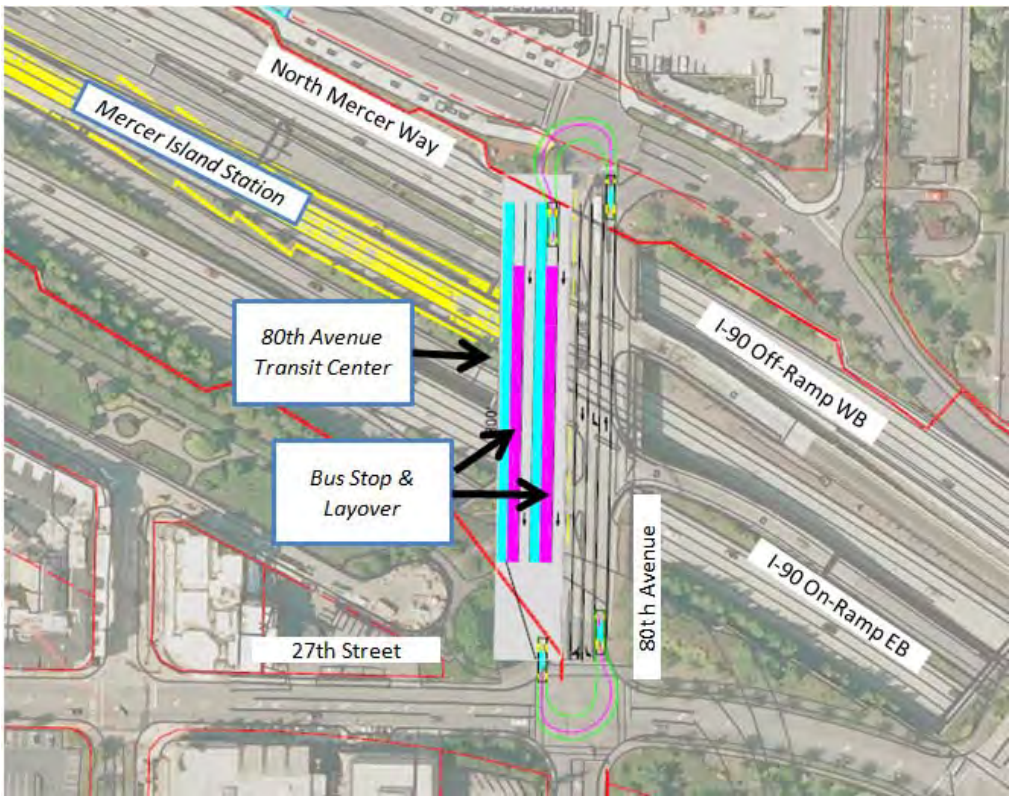


Figure 6. 80th Avenue Transit Center Concept

This concept was not incorporated into the evaluation for several reasons. Since the length of the two lanes could only accommodate up to three articulated buses each, it was determined that the total number of pick-up, drop-off, and layover spaces would similar to less than the amount provided in the scenarios already under evaluation. In conjunction, removing traffic lanes from 80th Avenue to accommodate more bus stop and layover spaces in the transit center would lead to traffic diversion from 80th Avenue to other parallel roadways such as 77th Avenue and Island Crest Way which would increase traffic volumes on those roads.

Other operational issues associated with this concept include the need to add a transit only signal at 80th Avenue and 27th Street and North Mercer Way to accommodate for bus u-turns and the potential for narrow travel lanes on 80th Avenue.

5.2. 76th Avenue/North Mercer Way Roundabout

Another concept that was considered was to create a roundabout at the intersection of 76th Avenue/North Mercer Way. Under this concept, buses would travel from the westbound I-90 HOV off-ramp to northbound 80th Avenue and turn left on North Mercer Way.

Buses could drop-off passengers along the north side of Mercer Way and then travel westbound on North Mercer Way until reaching 76th Avenue and then using the proposed roundabout to return back to the Mercer Island station area to layover or pick-up along the south side of North Mercer Way near the LRT station. After picking up passengers, bus routes would then travel along 80th Avenue and access I-90 via the eastbound HOV on-ramp.

Advantages of this concept could include an increased number of layover and bus stop spaces that can be used along North Mercer Way between 77th Avenue and 76th Avenue. Disadvantages of this concept include longer travel times for routes traveling on Mercer Island, potential design and grade issues for the roundabout at 76th Avenue, and the potential for a large number of passengers crossing North Mercer Way to access the LRT station from the north side of the street.

5.3. I-90 Off-Ramp Drop-Off Bus Stop

Under this concept, a bus drop-off area would be located along the westbound I-90 HOV off-ramp that would allow passengers to alight and access the LRT station by traveling under 80th Avenue in a new pedestrian underpass/walkway. This concept would require additional improvements on Mercer Island streets to allow for the turnaround of westbound routes in the opposite eastbound direction.

Advantages of this concept include eliminating pedestrian conflicts with vehicles and additional space for bus layover and pick-up stops for passengers transferring from LRT. With this concept, additional area on North Mercer Way could be used for layover or pick-up areas.

A disadvantage of this concept is the feasibility of constructing a pedestrian underpass from the westbound I-90 HOV off-ramp to the LRT station. There is limited clearance between the I-90 freeway mainline and the westbound HOV off-ramp, which would cause the construction of the undercrossing to be costly and/or infeasible. If this concept were to be considered it is expected that modifications to the freeway and/or the HOV ramps would be necessary to locate a pedestrian underpass beneath 80th Avenue.

5.4. Dual Roundabouts

This option could provide dual roundabouts along 77th Avenue at Sunset Way and North Mercer Way or provide dual roundabouts along North Mercer Way at 77th and 80th Avenue SE. This option could be included with Scenarios 3 or 4 if it is determined that the additional bus operations flexibility is necessary. An advantage of constructing dual roundabouts is the bus flexibility it provides bus routes and routing schemes. For the dual roundabout option along 77th Avenue SE, during the AM peak hour, routes can turnaround at the North Mercer Way roundabout, creating a shorter trip on Mercer Island streets. During the PM peak hour, routes could use the Sunset Way roundabout, which provides them with additional layover space on 77th Avenue. The disadvantage of this dual roundabout option is the extra costs and impacts associated with building two roundabouts within the study area.

With the dual roundabouts along North Mercer Way, routes will be allowed to pick-up and drop-off on the south side of North Mercer Way, while lying over on the north side of North Mercer Way. This additional flexibility may alleviate the need to use 77th Avenue as a stop or layover space. Potential disadvantages of dual roundabouts a 77th Avenue and 80th Avenue include increased congestion along North Mercer Way between 77th Avenue and 80th Avenue, potential impacts to the existing park and ride lot with the construction of a roundabout at the 80th Avenue SE, and pedestrian access from the park and ride lot to the LRT station.

6. Summary of Evaluation

Based on the evaluation results for the environmental criteria, Scenarios 1 and 2 have no additional impacts over what is presented in the East Link FEIS. Scenario 3 is expected to have some 4f impacts associated with the proposed roundabout at 77th Avenue/Sunset Way. Scenario 4 will require the acquisition of two single family residences to construct the proposed roundabout at 77th Avenue/North Mercer Way.

The transportation/traffic criteria shows that the amount of bus activity on Mercer Island streets is expected to increase for each of the systems integration plan scenarios (2, 3, and 4). Each of those scenarios is expected to have up to 45 buses during the peak hour and 340 buses throughout the day using Mercer Island streets. Scenario 1 is expected to have up to 19 buses during the peak hour and 200 buses throughout the day using Mercer Island streets. In terms of intersection operations, all scenarios are expected to have a similar level-of-service for the 8 intersections that were studied.

The design considerations criteria results show that Scenarios 1 and 2 are the lowest cost options and take the least amount of right-of-way. Scenario 3 is the highest cost option, but also provides the most amount of space that can be allocated to the bus drop-off, pick-up, and layover areas. Scenario 4 is the next highest cost option, but provides the least amount of bus drop-off, pick-up, and layover space.

The transit operations criteria results show that all scenarios are expected to have similar transit ridership across I-90 and similar walking times and distances between the bus stops and the LRT station platforms. In terms of regional transit travel times, Scenario 1 is expected to have the highest travel times (24.1 minutes during AM peak and 22.6 minutes during PM peak) while Scenario 2 is expected to have the lowest transit travel times. (23.4 minutes during the AM peak and 19.5 minutes during the PM peak). Scenarios 3 and 4 are expected to have similar regional travel times to Scenario 2.

In terms of pedestrian safety and level-of-service, Scenarios 2 and 3 are not expected to have any pedestrians crossing a Mercer Island public roadway to access the LRT from non-Mercer Island loop routes. Scenario 1 is expected to have approximately 250 pedestrians crossing a Mercer Island roadway, while Scenario 4 is expected to have the highest number of pedestrians, approximately 1300, crossing Mercer Island roadways.

Further, based on the results of evaluation presented in this report, the potential environmental impacts of all the scenarios are within the range of impacts that were disclosed in the Final EIS.

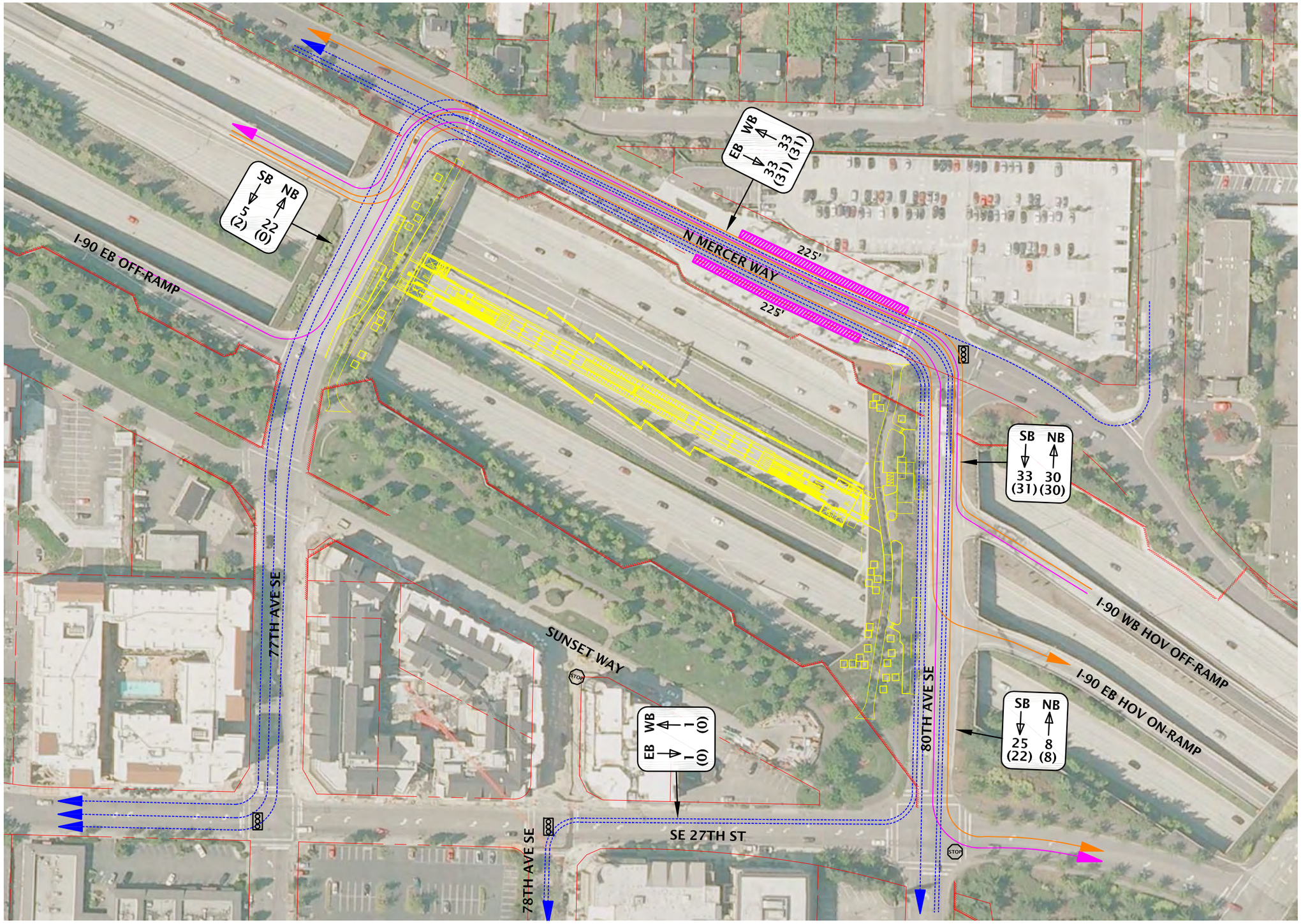
7. Next Steps

As this analysis is being completed there will continue to be discussion with the partnering agencies to identify a preferred concept for further engineering and design. The expectation is to develop a memorandum of understanding between the partnering agencies to work together on a preferred solution. Additionally a public open house is scheduled in July 2014 that would provide an opportunity for the community to comment on the scenarios and analysis documented in this study.

Appendix A:

Conceptual Design Drawings

Scenario 0: Existing Conditions
Scenario 1: East Link FEIS - Baseline
Scenario 2: Clockwise Bus Operations
Scenario 3: Counter-Clockwise Operations – Sunset Roundabout
Scenario 4: Counter-Clockwise Operations – North Mercer Way Roundabout



LEGEND

- EXISTING BUS STOP
- MERCER ISLAND EASTLINK STATION
- MERCER ISLAND LOOP ROUTES
- I-90/MERCER ISLAND ROUTES - AM PEAK HOUR
- I-90/MERCER ISLAND ROUTES - PM PEAK HOUR
- WSDOT ROW
- CITY ROW
- PEAK HOUR BUS VOLUMES
- EXISTING SIGNAL CONTROL
- EXISTING STOP CONTROL

NOTES:

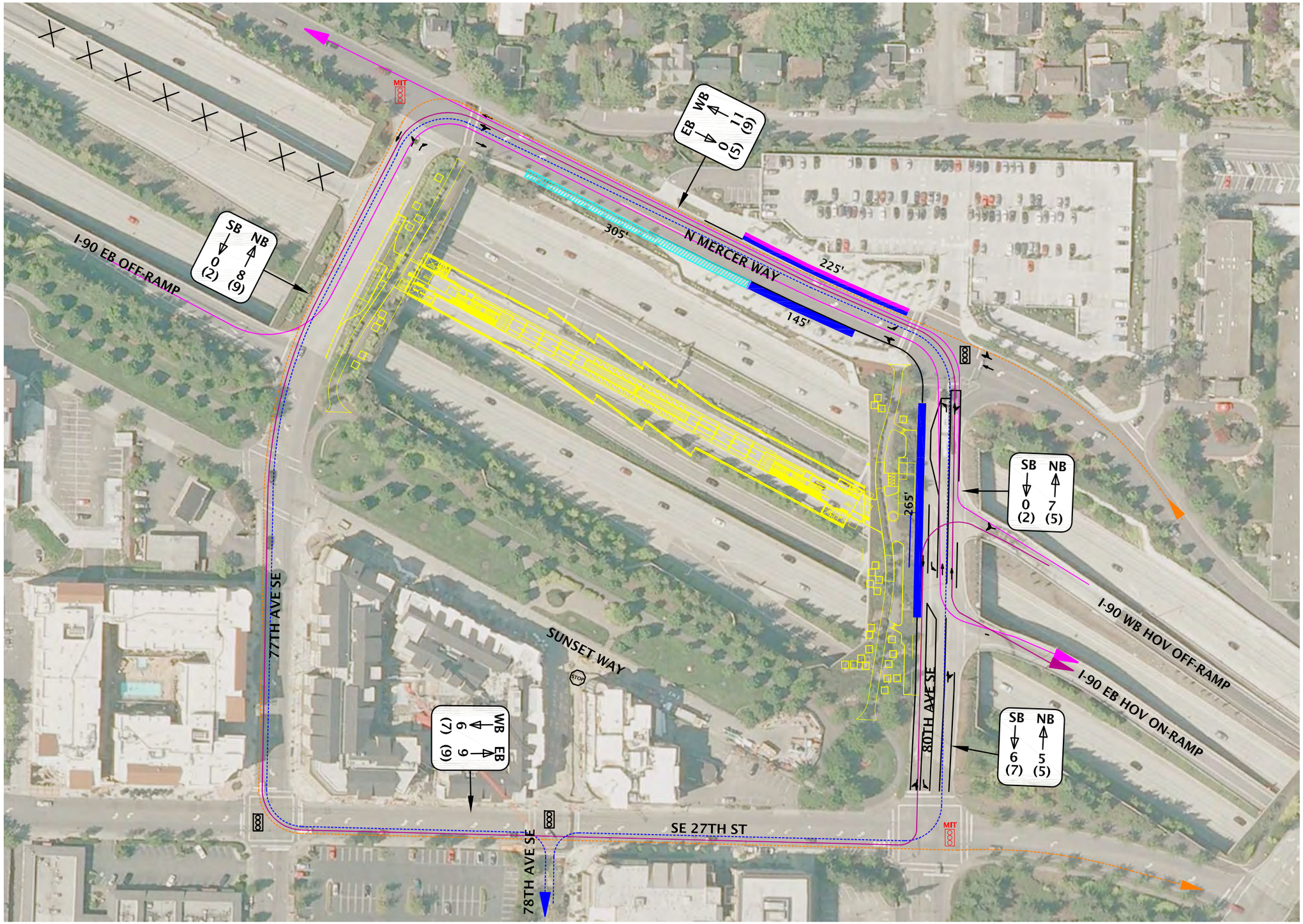
1. Bus Volumes are:
   X - AM Peak Hour
   (X) - PM Peak Hour

SOUNDTRANSIT

50' 25' 0' 50' 100'
HORIZONTAL SCALE

EASTLINK BUS/RAIL SYSTEMS INTEGRATION STUDY

Scenario 0 - Existing Conditions



LEGEND

- BUS DROP-OFF AREA
- BUS LAYOVER AREA
- BUS PICK UP
- MERCER ISLAND EASTLINK STATION
- MERCER ISLAND LOOP ROUTES
- MERCER ISLAND E/W LOOP
- KC METRO ROUTE 216
- SOUND TRANSIT ROUTE 554
- WSDOT ROW
- CITY ROW
- PEAK HOUR BUS VOLUMES
- MIT — EASTLINK FEIS PROPOSED MITIGATION
- EXISTING SIGNAL CONTROL
- STOP — EXISTING STOP CONTROL

NOTES:

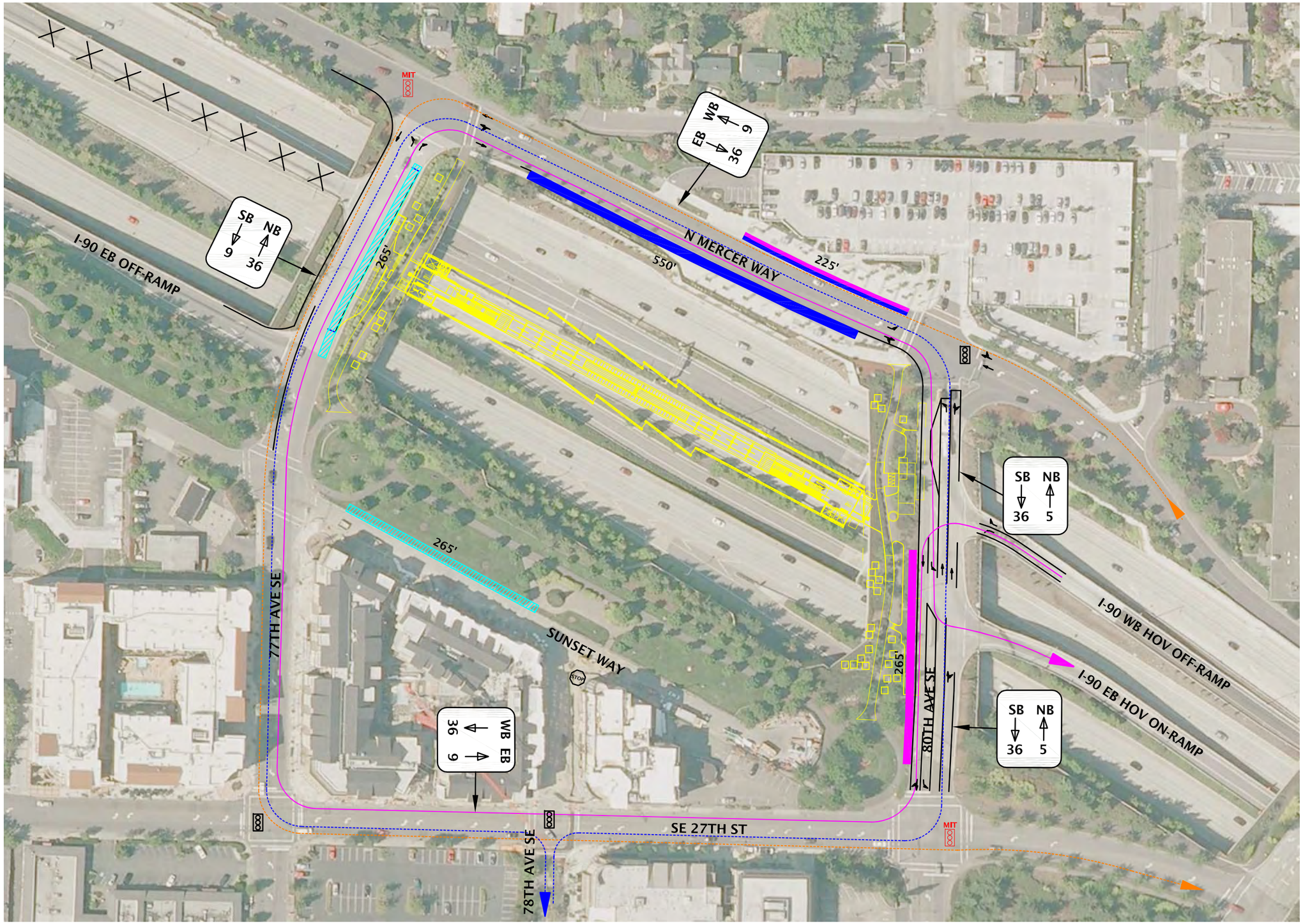
1. Bus Volumes are:
   X - AM Peak Hour
   (X) - PM Peak Hour

SOUNDTRANSIT

50' 25' 0' 50' 100'
HORIZONTAL SCALE

EASTLINK BUS/RAIL SYSTEMS INTEGRATION STUDY

Scenario 1 - Baseline Eastlink FEIS



LEGEND

- BUS DROP-OFF AREA
- BUS LAYOVER AREA
- BUS PICK UP
- MERCER ISLAND EASTLINK STATION
- MERCER ISLAND LOOP ROUTES
- MERCER ISLAND E/W LOOP
- KC METRO ROUTE 216
- SOUND TRANSIT ROUTE 554
- WSDOT ROW
- CITY ROW
- PEAK HOUR BUS VOLUMES
- MIT — EASTLINK FEIS PROPOSED MITIGATION
- EXISTING SIGNAL CONTROL
- STOP — EXISTING STOP CONTROL

NOTES:

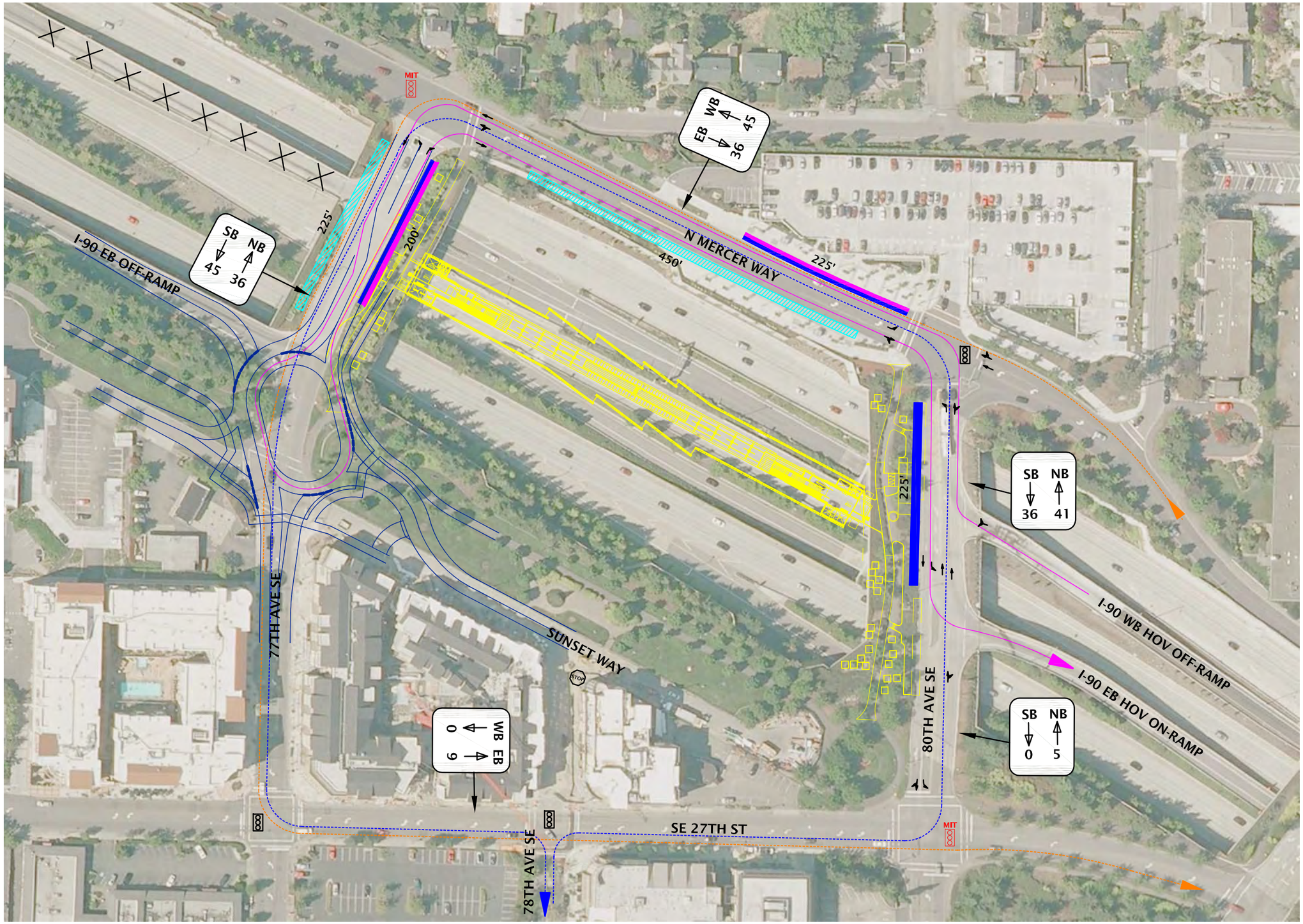
1. Bus Volumes are the same for AM and PM Peak Hours

SOUNDTRANSIT

50' 25' 0' 50' 100'
HORIZONTAL SCALE

EASTLINK BUS/RAIL SYSTEMS INTEGRATION STUDY

Scenario 2 - Clockwise Bus Operations



LEGEND

- BUS DROP-OFF AREA
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- BUS PICK UP
- MERCER ISLAND EASTLINK STATION
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- CITY ROW
- PEAK HOUR BUS VOLUMES
- MIT — EASTLINK FEIS PROPOSED MITIGATION
- EXISTING SIGNAL CONTROL
- STOP — EXISTING STOP CONTROL
- PROPOSED ROUNDABOUT

NOTES:

1. Bus Volumes are the same for AM and PM Peak Hours

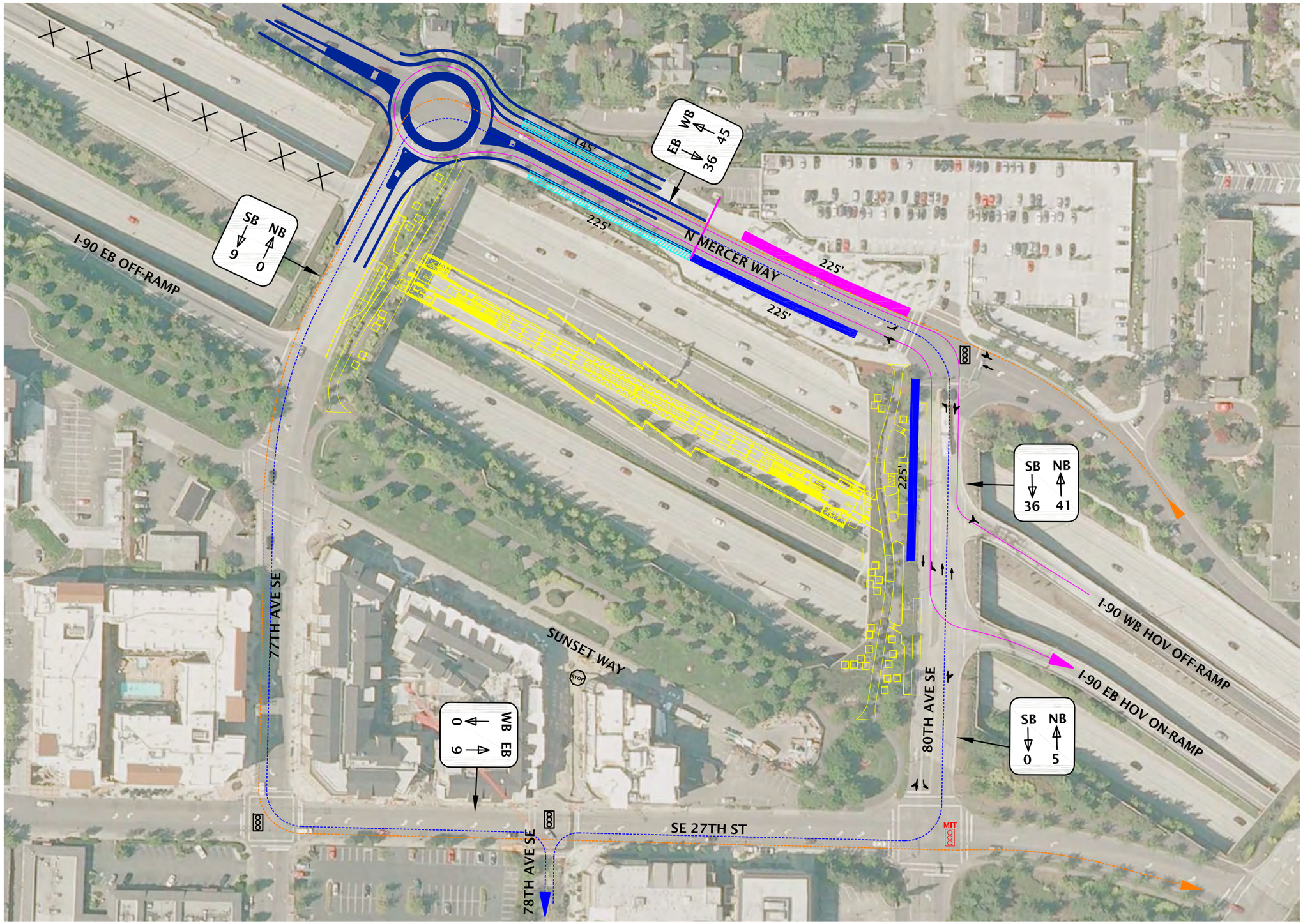
SOUNDTRANSIT

50' 25' 0' 50' 100'
HORIZONTAL SCALE

EASTLINK BUS/RAIL SYSTEMS INTEGRATION STUDY

Scenario 3 - Counter-Clockwise Bus Operations

Sunset Way Roundabout



LEGEND

- BUS DROP-OFF AREA
- BUS LAYOVER AREA
- BUS PICK UP
- MERCER ISLAND EASTLINK STATION
- MERCER ISLAND LOOP ROUTES
- MERCER ISLAND E/W LOOP
- KC METRO ROUTE 216
- SOUND TRANSIT ROUTE 554
- WSDOT ROW
- CITY ROW
- PEAK HOUR BUS VOLUMES
- MIT EASTLINK FEIS PROPOSED MITIGATION
- EXISTING SIGNAL CONTROL
- STOP EXISTING STOP CONTROL
- PROPOSED ROUNDABOUT

NOTES:

1. Bus Volumes are the same for AM and PM Peak Hours

SOUNDTRANSIT

50' 25' 0' 50' 100'
HORIZONTAL SCALE

EASTLINK BUS/RAIL SYSTEMS INTEGRATION STUDY

Scenario 4 - Counter-Clockwise Bus Operations

North Mercer Way Roundabout

Appendix B:

Analysis Results to Support Evaluation Framework

Appendix B.1 – Bus Volume Summary
Appendix B.2 – Intersection Level-of-Service
Appendix B.3 – Capital Cost Estimates
Appendix B.4 – Ridership Summary
Appendix B.5 – Bus Capacity Calculations
Appendix B.6 – Transit Rider Travel Time Summary
Appendix B.7 – Pedestrian Access
Appendix B.8 – Evaluation Criteria Table
Appendix B.9 – Noise Memo

Appendix B.1 - Eastlink Bus/LRT Systems Integration Study

Mercer Island and I-90 Peak Hour and Daily Bus Volumes

		Existing				2030 East Link FEIS				2030 Bus/LRT Systems Integration			
Route	Service	Stops on MI	AM Peak Volume	PM Peak Volume	Daily Volume	Stops on MI	AM Peak Volume	PM Peak Volume	Daily Volume	Stops on MI	AM Peak Volume	PM Peak Volume	Daily Volume
111	Renton/Newcastle	No	3	2	16	No	3	2	16	Reoriented to Downtown Bellevue			
114	Renton/Newcastle	No	2	2	9	No	2	2	9	Reoriented to Downtown Bellevue			
201	Mercer Island	Yes	1	0	2	Yes	1	1	2	Yes	1	1	2
202	Mercer Island	Yes	2	2	12	Deleted				Deleted			
203	Mercer Island	Yes	3	1	9	Yes	2	2	9	Yes	2	2	9
204	Mercer Island	Yes	0	0	30	Yes	4	4	30	Yes	4	4	30
205	Mercer Island	Yes	1	1	7	Yes	1	1	7	Deleted			
210	Issaquah	No	2	2	8	No	1	2	8	Deleted			
211	Issaquah	Yes	2	2	14	Deleted				Deleted			
212	Eastgate	No	9	7	44	No	10	10	55	I-90 Routes to serve Eastgate			
213	Mercer Island	Yes	0	0	0	Yes	2	2	9	Yes	2	2	9
214	Issaquah	No	3	4	24	No	3	4	24	Yes	16	16	128
215	Snoqualmie/N. Bend	No	2	2	10	Deleted				Yes	4	4	32
216	Issaquah/Sammmish	Yes	2	3	12	Yes	2	2	12	Replaced with 219			
217	Issaquah	No	3	0	6	Deleted				Deleted			
218	Issaquah/Sammmish	No	4	6	20	No	9	4	26	Yes	8	8	64
219	Issaquah/Sammmish	No	2	4	10	No	2	0	10	Yes	8	8	64
550	Bellevue	Yes	18	18	181	Replaced by Eastlink				Replaced by Eastlink			
554	Issaquah/Sammmish	Yes	4	4	85	Yes	6	7	128	Reoriented to Downtown Bellevue			
Total			**63**	**60**	**499**		**48**	**43**	**345**		**45**	**45**	**338**
Buses that Stop on Mercer Island			***33***	***31***	***352***		***18***	***19***	***197***		***45***	***45***	***338***
Buses that Do Not Stop on Mercer Island			***30***	***29***	***147***		***30***	***24***	***148***		***0***	***0***	***0***

Appendix B.2 - Eastlink Bus/LRT Systems Integration Study

2030 Intersection Level-of-Service for AM/PM Peak Hour

	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	East Link FEIS			Clockwise Bus Operations			Counter-Clockwise: Sunset Roundabout			Counter-Clockwise: North Mercer Roundabout		
Intersection	Traffic Control	AM LOS	PM LOS	Traffic Control	AM LOS	PM LOS	Traffic Control	AM LOS	PM LOS	Traffic Control	AM LOS	PM LOS
80th Ave and I-90 HOV Off-ramp	Stop	B	D	Stop	B	E	Stop	C	E	Stop	C	E
80th Ave and I-90 HOV On-ramp	Stop	A	A	Stop	A	A	Stop	A	A	Stop	A	A
80th Ave and SE 27th St	Signal	A	B	Signal	A	B	Signal	A	B	Signal	A	B
SE 27th St and 77th Ave	Signal	A	B	Signal	A	B	Signal	B	B	Signal	A	B
77th Ave and Sunset Hwy	Stop	C	C	Stop	C	C	Roundabout	A	B	Stop	C	C
77th Ave and I-90 Eastbound Off-ramp	Stop	B	C	Stop	B	C	Stop	B	C	Stop	B	C
77th Ave and N Mercer Way	Signal	A	B	Signal	A	B	Signal	A	B	Roundabout	A	B
N Mercer Way and 80th Ave	Signal	B	B	Signal	B	B	Signal	B	C	Signal	B	C

Notes:

- HCM 2000 methodology used for analysis procedures to be consistent with Eastlink FEIS methodologies
- WSDOT Level-of-Service Standard is LOS E
- City of Mercer Island Level-of-Service Standard is LOS C
- All scenarios assume Eastlink FEIS mitigation, including signal at 77th/North Mercer for Scenarios 1-3 and signal at 27th/80th for all scenarios
- Additional channelization improvments assumed at 80th and I-90 HOV off-ramp to faciliate westbound left turn bus movements (shaded)

Appendix B.3 - Eastlink Bus/LRT Systems Integration Study

Capital Costs Calculation per Scenario

Alternative Summary	Construction Subtotal	"Grand" Subtotal	ROW Cost Low	ROW Cost High	Reported Cost Range Low	Reported Cost Range High	
Scenario 1	$3,322,856	$5,183,655	$0	$0	$5,000,000	$6,000,000	
Subtotal	**$3,322,856**	**$5,183,655**	**$0**	**$0**	**$5.00**	**$6.00**	**(Million)**
Scenario 2	$3,856,749	$6,016,528	$0	$0	$6,000,000	$7,000,000	
Subtotal	**$3,856,749**	**$6,016,528**	**$0**	**$0**	**$6.00**	**$7.00**	**(Million)**
Scenario 3	$7,696,036	$12,005,817	$2,575,204	$3,484,100	$13,000,000	$18,000,000	
Subtotal	**$7,696,036**	**$12,005,817**	**$2,575,204**	**$3,484,100**	**$13.00**	**$18.00**	**(Million)**
Scenario 4	$4,789,685	$7,471,908	$1,488,053	$2,013,248	$8,000,000	$11,000,000	
Subtotal	**$4,789,685**	**$7,471,908**	**$1,488,053**	**$2,013,248**	**$8.00**	**$11.00**	**(Million)**

Appendix B.4 - Eastlink Bus/LRT Systems Integration Study

Transit Ridership Summary: PM Peak 3-Hour Period

Screenline: I-90 Floating Bridge

Mode	2011 Existing ST Ridership Model	2035 ST Ridership Eastlink FEIS Preferred	2035 ST Ridership Eastlink Bus/LRT Integration	[Bus/LRT Integration] - [Eastlink Preferred] Absolute	%
LRT-EB	0	6307	7635	1328	21%
LRT-WB	0	5792	6250	458	8%
LRT-Total	0	12099	13885	1786	15%
Bus-EB	3426	1454	0	-1454	n/a
Bus-WB	865	175	0	-175	n/a
Bus-Total	4291	1629	0	-1629	n/a
Total-EB	3426	7761	7635	-126	-2%
Total-WB	865	5967	6250	283	5%
Total-Summary	4291	13728	13885	157	1%

Screenline: I-90 East Channel

Mode	2011 Existing ST Ridership Model	2035 ST Ridership Eastlink FEIS Preferred	2035 ST Ridership Eastlink Bus/LRT Integration	[Bus/LRT Integration] - [Eastlink Preferred] Absolute	%
LRT-EB	0	5882	5405	-477	-8%
LRT-WB	0	5626	5428	-198	-4%
LRT-Total	0	11508	10833	-675	-6%
Bus-EB	3018	1456	1954	498	n/a
Bus-WB	808	175	827	652	373%
Bus-Total	3826	1631	2781	1150	71%
Total-EB	3018	7338	7359	21	0%
Total-WB	808	5801	6255	454	8%
Total-Summary	3826	13139	13614	475	4%

Appendix B.5 - Eastlink Bus/LRT Systems Integration Study

Bus Capacity and Ridership Summary: Peak 3-Hour Direction

Peak Direction 3 Hour Summary

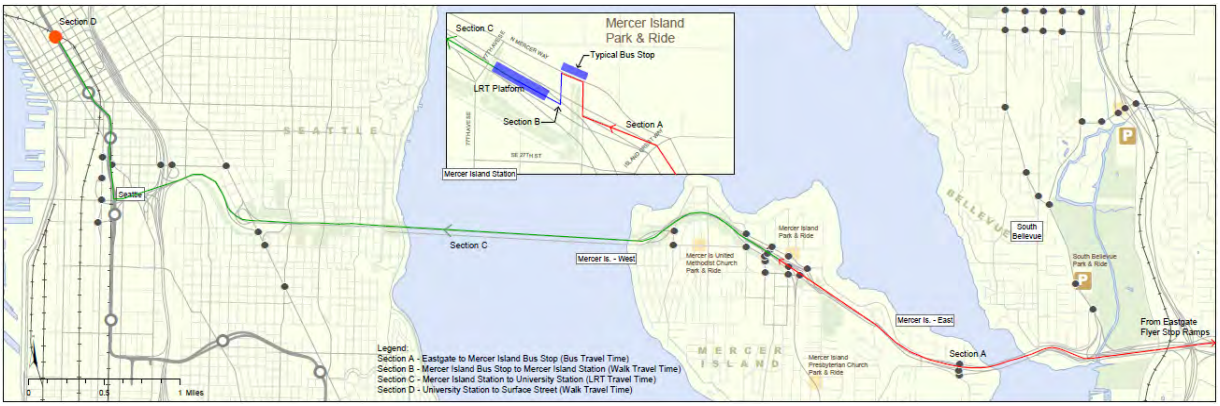
Route Number	Service	Seats Per Bus	Headway	Peak Direction Bus Volume	Peak Direction Capacity (seats)	2035 Sound Transit Ridership Model	
						Peak Demand	% Utilization
204	Mercer I.	42	1 bus @15 min	12	504	n/a	n/a
214	Issaquah	63	2 buses @ 8 min	48	3024	755	25.0%
215	Snoqualmie/N. Bend	60	1 bus @15 min	12	720	475	66.0%
218	Issaquah/Sammmish	63	1 bus @ 8 min	24	1512	1663	110.0%
219	Issaquah/Sammmish	60	1 bus @ 8 min	24	1440	899	62.4%
				Total	**7200**	**3792**	**52.7%**
	Ridership By Market		Issaquah Highlands P&R		2952	2562	86.8%

Notes:

- Ridership forecasts includes % adjustment based on King County Metro existing field data
- Peak direction corresponds to Westbound AM Peak period and Eastbound PM Peak period

Appendix B.6 - Eastlink Bus/LRT Systems Integration Study

2030 Transit Rider Peak Direction Travel Times: University Station to Eastgate



Westbound: AM Peak Hour

Scenario 1: WB Bus Only (FEIS)

Section	Start	End	Source	Time (min)	
A&B	Eastgate	Mercer Island Station (approx)	Eastlink FEIS	5.2	No Stops on Mercer Island
C&D	Mercer Island Station (approx)	University Station	D2 Study	18.9	via Rainier/Dearborn - at surface streets
			Total	**24.1**	

Scenario 2: Clockwise Bus Operations

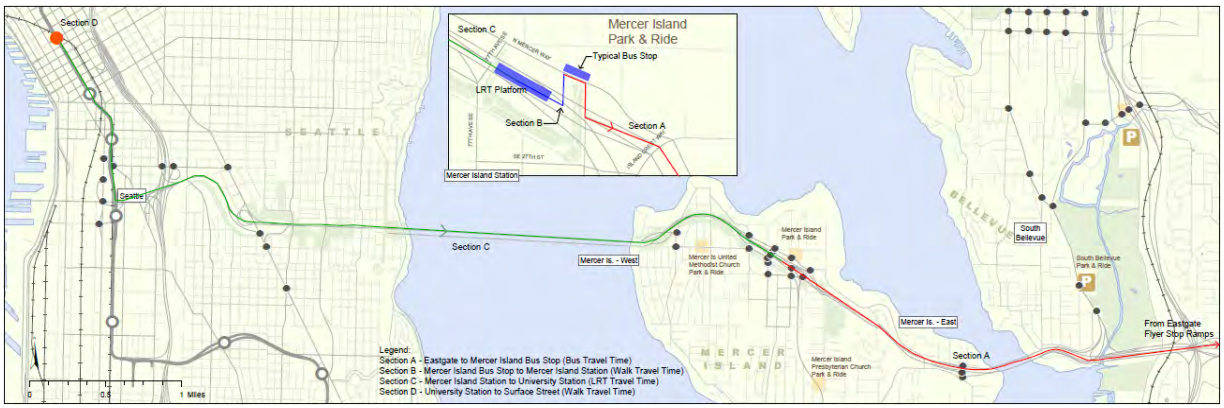
Section	Start	End	Source	Time (min)	
A	Eastgate	Mercer Island Bus Stop	Eastlink FEIS	6.4	Assumes stop on west side of 80th Avenue
B	Merer Island Bus Stop	Mercer Island Station	D2 Study	5.0	Transfer Time (includes walk and waiting time)
C	Mercer Island Station	University Station	D2 Study	11.0	Via LRT
D	University Station	Surface Streets	Calculated	1.0	Via Walk
			Total	**23.4**	

Scenario 3: Counterclockwise - 77th/Sunset Roundabout

Section	Start	End	Source	Time (min)	
A	Eastgate	Mercer Island Bus Stop	Eastlink FEIS	6.8	Assumes stop at north side of N. Mercer Way
B	Merer Island Bus Stop	Mercer Island Station	D2 Study	5.0	Transfer Time (includes walk and waiting time)
C	Mercer Island Station	University Station	D2 Study	11.0	Via LRT
D	University Station	Surface Streets	Calculated	1.0	Via Walk
			Total	**23.8**	

Scenario 4: Counterclockwise - 77th/North Mercer Roundabout

Section	Start	End	Source	Time (min)	
A	Eastgate	Mercer Island Bus Stop	Eastlink FEIS	7.4	Assumes stop at east side of 77th Avenue
B	Merer Island Bus Stop	Mercer Island Station	D2 Study	5.0	Transfer Time (includes walk and waiting time)
C	Mercer Island Station	University Station	D2 Study	11.0	Via LRT
D	University Station	Surface Streets	Calculated	1.0	Via Walk
			Total	**24.4**	



Eastbound: PM Peak Hour

Scenario 1: EB Bus Only (FEIS)

Section	Start	End	Source	Time (min)	
A&B	University Station	Mercer Island Station (approx)	D2 Study	17.0	Assume EB D2 Use w/3rd Bus Lane - Load on Surface street
C&D	Mercer Island Station (approx)	Eastgate	Eastlink FEIS	5.6	
			Total	**22.6**	

Scenario 2: Clockwise Bus Operations

Section	Start	End	Source	Time (min)	
A	Surface Street	University Station	Calculated	1.0	Via Walk
B	University Station	Mercer Island Station	D2 Study	10.5	via LRT
C	Mercer Island Station	Mercer Island Bus Stop	D2 Study	2.5	Transfer Time (assumes bus matches LRT schedule)
D	Mercer Island Bus Stop	Eastgate	Eastlink FEIS	5.5	Assumes pick up stop at N. Mercer Way
			Total	**19.5**	

Scenario 3: Counterclockwise - 77th/Sunset Roundabout

Section	Start	End	Source	Time (min)	
A	Surface Street	University Station	Calculated	1.0	Via Walk
B	University Station	Mercer Island Station	D2 Study	10.5	via LRT
C	Mercer Island Station	Mercer Island Bus Stop	D2 Study	2.5	Transfer Time (assumes bus matches LRT schedule)
D	Mercer Island Bus Stop	Eastgate	Eastlink FEIS	5.4	Assumes pick up stop at N. Mercer Way
			Total	**19.4**	

Scenario 4: Counterclockwise - 77th/North Mercer Roundabout

Section	Start	End	Source	Time (min)	
A	Surface Street	University Station	Calculated	1.0	Via Walk
B	University Station	Mercer Island Station	D2 Study	10.5	via LRT
C	Mercer Island Station	Mercer Island Bus Stop	D2 Study	2.5	Transfer Time (assumes bus matches LRT schedule)
D	Mercer Island Bus Stop	Eastgate	Eastlink FEIS	5.5	Assumes pick up stop at N. Mercer Way
			Total	**19.5**	

Appendix B.7 - Eastlink Bus/LRT Systems Integration Study

Bus Stop Location and Rider Accessibility

	Distance to LRT Plaza (feet)	Number of Street Crossings	Walk Time (min)
Bus Stop A	500	1	2.6
Bus Stop B	450	0	1.9
Bus Stop C	250	0	1.0
Bus Stop D	250	0	1.0

Notes:

- Assumes walking speed of 4 feet/second

Updated June 5, 2014

Appendix B.8 - Eastlink Bus/LRT Systems Integration Study: Evaluation Criteria Table

Criteria	Measure	Scenario 1: Baseline (FEIS)	Scenario 2: Clockwise Bus Operations	Scenario 3: Counter-Clockwise Sunset Roundabout	Scenario 4: Counter-Clockwise N. Mercer Roundabout
Environmental	Air	No impacts	No impacts	No impacts	No impacts
	Noise	No Impacts	No Impacts	No Impacts	No Impacts
	Acquisitions	No impacts	No impacts	No impacts	2 Single Family Residences
	Section 4f/Parks	No impacts	No impacts	0.6 acre	No impacts
	Historical	None	None	None	None anticipated, must be confirmed with DAHP
Transportation Impacts	Bus Activity on Mercer Island	AM peak hour: 18 buses PM peak hour: 19 buses Daily: 200 buses	AM peak hour: 45 buses PM peak hour: 45 buses Daily: 340 buses	AM peak hour: 45 buses PM peak hour: 45 buses Daily: 340 buses	AM peak hour: 45 buses PM peak hour: 45 buses Daily: 340 buses
	Intersection LOS	AM Peak Hour: - All 8 study int. operate better than LOS C PM Peak Hour: - 7 intersections better than LOS C - 1 WSDOT int. at LOS D - All intersections meet standards	AM Peak Hour: - All 8 study int. operate better than LOS C PM Peak Hour: - 7 Intersections better than LOS C - 1 WSDOT Int. at LOS E - All intersections meet standards	AM Peak Hour: - All 8 study int. operate better than LOS C PM Peak Hour: - 7 Intersections better than LOS C - 1 WSDOT Int. at LOS E - All intersections meet standards	AM Peak Hour: - All 8 study int. operate better than LOS C PM Peak Hour: - 7 Intersections better than LOS C - 1 WSDOT Int. at LOS E - All intersections meet standards

Appendix B.8 - Eastlink Bus/LRT Systems Integration Study: Evaluation Criteria Table

Criteria	Measure	Scenario 1: Baseline (FEIS)	Scenario 2: Clockwise Bus Operations	Scenario 3: Counter-Clockwise Sunset Roundabout	Scenario 4: Counter-Clockwise N. Mercer Roundabout
Design Considerations	Design Standards: WSDOT Limited Access	No change to WSDOT limited access	No change to WSDOT limited access	Existing limited access will be adjusted per WSDOT design criteria	Existing limited access will be adjusted per WSDOT design criteria
	Design Standards: Agency Roadway Guidelines	Met WSDOT Design Guideline except the left-turn pocket on 80th to EB I-90 which matches existing conditions	Met WSDOT Design Guideline except the left-turn pocket on 80th to EB I-90 which matches existing conditions	Met WSDOT Design Guideline except the left-turn pocket on 80th to EB I-90 which matches existing conditions	Met WSDOT Design Guideline except the left-turn pocket on 80th to EB I-90 which matches existing conditions
	Right-of-way Taken	0 Square Feet	0 Square Feet	17,700 Square Feet	900 Square Feet
	Capital Costs	$5.0 to $6.0 million	$6.0 to $7.0 million	$13.0 to $18.0 million	$8.0 to 11.0 million
	# of Bus Spaces[1]	Pick-up/drop-off: 1-2 spaces Drop-off: 3-5 spaces Layover: 4-7 spaces	Pick-up/drop-off: 1-2 spaces Pick-up: 2-3 spaces Drop-off: 4-7 spaces Layover: 4-7 spaces	Pick-up/drop-off: 3-5 spaces Pick-up: 1-2 spaces Layover: 5-9 spaces	Pick-up/drop-off: 1-2 spaces Pick-up: 3-5 spaces Layover: 3-4 spaces

Appendix B.8 - Eastlink Bus/LRT Systems Integration Study: Evaluation Criteria Table

Criteria	Measure	Scenario 1: Baseline (FEIS)	Scenario 2: Clockwise Bus Operations	Scenario 3: Counter-Clockwise Sunset Roundabout	Scenario 4: Counter-Clockwise N. Mercer Roundabout
Transit Operations	Transit Ridership[1]:	I-90 Floating Bridge Eastbound: 7,750 Westbound: 6,000 **Total: 13,750** East Channel Bridge: Eastbound: 7,350 Westbound: 5,800 **Total: 13,150**	I-90 Floating Bridge Eastbound: 7,650 Westbound: 6,250 **Total: 13,900** East Channel Bridge: Eastbound: 7,350 Westbound: 6,250 **Total: 13,600**	I-90 Floating Bridge Eastbound: 7,650 Westbound: 6,250 **Total: 13,900** East Channel Bridge: Eastbound: 7,350 Westbound: 6,250 **Total: 13,600**	I-90 Floating Bridge Eastbound: 7,650 Westbound: 6,250 **Total: 13,900** East Channel Bridge: Eastbound: 7,350 Westbound: 6,250 **Total: 13,600**
	Transit Travel Time: Regional[2]	AM Peak Hour/WB: 24.1 Minutes PM Peak Hour/EB: 22.6 Minutes	AM Peak Hour/WB: 23.4 Minutes PM Peak Hour/EB: 19.5 Minutes	AM Peak Hour/WB: 23.8 Minutes PM Peak Hour/EB: 19.4 Minutes	AM Peak Hour/WB: 24.4 Minutes PM Peak Hour/EB: 19.5 Minutes
	Bus Stop and LRT Station Proximity	Walk time: 1.0 - 1.9 Minutes Walk Distance 250 - 450 feet	Walk time: 1.0 - 1.9 Minutes Walk Distance 250 - 450 feet	Walk time: 1.0 - 1.9 Minutes Walk Distance 250 - 450 feet	Walk time: 1.0 - 2.6 Minutes Walk Distance 250 - 500 feet
	Additional Peds. Crossing from Bus/LRT Transfers	250 pedestrians	0 pedestrians	0 pedestrians	1300 pedestrians

Notes:

1 - The number of spaces is stated as a range. The lower range represents the approximate number of buses that can be accommodated with fully independent operations and the upper number represents the approximate number of buses that can be accommodated with dependent operations. Each bus space is designed to accommodate an articulated bus.

Michael Minor & Associates
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Portland, Oregon 97202
503.220.0495 ~ fax 866.847.0495

June 19, 2014

To:	Elma Borbe/Sound Transit
From:	Michael Minor/Michael Minor & Associates
Project:	East Link Bus/LRT System Integration Study
Subject:	Noise Analysis

1.0 Summary

As part of the East Link Bus/Light Rail Transit (LRT) System Integration study, this noise analysis has been prepared. The intent of the study to develop and evaluate a range of scenarios of an integrated King County Metro (Metro), Sound Transit (ST) bus system, and East Link Extension service at the Mercer Island Station. The objective is to ensure long-term reliability and an opportunity to increase transit service within the corridor.

Potential noise levels from revised transit operations for the different scenarios at the Mercer Island Station were evaluated using the methods from the Federal Transit Administration (FTA) to assure compliance with applicable noise regulations. The evaluation found that future noise levels under the four different scenarios are similar to the existing noise levels in the area. The day-night sound levels (L_{dn}) are not predicted to increase by more than 0 to 1 A-weighted decibels (dBA) L_{dn}. Given that no noise impacts were identified, no project-related noise mitigation is required.

2.0 Introduction

This memorandum summarizes the noise analysis performed for the bus operational scenarios evaluated at Mercer Island.. Two types of analysis were completed:

- Analysis of changes in bus traffic using FTA and state criteria
- Analysis of changes in roadway alignments using FHWA criteria

The analysis follows the FTA general assessment for a transit system analysis (FTA, 2006) and FHWA and WSDOT regulations for traffic analysis (23 Code of Federal Regulations [CFR] 772 and Washington State Department of Transportation [WSDOT], 2011).

3.0 Project Description

The objective of the project is to integrate the transit routes along I-90 with the East Link LRT system by creating an area on Mercer Island that allows bus riders to transfer to the East Link Station and vice-versa. Inherent to this integration is that bus routes traveling on I-90 to and from the eastside communities would terminate at the Mercer Island Station and not continue west into downtown Seattle.

As part of this, new transit circulation patterns are proposed. There are three different patterns under review in this analysis which are compared to maintaining bus service between the eastside and Seattle, which is what was analyzed in the East Link Final Environmental Impact Statement. The four circulation scenarios and associated roadway improvements are provided on Figures 1 through 4.

Figure 1. Bus Circulation Scenario 1

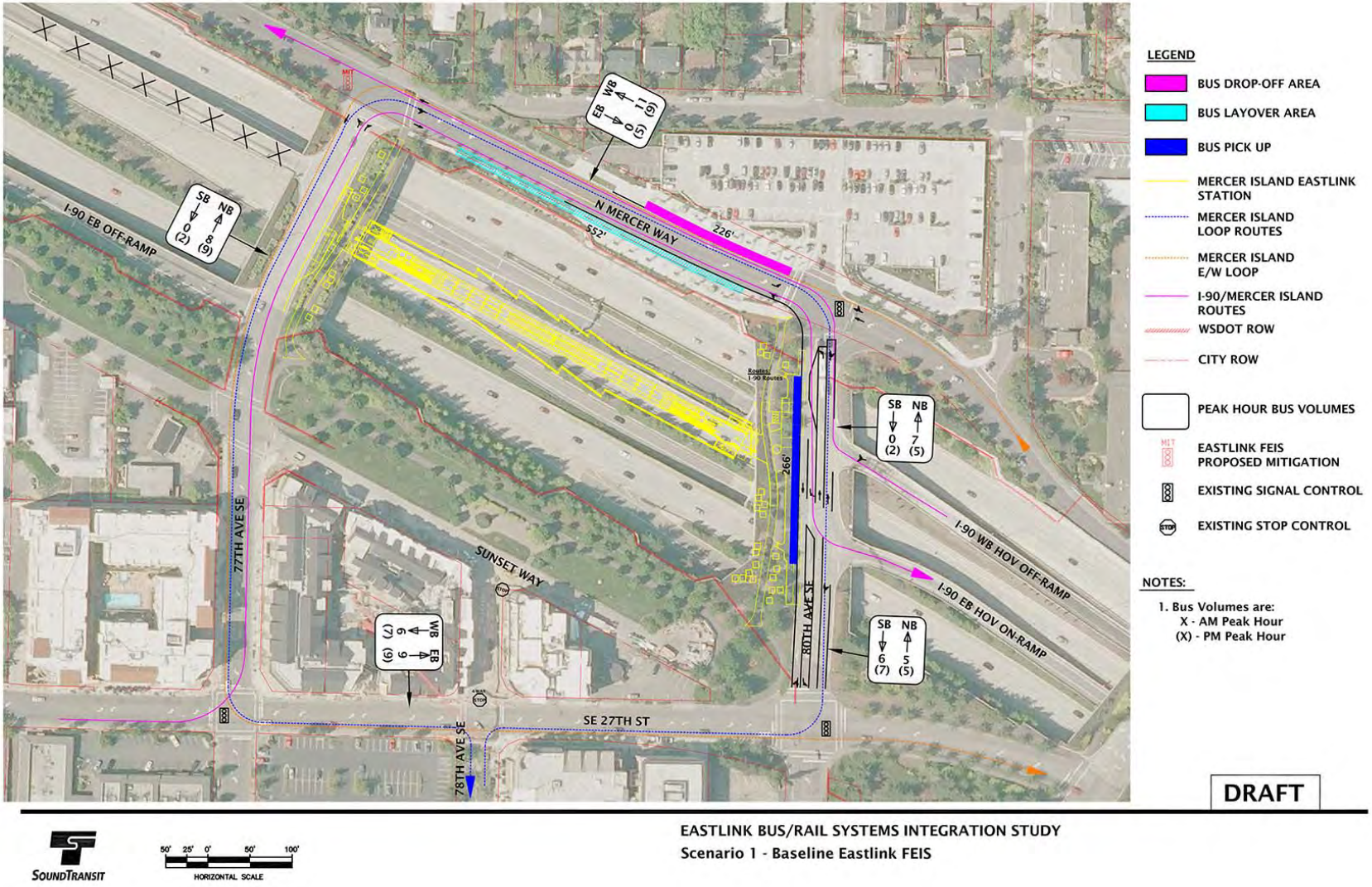


Figure 2. Bus Circulation Scenario 2

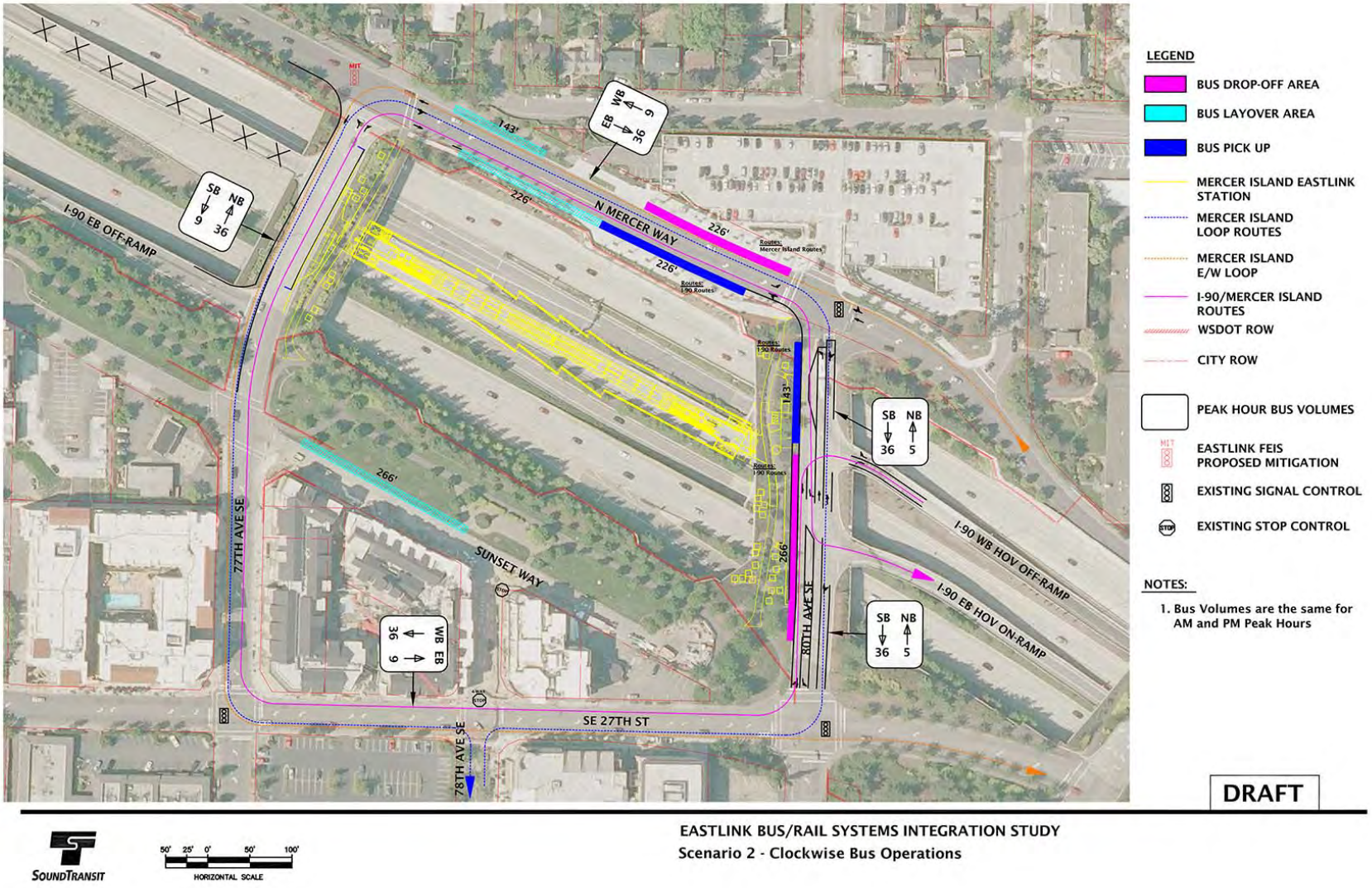


Figure 3. Bus Circulation Scenario 3

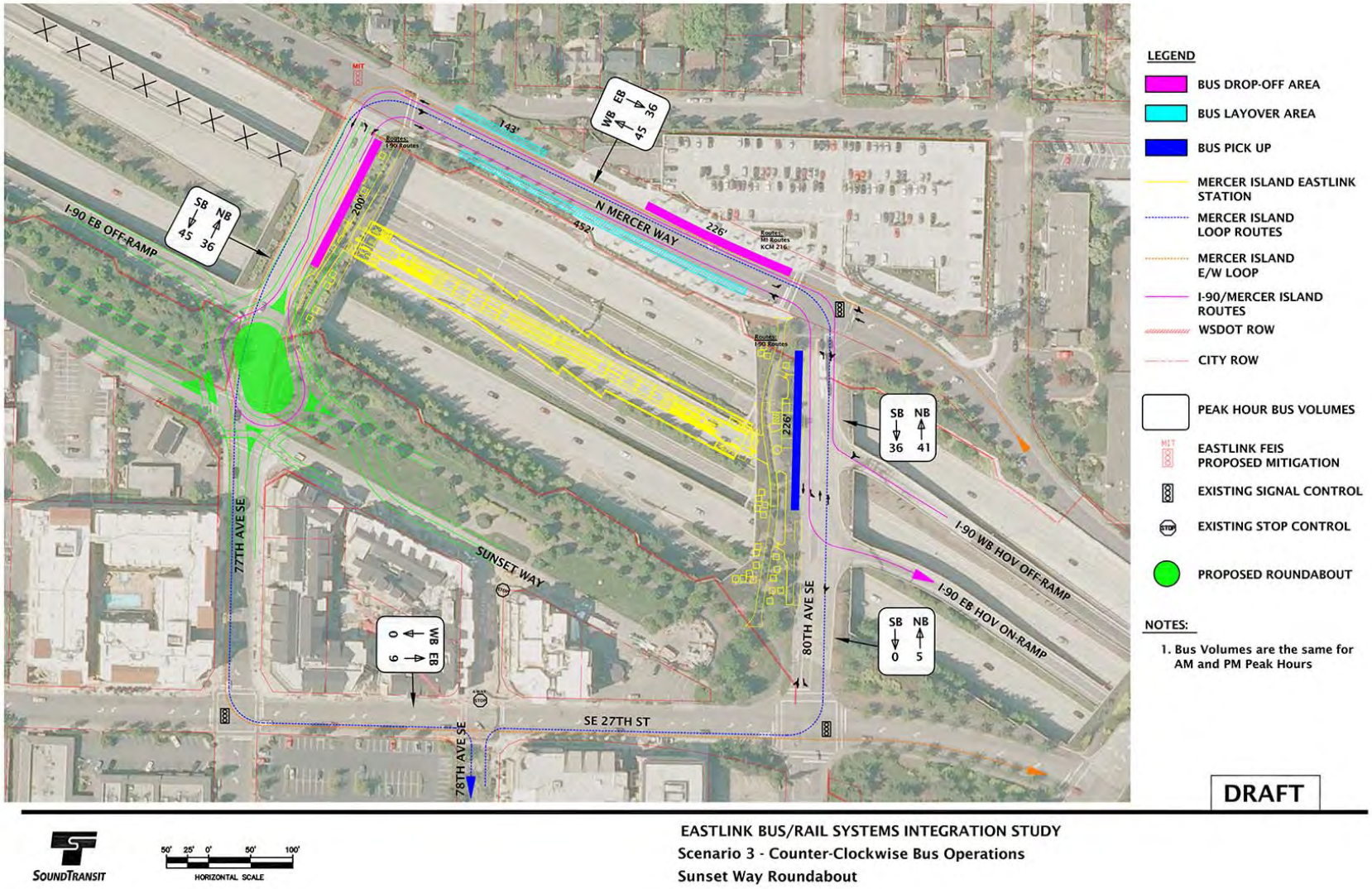
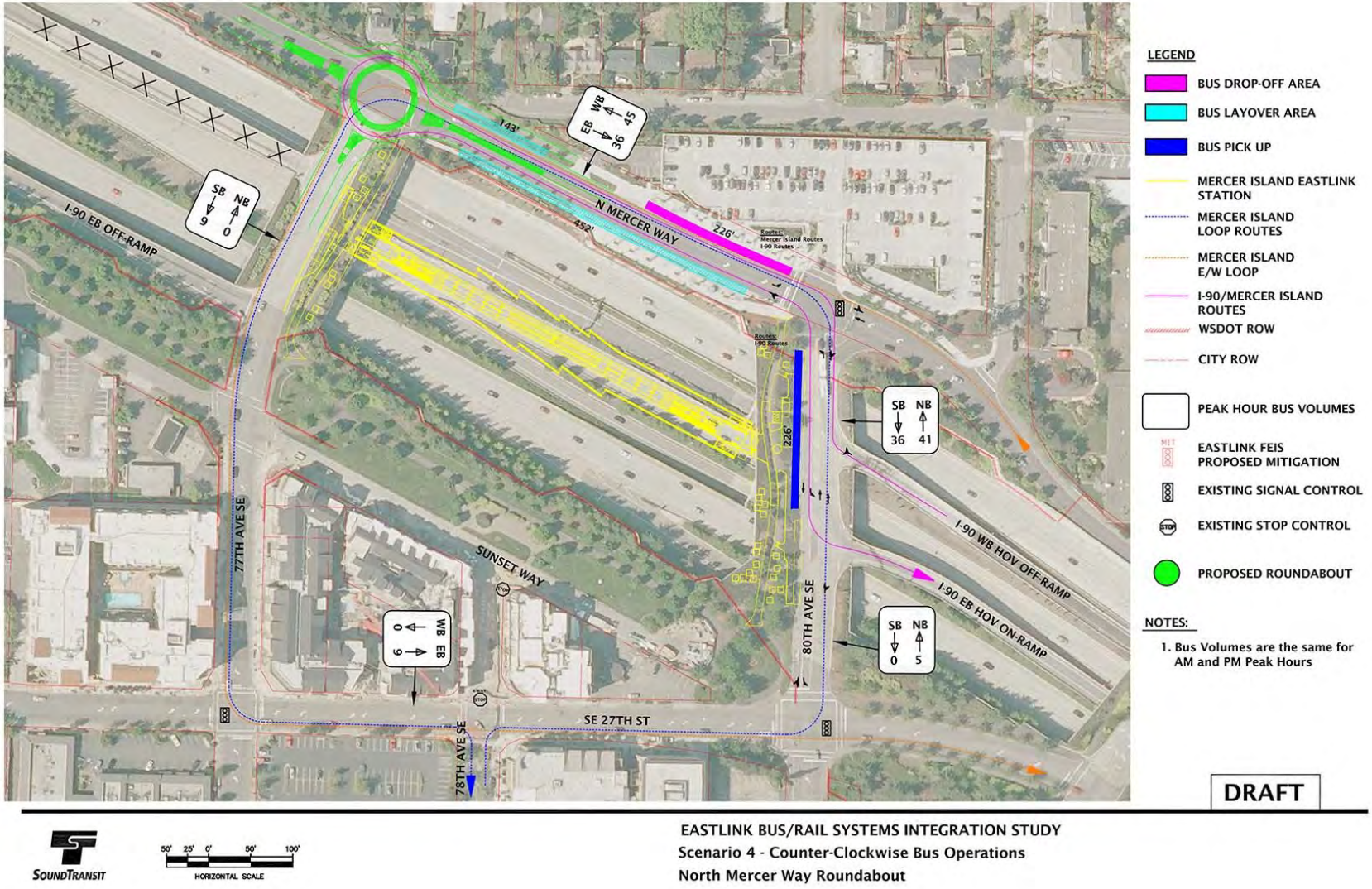


Figure 4. Bus Circulation Scenario 4



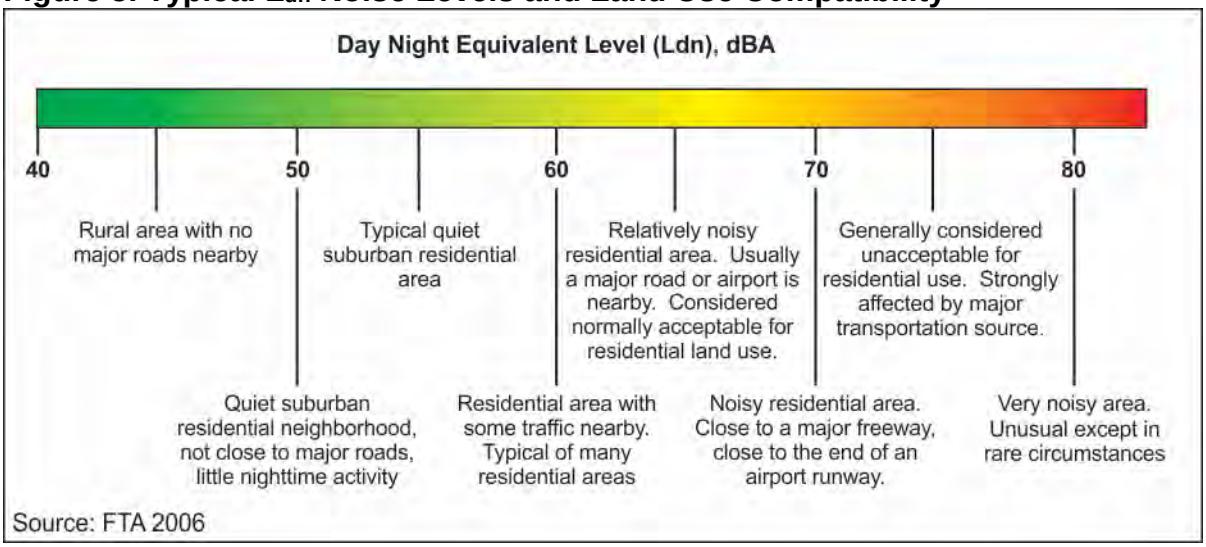
4.0 Introduction to Noise

Noise is defined as unwanted sound; it is measured in terms of sound pressure level and is usually expressed in decibels (dB), a conversion of the air pressure to a unit of measurement that represents the way humans hear sounds. The human ear is less sensitive to higher and lower frequencies than it is to midrange frequencies. To provide a measurement meaningful to humans, a weighting system was developed that reduces the sound level of higher and lower frequency sounds, similar to what the human ear does. This filtering system is used in virtually all noise ordinances. Measurements taken with this "A weighted" filter are referred to as "dBA" readings. There are two primary noise measurement descriptors that are used to assess noise impacts from traffic and transit projects, the L_{eq} and the L_{dn}, described below:

- L_{eq}: The equivalent sound level (L_{eq}) is the level of a constant sound for a specified period of time that has the same sound energy as an actual fluctuating noise over the same period of time. The peak-hour L_{eq} is used for all traffic noise analyses and for light rail noise analyses at locations with daytime use, such as schools and libraries.

- L_{dn}: The day-night sound level (L_{dn}) is an L_{eq} over a 24-hour period, with 10 dBA added to nighttime sound levels (between 10 p.m. and 7 a.m.) as a penalty to account for the greater sensitivity and lower background sound levels during this time. The L_{dn} is the primary noise-level descriptor for light rail noise at residential land uses. Figure 5 is a graph of typical L_{dn} noise levels and residential land use compatibility.

Figure 5. Typical L_{dn} Noise Levels and Land Use Compatibility



5.0 Method of Analysis

This proposed project is an FTA project and therefore follows the methods provided by the FTA (2006). As required by the FTA, other federal, state, and local noise regulations and ordinances were reviewed for relevance to this project. Under the FTA analysis, operational noise levels from buses and vehicles were predicted using measured data and followed the methods outlined by the FTA, (2006).

5.1 Traffic Noise Regulations

Consistent with the FTA guidance manual, Sound Transit used FHWA methodology and criteria to evaluate traffic noise impacts. Areas with major roadway modifications, which could increase traffic noise by 3 dBA or more, require a traffic noise analysis using the FHWA methods for a Type 1 Project. The traffic noise regulations from FHWA are found in *Traffic Noise and Construction Noise*, Title 23 CFR Subchapter H, Section 772. WSDOT is responsible for implementing FHWA regulations in Washington, and the criteria can be found in the WSDOT *Traffic Noise Policy and Procedure Manual* (WSDOT, 2011).

5.2 State and Local Noise Regulations

Both state and local noise regulations and ordinances were reviewed for applicability to this part of the project. The State of Washington has a noise control ordinance that can be found in the Washington State Administrate Code (WAC), Chapter 173-60, Maximum Environmental Noise Levels, and specifies residential, commercial, and industrial noise limits, along with noise limits for construction activities. However, the WAC exempts public transportation operating within public right-of-way, and therefore is not applicable to this project.

The City of Mercer Island has a community nuisance control code in Chapter 8, Section 24, of its municipal code; however, this code does not provide performance standards that could be used to evaluate noise from transit operations. Therefore, the nuisance code is not applicable to this project. There are no other noise regulations that are applicable to the proposed operations.

5.3 Source Data

Data used for the noise study included computer drafting files, plan and profile drawings, operational hours, and bus volumes. The data used in the analysis were obtained from CH2M HILL and Sound Transit. Measured noise levels of typical buses in normal operation from the FTA were used as reference noise levels in the noise models.

A noise analysis for this type of project is typically performed in three distinct steps:

1. Noise impact criteria are determined: using existing measured noise levels, and the land use of potentially affected properties, the FTA noise impact criteria are determined. FHWA and WSDOT traffic noise impact criteria are determined by land use type.
2. Future operational noise levels are calculated for nearby noise-sensitive receivers using methods to accommodate the different criteria, as needed. Potential noise impacts are then identified.
3. If impacts are identified, noise mitigation is examined.

5.4 Impact Criteria

This memorandum has been prepared to meet the requirements of the FTA Manual. Under the FTA guidance for Federally Funded High Capacity Transportation Projects, the noise analysis must be performed in accordance with the FTA guidelines as stated in the FTA Manual. Therefore, in addition to meeting FTA noise impact criteria, the regulations from FHWA and WSDOT are considered in this analysis for scenarios where modifications to the existing roadways could increase traffic noise by 3 dB or more.

5.4.1 FTA Noise Regulations

The criteria in the FTA Manual are founded on well-documented research on community reaction to noise and are based on change in noise exposure using a sliding scale. The amount that a transit project is allowed to change the overall noise environment is reduced as levels of existing noise increase. The FTA noise impact criteria group noise-sensitive land uses into the following three categories:

- **FTA Category 1:** Tracts of land where quiet is an essential element in the intended purpose. This category includes lands set aside for serenity and quiet and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included in this category are recording studios and concert halls. There are no Category 1 uses in this study area.
- **FTA Category 2:** Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
- **FTA Category 3:** Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities are also considered to be in this category. Certain historical sites and parks are also included, but their sensitivity to noise must be related to their defining characteristics, and generally parks with active recreational facilities are not considered noise sensitive.

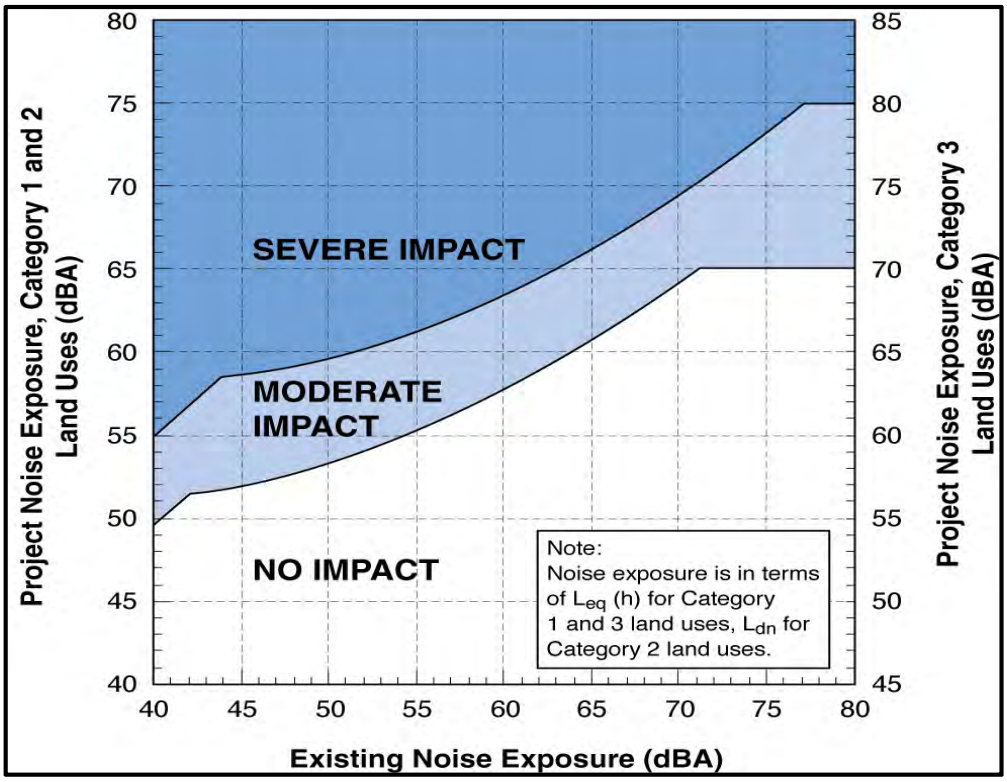
The L_{dn} is used to characterize noise exposure for residential areas (Category 2), and maximum 1-hour L_{eq} during the period that the facility is being used is used for other noise sensitive land uses such as school buildings (Category 3). There are no Category 1 land uses in the project corridor.

There are two levels of impact included in the FTA criteria. The interpretations of these two levels of impact are summarized below:

- **Severe Impact:** Project-generated noise in the severe impact range can be expected to cause a substantial percentage of people to be highly annoyed by the new noise and represents the most compelling need for mitigation. Noise mitigation will normally be specified for severe impact areas unless there are extenuating circumstances that prevent it from being applied.
- **Moderate Impact.** In this range of noise impact, the change in the cumulative noise level is noticeable to most people but might not be sufficient to cause strong, adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These factors include the existing noise level, the predicted level of increase over existing noise levels, the types and numbers of noise-sensitive land uses affected, the noise sensitivity of the properties, the effectiveness of the mitigation measures, community views, and the cost of mitigating noise to more acceptable levels.

Figure 6 summarizes the noise impact criteria for transit operations.

Figure 6: FTA Noise Impact Criteria



Under the FTA criteria, as the existing noise exposure increases, the amount of the allowable increase in the overall noise exposure caused by a project decreases. For example, a residence (FTA Category 2) with an existing L_{dn} of 65 dBA would have an impact if project noise levels equaled or were greater than 61 dBA L_{dn}, and the impact would be considered severe if the project L_{dn} were greater than 66 dBA L_{dn}.

5.4.2 Federal Highway Traffic Noise Criteria

The FHWA traffic noise abatement criteria, against which the project traffic noise levels are evaluated, are taken from 23 CFR 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise. The FHWA exterior approach level criterion applicable for residential uses is an exterior hourly equivalent sound level (L_{eq}) that approaches or exceeds 67 dBA. The criterion applicable for hotels, motels, offices, restaurants/bars, and other developed lands is an exterior L_{eq} that approaches or exceeds 72 dBA. There are no FHWA traffic noise impact criteria for retail facilities; agricultural, industrial, and warehousing uses; undeveloped lands that are not permitted; or construction noise. No analysis of traffic noise impacts is required for those uses for which no criteria exist.

Table 1 summarizes FHWA and WSDOT traffic noise abatement criteria. For purposes of this study, unless indicated otherwise, any reference to “noise abatement criteria” refers to the WSDOT approach level and substantial increase noise abatement criteria (NAC).

Table 1. Noise Abatement Criteria (NAC) by Land Use Category				
Activity Category	Activity Criteria in hourly L_{eq} (dBA)		Evaluation Location	Activity Description
	FHWA NAC	WSDOT NAC		
A	57	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B[1]	67	66	Exterior	Residential (single-family and multifamily units)
C[1]	67	66	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	51	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E[1]	72	71	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A – D or F
F	--	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	--	Undeveloped lands that are not permitted

1. Includes undeveloped lands permitted for this activity category.
2. "—" Indicates that there is no noise impact criteria for these land use activity categories

WSDOT considers a predicted sound level of 1 dBA below the FHWA noise abatement criteria as sufficient to satisfy the condition of "approach," or approaching, the noise abatement criteria required by FHWA for all land use categories. For example, where the noise abatement criteria is 67 dBA L_{eq} for residential uses (FHWA Activity Category B properties), a noise level of 66 dBA L_{eq} would be considered an impact. Receivers would also be considered affected when the worst hourly traffic noise is predicted to increase 10 dB ("substantial increase") or more between the existing and build conditions. Hotel/motel, office building, and restaurant/bar impacts (FHWA Activity Category E property) occur at 71 dBA L_{eq} or higher.

6.0 Area Land Use and Existing Noise Levels

The current land use is used to determine the noise analysis category. Land use in the project area includes single-family residential to the north of
I-90 and the existing Mercer Island park and ride, with mixed multifamily and commercial uses located to the south of I-90. There is a large condominium complex east of the park and ride , and there are paths and green space on the I-90 lid, along with the Mercer Island Community and Event Center located to the northeast of the park and ride.

I-90 runs in the middle of the study area and is depressed in a cut approximately 30 to 40 feet below grade, reducing noise from the highway at most residences in the area. Figure 7 provides an overview of the project area and shows the closest noise-sensitive land uses.

6.1 Ambient Noise Monitoring

The detailed noise analysis under the FTA Manual (FTA, 2006) requires existing noise level measurements in the study area. Noise levels were measured at site M1, 2257 80th Avenue SE, a single-family residence directly north of the existing park and ride facility. Supplemental noise measurements at West Mercer Way Park and near the east end of Mercer Island at 3700 East Mercer Way were also reviewed and used to establish the existing noise levels in the project area.

All noise measurements were taken in accordance with the American National Standards Institute (ANSI) procedures for community noise measurements. The sound level meters were calibrated before and after each measurement period using a sound level calibrator. System calibration is traceable to the National Institute of Standards and Testing (NIST). The systems meet or exceed the requirements for an ANSI Type 1 noise measurement system.

The measured existing noise environment was dominated by traffic noise from North Mercer Way and other nearby arterial roadways. Noise from I-90 was audible but not generally a major contributor. Noise levels at homes to the west of the bus layover area are be predicted to be slightly higher than those at site M1 due to traffic noise from the I-90 ramps, North Mercer Way, and the commercial activities along SE 27th Street. Noise levels at residences located south of I-90 are also be predicted to have slightly higher noise levels due to the added traffic related to the commercial activities in the city center.

The L_{dn} noise level at measurement site M1 was 54 dBA, with peak hour noise levels of 51 dBA L_{eq}. Noise levels for homes directly adjacent to North Mercer Way, and along Sunset Highway SE are predicted to be 65 dBA L_{dn}, with peak hour L_{eq} noise levels of 65 dBA.

7.0 Noise Modeling Receiver Locations

Seven representative noise-sensitive receivers near the proposed bus layovers and travel routes were selected for the noise analysis under FTA criteria. These are the closest receivers to those areas with added noise that would have the potential for noise impacts under FTA criteria. Receiver R1 represents the residences located north of the project area near the intersection of 77th Avenue SE and North Mercer Way. Receivers R2 and R3 represents residences behind the existing park and ride lot on SE 24th Street. Receiver R3 is the same site as the monitoring site M1. Receivers R4 through R7 represent the multifamily residences located south of I-90, along Sunset Highway SE. These receivers are shown on Figure 8.

Figure 7. Project Area Overview and Land Use

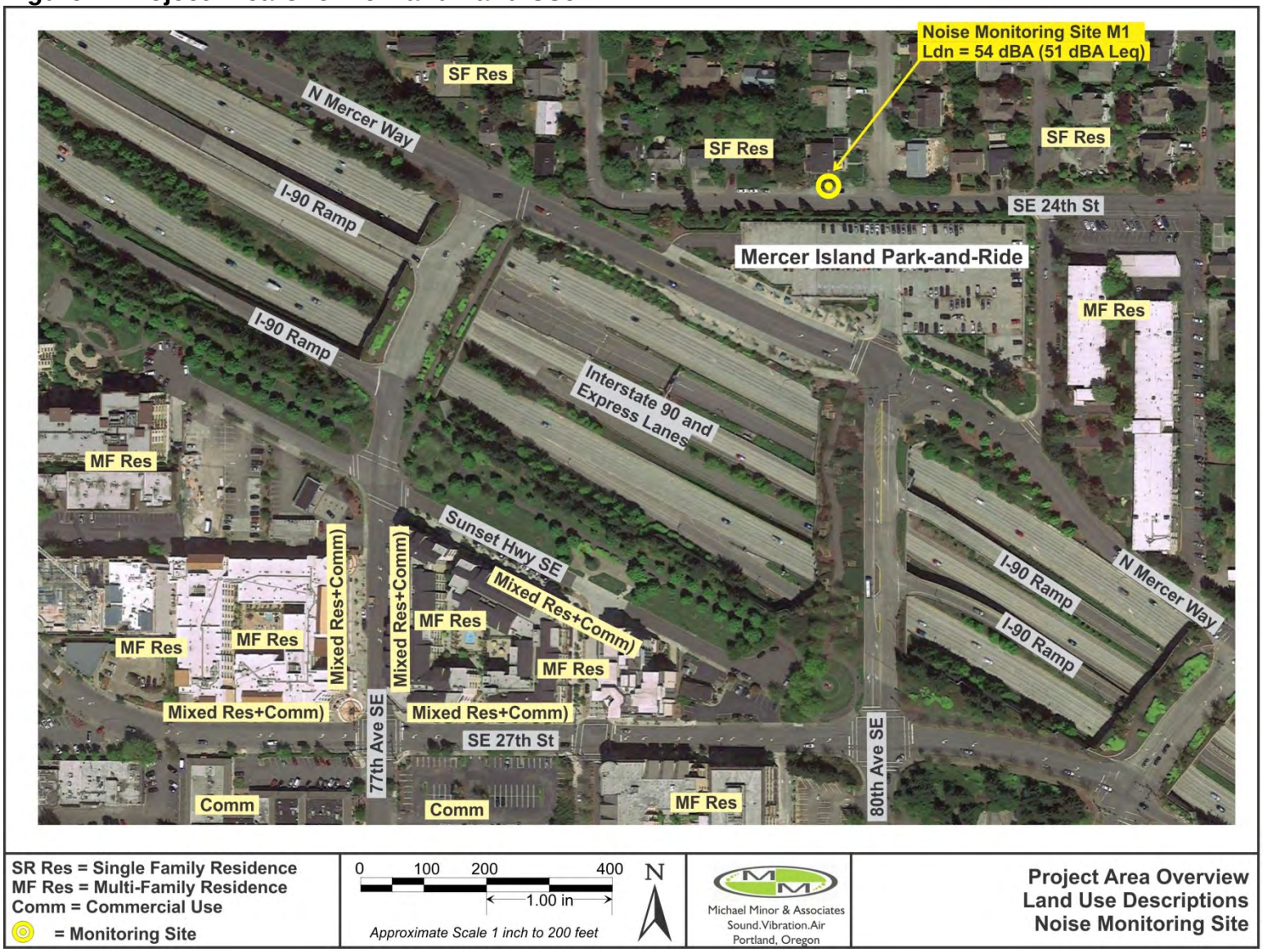
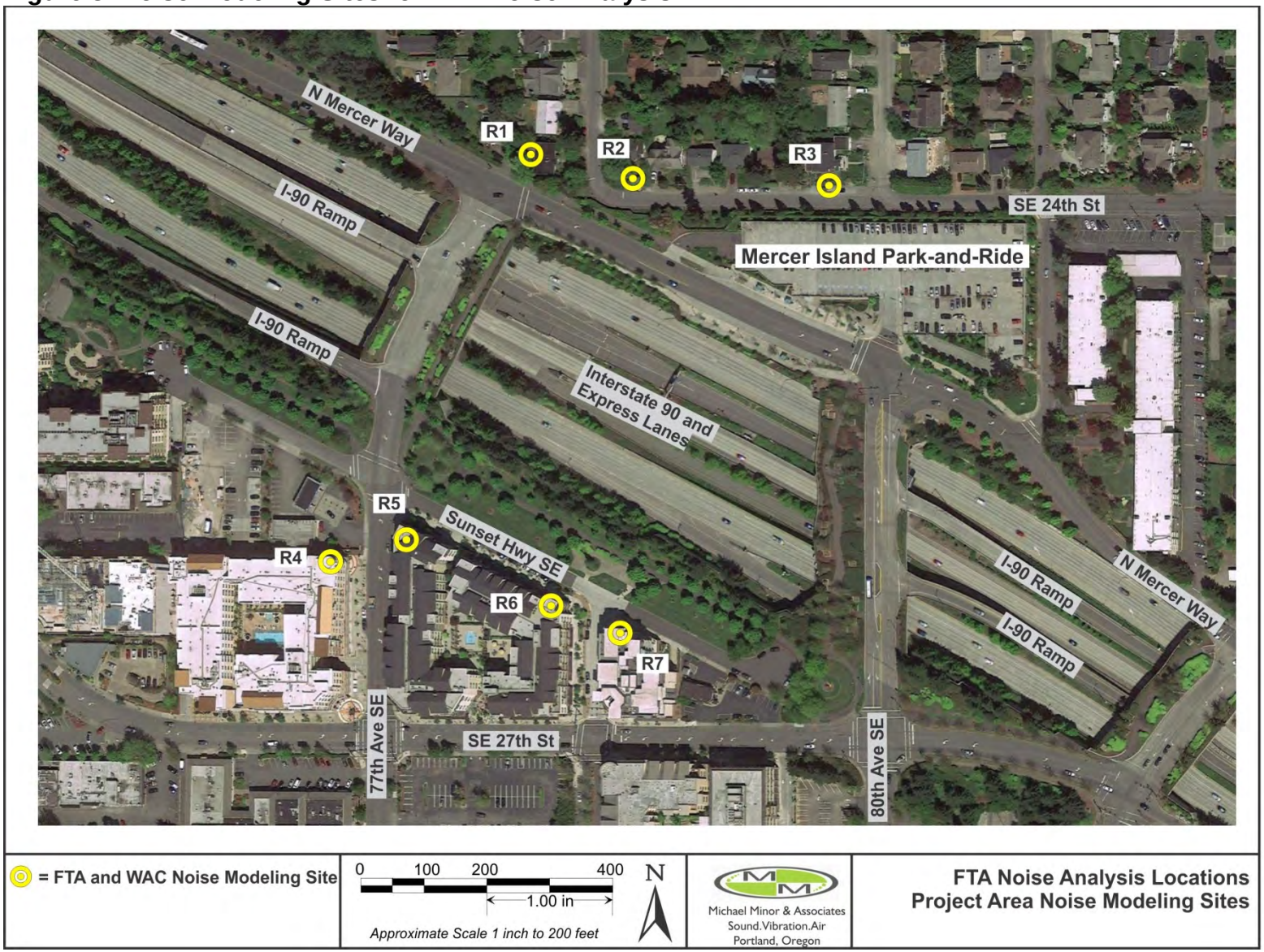


Figure 8. Noise Modeling Sites for FTA Noise Analysis



Using the data from the onsite noise measurements and standard acoustical formulas, the existing noise levels were projected for the seven representative receiver locations. Table 4 provides the results of the existing noise level projections.

Table 4. Existing Noise Levels

Rec[1]	Description[2]	24-hour L_{dn}[4]
R1	2297 78th Ave	65
R2	2290 78th Ave	63
R3	2257 80th Ave	54
R4	7650 SE 27th St	64
R5	7705 Sunset Hwy	65
R6	7725 Sunset Hwy	62
R7	7800 SE 27th St	61

1. Receiver locations are shown in Figure 8.
2. Addresses taken from Google Earth Pro Image dated 5-4-2013
3. Peak-hour L_{eq}.
4. 24-hour L_{dn} noise levels, nighttime noise dominated by background traffic on I-90.

8.0 Noise Impact Analysis

Operational noise levels were projected for impact analysis under FTA criteria. The typical 24-hour L_{dn} was used for compliance with the FTA regulations. The 24-hour L_{dn} was projected using the methods described by the FTA (FTA, 2006). For this evaluation, the sources of potential transit noise impacts are at the bus layover areas.

For the scenarios with modified roadways that meet FHWA Type 1 requirements, a traffic noise review was performed to determine if the roadway improvements result in a 3 dB increase in noise levels. Scenarios that are predicted to have a 3 dB or more increase due roadway modifications would be analyzed using the methods from the FHWA and WSDOT. This requirement is fully clarified in Section 8.3, Highway Traffic Noise Analysis.

The following sections describe the methods and results.

8.1 FTA Noise Level Impact Analysis

The 24-hour L_{dn} noise levels were projected using the methods given in the FTA manual. The analysis uses the number of buses accessing the site during daytime and nighttime hours to project a single-site L_{dn} for each receiver of interest. Input to the model assumes 329 buses per day, with 287 buses during daytime hours and 42 buses during nighttime hours. The resulting noise levels were compared with the FTA impact criteria, and no exceedance of the criteria was identified. Tables 5 through 8 provide the results of the FTA projections for the four scenarios and compare the operational projections with the existing L_{dn} values from Table 4 and the FTA noise impact criteria.

Note that under the FTA criteria, it is possible to have a noise impact even when project levels are lower than the existing noise levels. For example, the criterion for R1 is 61 dBA L_{dn} for a moderate impact even though the existing noise levels are higher at 65 dBA L_{dn}. Also note that the "Station Level (dBA L_{dn})" in Table 5 is the noise from transit operations only and does not include other noise sources. The project noise levels are compared to the FTA criteria (which are based on the existing noise levels), and if the project criteria meet or exceed the FTA criteria, noise impacts would be

identified and mitigation would need to be investigated. As stated above, no noise impacts predicted under the FTA criteria for any of the proposed operational scenarios shown on Figures 1 through 4.

Table 5. FTA Operational Noise Level Impact Analysis: Scenario 1 (Figure 1)
(24-hour L_{dn} and peak-hour L_{eq} impact analysis)

Rec Num[1]	Existing Level (dBA L_{dn})[2]	Project Level (dBA L_{dn})[3]	FTA Criteria (dBA)[4]		Impact[5]
			Moderate	Severe	
R1	65	50	61	65	No
R2	63	48	60	64	No
R3	54	45	55	62	No
R4	64	47	61	65	No
R5	65	48	61	65	No
R6	62	48	59	64	No
R7	61	49	59	64	No

1. Receiver locations are shown on Figure 8.
2. Predicted 24-hour L_{dn} dBA.
3. Calculated 24-hour L_{dn} from transit operations only.
4. FTA impact criteria from Figure 6.
5. Impacts identified using FTA criteria.
6. Total future noise levels: existing noise + transit noise.
7. Change in noise levels: total future noise – existing noise.

Table 6. FTA Operational Noise Level Impact Analysis: Scenario 2 (Figure 2)
(24-hour L_{dn} and peak-hour L_{eq} impact analysis)

Rec Num[1]	Existing Level (dBA L_{dn})[2]	Project Level (dBA L_{dn})[3]	FTA Criteria (dBA)[4]		Impact[5]
			Moderate	Severe	
R1	65	50	61	65	No
R2	63	48	60	64	No
R3	54	45	55	62	No
R4	64	49	61	65	No
R5	65	51	61	65	No
R6	62	51	59	64	No
R7	61	50	59	64	No

1. Receiver locations are shown in Figure 8.
2. Predicted 24-hour L_{dn} dBA.
3. Calculated 24-hour L_{dn} from transit operations only.
4. FTA impact criteria from Figure 6.
5. Impacts identified using FTA criteria.
6. Total future noise levels: existing noise + transit noise.
7. Change in noise levels: total future noise – existing noise.

Table 7. FTA Operational Noise Level Impact Analysis: Scenario 3 (Figure 3)
(24-hour L_{dn} and peak-hour L_{eq} impact analysis)

Rec Num[1]	Existing Level (dBA L_{dn})[2]	Project Level (dBA L_{dn})[3]	FTA Criteria (dBA)[4]		Impact[5]
			Moderate	Severe	
R1	65	51	61	65	No
R2	63	48	60	64	No
R3	54	45	55	62	No
R4	64	48	61	65	No
R5	65	49	61	65	No
R6	62	48	59	64	No
R7	61	48	59	64	No

1. Receiver locations are shown in Figure 8.
2. Predicted 24-hour L_{dn} dBA.
3. Calculated 24-hour L_{dn} from transit operations only.
4. FTA impact criteria from Figure 6.
5. Impacts identified using FTA criteria.
6. Total future noise levels: existing noise + transit noise.
7. Change in noise levels: total future noise – existing noise.

Table 8. FTA Operational Noise Level Impact Analysis: Scenario 4 (Figure 4)
(24-hour L_{dn} and peak-hour L_{eq} impact analysis)

Rec Num[1]	Existing Level (dBA L_{dn})[2]	Project Level (dBA L_{dn})[3]	FTA Criteria (dBA)[4]		Impact[5]
			Moderate	Severe	
R1	65	51	61	65	No
R2	63	50	60	64	No
R3	54	46	55	62	No
R4	64	47	61	65	No
R5	65	47	61	65	No
R6	62	48	59	64	No
R7	61	48	59	64	No

1. Receiver locations are shown in Figure 8.
2. Predicted 24-hour L_{dn} dBA.
3. Calculated 24-hour L_{dn} from transit operations only.
4. FTA impact criteria from Figure 6.
5. Impacts identified using FTA criteria.
6. Total future noise levels: existing noise + transit noise.
7. Change in noise levels: total future noise – existing noise.

8.2 Highway Traffic Noise Analysis

A highway traffic noise analysis using the FHWA and WSDOT methodology is required whenever a new roadway is planned, an existing roadway is widened with new through lanes, or the horizontal or vertical alignment of a roadway is changed such that an increase of 3 dB or more can be expected at a noise-sensitive property. In general, to have an increase of 3 dB in traffic noise, the distance between the roadway and receivers must be reduced by half. For example, moving a roadway that is 50 feet from a house to 25 feet from the same house would cause an increase of 3 dB. In addition, if a project removes existing shielding that results in a 3 dB change in noise levels, that is also considered a change in the horizontal or vertical alignment and a traffic noise study would be required.

The four bus circulation scenarios (see Figures 1 through 4) were reviewed for improvements that meet the criteria, and Scenarios 3 and 4 were found to meet the criteria for a change in the horizontal or vertical alignment. Scenarios 1 and 2 would not change the horizontal or vertical alignment of any

roadways and would not add new through lanes; therefore, no traffic study was required for Scenarios 1 or 2.

Under Scenario 3, there would be a large roundabout located north of Sunset Highway along 77th Avenue SE. This scenario would result move some traffic farther from the residences on Sunset Highway and some traffic closer. The overall change in traffic patterns would not increase noise levels by 3 dB, and, in fact, due to the movement of the stop at the intersection of Sunset Highway and 77th Avenue SE, noise levels could actually be reduced slightly at the nearest receivers. Therefore, no traffic noise analysis was required for this improvement.

Under Scenario 4, the new roundabout would remove two residences near the intersection of North Mercer Way and 77th Avenue SE. This combination of moving the roadway and removing two homes that provide acoustical shielding to the residences behind them made this scenario an FHWA Type 1 project, which requires a traffic noise study.

For this study, the four nearest homes that would remain under Scenario 4 were evaluated. The homes are identified as T1 through T4 in order to prevent confusion with the FTA modeling sites. Two noise models were run for this area using the FHWA Traffic Noise Model (TNM) version 2.5. The first is a model of the existing conditions, using existing bus and vehicle traffic, and the second is a model of the future traffic and bus volumes along with the new roadway configuration. In order to calculate the change in noise from the installation of the roundabout, the noise model did not include I-90, because the background noise from I-90 would have masked the overall change in noise related to the traffic on Mercer Island. Figure 9 provides as aerial view of the receivers used in the modeling along with the proposed roadway configuration, and Table 17 provides the results of the modeling.

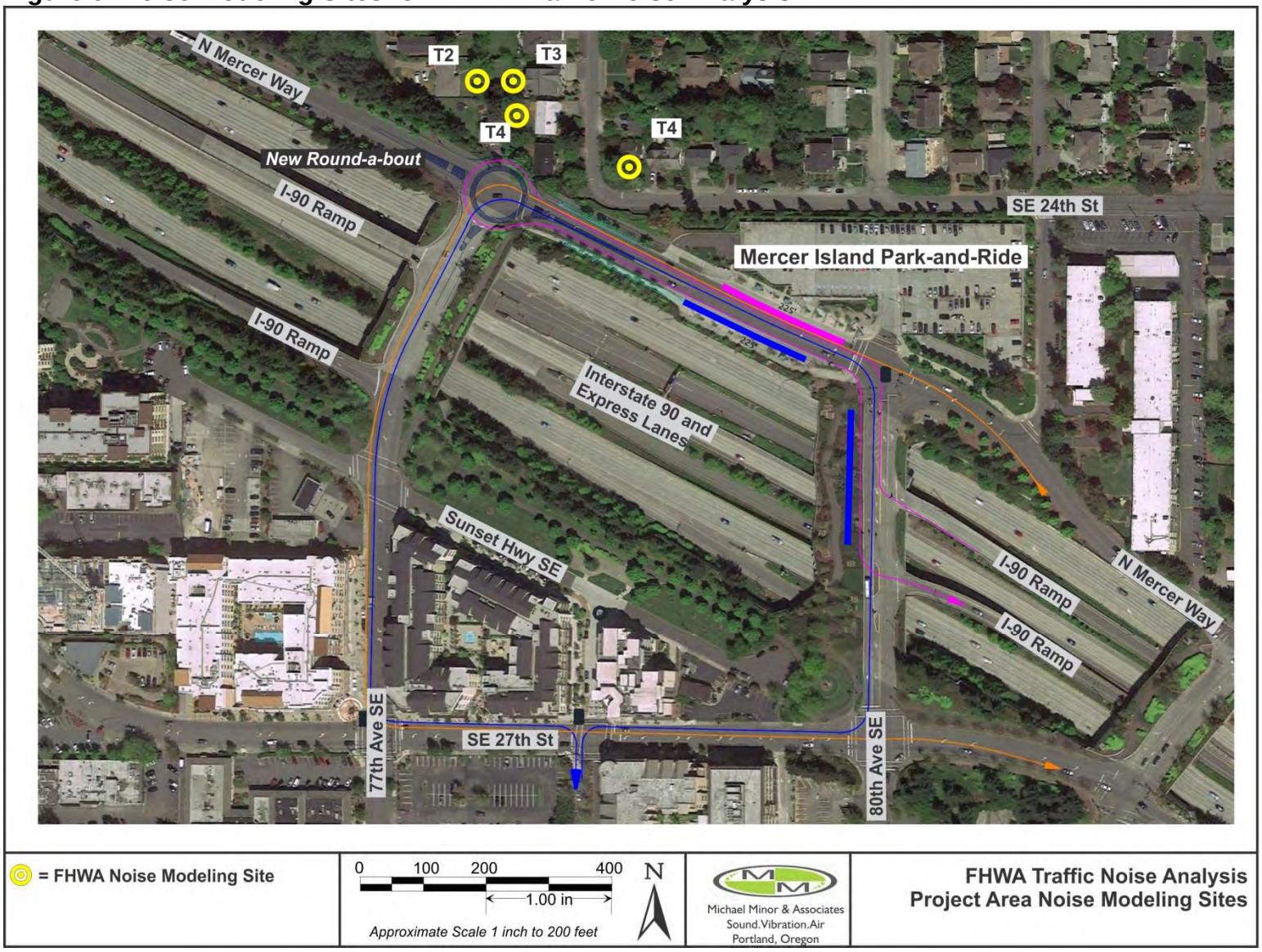
As is shown in Table 17, there are no residences that have an increase of 3 dB because of the proposed project, and therefore no traffic noise study is required. It is also important to note that none of the residences evaluated are predicted to meet or exceed the FHWA criteria as a result of operations at the new roundabout. Local traffic noise levels currently range from 55 to 57 dBA, and with the roundabout, the noise levels would increase by up to 1 dB at one receiver, from 57 to 58 dBA L_{eq}. All noise levels are well below the FHWA criteria.

Table 17. Summary of Traffic Noise Levels

Rec Num[1]	Land Use[2]	WSDOT Noise Criteria (dBA L_{eq})[3]	Existing Conditions	Build Scenario 4		
			Traffic Noise (L_{eq} dBA)[4]	Traffic Noise (L_{eq} dBA)[5]	No. of Impacts[6]	Vs. Existing (in dB)[7]
T1	B	66	56	55	0	-1
T2	B	66	55	54	0	-1
T3	B	66	57	57	0	0
T4	B	66	57	58	0	+1
Summary	**Minimum**		55	54		-1
	Maximum		57	58		+1
	Receivers Meeting NAC		0	0	0	

1. All receivers are shown in Figure 9.
2. FHWA land use activity category designation from Table 1.
3. WSDOT traffic noise abatement criteria from Table 1.
4. Calculated existing peak-hour noise levels in dBA L_{eq} from TNM version 2.5, with **Bold-Red** typeface used to indicate noise levels that are equal to or greater than the NAC of 66 dBA L_{eq} for Category B uses.
5. Calculated future build peak noise hour levels in dBA L_{eq} from TNM version 2.5, with **Bold-Red** typeface used to indicate noise levels that are equal to or greater than the NAC of 66 dBA L_{eq} for category B uses.
6. Number of traffic noise impacts.
7. Change in noise, build alternative compared to existing.

Figure 9. Noise Modeling Sites for FHWA Traffic Noise Analysis



8.3 Construction Noise

Construction noise levels for the Mercer Island operational improvements would result from normal construction activities. Noise levels for these activities can be expected to range from 70 to 95 dBA at sites 50 feet from the activities. These noise levels, although temporary in nature, can be annoying. Sound Transit's Light Rail Noise Mitigation Policy indicates that construction noise levels and impacts should meet applicable noise regulations and ordinances. Most daytime construction noise activities would be exempt from the local noise control ordinance. When required, Sound Transit or its contrctor would seek the appropriate noise variance from the local jurisdiction. Typical mitigation measures that could be applied are presented below and contractors would be required to meet the criteria in the city noise ordinance.

Noise-control mitigation might include the following measures, as necessary, to meet required noise limits:

- During nighttime work, use smart back-up alarms that automatically adjusts or lowers the alarm level or tone based on the background noise level, or switch off back-up alarms and replace with spotters.
- Use low-noise emission equipment.
- Conduct monitoring and maintenance of equipment to meet noise limits.
- Use acoustic enclosures, shields, or shrouds for equipment and facilities.
- Minimize the use of generators or use whisper quiet generators to power equipment.
- Implement noise-deadening measures for truck loading and operations.
- Prohibit aboveground jack-hammering and impact pile driving during nighttime hours.
- Minimize the use of generators or use whisper quiet generators to power equipment.
- Limit use of public address systems.
- Limit or avoid certain noisy activities during nighttime hours.

9.0 Conclusion

The proposed operational improvements are not predicted to result in noise impacts at any of the nearby noise-sensitive land uses. Because of the moderate to low volumes and limited nighttime use, transit operations are predicted to be in compliance with all applicable noise regulations and ordinances, regardless of the scenario selected.

APPENDIX A

References

23 CFR 772. *Procedures for Abatement of Highway Traffic Noise and Construction Noise,* U.S. Department of Transportation.

FTA. 2006. *Transit Noise and Vibration Impact Assessment.* Federal Transit Administration, U.S. Department of Transportation.

WSDOT. 2011. *Traffic Noise Policy and Procedure Manual*.

Appendix C:

Methods and Assumptions Memorandum

Sound Transit Eastlink Project:
Mercer Island Bus Route Truncation Analysis Methods & Assumptions

PREPARED FOR: Sound Transit

PREPARED BY: Tony Woody/CH2M HILL

Craig Grandstrom/CH2M HILL

DATE: February 17th, 2014

Memorandum Overview

This memorandum outlines the methods and assumptions of the transportation and enviornmental analysis and evaluation associated with the Mercer Island Bus Route Truncation task. The purpose of this task order is to assess any additional impacts associated with the truncation of King County Metro buses at Mercer Island that may occur over what has been previously stated in the Eastlink FEIS.

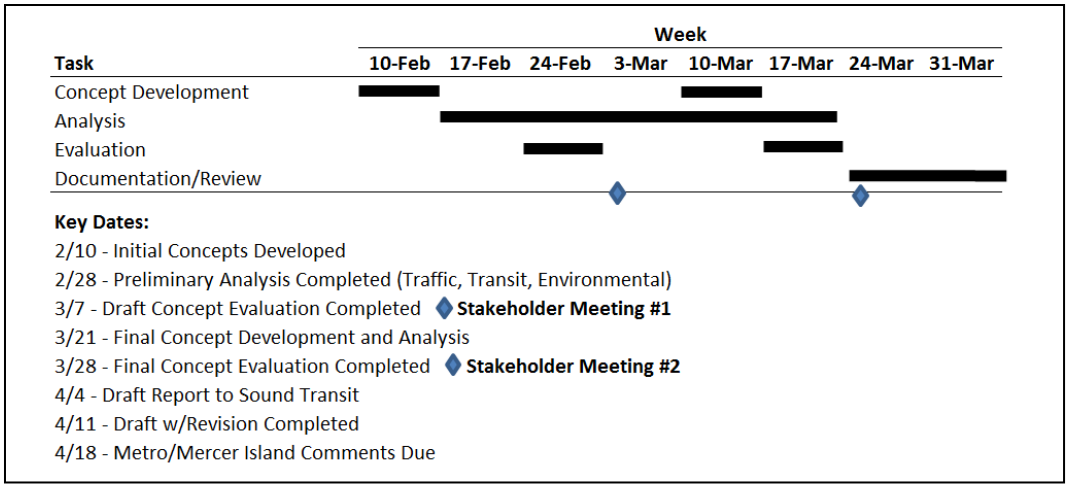
A task outline and schedule, analysis assumptions, initial concepts and the evaluation framework are provided within this memo.

Task Outline and Schedule

The three main tasks associated with this task order are:

1) Concept Development: Develop network and operating concepts that address the needs of Sound Transit and other stakeholders (King County Metro, City of Mercer Island, and WSDOT).
2) Analysis: Analyze traffic impacts, transit operations and ridership and environmental impacts for each concept developed.
3) Evaluation: Conduct an evaluation that compares impacts between each of the concepts developed.

The schedule for the task order is shown in the figure below.



Mercer Island Truncation Task Order Schedule/Dates

Analysis Scenarios

Based upon previous work completed and additional comments from King County Metro and the City of Mercer Island, six base concepts were developed for the truncation study. Each concept includes two elements; the 'Bus Operating Condition' which details which routes the buses will take on Mercer Island, where the truncation will occur, and any details around staging and stop locations and the 'Mercer Island Network' element which includes any changes to the Mercer Island road network that differs from what is stated in the Eastlink FEIS.

Table 1 provides a summary of the initial concepts developed. Figures 1-4 provides graphical representations of each of the intial concepts.

Table 1. Mercer Island Bus Truncation: Initial Concepts

Scenario	Bus Operating Condition	Mercer Island Network
1: Baseline	• Per FEIS	• Per FEIS
2: Truncation Option A: Clockwise Operations	• Truncation at Mercer Island • Clockwise Operations • 80th-27th-77th-N.Mercer Route	• Intersection Mitigation where Required
3: Truncation Option B: 77th/Sunset Roundabout	• Truncation at Mercer Island • Counter-Clockwise operations • 80th-N. Mercer-77th w/Turnaround • 77th/Sunset Turnaround	• Roundabout at 77th/Sunset • Intersection Mitigation where Required
4: Truncation: Option C: 77th/N. Mercer Way Roundabout	• Truncation at Mercer Island • Counter-Clockwise operations • 80th-N. Mercer w/Turnaround • 77th/N. Mercer Turnaround	• Roundabout at 77th/North Mercer • Intersection Mitigation where Required

Notes:
- Up to 2 additional concepts may be defined as part of this task

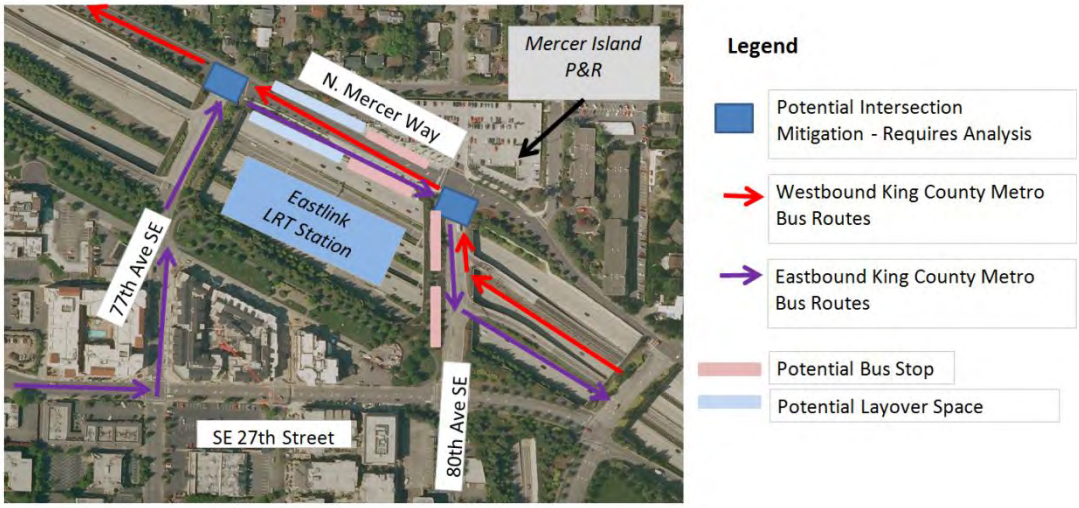


Figure 1. Scenario 1: Eastlink FEIS Bus Routing

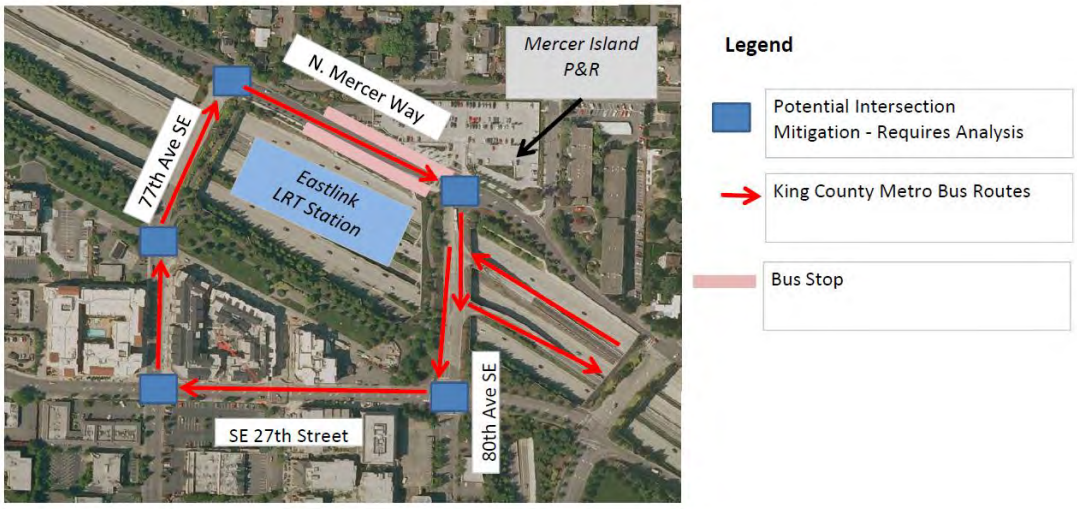


Figure 2. Scenario 2: Mercer Island Truncation: Option A

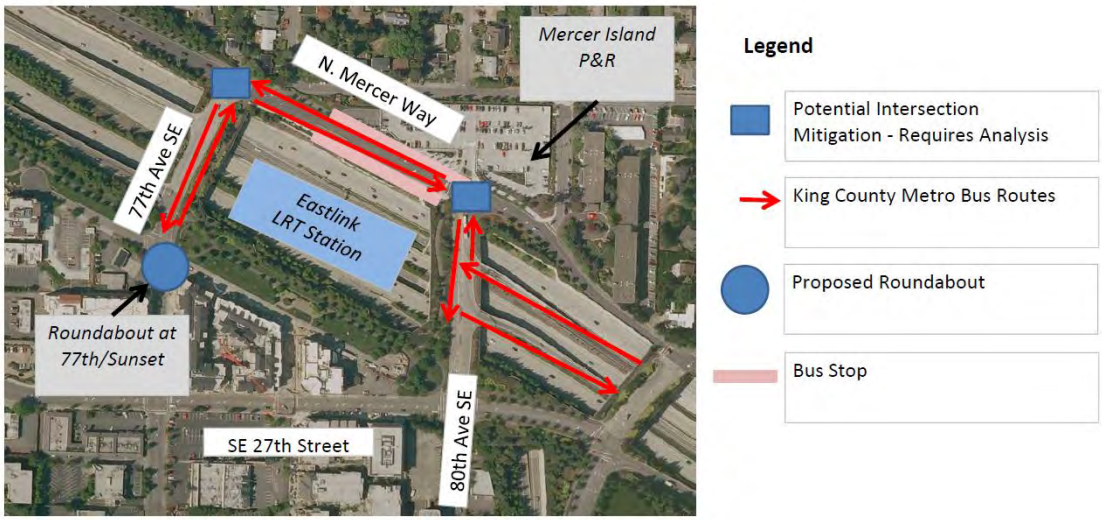


Figure 3. Scenario 3: Mercer Island Truncation: Option B

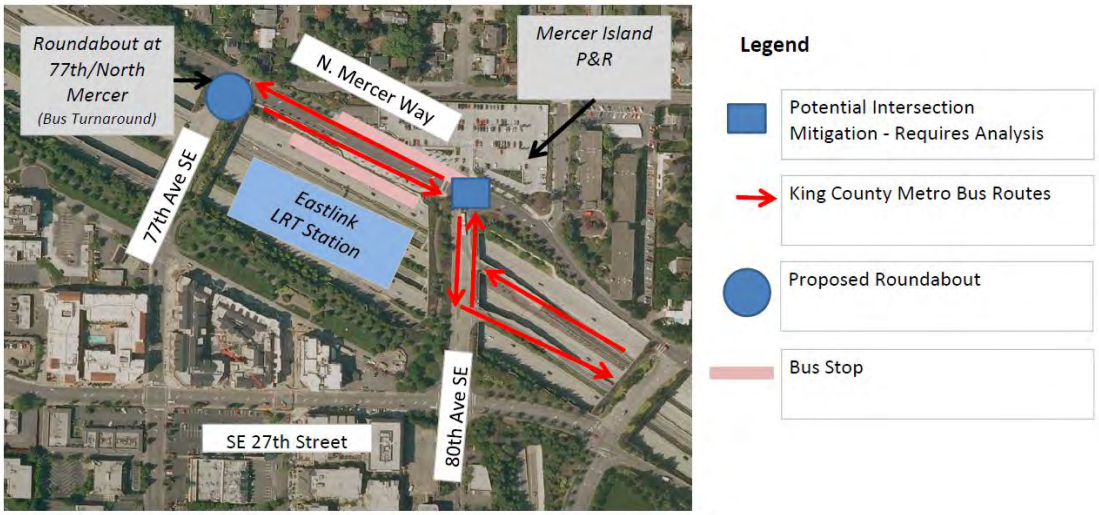


Figure 4. Scenario 3: Mercer Island Truncation: Option C

Analysis Assumptions

Traffic, transit and environmental data from the Eastlink FEIS will be used as the basis for this study. Year 2030 traffic and transit volumes and assumptions will be used in this study.

For all intersection related traffic analysis on Mercer Island, Synchro traffic analysis software will be used. For transit (bus and LRT) travel times along I-90, VISSIM traffic analysis software will be used. Base AM and PM peak volumes and traffic demands will be used from the FEIS. In addition, transit ridership forecasts for this effort will be based on model used in the Eastlink FEIS.

Future bus routing will be based on what was reported in the Eastlink FEIS as well as from bus routing and headway data that was provided by King County Metro.

Evaluation Framework

A draft evaluation criteria form has been developed to compare the concepts to one another. Seven main criteria were included as part of the evaluation form. The six main criteria (and sub-criteria) are listed below.

- Environmental Impacts
    - Air/Noise
    - Acquisitions
    - Section 4f
    - Historical
- Community Impacts
    - Bus Activity
    - Intersection Level-of-Service & Delay
- Design Considerations
    - Right-of-Way
    - Design Standards Met
    - Number of Bus and Layover Stops
- Transit Operations
    - Ridership
    - Bus Travel Time
- Rider Experience
    - Average Distance to Bus Stop
    - Bus Stop Location
- Construction Costs

Appendix D:

King County Metro White Paper:

Mercer Island Bus Route Truncation with East Link – Bus Intercept Concept Paper

DRAFT

Mercer Island Bus Route Truncation with East Link--Bus Intercept Concept Paper

Prepared by King County Metro

November 18, 2013

Background

With East Link targeted for service in 2023, Sound Transit requested that Metro Transit examine the truncation of I-90 peak-only routes at Mercer Island to eliminate the need to provide bus lane(s) beside Link on the D-2 roadway and to improve service frequency in the corridor. This is a "high level" conceptual look into what a service plan might entail for an "intercept" facility on Mercer Island: under the intercept concept, I-90 corridor buses would meet at the Mercer Island Link Station enabling passengers to transfer to/from light rail and continue their trip to Seattle. More detailed analysis concerning roadway engineering, signal design, layover availability, ridership impacts and other critical issues would still be required to determine operational feasibility and potential fatal flaws. The intent of this paper is not to advocate for or against, but rather to initially explore and describe what a potential service and facility intercept concept might look like.

The paper describes current I-90 routes and bus volumes and anticipated future routes and volumes--followed by a rough, high and low estimate of the peak hour bus trips that an intercept facility would need to accommodate. The paper also describes a potential facility operation and design scheme for the intercept facility.

Current Routes/Volumes

As of Fall 2013, Metro and Sound Transit presently provide the following routes in the I-90 corridor and on Mercer Island: 111, 114, 201, 202, 203, 204, 205, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 550 and 554. Route 550 will be replaced by East Link. The all-day Sound Transit Route 554 provides the heaviest all-day volumes: 42 trips. The popular Route 212 to Eastgate produces the heaviest coach volumes during the peak periods, with trips every eight minutes 9 trips during the a.m. peak hour.

The 2007 East Link Draft Environmental Impact Statement assumed that transit volumes for Metro Routes 212, 214, 215, 216 and 218 would provide 21 vehicles per hour. Presently, there are 24 trips among these routes between 7:00 and 8:00 a.m.

In regards to passenger loads, the table below shows approaching passenger loads from the east. Routes 212 and 218 are averaging the heaviest loads coming from Eastgate and Issaquah Highlands, respectively.

Average Passenger Loads Approaching Mercer Island P&R from the East

Route	AAM	AM	MID	PM	XEV	XNT	Grand Total
111		420					420
114	20	170					190
202		30					30
205		30					30
210		80					80
211	10	60					70
212		920	150				1,070
214		370					370
215	30	190					220
216		240					240
217				80			80
218/219		770	70				840
554	70	220	580	220	130	20	1,240
TOTAL	**130**	**3,500**	**800**	**300**	**130**	**20**	**4,880**

Future Routes/Volumes

Upon the completion of East Link, there will continue to be three major destinations east of Mercer Island: Eastgate, Issaquah Transit Center, and the Issaquah Highlands. Other destinations include Sammamish, Snoqualmie and North Bend. As described below, these destinations would be served by multiple peak commuter routes, all of which would serve the Eastgate Freeway station and terminate at Mercer Island.

This planning effort assumed that all-day service (current ST Route 554) in the I-90 corridor would be reoriented to Downtown Bellevue via South Bellevue Station Link Station, consistent with the network design concept developed for the City of Bellevue's Transit Master Plan. Similarly, I-90 routes from I-405 and South King County (current Metro routes 111 and 114), would be reoriented to Downtown Bellevue via the South Bellevue Link Station.

Based on these assumptions, the Mercer Island station would be served by five routes, the 204, 214, 215, 218 and 219. The table below describes a future scenario of the routes that would serve the Mercer Island station and their respective trips per hour. Also listed are the current routes that would either be re-oriented to Bellevue, or would no longer operate under the future scenario.

DRAFT

Mercer Island Bus Route Truncation with East Link--Bus Intercept Concept Paper

Prepared by King County Metro

November 18, 2013

Forecast Routes/Volumes in I-90 Corridor

Routes to be re-oriented to Bellevue

Route	Destination	Current AM Peak Hr. Trips	Low-End Estimate		High-End Estimate		Comment
			AM Peak Hour Trips	Frequency	AM Peak Hour Trips	Frequency	
111	Seattle/Renton	4	--	--	--	--	re-oriented to downtown Bellevue
114	Seattle/Renton	2	--	--	--	--	re-oriented to downtown Bellevue
554	Seattle/Renton	2	--	--	--	--	ST routes combined/re-oriented to Bellevue
Subtotal		**8**					

Routes to be deleted

202	Seattle/Mercer Island	3	--	--	--	--	deleted
205	Univ. Dist./Mercer Island	1	--	--	--	--	deleted
210	Seattle/Issaquah	1	--	--	--	--	deleted
211	First Hill/Issaquah Highlands	2	--	--	--	--	deleted
212	Seattle/Eastgate	9	--	--	--	--	deleted; all I-90 routes to serve Eastgate Frwy Station
216	Seattle/Bear Creek P&R	1	--	--	--	--	deleted; see Route 219
217	Seattle/North Issaquah	0	--	--	--	--	deleted; remaining routes would provide reverse peak service
Subtotal		**17**					

Remaining Future Routes serving Mercer Island Station

204	Mercer Island	0	4	1 bus every 15 min.	4	1 bus every 15 min.	
214	Issaquah TC via Eastgate FS	5	16	2 buses every 8 min.	24	3 buses every 8 min.	
215	North Bend via Eastgate FS	2	4	1 bus every 15 min.	4	1 bus every 15 min.	
218	Issaquah Highlands via Eastgate FS	5	8	1 bus every 8 min.	16	2 buses every 8 min.	
219	Sammamish via Eastgate FS	2	8	1 bus every 8 min.	8	1 bus every 8 min.	
Subtotal		**14**	**40**		**56**		
TOTAL		**39**	**40**		**56**		

The high-end estimate assumes 56 trips in the AM peak hour for the five routes (204, 214, 215, 218 and 219). The current average a.m. ridership or demand for these routes approaching Mercer Island is 2,630. Planning for 56 trips would provide a total capacity of 10,480, so this high-end estimate would have room to accommodate significant growth.

The low-end estimate assumes 40 trips per hour, which provides a total ridership capacity of 7,260. To get an idea of when demand might meet or exceed this capacity, one could apply the annual growth rate of 2.25% used by the Puget Sound Regional Council in their 2040 Transportation Plan to the current demand for these routes. Using this methodology, the demand would meet the low-end estimate of 40 trips in 2058, while the high-end estimate of 56 trips would meet capacity in 2075, or 52 years after the estimated start of East Link. It should be noted however that the existing park-and-ride facilities in the I-90 corridor are currently over 85% occupied on an average weekday. Without a significant commitment to develop new park and rides, or increase the capacity at the existing ones, transit demand in the corridor will be somewhat limited. However, other changes in the corridor, such as future I-90 tolling, residential and commercial development or increased transit service, could have a positive effect on ridership. For example, with transit service increases and tolling on SR520, ridership there has grown 40% in three years.

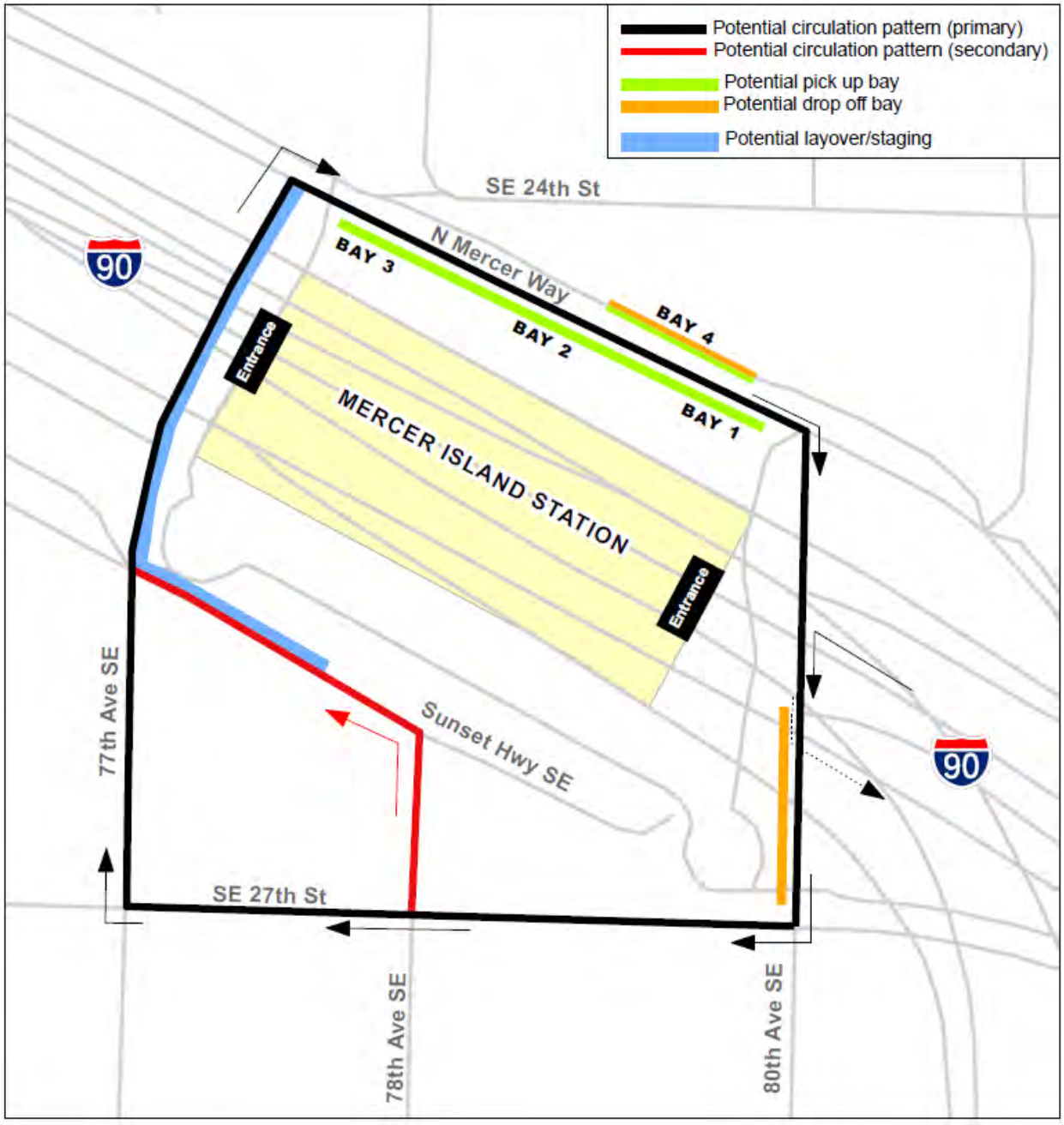
The total number of weekday bus trips on Mercer Island would be about 550, assuming the provision of 56 trips per hour during peak hours (8 hours) and 16 trips per hour during off-peak and evening hours (6 hours).

Given the high-level, conceptual nature of the work to assess the possibility of truncating service on Mercer Island, the operational costs associated with the two scenarios described above have yet to be quantified and should therefore not be viewed as a commitment of any kind by Metro. The level of service ultimately provided will be determined by a number of factors, including the availability of operating resources at any given point in time.

Facility Operation and Design Concept

Under one potential facility operation and design concept, buses would access Mercer Island from the I-90 HOV lanes at 80th Avenue SE. Buses would then operate in a clockwise circulation pattern as shown

below:



The clockwise circulation pattern would be the most efficient way of boarding and alighting riders, as it would not require any riders to cross the street to connect between bus and rail. Inbound routes would drop off riders on the southern half of 80th Avenue SE. This location would provide the earliest

opportunity for riders to alight and transfer to Link. Boardings could occur at Bays 1-3 on North Mercer Way.

An alternative circulation pattern could run the buses along 78th Ave SE/ Sunset Highway. Sunset Highway is an east-west running street just south of I-90. This pattern is slightly more circuitous with extra turns, but provides access to a potential layover location on Sunset Highway.

The I-90 routes would operate with 60-foot articulated coaches. Inbound AM trips would be scheduled to meet, or "pulse" with inbound Link trains, while outbound PM trips would do the same with the outbound Link trains. In order to ensure that passenger connections are reliable and efficient, buses will need to have adequate space to layover between trips, at least in the PM peak. Ideally, layover space would be located along on 77th Ave SE and/or Sunset Highway, in order to maximize operational efficiency and reduce impacts to surrounding neighborhoods.

During the AM peak, the concept of "live-looping" the buses could be considered. Given that buses would be timed to meet the peak direction Link trains - inbound in the morning, outbound in the afternoon - the buses could, upon dropping of riders on 80th Ave SE, immediately proceed to North Mercer Way and board the outbound passengers. The viability of this approach would depend on the frequency of reverse peak service; the need for reliability (and therefore recovery/layover time) increases as headway increases. Live-looping in the AM peak would not, however, eliminate the need for layover space, as live-looping the PM peak has been ruled out as a feasible option.

With the majority of the routes operating one-way service today, consideration should be given to operating in both directions, if the routes are truncated at Mercer Island. With growing employment in areas east of Mercer Island, and given that the trips would be deadheading east regardless, there would be an opportunity to expand service in a relatively cost-effective manner. In addition, with the truncation of routes at Mercer Island at "low-end" frequency, Metro would realize a savings of hours, all else equal, which could potentially be re-invested in additional service frequency and/or span in the I-90 corridor or anywhere in the Metro system.

Buses that serve the local market on Mercer Island would operate in a counter-clockwise loop serving Bay 4. These customers would have to cross North Mercer Way to access the Link station and regional I-90 bus service. There is currently a signalized pedestrian crosswalk at this location.

I-90 routes (214, 215, 218 and 219) would board passengers at three bays headed eastbound on North Mercer Way, numbered 1 to 3 starting at the eastern most bay. The bays would be separated by 60 feet, allowing coaches to pull in and out independently of on another.

Specific routes would be assigned as follows:

- **Bay 1** - Routes 214 and 218. These buses would be located nearest to the eastern entrance and would be expected to fill first. They would depart as soon as the applicable loading threshold was reached, an operating procedure not currently employed at Metro.
- **Bay 2** - Routes 214 and 218. These buses would provide overflow capacity for buses in Bay 1 and would depart later.
- **Bay 3** - Routes 214, 215 and 219. These buses would be located furthest from the east entrance to "protect" them from being overloaded by Eastgate riders.
- **Bay 4** Route 204 would layover, board and alight riders at a westbound zone on North Mercer Way (the current westbound zone near the P&R).

Bays 1-3 would accommodate seven coaches at any given time. However, assuming the coaches operating I-90 routes will be on Mercer Island for more than eight minutes– the assumed peak hour headway for buses and trains - additional space for layover would be needed to accommodate an additional seven coaches (aside from the bays on North Mercer Way) in the high-end frequency scenario. Potential layover space could be the east side of 77th Ave SE or the north side of Sunset Highway west of 78th Ave. SE. No boardings would occur on 80th Ave SE.

A more in depth analysis regarding traffic engineering issues such as roadway configuration, signal coordination/timing and safety-related concerns would be needed to determine the feasibility of the facility operations and design concept. Ultimately, the facilities and operations plan would require the full agreement and permitting of the City of Mercer Island. Potential issues include, but are not limited to the following:

1. The current westbound I-90 exit from the I-90 westbound HOV lanes to 80th Avenue SE is a right turn only. A left-turn lane for buses would be needed to enable the clockwise loop.
2. 80th Avenue SE would likely need to be re-channelized and/or signalized to prevent conflicts between the southbound buses turning left onto the I-90 eastbound ramp and the buses coming off of the westbound off ramp, turning left onto 80th Avenue SE
3. Preliminary estimates suggest that the southern half of 80th Avenue SE could accommodate up to three 60 foot coaches for drop off. Given the number of peak hour buses estimated under the high-end scenario, there is the possibility of buses queuing on the westbound I-90 HOV ramp. The bus-only left turn lane would need to be designed to handle potential queuing on the ramp and prevent buses from blocking cars turning right onto 80th Avenue SE.
4. Adequate capacity would need to be provided to accommodate the volume of riders waiting at, and moving between the bus and rail platforms to connect between modes.
5. Pullouts may be required in some locations depending on planned roadway configuration. The layover location on Sunset Highway may be problematic, as it is located adjacent to a park and across the street from a multi-family housing complex. A critical question is if the City of Mercer Island will allow expansion for drop off/pick up bays and layover locations.

6. The high volume of buses traveling on the identified roadways will likely impact general purpose traffic on Mercer Island. Such impacts should be quantified and evaluated.
7. The alternate routing pattern along 78th Avenue SE and Sunset Highway SE involves a turning movement not made by transit today – the west-to-north right turn from SE 27th Street to 78th Avenue SE. Physical modifications, potentially including changes to curb radii, channelization or stop bar placement may be needed to accommodate these turning movements.
8. To ensure efficient operation, intelligent transportation systems (ITS) technologies, such as signal prioritization and/or queue jumps at traffic signals should be considered.

Cost Projections for Future Service

Metro has estimated the future service hours that would be required for three different peak-period service scenarios: 1) existing service levels, 2) low-end service levels (40 a.m. peak trips) and 3) high-end service levels (56 a.m. peak trips). Cost estimates are summarized in the table below. Truncating Metro existing service at Mercer Island would save approximately 36,000 annual service hours (approximately $5.4 Million in 2013 dollars[1]) over the existing service levels due to the shorter routing. Even under the future low-end service level scenario, there would be savings from existing levels of almost 13,000 hours ($1.9 Million in 2013 dollars). However, the high-end service level scenario would require approximately 12,000 additional service hours over existing hours ($1.8 Million in 2013 dollars).

Metro also estimated the cost to provide weekday off-peak and evening bus service on I-90 east of Mercer Island. The Route 218 to Issaquah Highlands was assumed to be the only route operating during this time. Service would operate in both directions with 15-minute frequency during the mid-day and 15-30 minutes during the evening and night. The estimated cost to provide this level of off-peak and night service was 11,500 annual hours. This cost would be the direct result of a Sound Transit decision to redirect its all-day service to South Bellevue instead of Mercer Island.

Based on this analysis, it appears that Metro could afford to provide peak period service specified in the low-end service scenario with weekday midday/night service in both directions on the Route 218 without exceeding current service hours.

[1] Costs were estimated based on the fully-allocated hourly rate for 60-foot buses in 2013

Appendix E:

Agency Comments

Comments from Metro regarding the East Link Bus/Rail Systems Integration Study—March 13, 2014

- Metro has concerns that the concepts in the recent drawings are not in sync with the general operating scheme of each alternative. Areas for layover, staging (pick-up), and drop-off should be clearly identified, with the number of 60' buses that the zone can accommodate--assuming the following scenarios: independent pull-in and out, independent pull-out, and no independency. Some of the locations identified for bus stops (pick-up and drop-off) and/or layover may not be fully usable.

- While existing and potential zones and layover spots are identified and measured on each alternative map, analysis needs to be done to identify how many 60 ft. coaches each area can accommodate and whether it would be sufficient in relation to the high and low bus volumes forecast in the KCM white paper. In the paper, room for coaches would be required along 80th Ave. SE. for passenger drop-off (for an estimated 2 -3 buses). Under the high scenario, a total of 8 "pick-up" spaces would be required along N. Mercer Way (7 EB) and 1 (WB). An additional 7 spaces would be required for layover. Under the low scenario, a total of 6 would be required for passenger "pick-up" along N. Mercer Way (5 EB) and (1 WB), with 5 additional spaces needed for layover.

- Potential layover on 77th Ave SE., as identified in the KCM white paper are no longer identified on the map alternatives. Has this been ruled out? If so, there would be no need to consider Alternative 3 (roundabout at Sunset Way), unless the taking of the two homes under Alternative 4 is a fatal flaw.

- Recommend evaluating the east side of 77th Ave. SE and/or the south side of N. Mercer Way for passenger drop-off in Scenarios 3 and 4 (so riders do not have to cross the street).

- The ***Bus Capacity and Ridership Summary: Peak 3-Hour Direction*** table shows a total ridership projection of 2,882 in comparison to 2,690 existing (Fall 2013, Routes 202, 205, 210, 211, 212, 214, 215, 216, 218 and 219), a growth rate of only x% per year. Tony Woody said at the last meeting that he would verify the model's assumptions in regards to the projection.

- Although this analysis is attempting to model various routing alternatives, Metro will need to see further design details of bus stop facilities, traffic signal operations, bus turning movements at intersections and into and out bus stops to verify the following:

- Left turns on 80th from the off-ramp and from the bus stop onto the ramp with potential delays and conflicts from buses and cars for each alternative that propose left turns (physically making the stops and turns, as well as what are the delays for those movements with and without signals)
- What the analysis for delays and travel time would be if new signals or special signal on 80th to make left turns would be

- What if 80th was made a transit only facility except for right ons (going to the ramp) and right offs getting off the ramp for HOV's? How would this impact traffic circulation?

- Will you be analyzing/simulating the peak pedestrian loads that would be getting off the buses to access the train, assuming some grouping of buses arriving at the same time, and vice versa for trains alighting peak passenger loads to buses staged to leave? What are these projected passenger loads and how do they compare with other existing facilities?

- The transit operations for serving an intercept concept of this magnitude has not been done before locally, so there are concerns about how buses would be staged and leave the facility with a large number of passengers alighting the train. We may need to work out details to somehow use both east and west station entrances to board buses.

- We would like to see a bus stop capacity analysis for each of the bus stops to determine if they are sufficient for the highest proposed peak hour of buses and would like to know what parameters were assumed for the analysis (see latest TCRP Transit Capacity and Quality of Service Manual). The capacity should be based on the number of buses that can service the stop, probably assuming all 60' coaches that can actually serve the stop with independent pull-in and pull-out. There may be some stops that don't require independent pull-in and pull-out, but these need to be stated in the assumptions.

- The study should consider potential ADA issues

- How will the implementation of the Mercer Island intercept concept impact passenger loading LOS on Link? Will Link provide adequate capacity to accommodate the projected demand?

Potential New Concepts

Metro has a few new potential concepts that the group may want to explore further:

80th Ave. SE Transit Center Concept

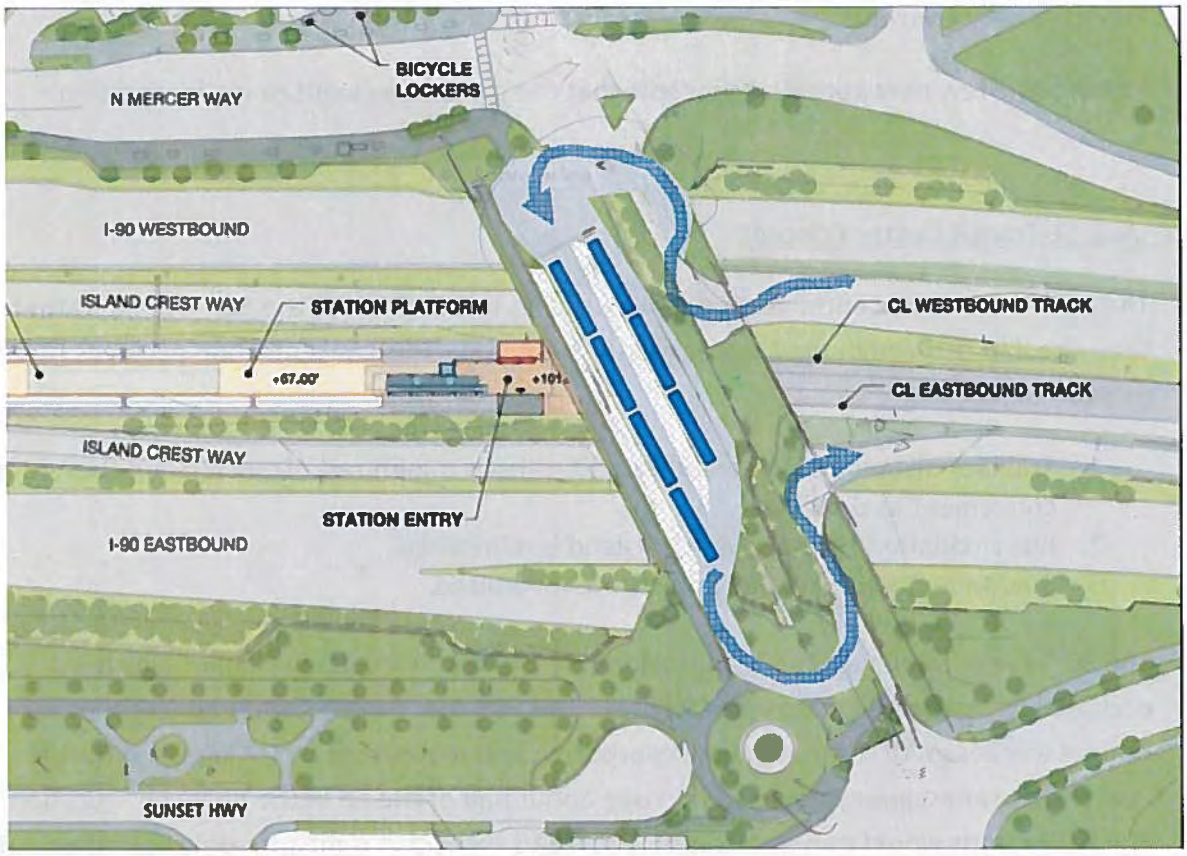
The 80th Ave Transit Center concept concentrates bus activity on the 80th Ave lid, rather than circulating through the Mercer Island street grid. This concentration achieves three primary objectives:

1. Transfer distance between buses and trains is minimized. Transfers are therefore as convenient as possible.
2. Bus circulation through Mercer Island is minimized.
3. Bus/pedestrian/bike/GP conflicts are minimized.

The 80th Ave overpass and lid is approximately 140 feet wide, about half of which is occupied by landscaping and bike facilities. The 80th Ave Transit Center concept would require a redesign of this overpass, repurposing space occupied by GP lanes for transit center use. Landscaping would still occupy about half of the lid in the final configuration. The HOV ramps would remain accessible to HOVs through a right-turn only operation. The bike facility would be relocated to the western edge of the lid. GP traffic would be accommodated by the nearby 77th Ave and Island Crest Way overpasses.

As stated in the East Link FEIS, the I-90 Parks on the Lid are determined to be a part of the I-90 freeway and not Section 4(f) resources—would need to confirm not a fatal flaw.

What, if any WSDOT and/or FHWA involvement/approvals may be required?



Double Round-About Concept

It would appear that under Alternative 4 (round-about at N. Mercer Way), there is inadequate space for layover to accommodate the number of spaces required for an intercept operation. Under this scenario, both round-abouts (at N. Mercer Way and Sunset Way) would be constructed. The Sunset Way round-about would allow access to potential layover spots on either side of 77th Ave. SE. In addition, the east side of 77th could be used for drop-off. In the AM, when the buses are "live-looping" and taking layover elsewhere, the N. Mercer Way round-about would be used. In the PM however, when layover space is required on Mercer Island, the Sunset Way round-about would be used.

Passenger Drop-Off with Pedestrian Ramp on I-90 Off-Ramp Concept

Under this scenario, passengers would alight along the westbound HOV off-ramp then access the Link station via a pedestrian access ramp under 80th Ave. New passenger facilities would be constructed along the north side of the off-ramp. This would allow riders to alight in close proximity to the station and would not require crossing at grade. This facility could be

incorporated with any of the specified scenarios. With a clockwise pattern, a signal with a queue jump would likely be necessary to allow an unimpeded left turn, while a counter-clockwise pattern would require a round-about to turn around and board riders.

What, if any WSDOT and/or FHWA involvement/approvals may be required.

City of Mercer Island Comments
Bus/Rail Integration Study
March 13, 2014

Clarifications Needed

1. Could we get definition clarification on terms like 'PM peak volume' and 'PM peak hour'? Specifically which hours are considered peak hours for both AM and PM peak volume.
2. Regarding the LOS table, what are the current LOS at those intersections?
3. Regarding the 'transit ridership summary: PM Peak 3-hour period', is it correct that it is predicting essentially no change in ridership on the floating bridge and a 3% increase in ridership on the east channel bridge?

Scenario Maps

1. Regarding the scenario maps, it appears that the peak hour bus volume box in the lower right corner is misplaced or incorrect. eg on scenario 4, it shows SB 36 and NB 41, yet there should be only local buses at that point. Please clarify.
2. Regarding 'Mercer Island and I-90 Peak Hour and Daily Bus Volumes', it appears under the FEIS, our peak volume and daily total would drop significantly, while under the intercept plan our peak would increase 50% and while our daily total would drop a little. True?
3. It would be helpful to have a scenario 0 map that would show existing movements…including perhaps an I-90 screen for buses passing by but not stopping. Scenario 1 could benefit from the I-90 screen too.
4. Scenario 1-4
    a. Shows a 4-way stop at SE 27th St./78th Ave. SE. There is a traffic signal there today so it should be shown that way in all scenarios.
    b. It would be helpful for staff and lay persons to be able to see on the scenario graphics or a separate map,
        i. All buses by route and frequency/time of day on MI surface streets currently and proposed, highlighting the peak hour trips. Identify which ones will dead end on MI, which buses could turn around elsewhere on the eastside, and which must turn around on MI because it's the first/last stop.
        ii. Show graphically, the bus routes that use the streets shown on the scenario maps.
        iii. The purpose of this request is so the pertinent data is easy to understand so there is less confusion.
5. Scenario 3 (CCW with Sunset Highway/77th Ave. SE roundabout)
    a. Since bus layover is only needed during the pm peak hour(s), a roundabout at Sunset Highway results in all of the buses having to go down to Sunset before they can turn around. I'd suggest constructing an additional roundabout at NMW/77th Ave. SE to provide a shorter off-peak route so buses can turn around at that location during the other 21 hours of the day when buses don't need to layover.
    b. This scenario directs more buses through the NMW/77th Ave. SE intersection that contemplated in the EIS. These additional trips need to be mitigated. This might mean that Sound Transit either constructs the required traffic signal or a roundabout in this location at the same time as a roundabout at Sunset Highway.
    c. I am concerned that this roundabout will result in buses stopping along 77th Ave. SE, resulting in impacting potential emergency vehicle access to the sidewalk area at the top of the escalators as well as blocking access to kiss-n-ride spaces on 77th Ave. SE.

Bus Staging

There's nothing in writing/on the scenario maps about number of buses staging on MI at any given time…is that not a part of the study? Please include the linear space needed to accommodate them. Also include information about idle time and/or noise.

Bus Trips

In previous material, there was a sizeable range of bus trips, dependent on whether Metro had funding or not and other factors. It would be good to understand the underlying assumptions in this analysis. Please provide information with assumptions based on the higher range of bus trips as well.

Bus Routes

1. What exactly is going on with the internal MI routes:
    a. According to the Metro website, it looks like the 203 and 213 run the same route (from the Park and Ride to EMW and Shorewood) and that there are 18 runs of the 203 and 6 runs of the 213 every day. That does not square with the numbers in the "Mercer Island and I-90 Peak House and Daily Bus Volumes" chart which show 9 as the Daily Volume for the 203 and 0 for the 213.
    b. As to the 204 (ICW), it looks like they plan on significantly increasing Peak Hour service on this route. They now say there are no buses during the Peak Hour. Unless the AM Peak Hour ends before 9am, this does not seem correct based on the website.
    c. Similarly as to the 201 (also ICW), according to the website there are currently 2 AM Peak Volume runs.
2. Why would Routes 111 and 114 be reoriented to Downtown Bellevue if they are coming up from Renton/Newcastle. They now go across I-90 without stopping on MI. Same as to 554 which now goes on I-90. Would make no sense to run that into Downtown Bellevue.

Financial Analysis

Is there any financial analysis planned? Value to Metro of reduced route lengths? Cost of mitigation improvements on MI? Savings on the D2 roadway? etc.

Eastlink Bus/LRT Systems Integration Study

Response to comments from CH2M HILL/Sound Transit
April 4th, 2014

King County Metro:

1st Bullet: Comment on graphic

- Will update where drop-off, pick-up and layover will be located at on drawings
- Will address how many buses can be accomdated in terms of dependency of buses at stops/layovers

2nd bullet: Comment on # of spaces for pickup, layover

- An assessment of the number of required spaces vs. spaces available will be assessed in evaluation criteria for each alternative

3rd bullet: Layover space on 77th Ave.

- 77th Layover space has been included back into the alternatives and will be documented in the final evaluation and report

4th bullet: 77th Avenue drop-off space

- Drop off space on 77th Avenue is being evaluated in the final evaluationa nd report

5th bullet: Comment on ridership

- This was a result of not all buses stopping at Eastgate. This problem has been fixed in the model and show an increase for the routes mentioned in the 25%-35% range.

6th bullet: Comment on transit left turns, signal timings

- This level of detail will not be addressed in final design

7th bullet: Comment on 80th Avenue Transit center

- 80th Avenue Transit Center concept is being rejected to do limited space available and effects on traffic flow

8th bullet: Passenger load

- Passenger loads will be assessed for the different scenarios in the evaluation

9th bullet: Comment on loading areas

- Will note in final evaluation/report

10th bullet: Bus stop capacity analysis

- Initial calculations show that stop capacity will be sufficient with 2 or 3, but the TRCP manual does not take into account the type of loading that is occuring at this location (multiple buses being loaded at the same time and leaving at the same approximate time)

11th bullet: ADA issues

- ADA issues will be covered in the design stage

12th bullet: Passenger loading LOS

- This will be addressed in the final evaluation and report.

Other concepts presented in comments from KCM

- Will address and discuss in final report

<u>Mercer Island Comments:</u>

{Clarification:}

1. We will clarify this in the final report and graphics. In general, PM Peak Period represents a 2-4 hour period and peak hour only represents a 1 hour period
2. Current LOS is documented in Eastlink FEIS
3. Correct - 3% total transit ridership on east channel bridge

{Scenario Maps}

1. Fixed
2. Under FEIS, many I-90 routes will not stop on Mercer Island. Under the systems integration scenario, all buses will have to stop on Mercer Island for the LRT transfer. Thus the increase of ~ 50% for peak hour systems integration
3. Will try and add existing conditiosn map (Scen 0)
4. Will attempt to add additional graphics/details for better explanation
5. Comments on Scenario 3
    a. Suggestion to create additional roundabout at 77th/NMW for shorter routes during off-peak
    b. Impacts at 77th/NMW will be noted in final report. It is assumed that 77th/NMW will be signalized as part of this project
    c. Concerns with EV access on 77th

{Bus Staging}

1. Request to include linear space for bus staging on MI at any given time. Information about idle time and noise →Will address in enviornmental evaluation

{BusTrips}

1. Please refer to KCM white paper on underlying assumptions about # of buses

{Bus Routes}

1. 203/213 become the 204 routes – the routes are integrated together
2. Routes 111/114 will go to Bellevue and use Eastlink to travel to Seattle

{Financial Analysis}

1. Not being addressed in this study