Appendix C
RapidRide Roosevelt
Transportation Technical Report

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FINAL REPORT

RAPIDRIDE ROOSEVELT
TRANSPORTATION TECHNICAL REPORT

Prepared for

Seattle Department of Transportation

November 2018 (updated October 2019)

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ACRONYMS AND ABBREVIATIONS

AAWDT	average annual weekday traffic
ADA	Americans with Disabilities Act
AVL	automated vehicle location
BAT	business access and transit
BRT	bus rapid transit
City	City of Seattle
CVLZ	commercial vehicle loading zone
FTA	Federal Transit Administration
HOV	high-occupancy vehicle
I-5	Interstate 5
ITS	intelligent transportation system
KCM	King County Metro Transit
LOS	level of service
min	minutes
mph	miles per hour
NB	northbound
OCS	overhead contact system
PBL	protected bicycle lane
PLZ	passenger loading zone
PSRC	Puget Sound Regional Council
RPZ	restricted parking zone
SB	southbound
SDOT	Seattle Department of Transportation
SR	State Route
STOPS	Simplified Trips-on-Project Software
TOL	transit-only lane
TPSS	traction power substation
VMT	vehicle miles traveled
WSDOT	Washington State Department of Transportation

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EXECUTIVE SUMMARY

Introduction

This Executive Summary highlights the transportation effects associated with the RapidRide Roosevelt project (also called the Build Alternative) on the transportation system. A broad set of transportation elements were analyzed to compare the project (Build Alternative) to the No Build Alternative.

This Executive Summary provides a description of the project alternatives, a summary of the transportation methodology and assumptions, discussion of key project impacts, followed by discussions of likely construction impacts and the potential mitigation measures for both operational and construction impacts. Indirect and cumulative impacts are addressed in Sections 8 and 9 of this Transportation Technical Report, but they are not summarized here because they do not involve direct project impacts.

Project Alternatives

Two alternatives were evaluated in this transportation analysis for the RapidRide Roosevelt Transportation Technical Report: a No Build Alternative and a Build Alternative. These alternatives are summarized below and further described in Section 2 of this report.

The project is expected to be open by year 2024 with a horizon year of 2040; consistent with local and regional planning. Therefore, the No Build Alternative would include all reasonably foreseeable projects by years 2024 and 2040. Within or adjacent to the study area, the key transportation projects include the Sound Transit North Link Extension that provides light rail service to University District and Roosevelt areas; State Route (SR) 520 improvements at Interstate 5 (I-5); SR 99 Viaduct Replacement; and Center City Connector Streetcar. These projects are all assumed to be operating by year 2024. By year 2024 and 2040, traffic growth in the study area is expected to increase, but within the project alignment, minimal direct transportation changes from existing conditions are expected except for the Sound Transit Link Roosevelt station near the north end of the project.

The RapidRide Roosevelt project is approximately 6 miles long and would operate in its own lane or in mixed traffic within existing rights-of-way. Figure ES-1 illustrates the project alignment and location. The RapidRide Roosevelt project would include installation of 26 stations—13 per direction—and a network of 33 traffic signal upgrades, which could include transit signal priority and queue jumps. These improvements along with the exclusive transit lanes in strategic locations and direct service between all neighborhoods along the corridor would provide between a 31-36% transit travel savings and reliability benefits in the PM peak period compared to the No Build Alternative. The project would also provide additional service to existing RapidRide stations in Downtown Seattle. RapidRide Roosevelt station design, branding, and amenities would be consistent with the existing RapidRide stations.

Figure ES-1. RapidRide Roosevelt Project Alignment

The RapidRide Roosevelt project would provide increased service frequency over existing transit service in the corridor and would extend the span of service to 24 hours per day. Buses would run at 7.5-minute headways or better during peak periods, and at 10-minute headways during midday and until 10 PM on weekdays. Weekend headways would range from 10 to 15 minutes. Overnight service would be provided 7 days per week.

Methods and Assumptions Summary

A Transportation Technical Analysis Methodology Technical Memorandum was developed for this project and is described in Section 3 and included in Appendix A of this report. The memorandum describes the evaluation measures and key assumptions for each transportation element analyzed, which were reviewed and approved by the Federal Transit Administration and cooperating agencies.

Figures ES-2 and ES-3 illustrate the north half and the south half, respectively, study area for the transportation technical analyses. The figures include the 67 study intersections, screenlines (segments of the alignment where certain analysis results are presented, such as vehicle volumes), truck streets on the alignment, and those streets that were included in the parking analysis. The exact geography studied varied by evaluation measure; refer to Section 3, Methodology and Assumptions, for more information.

Based on the project's schedule, available traffic forecasting information and consistency with local and regional planning, the transportation analysis focuses on the following 3 years:

- Existing Year: 2017
- Year of Opening: 2024
- Future Horizon Year: 2040

In all three analysis years, the PM peak hour, defined as 5 to 6 PM, was analyzed because it is considered to be the worst-case traffic conditions with the highest congestion. A review of traffic volumes along the corridor confirmed that the PM period generally had the highest volumes along the corridor.

Measures for assessing the transportation elements in the region and the study area (Table ES-1) are both quantitative and qualitative. These measures are organized by their respective transportation element and discussed in more detail in Section 3 and Appendix A, RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum.

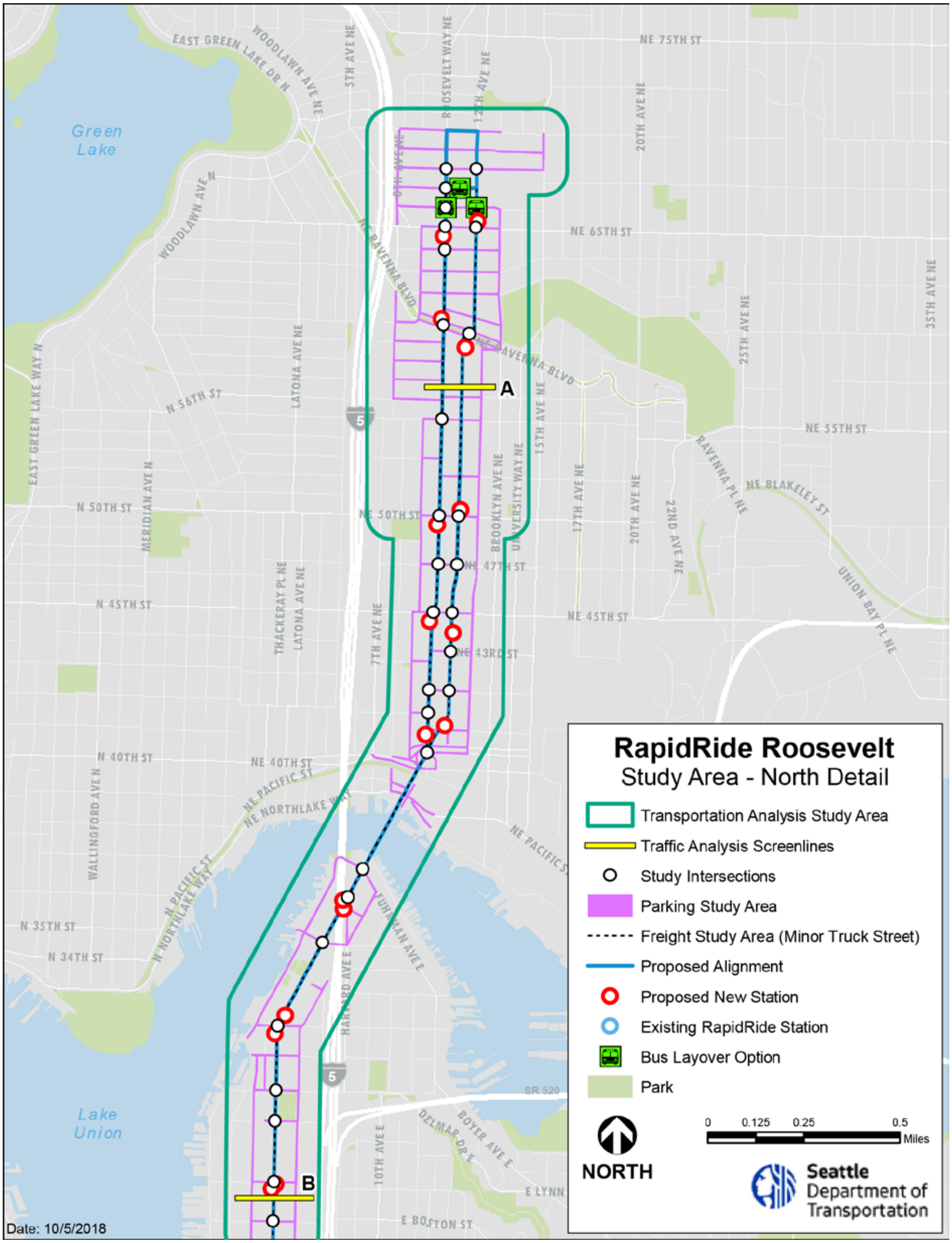

Figure ES-2. Study Area - North Detail

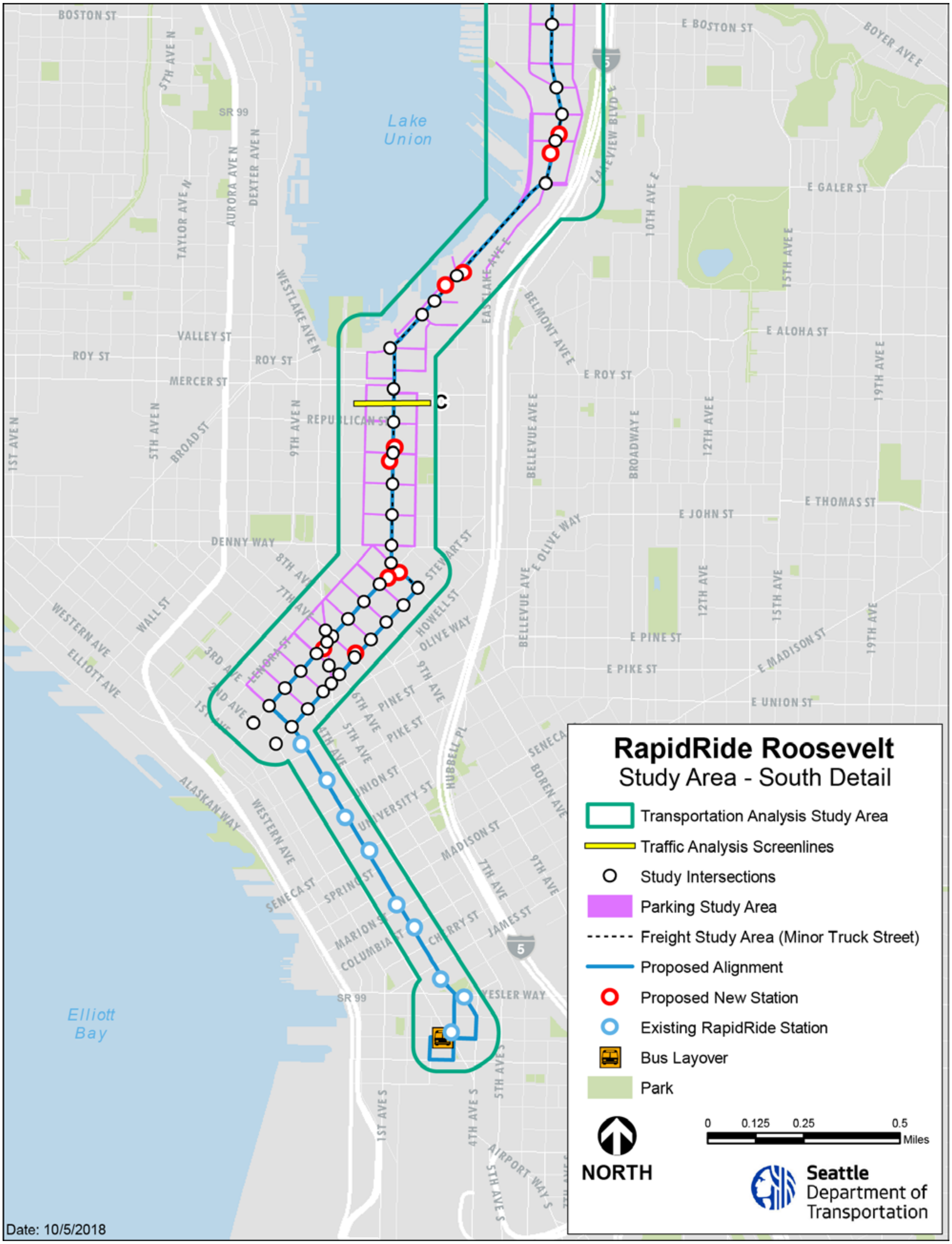

Figure ES-3. Study Area - South Detail

Table ES-1. Transportation Measures

TRANSPORTATION ELEMENT	MEASURES
Regional Traffic and Roadways	Regional roadway volumes Vehicle miles traveled (VMT)
Transit System	Annual and daily transit system trips Annual transit system boardings
	Annual and daily corridor ridership Transit reliability Transit service levels Transit service patterns Transit travel times Passenger loads
	Bus layover Daily bus stop boardings Station capacity
Arterial and Local Streets	General purpose traffic travel times Vehicle/person throughput and mode share Intersection level of service Roadway system Traffic forecasts Property access and circulation
Pedestrians and Bicyclists	Pedestrian system completion Sidewalk maintenance condition Intersection treatments Pedestrian volumes Bicycle volumes Bicycle facilities
Parking	Occupancy Supply impacts
Safety	Collisions Safety impacts
Freight	Freight travel times Freight access
Construction (for all Transportation Elements)	Qualitative assessment of construction impacts
Indirect Impacts	Qualitative assessment of changes to mobility and access due to project-related land use changes
Cumulative Impacts	Qualitative assessment of the incremental impacts of all the project's effects

Impact Summary

A broad set of transportation elements were analyzed in this Transportation Technical Report, including:

- Regional Traffic and Roadways
- Transit System
- Arterial and Local Streets
- Pedestrians and Bicyclists
- Parking
- Safety
- Freight

These elements were analyzed to compare the project (Build Alternative) to the No Build Alternative. From this analysis, four transportation elements were determined to have project impacts and are summarized in this section. These elements are:

- Transit System
- Arterial and Local Streets
- Pedestrians and Bicyclists
- Parking

Three transportation elements, regional traffic and roadways, safety, and freight, were determined to have no substantial impacts or changes due to the project and are therefore not discussed in this summary. Table ES-2 highlights the analyses for key transportation measures and compares the results between the No Build and Build alternatives.

Transit System

Under the existing condition (year 2017), King County Metro Transit (KCM) routes 67 and 70 jointly serve the RapidRide Roosevelt corridor. However, no transit route currently serves the full extent of the project corridor; routes 67 and 70 converge from the north and the south in the University District, east of the corridor, where a transfer is possible. This service pattern would remain unchanged under the future No Build Alternative, so no direct transit connection would be provided between the neighborhoods that would be served by the RapidRide Roosevelt project. Under the Build Alternative the project would provide direct and more frequent transit service between the Downtown, South Lake Union, Eastlake, University District, and Roosevelt neighborhoods.

With RapidRide service, the transit service levels in the corridor would increase from the existing condition. The service hours along the corridor would increase from 21-hour to all-day (24-hour) service. In addition, off-peak headways would improve from 15 minutes to 10 minutes with RapidRide service. This would increase the number of daily transit trips from approximately 400 by Routes 67 and 70 today to about 460 per weekday with the RapidRide Roosevelt project (including Route 67) under the Build condition.

Table ES-2. Transportation Elements Summary

TRANSPORTATION ELEMENT	EXISTING CONDITIONS	2024		2040	
		NO BUILD	BUILD[a]	NO BUILD	BUILD[a]
TRANSIT SYSTEM					
Daily Weekday Trips (number)[b]	401	401	463 (+62)	401	463 (+62)
PM Average Transit Travel Times (minutes)	50.7	55.9	38.6 (-17.3, 31%)	66.4	42.2 (-24.1, 36%)
Reliability	Limited to no transit priority treatments		RapidRide features, such as, transit signal priority, queue jumps and bus-only lanes	Same as Year 2024	
Daily Ridership (boardings)[b]	13.090	10,250	21,600 (+11,350, 112%)	12,400	26,750 (+14,350, 116%)
ARTERIAL AND LOCAL STREETS					
Intersections at LOS F in PM Peak Hour (#)	2	6	8 (+2)	14	13 (-1)
PM Peak Hour Person Throughput[c] (#)	2,516	2,664	2,918 (+10%)	3,013	3,424 (+14%)
PM Average Auto Travel Times (mins)	27.3	31.7	33.2 (+1.7, +5%)	41.1	38.1 (-3.0, -7%)
PEDESTRIANS AND BICYCLISTS					
ADA Compliant Curb Ramps	130	130	323 (approximately 200 upgraded ramps)	130	323 (approximately 200 upgraded ramps)
Protected Bike Lanes (lane-miles)	1.9	2.6	7.3 (approximately 5 new miles)[d]	2.6	7.3 (approximately 5 new miles)[d]
PARKING[c]					
On-Street Parking Supply and Utilization[e]	4,271 – 4,589 stalls with 72-85% utilization		Project removes up to 471 to 699 stalls	Same as Year 2024	
On-Street Commercial Vehicle and Passenger Loading Zones	CVLZ: 148-170 stalls PLZ: 89-100 stalls		Project relocates up to 21 to 34 CVLZs and 15 to 24 PLZs	Same as Year 2024	

[a] The values within the parentheses indicate the expected change compared to the No Build Alternative.
[b] Daily weekday transit trips and transit ridership include Routes 67 and 70 under existing conditions and the No Build Alternative and includes Route 67 and RapidRide Roosevelt in the Build Alternative.
[c] Person throughput is the number of people that pass through that location for all vehicular modes (auto, bus, and transit).

Table ES-2. Transportation Elements Summary

TRANSPORTATION ELEMENT	EXISTING CONDITIONS	2024		2040	
		NO BUILD	BUILD[a]	NO BUILD	BUILD[a]

[d] New PBL lane-miles have been rounded from 4.7.
[e] Range of on-street parking values is due to time-of-day restrictions. Utilization is for the entire Project corridor.
LOS = level of service
ADA = Americans with Disabilities Act
CVLZ = commercial vehicle loading zone
PLZ = passenger loading zone

The project would improve transit travel times and reliability along the corridor. Project improvements would include signal upgrades, transit-only or business access and transit lanes, transit queue jumps at intersections, and station enhancements. In the existing condition, there is no direct bus route that travels between the northern and southern project limits. Riders currently need to transfer between Routes 67 and 70 or other less-direct routes. Therefore, a bus ride between NE 65th St and 3rd Ave in Downtown currently takes 50.7 minutes in the PM peak. With congestion expected to grow in the future, this trip in the No Build condition would take, on average, 55.9 and 66.4 minutes by years 2024 and 2040, respectively. With the project's proposed transit speed and reliability improvements and direct transit service, the same trip by bus would decrease to 42.2 minutes in 2040, as much as a 24.1-minute (36%) improvement over No Build conditions. In addition, Link light rail will provide service between Roosevelt and Downtown Seattle in the future No Build Alternative, with travel times of approximately 15 minutes between these two areas.

Because of bridge opening restrictions between 7 AM and 9 AM and 4 PM and 6 PM, travel along the corridor would not typically be interrupted by the University Bridge during those travel times. Outside of those periods, the bridge opens an average of fewer than 4 times per day (between 9 AM and 4 PM and 6 PM and 11 PM in 2017). In comparison, the RapidRide Roosevelt project would have over 100 bus trips crossing the University Bridge during those periods. Based on existing KCM Route 70 data, the bridge opening affects about 8% of the Route 70 trips over the bridge and, while the bridge opening typically takes up to 4.6 minutes, the average delay experienced by Route 70 buses is about 1 minute. This indicates that the bridge opening has a minor impact on overall reliability and the transit speed and reliability improvements proposed along the rest of the corridor would help ensure the RapidRide route maintains its schedule.

With the increased transit service hours, more frequent service, travel time savings, and improved reliability, transit ridership in this corridor is expected to increase with the project. Currently, the combined total ridership of KCM routes 67 and 70 is slightly over 13,000 daily riders. In the future No Build condition, with light rail service to Northgate, the ridership on those routes would decrease to 12,400 by 2040. With the project, ridership on RapidRide Roosevelt would be 17,400 in year 2024 and up to 22,150 by year 2040. Daily ridership in the corridor would increase to over 26,000, an increase of 14,350 riders by year 2040 with the project.

Arterial and Local Streets

Many of the streets along the corridor are classified as Principal Arterials, including Roosevelt Way NE, 11th Ave NE and 12th Ave NE, Eastlake Ave E, Fairview Ave N, and Stewart St. Currently, two major intersections operate at LOS F in the corridor: Fairview Ave N at Mercer St and Fairview Ave N at Denny Way.

In the future, traffic volumes are expected to increase, which would increase traffic congestion in the corridor. By 2024 and 2040, 6 and 14 intersections in the study area, respectively, would operate at LOS F in the PM peak hour under the No Build Alternative. With the project, travel patterns and roadway operations would adjust along the corridor as more people use transit and roadways are modified with the project's transit improvements. As a result, some intersections would experience lower amounts of delay while at others delay would increase. Overall, traffic operations with the project would be similar to the No Build Alternative; by 2024 and 2040, as 8 and 13 intersections would operate at LOS F in the PM peak hour, respectively.

The ability for more persons to travel through the corridor (person throughput) would increase due to the increase in transit ridership under the Build Alternative. By year 2040 about 3,000 people would, on average, be able to travel through the project's three screenlines (Figures ES-2 and ES-3) in the No Build Alternative. With the project, person throughput would increase to about 3,425 (+14%) across the three screenlines.

Auto travel times in the PM peak hour vary by a few minutes between the No Build and Build alternatives. In year 2024, average auto travel time would be about 2 minutes higher with the project, but by year 2040, auto travel times would decrease by 3 minutes with the project as some of the proposed roadway and signal improvements would reduce congestion in certain areas of the corridor. The changes in auto travel times over the full 6-mile corridor are not considered to be substantially different between the No-Build and Build alternatives.

At the Fairview Ave N and Mercer St intersection there are no infrastructure or channelization changes proposed to the east leg of the intersection that serves as the southbound and northbound I-5 off- and on-ramps and I-5 express lane exit ramp. Additionally, no roadway modifications are proposed to the west leg of the intersection (Mercer Street). There are channelization changes proposed on the north and south approaches at the Fairview Ave N and Mercer St intersection and on the south leg at the Fairview Ave N and Valley St intersection. Based on the traffic analysis, vehicle queues on the east leg, I-5 westbound off-ramp at the Fairview Ave N and Mercer St intersection would not be longer with the LPA than with the No Build Alternative. Therefore, the project is not expected to impact I-5 ramps or the I-5 travel lanes at this location.

Pedestrians and Bicyclists

Currently, sidewalks are present along the entirety of the corridor and are generally in fair to good condition. Within the corridor, there are more ADA-compliant curb ramps in the Downtown Seattle and South Lake Union neighborhoods, and fewer in the Eastlake, University District, and Roosevelt neighborhoods. With the RapidRide Roosevelt project, the sidewalks at the stations would be replaced and improved, pedestrian street crossings would be maintained, and approximately 200 curb ramps would be upgraded to be ADA-compliant.

The Roosevelt corridor has a high level of bicycle use as about 1,600 riders cross the University Bridge per day; the second highest bicycle count in the City of Seattle (City). There are currently 1.9 lane miles of protected bicycle lanes (PBLs) along the project alignment, with most of this being the southbound PBL on Roosevelt Way NE between NE 65th St and University Bridge. No PBLs are currently provided along Eastlake and Fairview Avenues in the project corridor, and these avenues experience some of the highest numbers of bicycle collisions in the corridor.

In the future, the Seattle Department of Transportation (SDOT) Fairview Ave N Bridge Replacement project would add a short section of PBL on Fairview Ave N as part of the No Build condition, while the project would add about 5 lane miles of PBLs on 11th Ave NE and 12th Ave NE to serve as the couplet to the existing PBL on Roosevelt Way NE, as well as PBLs on Eastlake Ave E and a two-way cycle track on Fairview Ave N. Specifically, the Project includes the following PBLs:

- Two-way cycle track on north side of Fairview Ave N would connect Valley St to the Fairview Ave N Bridge. The cycle track would be separated from road by proposed sidewalks and landscaping between Valley St and Yale Ave N and separated by a buffer from vehicular traffic on Yale Ave N up to the planned PBLs on north side of bridge (except between Yale Ave N and Ward St where there would not be a cycle track and bicycles and pedestrians would both use a shared use path that is separated from vehicular traffic by a landscaped strip).
- PBLs on Eastlake Ave E would be provided on both street curbsides between the Fairview Ave N Bridge and Harvard Ave E. These PBLs would serve about 900 riders that currently travel on Eastlake Ave E with no bicycle facility (see section 4.4.6 and Appendix E, *Eastlake Bicycle Facility Evaluation Memorandum*). Transit islands for four in-lane stations in each direction would route the PBLs between the bus island and the curb. Between Harvard Ave E to the University Bridge, bicycle lanes would not be protected from vehicular traffic and would connect to the existing PBLs across the bridge.
- A northbound curbside PBL on 11th/12th Avenues NE between NE Campus Pkwy and NE 67th St would serve as the couplet to the existing southbound PBL on Roosevelt Way NE. The PBL would be located on the east curbside between NE Campus Pkwy and NE 43rd St to connect more safely with the University District Link station near NE 43rd St, then shift to the west curbside between NE 43rd St and NE 67th St to connect with the Roosevelt Link station near NE 67th St. Having the PBL on the west curbside locates the PBL on the left side of a one-way street consistent with City guidance for one-way streets with transit service and bicycle lanes.[1] A transit island for one in-lane northbound station in each direction would route the PBL between the bus island and the east curbside at NE 41st St but remaining stations would be along the east curbside on the opposite side of the street from the PBL.

The bicycle facilities would serve the Project by providing access to the transit stations along the corridor, connect with existing bicycle facilities, and fill an existing gap in the regional bicycle network, thereby improving bicycle connections with the transit system. The PBLs would buffer the bicycle lane from the travel lanes and improve safety for bicyclists by separating them from

[1] Seattle Right-of-Way Improvements Manual - https://streetsillustrated.seattle.gov/design-standards/bicycle/bike-lanes-and-transit-service/

other modes and removing them from mixed traffic. These improvements are consistent with the Seattle Bicycle Master Plan (City of Seattle, 2014).

Parking

On-street and off-street parking exists throughout the project corridor. Within the parking study area, there are between 4,271 and 4,589 on-street parking stalls with an average utilization rate of 72% to 85% depending on the time of day. Additionally, depending on the time of day, between 148 and 170 commercial vehicle loading zones are provided and between 89 and 100 passenger loading zones are available in the corridor.

Throughout the study area, there are numerous off-street parking facilities, with most located in the Downtown, South Lake Union, and University District neighborhoods. The Eastlake neighborhood, unlike the other neighborhoods in the project corridor, has relatively few off-street parking facilities.

With the project, depending on the time of day, between 471 and 699 on-street parking stalls would be removed, and 21 to 34 commercial vehicle loading zones and 15 to 24 passenger loading zones would be relocated, where feasible. Within the Eastlake neighborhood, the project would remove all the on-street parking and loading zones along Eastlake Ave E between Fairview Ave N and Fuhrman Ave E. This is estimated to be 325 on-street parking stalls, of which on average more than 90% are occupied during the mid-day period and about 25% of these vehicles are parked for over 4 hours. An overnight study of parking in the Eastlake neighborhood had an overall parking utilization rate of 76% in the extended study area, due in part to a relatively low on-street parking utilization rate of 34% on Eastlake Ave E. This indicates residents may not use available parking along Eastlake Ave E after businesses and restaurants close in the evenings or because of early morning parking restricted zones for the southbound curb lane.

With the northern layover options, the school bus loading zones along 12th Ave NE between NE 67th St and NE 68th St would be impacted if layover was provided along this section of the street with the NE 70th St bus turnaround option. With the NE 67th St bus turnaround option, proposed curb space uses including passenger load zones associated with developments along NE 67th St as part of the Roosevelt Link light rail station could be impacted if layover is provided along NE 67th St.

Construction Impacts

The construction of this project would affect all modes of travel that use this corridor. The total construction duration of the project would be approximately 24 months, depending on how the project is staged and phased, but the impacts to any specific segment of the corridor would be shorter in duration.

Construction of the RapidRide Roosevelt project would result in short-term construction impacts along the corridor. In general, one lane of traffic adjacent to the station area would be temporarily closed. For some work elements, such as traffic signal work, overhead contact system (OCS) pole and wiring installation, paving, and utility work, half of the roadway may need to be closed for short periods. To the extent feasible, these activities would be scheduled during non-peak traffic periods. During construction, work zone traffic control measures would help to ensure vehicles are able to navigate safely through or around construction areas.

Lane closures would affect transit service, including temporary stop closures and delays to buses from congestion. It is expected that the transit routes would continue along the corridor and not require detours. With the upgrade to RapidRide stations for many existing stops, station construction would require temporary relocation of the stop.

To the extent feasible, access to adjacent properties would be maintained along the corridor.

Station construction would generally require the closure of the surrounding sidewalk near that station. At intersections where construction work would take place, one or more crossing movements could be temporarily closed. In these conditions, pedestrians would need to use an adjacent crossing or cross the street using the other intersection crossings.

Bicycles would be required to detour from existing bicycle lanes to general purpose travel lanes where those facilities overlap with station, OCS, and signal construction work. Cyclists continuing to ride on the corridor may need to ride over disturbed asphalt or steel plates, and in lanes with general purpose traffic. Alternatively, they would have the option of using parallel streets, which in the Roosevelt, University District, and Eastlake neighborhoods include designated neighborhood greenways and signed bicycle routes.

Most of the construction activities would likely remove the current parking along the segment being constructed. Parking along the cross-streets or on parallel streets is less likely to be affected by the project construction. In areas where the parking would not be replaced following construction, this removal would be permanent. In some segments, the loss of parking would only be temporary for the duration of the construction in that area. CVLZs and PLZs would also be removed in the areas where on-street parking is removed during construction and temporarily relocated where feasible.

Potential Mitigation Measures

This section describes the potential mitigation measures that would be implemented for the operational (parking) and construction impacts of the RapidRide Roosevelt project. No mitigation is anticipated for operational impacts to the regional traffic and roadways, transit system, arterial and local street operations, pedestrians and bicyclists, safety, and freight because either there are no substantial impacts or the project results in benefits.

Operation (Parking)

The RapidRide Roosevelt project would improve transit service and offer new and upgraded pedestrian and bicycle facilities to provide alternatives to driving and parking in the corridor. The project is planning to provide frequent, all-day transit service that would have shorter travel times and better reliability that would attract new transit riders.

Within the Roosevelt, University District, South Lake Union, and Downtown neighborhoods (zones 1 through 4 and zones 8 through 10), additional parking strategies would not be proposed as either the parking removed is not substantial or there is available parking (on-street or off-street) to accommodate the loss of the parking removed by the project, as identified in Tables 4-16, 4-17, and 5-23. Along the entire project corridor, the City would relocate potential loading zones near the removed loading zone areas, where feasible, to facilitate deliveries and other functions for those activities.

Within the Eastlake neighborhood (zones 5 through 7), the project would remove all the on-street parking and loading zones along Eastlake Ave E between Fairview Ave N and Fuhrman Ave E. The Eastlake commercial area is constrained by limited on-street parking on the adjacent block faces and the fact that, unlike the other study zones, there are relatively few off-street parking facilities that would provide additional parking options. Results of the parking duration study in Eastlake commercial area show that about 25% of the vehicles parked on Eastlake Ave E (zone 6) are parking long-term (over 4 hours). These longer-term parked vehicles most likely belong to employees or residents in the area.

Beyond the relocation of loading zones throughout the project corridor, the City would coordinate with the Eastlake neighborhood on parking and access strategies, which may include:

- Working with the businesses and neighborhood to communicate the parking regulations and the available commute options.
- Considering adjustments to the RPZ to better ease parking congestion in the residential area and to address the needs of all curb space users in the area.
- Facilitating a discussion, and if desired, seeking funding to work with private businesses that may be interested, or able to, allow parking lots to be shared parking for other uses.

The City will evaluate the costs, timing, issues, and opportunities with these potential mitigation strategies throughout the rest of the project design and development.

Construction

SDOT would finalize detailed construction plans during the project final design and permitting phases prior to construction. All mitigation associated with constructing RapidRide Roosevelt would comply with applicable regulations governing construction traffic control and truck routing. Potential mitigation measures for impacts during construction would include the following, as appropriate:

- Construction activities would be coordinated with any other ongoing construction projects and would be scheduled to reduce their impacts at periods of high travel demand, such as during peak weekday commute hours and special events.
- SDOT and KCM would work together to monitor the impact of construction on transit service through the corridor. If needed, the following additional actions could be taken:
  - Establish temporary roadway changes to improve roadway capacity during periods of lane closure, such as restricting parking to provide an additional travel lane.
  - Establish temporary transit reroutes or detours around construction sites.
  - Establish temporary bus stops near closed stops, when practical, to reduce the distance that transit passengers need to walk to catch the bus.
  - Avoid concurrent closure of adjacent bus stops unless temporary stops can be established. This would minimize the additional distance that passengers must walk to catch the bus.

  - Establish and maintain ADA-accessible pedestrian access routes to adjacent open bus stops.

- Work requiring signal deactivation would be limited to off-peak periods, when practical, and uniformed police officers would direct traffic.
- SDOT would coordinate with the City's Special Events Committee and Seattle Police Department traffic control to provide enhanced public awareness of congestion and alternative modes for accessing events. It would post traveler's advisories on the SDOT Blog and website ("On the Move") and include special events on the City Traveler's Map.
- SDOT would provide signing and wayfinding to help travelers locate key destinations.
- SDOT would provide flaggers and/or uniformed police officers at key intersections when needed to facilitate the movements of freight and general purpose traffic and expedite emergency vehicles.
- Traffic management would be coordinated through the SDOT Project & Construction Coordination Office.
- If an existing pedestrian route is blocked by construction or other temporary conditions, a pedestrian detour route would be provided to maintain the continuity of movement. The existing facility would be replaced with a reasonably safe, convenient, and accessible temporary pathway. Proper signage meeting *Manual on Uniform Traffic Control Devices* (Federal Highway Administration, 2009) requirements would be in place during construction.
- If a safe bicycle facility cannot be provided on the corridor, then a bicycle detour route would be provided, which along most of the corridor would likely consist of a neighborhood greenway or existing signed bicycle route.
- For areas where parking space losses are short-term (during construction only), the parking would be re-established once the construction is completed in that area. The City would provide information to the neighborhood and businesses about other parking opportunities in the area and the available transportation options in lieu of driving.
- Where feasible, the City would create temporary loading zones (depending on construction activity and loading needs) to maintain commercial and passenger loading in reasonably close proximity to businesses (i.e., on side streets or on the other side of the street under construction).
- Temporary roadway rechannelization during construction would be implemented in accordance with standard City procedures, and traffic movements would be maintained where feasible. The closures of minor street approaches for construction at intersections would be scheduled for nighttime whenever possible to minimize disruptions to local circulation.
- Where driveways would be replaced or relocated, the City would coordinate with property owners to maintain access during construction, where feasible. If access is not feasible for limited durations, the City would attempt to schedule the construction to minimize access disruptions.

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1.0 INTRODUCTION

1.1 Project Background

The RapidRide Roosevelt project would provide electric bus rapid transit (BRT) service between Downtown Seattle and the Roosevelt neighborhood in northeast Seattle, while serving the Belltown, South Lake Union, Eastlake, and University District neighborhoods. The project corridor is approximately 6 miles long. Buses would operate in their own lane or in mixed traffic within existing rights-of-way.

The project's purpose is to improve transit capacity, travel time, reliability, connectivity, comfort, visibility, and legibility in the Roosevelt corridor, while also making related improvements for people walking and bicycling. In so doing, the project would improve overall access and mobility in a rapidly growing urban corridor, providing new and enhanced connections to major employment nodes, residential areas, schools, and businesses. The project includes numerous transit priority treatments to improve speed, reliability, capacity, and the passenger experience.

The RapidRide Roosevelt project would provide increased service frequency over existing transit service in the corridor and would extend the span of service to operate 24 hours per day. Buses would run at 7.5-minute headways or better during peak periods, and at 10-minute headways during midday and until 10:00 PM on weekdays. Weekend headways would range from 10 to 15 minutes. Nighttime hourly service would be provided 7 days per week from 1 AM to 5 AM.

1.2 Transportation Elements

This *Transportation Technical Report* evaluates existing and future local and regional transportation impacts and potential mitigation associated with the proposed RapidRide Roosevelt project. The future years are 2024 (the projected year of opening of the project) and 2040 (the project planning horizon). A formal project description is presented in Section 2, followed by a brief overview of the study methodology in Section 3. Section 4 describes the affected environment (existing conditions), Section 5 discusses environmental consequences (future conditions) of operation of the project, Section 6 discusses construction impacts of the project, Section 7 describes potential mitigation measures, and Sections 8 and 9 discuss indirect and cumulative impacts.

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2.0 PROJECT DESCRIPTION

2.1 No Build Alternative

The No Build Alternative assumes the RapidRide Roosevelt project would not be constructed. KCM periodically restructures their bus network to increase its efficiency and effectiveness. Without specific restructure commitments, the No Build Alternative assumes KCM's current bus network of Routes 67 and 70 continuing to serve the corridor without a direct bus connection between the Roosevelt neighborhood and Downtown Seattle and no improvements in bus reliability and speed. The projects listed in Table 2-1, are key future transportation infrastructure improvements near the project vicinity assumed in the No Build Alternative for 2024 and 2040. These improvements were assumed because they are considered reasonable and foreseeable, meaning these projects have been through environmental review, have funding identified, or are expected to be near term improvements. Refer to Appendix A for the complete list of transportation projects assumed in the No Build Alternative.

Table 2-1. Key Transportation Improvements Assumed in the No Build Alternative

TYPE	NAME	DESCRIPTION
Street and Highway	State Route (SR) 520	New six lane connection between I-5 and Montlake Blvd E. Includes reconstruction of the Portage Bay Bridge and new westbound to southbound freeway-to-freeway core HOV connection at the I-5/SR 520 interchange.
	SR 99 S King St to Roy St—Central Waterfront Viaduct Replacement	Construction of a bored roadway tunnel under Downtown Seattle, between the vicinity of S King St and Roy St, to replace the seismically vulnerable Alaskan Way Viaduct along the central waterfront.
	I-5: Seneca to Mercer St – Additional lane	Addition of a northbound lane in the Downtown Seattle area of I-5 between Seneca and Mercer Streets.
	Waterfront Seattle Program	Collection of streetscape and infrastructure projects to rebuild and enhance the downtown Seattle waterfront following the removal of the Alaskan Way viaduct.
Transit	Downtown Seattle Transit Tunnel (DSTT) – Transit Bus Operations	Transition of tunnel bus service to surface streets to accommodate light rail operations.
	Seattle Transit Corridors	Bus rapid transit service in City of Seattle as part of Metro CONNECTS. This includes RapidRide G Line (Madison St), RapidRide H Line (Delridge Corridor), Rainier, Market/45th, Westlake/Fremont, and 23rd Avenue corridors,

Table 2-1. Key Transportation Improvements Assumed in the No Build Alternative

TYPE	NAME	DESCRIPTION
	Center City Connector	Frequent streetcar service through downtown in a dedicated right-of-way, linking the existing South Lake Union and First Hill lines.
	Sound Transit Link Extension	Expansion of the Link Light Rail from the University of Washington to Northgate.
	Eastlake Off-Street Layover Facility	Facility for bus layover on Eastlake Ave E, north of Mercer St. Includes rechannelization of Eastlake Ave E.
Improvements on alignment	Fairview Ave N bridge Replacement	Replacement of Fairview Ave N bridge. Includes sidewalks and two-way protected bicycle lane.
	Third Ave Improvements	Transit improvements including extended bus-only hours, new ORCA readers, and new and moved bus stops.

2.2 Proposed Action

The RapidRide Roosevelt project would connect Downtown Seattle with the neighborhoods of Belltown, South Lake Union, Eastlake, University District, and Roosevelt. Compared to the existing conditions, the project would increase transit speed and reliability through enhanced signal systems and signal timing and roadway improvements. The project would increase passenger carrying capacity, serving high existing ridership and future population and employment growth. Service is targeted to begin in 2024.

The RapidRide Roosevelt project would run from 3rd Ave in Downtown Seattle to NE 65th St in the Roosevelt neighborhood (Figure 2-1 and Figure 2-2). Bus service would be provided using existing stations along 3rd Ave south of Virginia and Stewart Streets. No project improvements are proposed for the corridor south of the Virginia St and 3rd Ave intersection. The project would use the existing transit lanes on Stewart St between 9th Ave and 3rd Ave. Buses would travel along portions of S Main St, 2nd Ave S, and S Jackson St to transition from southbound to northbound service.

The RapidRide Roosevelt project would connect bicyclists with new transit service and enhance bicycle and pedestrian safety throughout the corridor. The project would add protected bike lanes along 11th Ave NE and 12 Ave NE and along Eastlake and Fairview Avenues. Pedestrian improvements would be added throughout the corridor.

The project includes the following elements:

2.2.1 Stations

- 26 new or upgraded RapidRide stations (13 for each direction of travel) from 3rd Ave in the south to NE 65th St in the north.
- Stations would be consistent with the existing RapidRide station standard, typically 80 feet long including a 12-foot-long shelter/transit canopy (see photo at right); longer stations would be provided where serving multiple routes. Each station could include a real-time arrival information system display, an off-board fare collection/card reader, a bench, pedestrian-level lighting, a trash receptacle, and RapidRide branding elements, including a signature signpost/blade marker, and a route information map.

Typical RapidRide Station

- All stations would meet Americans with Disabilities Act (ADA) requirements.
- The RapidRide Roosevelt line will serve existing stations along 3rd Ave in Downtown Seattle south of Stewart St.

2.2.2 Operations

- The Project would use 19 buses from the existing KCM fleet: 16 buses for operation in peak periods and 3 spare buses. All buses are buses would be 60 feet long, ADA-accessible from the front doors with a bridge plate, and articulated with front, middle, and back doors. The existing fleet has a service life until the early 2030s when the current fleet of buses would be replaced.
- The RapidRide Roosevelt route is expected to operate 24 hours per day. Buses would run at 7.5-minute headways or better during peak periods and at 10-minute headways during midday and until 10 PM on weekdays. Weekend headways would range from 10 to 15 minutes. Nighttime hourly service would be provided 7 days per week from 1 AM to 5 AM. Service will stop near the Roosevelt Link light rail station at 12th Ave NE and NE 65th St.
- Upgrading 33 intersections with traffic signals (including transit signal priority and/or adaptive signals) with 5 transit queue jumps. The enhanced signal system would provide priority to transit and respond to corridor traffic congestion.

Figure 2-1. RapidRide Roosevelt Alignment – North

Figure 2-2. RapidRide Roosevelt Alignment - South

2.2.3 Roadway Improvements

2.2.3.1 Transit Lanes

- The Project would provide approximately 0.2 mile of new transit-only lanes (TOLs) and 2.1 miles of new business access and transit (BAT) lanes, for a total of 2.3 miles of transit lane improvements in the South Lake Union and Eastlake neighborhoods. TOLs are typically indicated on the roadway with paint and allow buses to operate in a dedicated space and travel relatively unimpeded through congested areas. Fairview Ave N would be widened within the existing right-of-way to allow for a TOL in the center lane in the southbound direction between Valley St and Yale Ave N, which would also be utilized by the existing South Lake Union streetcar line. BAT lanes are signed curb lanes located along the route expressly reserved for buses, business access, and right turns.

2.2.3.2 Paving

- Concrete paving would be installed at new stations where required to support the weight of the buses. Full-depth concrete paving for approximately 1.4 miles is proposed on Eastlake Ave E between Fairview Ave and Fuhrman Ave E. Paving of approximately 0.5 mile is also proposed on Fairview Ave N between Mercer St and Yale Ave N to add the northbound BAT lane and southbound TOL. The Project would include approximately 1.5 miles of mill-and-overlay asphalt paving along 11th/12th Avenues NE from NE Campus Parkway to NE 67th St.[2] See Appendix D, Conceptual Design Drawings, for paving locations within the Project corridor.

2.2.3.3 Improvements within Washington State Department of Transportation (WSDOT) Limited Access Area

- The Project crosses the WSDOT Modified Limited Access Area along Fairview Ave N between Mercer St and Valley St. Limited access highways (such as I-5) mean the abutting property owner's right of access to the highway has been purchased, with the result being that the abutting property owner may, or in most cases may not, have access to the highway. "Modified limited access control" allows residential and commercial usage, but only in the specified locations and only for the specified uses as defined in the Limited Access Plans. Numerous studies have shown that controlling and limiting access to highways is a cost-effective way to help maintain the safety, capacity, and functional integrity of a highway (WSDOT, 2002).

- At the intersection of Mercer St and Fairview Ave N, the east leg of the intersection is the north and south off- and on-ramps to I-5. The east leg of the intersection is within WSDOT right-of-way and the remaining three legs of the intersection are within City right-of-way. No changes are proposed to the east leg of the intersection (I-5 ramps) or the west leg of the intersection (Mercer St). There are channelization changes being proposed on the north and south legs at Fairview Ave N and Mercer St and south leg at Fairview Ave N and Valley St described below.

[2] A concurrent non-Project activity would also mill and overlay 12th Ave NE from NE 67th St to Lake City Way.

- North Leg of Fairview Ave N and Mercer St Intersection
  From the centerline of the I-5 exit ramp terminal, the WSDOT Limited Access Area (with full access control) extends approximately 150 feet to the north along Fairview Ave N, with an additional 180 feet to the north of this Limited Access Area being a modified access control area. The proposed channelization would modify the existing 12-foot right turn lane to become a 12-foot combination through/right-turn lane and would add an additional 11-foot BAT lane by widening to the east.
- South Leg of Fairview Ave N and Mercer St Intersection
  From the centerline of the entrance ramp terminal, the WSDOT Limited Access Area (with full access control) extends approximately 140 feet to the south along Fairview Ave N with an additional 180 feet to the south of Limited Access with modified access control. The Project does not propose any channelization changes to the southbound lanes. The proposed channelization would modify the northbound lanes to be a combination 11-foot through/left turn lane, two 11-foot right turn lanes, and an 11-foot transit only lane.
- South Leg of Fairview Ave N and Valley St Intersection
  The WSDOT Modified Limited Access Area ends at the south leg of the Fairview Ave N and Valley St intersection. At the intersection of Valley St and Fairview Ave N there is an existing curb bulb in the southwest corner of the intersection that would be removed to create an additional southbound through lane.

2.2.4 Overhead Contact System and Traction Power Substation

2.2.4.1 Overhead Contact System

- Trolleybuses would be powered by electricity provided by an overhead contact system (OCS). OCS includes both poles and wires. The OCS consists of a contact wire above the roadway that conveys electric power from the traction power substation (TPSS) to the buses.
- New OCS poles and wire would be added north of the University Bridge, starting at Eastlake Ave E and NE 40th St, and along both 11th Ave NE and 12th Ave NE and Roosevelt Way NE (Figure 2-1). The OCS poles would be located within existing right-of-way (sidewalk) and would be spaced typically 100 feet apart. The OCS poles would be designed as consolidated traffic signal and/or lighting poles where possible. The Project would install approximately 360 to 410 OCS poles and between approximately 3.4 and 3.8 miles of OCS wiring would be installed, depending on the northern bus turnaround option selected. Construction of new OCS poles and wiring could affect solid waste pick up in the Project corridor. SDOT will coordinate with Seattle Public Utilities and adjacent properties through final design.

2.2.4.2 Traction Power Substation (TPSS)

- One approximately 13- by 21-foot TPSS with a surrounding 5-foot setback would be required for the Project (approximately 1,520 square feet in total); an adjacent transformer may also be needed. The OCS would connect to the TPSS via new OCS poles or underground conduits, depending on the TPSS site selected.
- Four sites on publicly owned property are being considered (Figure 2-1): the existing transportation right-of-way at the intersection of NE Ravenna Blvd and 12th Ave NE, Roosevelt High School property, the property associated with construction of Sound Transit’s Roosevelt Link Station, and the City of Seattle Green Lake Reservoir, which would

use existing utility poles for OCS along 12th Ave NE. The TPSS site will be determined during final design and based on several factors including space requirements, siting criteria (i.e. close proximity to the corridor, site accessibility, and use of public property), position in relation to the existing TPSS and OCS system, and costs. Through coordination with Seattle City Light, it has been determined that power would be available at any of the four potential TPSS sites.

2.2.4.3 Communications Cabinet

- One existing signals communications cabinet located at the southeast corner of NE 68th St and 15th Ave NE would be replaced with a larger cabinet (approximately 3 feet by 3 feet) because the current cabinet is not large enough to serve the upgraded signals along the corridor (Figure 2-1). The cabinet sends all communication information and data through fiber optic lines. Fiber optic lines associated with the cabinet would use existing utility poles along NE 65th St and 15th Ave NE.

2.2.5 Bus Layovers

- Bus layover areas where buses park while transitioning to service in a different direction would be provided at the southern and northern ends of the route.
- At the southern end, buses would use an existing layover area on S Main St between 2nd Ave S and 4th Ave S. The southern layover does not affect existing bus routes (Figure 2-2).
- Two bus turnaround options (NE 67th St and NE 70th St) are being evaluated to accommodate between 3 or 4 bus layover spaces. The bus layover spaces would be on either NE 67th St, Roosevelt Way NE, or 12th Ave NE. For the NE 67th St turnaround option, NE 67th St would be converted to one-way westbound. Compared to the NE 67th St turnaround option, the NE 70th St turnaround option would require additional OCS poles and wire. These bus turnaround options and potential layover space locations are shown in Figure 2-3.
    - o **NE 67th St.** Up to four bus layover spaces are being considered along NE 67th St.
    - o **Roosevelt Way NE**. Up to four bus layover spaces are being considered

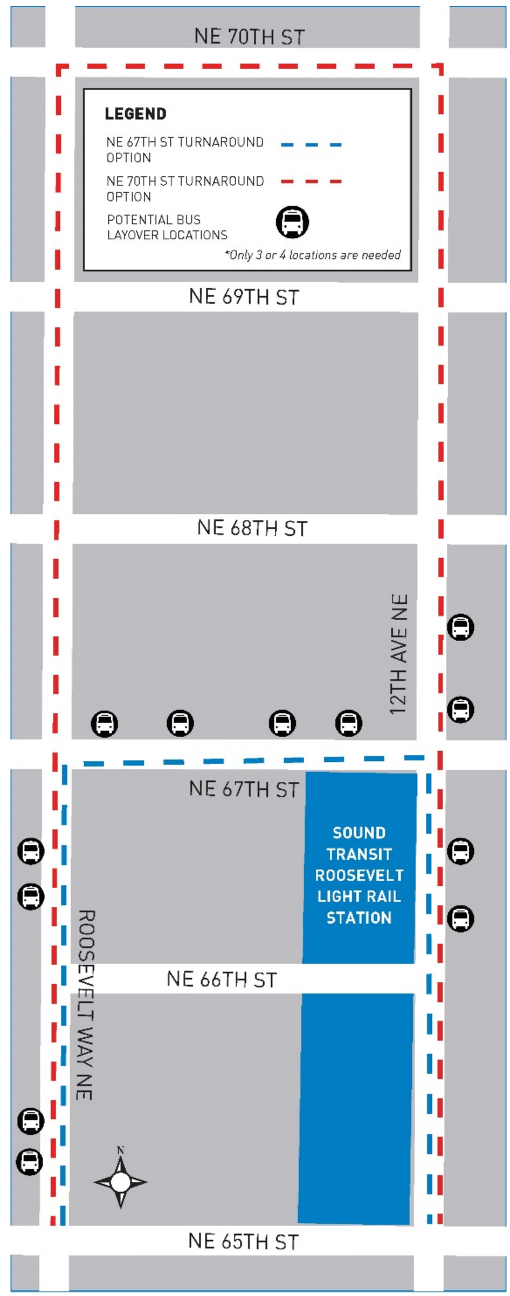

Figure 2-3. Northern Layover Options

along the west curb on Roosevelt Way NE.

- **12th Ave NE.** Up to four bus layover spaces are being considered along the east curb on 12th Ave NE.

The layover spaces on Roosevelt Way NE and 12th Ave NE, south of NE 67th St, could be used by buses with either turnaround option. The layover spaces along NE 67th St would only be for the NE 67th St bus turnaround option. The layover spaces on 12th Ave NE, north of NE 67th St, would only be for the NE 70th St bus turnaround option.

2.2.6 Nonmotorized (Bicycle and Pedestrian) Improvements

- The project would include approximately 5 miles of protected bicycle lanes (PBLs) along 11th Ave NE, 12th Ave NE, Eastlake Ave E, and Fairview Ave N that would provide access to stations and improve safety along the corridor.
- The project would include ADA-compliant curb ramps and ADA-compliant pedestrian push buttons and countdown pedestrian signal heads to control pedestrian traffic at intersections near proposed station locations.
- The project would include intersection safety improvements for pedestrians accessing the stations, including sidewalk repairs and crosswalk striping and sidewalk repairs at or near 23 new station locations and where Fairview Ave N is widened.

2.2.7 Stormwater Improvements and Utility Relocations

- Ten stormwater detention facilities (with a total capacity of approximately 25,400 cubic feet), are required to meet flow control code requirements per the City of Seattle Stormwater Manual (City of Seattle, 2017d) as a result of increased new and replaced impervious surfaces.
- Approximately ten detention pipes (with a total capacity of approximately 25,400 cubic feet) would be installed along Fairview Ave N, Eastlake Ave E, and 11th Ave NE to control the stormwater flows into the combined sewer prior to transport to the WPTP. The Project may use the fee-in-lieu option through Seattle Public Utilities for alternative compliance for flow control, eliminating the need for proposed detention facilities.
- The Project would also install or modify existing stormwater intake structures and catch basins that connect to existing stormwater facilities. Other existing utilities that conflict with Project elements would be relocated, modified, protected, or upgraded to avoid conflicts, pavement moratoriums (timeframe when pavement cannot be disrupted), or future construction impacts. A concurrent non-project Seattle Public Utilities activity may also replace parts of the watermain underneath Eastlake Ave E during Project construction.

2.2.8 Parking and Loading Zones

- To enable buses to operate in dedicated transit lanes and allow for PBLs, the Project would remove up to 699 on-street parking spaces and up to 58 vehicle loading zones in some areas of the corridor.

2.2.9 Construction

- Project construction would require up to 24 months to complete and would be phased to minimize construction impacts along the alignment. Construction is planned to be limited to existing right-of-way but may require temporary construction easements on adjacent parcels.
- Construction would affect on-street parking and require temporary closures of travel lanes and/or stops. Temporary sidewalk closures with signage noting detour routes would be necessary when constructing around stations and installing utilities or OCS poles. Prior to temporary bus stop closures or relocation of existing stations, notifications to transit users would be posted.
- Bicycles may be detoured from existing facilities to nearby parallel routes or required to share the general purpose travel lanes during certain construction activities. Obstacles for bicyclists would be minimized, but may entail riding over disturbed asphalt or steel plates.
- City of Seattle facilities would be used as staging areas for storage of equipment and materials. Other staging areas would be established where feasible within the roadway right-of-way. Other staging locations could include vacant or underutilized lots. Temporary construction easements (TCEs) for staging may be required and would be identified during final design.

3.0 METHODOLOGY AND ASSUMPTIONS

This section provides an overview of the transportation measures, methodology and assumptions, and analysis study area for the RapidRide Roosevelt project. A detailed description of the transportation measures and methodology and assumptions used to prepare the technical analysis is located in Appendix A, RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum.

3.1 Evaluation Measures

Table 3-1 provides a summary of the evaluation measures included in the transportation analysis, organized by transportation element.

Table 3-1. Transportation Measures

TRANSPORTATION ELEMENT	MEASURES
Regional Traffic and Roadways	Regional roadway volumes Vehicle miles traveled (VMT)
Transit System	Annual and daily transit system trips Annual transit system boardings
	Annual and daily corridor ridership Transit reliability Transit service levels Transit service patterns Transit travel times Passenger loads
	Bus layover Daily bus stop boardings Station capacity
Arterial and Local Streets	General purpose traffic travel times Vehicle/person throughput and mode share Intersection level of service Roadway system Traffic forecasts Property access and circulation
Pedestrians and Bicyclists	Pedestrian system completion Sidewalk maintenance condition Intersection treatments Pedestrian volumes Bicycle volumes Bicycle facilities
Parking	Occupancy Supply impacts

Table 3-1. Transportation Measures

TRANSPORTATION ELEMENT	MEASURES
Safety	Collisions Safety impacts
Freight	Freight travel times Freight access
Construction (for all Transportation Elements)	Qualitative assessment of construction impacts
Indirect Impacts	Qualitative assessment of changes to mobility and access due to project-related land use changes
Cumulative Impacts	Qualitative assessment of the incremental impacts of all the project's effects

3.2 Key Transportation Analysis Assumptions

To prepare the transportation analysis, key assumptions are required to develop the technical content. These assumptions are summarized in this section and are further described in Appendix A, RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum.

- **Study area:** The study area encompasses the proposed project alignment and surrounding streets as shown on Figures 3-1 and 3-2. This study area was selected so the analysis for the measures identified in Section 3.1 can be developed to determine project benefits and impacts. Some evaluation measures consider project effects that extend beyond this boundary; see Section 3.3 and Appendix A, RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum, for more details.
- **Study years**: The transportation analysis was prepared for three analysis years: existing condition (2017), project opening year (2024), and a future horizon year (2040).

  At the time this analysis was being developed, the project had a year of opening of 2021. Since then, the project's year of opening has been extended to 2024. The analysis prepared for year 2021 remains applicable to year 2024 because:

  - Future horizon year of 2040 is still valid and provides the highest, most conservative impact assessment of the transportation elements.
  - The 2021 analysis already assumed all relevant and foreseeable background transportation projects in the project corridor that would be assumed in year 2024.
  - From a review of traffic forecast, the level of traffic growth between 2021 and 2024 would be less than 3%. This level of change in data would not alter the results of the transportation analysis. For further information refer to Appendix F, 2021/2024 Travel Demand Forecast Comparison.
- **Analysis period**: The transportation analysis focuses on the PM peak hour (5-6 PM) unless otherwise stated.

- **Analysis tools**: Vissim (version 8.00-15) was used to assess corridor and intersection operations. Travel demand forecast estimates were generated using the Puget Sound Regional Council (PSRC) 4k model, base year 2014. Transit ridership forecasts were generated using the Federal Transit Administration (FTA) Simplified Trips-on-Project Software (STOPS) model, version 2.01.
- **Data sources**: PM peak hour traffic counts were conducted in spring 2017 and included automobiles, trucks, pedestrians, and bicyclists. Daily traffic volumes were obtained from the SDOT *2017 Traffic Report*. Travel times were collected in the field in spring 2017. Parking utilization data were collected in the field in winter 2017. Transportation facility and transit route data were collected from the SDOT and KCM in 2017.[3] Pedestrian facilities conditions data were collected between 2015 and 2017, with updates as needed to account for new capital projects.
- **Transit vehicle data**: Automated passenger counter and automated vehicle location data were collected in 2016 and 2017 for transit routes in the study area.

3.3 Study Area

Figures 3-1 and 3-2 show the north half and the south half, respectively, study area for the transportation technical analyses. This study area was selected so the analysis for the measures identified in Section 3.1 can be developed to determine project benefits and impacts. The project study area includes the streets that comprise the proposed project alignment, adjacent streets (for the parking analysis), analysis screenlines (segments of the alignment where certain analysis results are presented, such as vehicle volumes), and study intersections.

The following measures evaluate effects within the project study area boundary but omit 3rd Ave between Virginia St and the southern terminus. This is because the project would not affect this area of the project because no street or sidewalk modifications are proposed, intersection volumes are not expected to noticeably change, and peak transit headways would remain similar with the project.

- Roadway system
- Travel times (general purpose, transit, and freight)
- Intersection level of service (LOS)
- Property access and circulation
- Sidewalk maintenance condition
- Pedestrian intersection treatments
- Pedestrian and bicycle volumes
- Collisions and safety impacts

[3] KCM monitors and regularly adjusts transit routes and frequencies. Therefore, the transit routes and frequencies described in this report may be different than what is currently operating at the time of this report's publication. The analysis for this report used the most recent and best available data at the time it was conducted.

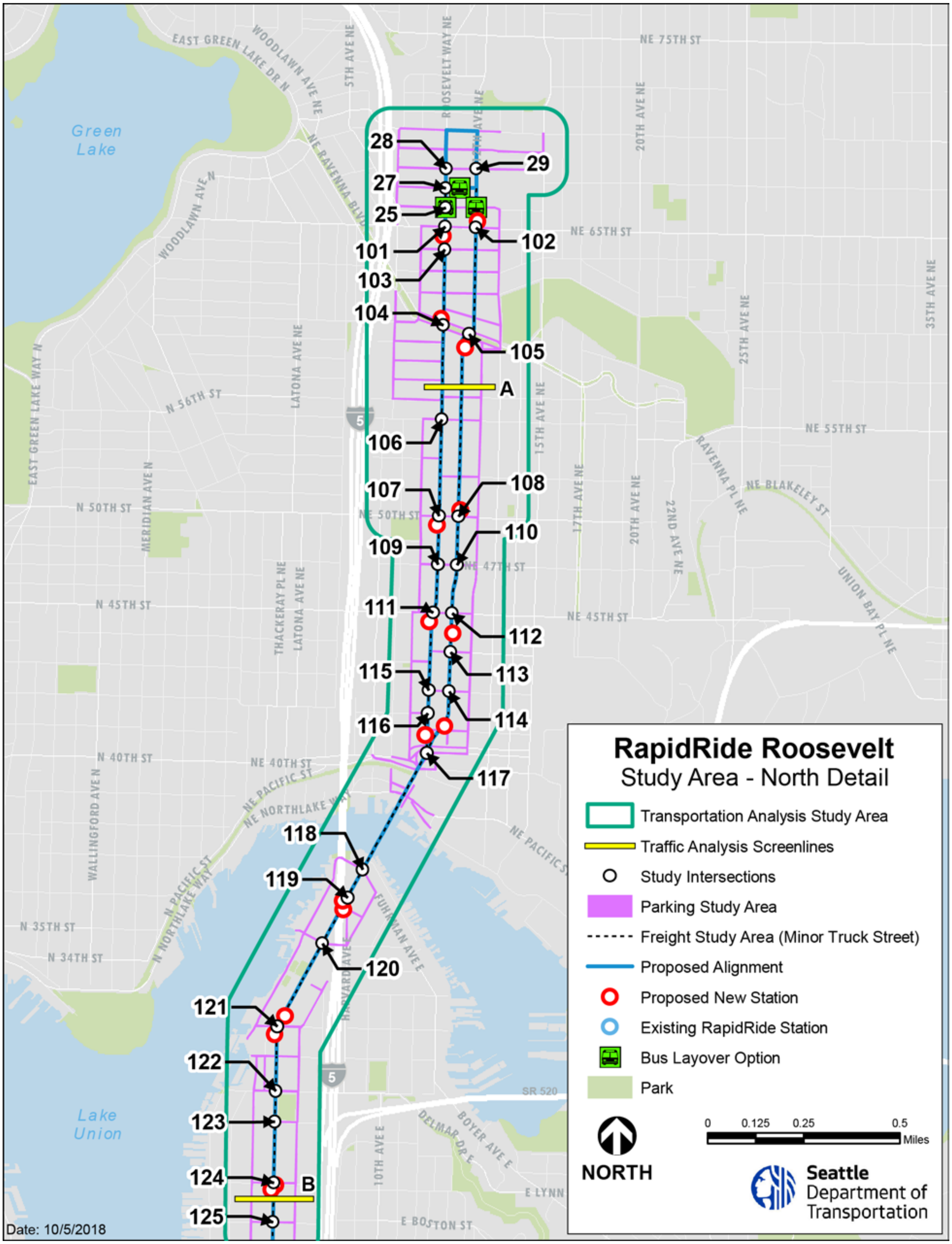

Figure 3-1. Study Area - North Detail

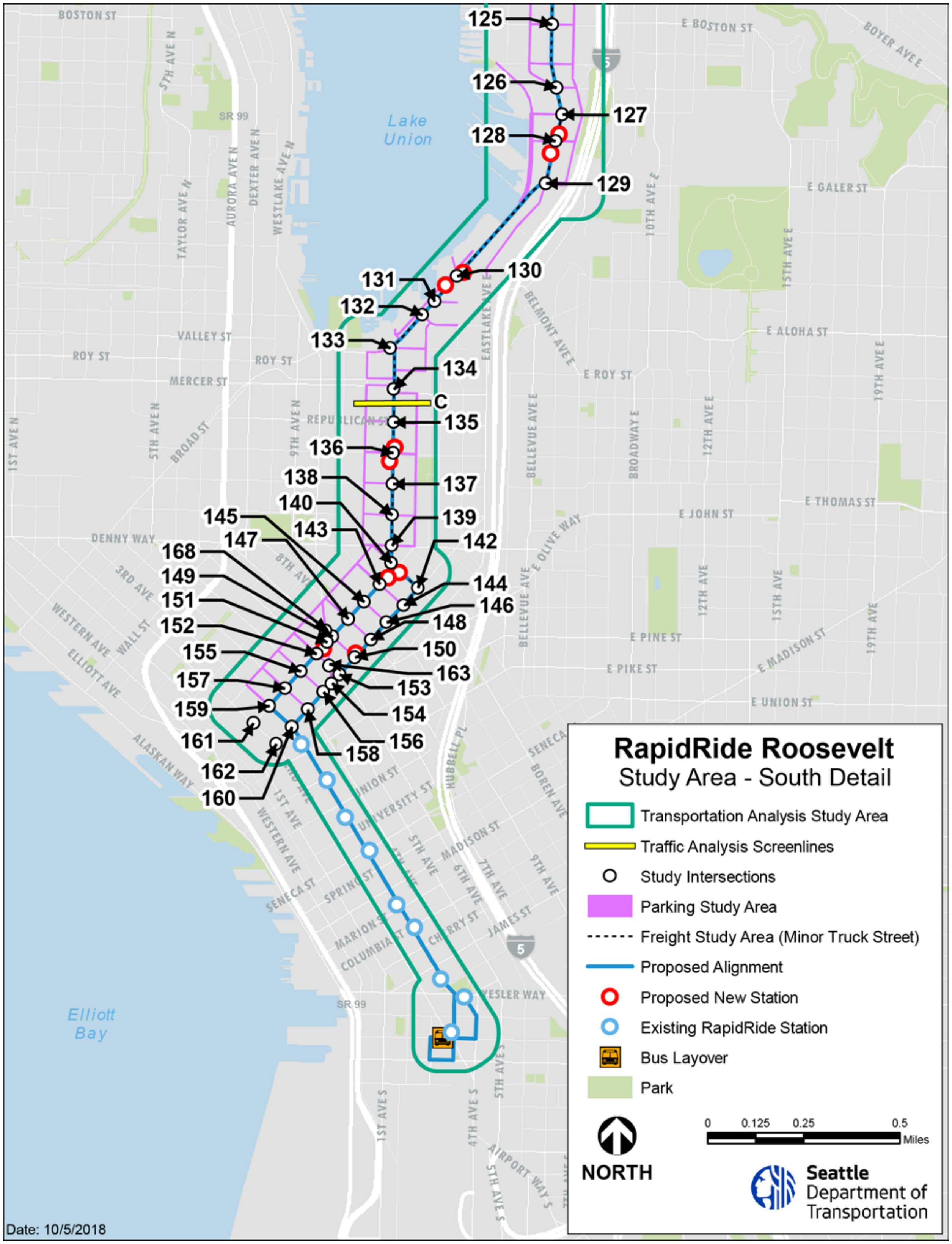

Figure 3-2. Study Area - South Detail

The following measures consider impacts that extend beyond the project study area boundary:

- Annual and daily transit system trips
- Annual transit system boardings
- Impacts to other transit facilities
- Regional roadway volumes
- Vehicle miles traveled
- Indirect and cumulative impacts

For further details about the geographic scope of the transportation analysis see Appendix A, RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum.

The study intersections include in the analysis are all signal-controlled and major stop-controlled intersections and were selected based on whether they have proposed channelization or signal modifications with the project or if there is the potential for noticeable changes in traffic volumes caused by the project. All study intersections are managed by the City of Seattle except the intersection of Fairview Ave N and Mercer St, which is managed jointly by the City and Washington State Department of Transportation (WSDOT).

Table 3-2 lists the study intersections included in the analysis and their reference numbers, which are illustrated on Figures 3-1 and 3-2. No intersections are included on 3rd Ave south of Virginia St and Stewart St as auto traffic is prohibited between 6 AM and 7 PM. Two intersections on 2nd Ave are included in the traffic operations study area due to possibility of traffic impacts to those facilities (intersection #161 and #162).

Table 3-2. Study Intersections

MAP REFERENCE #	NAME
25	Roosevelt Way NE & NE 66 St
27	Roosevelt Way NE & NE 67th St
28	Roosevelt Way NE & NE 68th St
29	12th Ave NE & NE 68th St
101	Roosevelt Way NE & NE 65th St
102	12th Ave NE & NE 65th St
103	Roosevelt Way NE & NE 64th St
104	Roosevelt Way NE & NE Ravenna Blvd Westbound
105	12th Ave NE & NE Ravenna Blvd Westbound
106	Roosevelt Way NE & NE 55th St
107	Roosevelt Way NE & NE 50th St
108	NE 50th St & 11th Ave NE

MAP REFERENCE #	NAME
109	Roosevelt Way NE & NE 47th St
110	11th Ave NE & NE 47th St
111	Roosevelt Way NE & NE 45th St
112	11th Ave NE & NE 45th St
113	11th Ave NE & NE 43rd St
114	11th Ave NE & NE 42nd St
115	Roosevelt Way NE & NE 42nd St (north leg)
116	Roosevelt Way NE & NE 42nd St (south leg)
117	11th Ave NE & NE Campus Pkwy & Roosevelt Way NE
118	Eastlake Ave E & Fuhrman Ave E
119	Eastlake Ave E & Harvard Ave E

MAP REFERENCE #	NAME
120	Eastlake Ave E & E Allison St
121	Eastlake Ave E & E Hamlin St
122	Eastlake Ave E & E Roanoke St
123	Eastlake Ave E & E Louisa St
124	Eastlake Ave E & E Lynn St
125	Eastlake Ave E & E Boston St
126	Eastlake Ave E & E Howe St
127	Eastlake Ave E & E Blaine St
128	Eastlake Ave E & E Garfield St
129	Fairview Ave N & Eastlake Ave E/E Galer St
130	Fairview Ave N & Yale Ave N
131	Fairview Ave N & Ward St
132	Fairview Ave N & Aloha St
133	Fairview Ave N & Valley St
134	Fairview Ave N & Mercer St
135	Fairview Ave N & Republican St
136	Fairview Ave N & Harrison St
137	Fairview Ave N & Thomas St
138	Fairview Ave N & John St
139	Fairview Ave & Denny Way
140	Fairview Ave & Boren Ave
142	Boren Ave & Stewart St

MAP REFERENCE #	NAME
143	Terry Ave & Virginia St
144	Terry Ave & Stewart St
145	9th Ave & Virginia St
146	9th Ave & Stewart St
147	8th Ave & Virginia St
148	8th Ave & Stewart St
149	7th Ave & Virginia St
150	7th Ave & Stewart St
151	Westlake Ave & Virginia St
152	6th Ave & Virginia St
153	6th Ave & Stewart St
154	Westlake Ave & Stewart St
155	5th Ave & Virginia St
156	5th Ave & Stewart St
157	4th Ave & Virginia St
158	4th Ave & Stewart St
159	3rd Ave & Virginia St
160	3rd Ave & Stewart St
161	2nd Ave & Virginia St
162	2nd Ave & Stewart St
163	6th Ave & Westlake Ave
168	7th Ave & Westlake Ave

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4.0 AFFECTED ENVIRONMENT

This section describes the Affected Environment (also called existing conditions) for the RapidRide Roosevelt transportation elements. This includes:

- Regional Traffic and Roadways
- Transit System
- Arterial and Local Streets
- Pedestrians and Bicyclists
- Parking
- Safety
- Freight

4.1 Regional Traffic and Roadways

4.1.1 Vehicle Miles Traveled

Vehicle miles traveled (VMT) is a measure of the number of miles driven by motorized vehicles including personal autos, buses, and trucks. Table 4-1 shows existing VMT as modeled by the PSRC travel demand model for trips originating or terminating in the study area. The base year for the PSRC model is 2014, and that is used as the existing year here.

Table 4-1. Daily Vehicle Miles Traveled to and from the Study Area (Existing, 2014)

TIME PERIOD	VEHICLE MILES TRAVELED
Daily	8,596,000

4.1.2 Regional Roadway Volumes

Regional roadways are major, limited-access facilities with high volumes of trips, many of which pass through the study area rather than traveling to or from it. The only major regional roadway identified within the study area is I-5. There are other major regional roadways, such as State Route (SR) 520 and SR 99 near the corridor, but travel demand forecast modeling indicated negligible changes to their volumes, so they are not discussed in this analysis.

I-5 is a “Major Urban Interstate” freeway that runs the length of the West Coast between the borders of Mexico and Canada. It is an essential roadway for the movement of people and goods in the Puget Sound region. I-5 runs parallel with the project alignment, on the west side of it north of the Ship Canal, crossing over to the east side of it south of the Ship Canal. The corridor serves all trip types, including commuters, freight transport, and bus service. I-5 varies between two and six mainline travel lanes in both directions within the study area, with lanes from the collector-distributor for the I-5/I-90 interchange and the reversible express lanes providing additional capacity. I-5 has a minimum of two mainline lanes and one high-occupancy vehicle (HOV) lane southbound and two mainline lanes northbound through Downtown Seattle. The I-5 express lanes are reversible and operate southbound during the morning peak period and northbound during the rest of the day.

There are multiple points of access to I-5 adjacent to the project corridor. Access to northbound I-5 includes on-ramps at Olive Way, Denny Way, Mercer St, Harvard Ave E, NE 45th St, NE 50th St, and NE Ravenna Blvd. Northbound off-ramps are at Olive Way, Mercer St, Boylston Ave E, SR 520, NE 45th St/NE 50th St, and NE Ravenna Blvd. Access to southbound I-5 includes on-ramps at NE 50th St, NE 45th St, Boylston Ave E, Mercer St, and Yale Ave. Southbound off-ramps are at NE 50th St/NE 45th St, SR 520, Boylston Ave E, Mercer St, Stewart St, and Union St.

I-5 carries an average of approximately 195,880 vehicles per day and 12,950 at the PM peak at Exit 169 (NE 45th St), which serves as a reference point for reporting vehicle volumes (WSDOT, 2017). The PSRC regional model estimates that I-5 carries an average of approximately 12,000 vehicles in the northbound direction during the weekday PM peak between NE 45th St and NE 50th St, and 6,600 in the southbound direction. Traffic volumes at other points along I-5 between Roosevelt and Downtown Seattle are generally similar to those reported at Exit 169.

4.2 Transit System

4.2.1 Service Patterns

4.2.1.1 Transit Service

The proposed RapidRide Roosevelt project alignment is currently primarily served by KCM Routes 67 and 70. Route 67 serves the northern portion of the corridor, while Route 70 serves the southern portion, with both routes exiting the project corridor in the University District.

Route 67 provides service between the Northgate Transit Center and the University of Washington, travelling through the Maple Leaf and Roosevelt neighborhoods. Route 67 is through-routed with Route 65, which serves areas east and north of the University of Washington. All southbound Route 67 trips continue as eastbound Route 65 trips, changing route signs at the intersection of Roosevelt Way NE and NE 45th St. Northbound Route 67 trips are signed consistently throughout the project corridor.

Route 70 provides service between the University District and the Chinatown-International District, connecting Eastlake, South Lake Union, Denny Triangle, and Downtown Seattle along the way.

In addition, there are 82 other transit routes that currently operate along portions of the project alignment, with most of them overlapping the corridor in Downtown Seattle. These include peak and all-day services operated by KCM, Sound Transit, and Community Transit (see Table B-5 in Appendix B, Transit Level of Service Measures, Existing Transit Service Levels, and Proposed Stop Revisions). They serve the needs of neighborhoods throughout Seattle as well as longer-distance commuters. Table 4-2 illustrates the neighborhood connections created by the primary transit routes that run along the corridor. In general, existing transit service provides good connections between neighborhoods in North Seattle, including Green Lake, Roosevelt, Ravenna, the University District, and Montlake. Route 70 provides high-frequency service between the University District, Eastlake, South Lake Union, and Downtown, and several very frequent transit routes connect South Lake Union and Downtown Seattle.

However, no single transit route currently serves the RapidRide Roosevelt project corridor from end to end efficiently and limited to no service occurs between various neighborhoods such as

Roosevelt between Eastlake and South Lake Union. Routes 67 and 70 provide split service in the corridor, and as a result several neighborhoods in North Seattle, including, Roosevelt, have only indirect transit service to South Lake Union and Downtown Seattle outside of peak hours on KCM Route 62. This route uses a circuitous path to reach Downtown Seattle, resulting in long travel times from North Seattle. Route 62 travels along NE 65th St through the project corridor in the Roosevelt neighborhood. During peak hours, limited peak-direction service is provided between Roosevelt and Downtown Seattle (KCM Routes 76 and 316) and between Roosevelt and South Lake Union (KCM Routes 63 and 64). These transit connections are not provided during most hours of the day.

Table 4-2. PM Peak Existing Direct Transit Connections

		DESTINATIONS				
		ROOSEVELT	UNIVERSITY DISTRICT	EASTLAKE	SOUTH LAKE UNION	DOWNTOWN
ORIGIN	ROOSEVELT	-	[Green]	No direct service	[Yellow]	[Yellow]
	UNIVERSITY DISTRICT	[Green]	-	[Green]	[Green]	[Green]
	EASTLAKE	No direct service	[Green]	-	[Green]	[Green]
	SOUTH LAKE UNION	[Yellow]	[Green]	[Green]	-	[Green]
	DOWNTOWN	[Yellow]	[Green]	[Green]	[Green]	-

Green = 10-minute headways or better

Yellow = 11- to 15-minute headways

Orange = 16- to 30-minute headways

Source: KCM Schedules, Fall 2017

Black = No direct service; transfer required

White = Not applicable, within neighborhood

Additional details on transit routes currently serving the project corridor can be found in Appendix B, Transit Level of Service Measures, Existing Transit Service Levels, and Proposed Stop Revisions.

4.2.1.2 Transit Stops

There are currently 50 transit stops located along the RapidRide Roosevelt project alignment between NE 70th St and north of 3rd Ave. These bus stops are owned and maintained by KCM and serve a variety of transit routes, including local KCM routes, RapidRide routes, and regional and commuter express routes operated by Community Transit and Sound Transit. Additionally, there are existing transit stops and RapidRide stations located along 3rd Ave in Downtown Seattle. The RapidRide stations feature real-time arrival and off-board fare payment for RapidRide routes.

4.2.2 Service Levels

Existing transit service levels for Routes 67 and 70 were evaluated based upon a LOS grade between LOS A and F for service span and service frequency (shown by headways). Higher frequency and longer service span represent higher service levels and result in higher LOS scores.

Routes 67 and 70 operate 7 days per week with approximate scheduled headways ranging from 10 to 15 minutes on weekdays for both routes. This equates to a transit service LOS of B and C. Table 4-3 shows the span of service and typical headways by time of day for Routes 67 and 70. Weekend service frequency is lower for both routes, with 15- to 20-minute headways during most times. Both routes provide service for 21 to 22 hours of the day on weekdays and weekends, equating to LOS A for service span.

Transit Service Level Definitions & LOS Scores

Transit Service Span: The number of hours in a day that transit service operates. The LOS is based on daily hours of operation. LOS A indicates over 18 hours of operation per day and allows transit to serve a full range of trip purposes. LOS F indicates less than four hours operation per day and requires passengers to plan their day around the transit schedule.

Transit Headways: The length of time between transit vehicles arriving at a location. Shorter headways mean higher frequency of service. Headways are scored for different times of day to show the range of service available. LOS A indicates very frequent transit service with headways under five minutes, while LOS F indicates headways greater than 60 minutes.

(Adapted from Transportation Research Board, 2013)

Refer to Appendix B for the full set of LOS thresholds used for these two measures.

For other routes serving the study area see Appendix B.

Table 4-3. Existing Transit Service Levels

	MONDAY – FRIDAY	SATURDAY	SUNDAY
ROUTE 67			
Service Span	5:30 AM – 2 AM	5 AM – 3 AM	5:30 AM – 2 AM
Daily Hours of Operation	A (21.5)	A (22)	A (21.5)
Daily Trips	203	137	104
Headways – Peak	B (10 min)	C (15 min)	C (15 min)
Headways - Midday	B (10 min)	C (15 min)	D (20 min)
Headways - Other	D (15-30 min)	D (20 min)	D (30 min)
ROUTE 70			
Service Span	5 AM – 2:30 AM	5 AM – 2:30 AM	5 AM – 2:30 AM
Daily Hours	A (21.5)	A (21.5)	A (21.5)
Daily Trips	198	164	164
Headways – Peak	B (7.5 min)	C (15 min)	C (15 min)
Headways – Midday	C (15 min)	C (15 min)	C (15 min)
Headways - Other	C (15 min)	C (15 min)	C (15 min)

Source: KCM Schedule, Fall 2017

min = minutes

4.2.3 Ridership

Because no single transit route currently serves the length of the RapidRide Roosevelt corridor, existing ridership is derived from the bus stops served by Routes 67 and 70. Table 4-4 shows the average weekday ridership and estimated annual ridership, as well as the number of weekday boardings on those routes that occur at stops within the project corridor based on KCM automated passenger counter data. Because all of Route 70 is within ¼ mile of the project corridor, the total ridership is included in the existing project corridor ridership to provide a conservative baseline for comparison. Route 67 ridership within the Roosevelt corridor includes all the boardings between NE 65th St and Campus Parkway, where riders can transfer between Route 70 service. Between these two KCM routes, the total existing ridership in the RapidRide Roosevelt corridor is 9,770 boardings in an average weekday, and total combined ridership for Routes 67 and 70 is slightly over 13,000.

Table 4-4. Existing RapidRide Roosevelt Corridor Transit Ridership

ROUTE	AVERAGE WEEKDAY BOARDINGS WITHIN ROOSEVELT CORRIDOR	AVERAGE TOTAL ROUTE WEEKDAY BOARDINGS	TOTAL ROUTE ANNUAL BOARDINGS
67	1,780	5,100	1,592,100
70	7,990	7,990	2,442,200
Total	**9,770**	**13,090**	**4,034,300**

Source: KCM automated passenger counts, Spring 2017

4.2.4 Passenger Loads

Current passenger loads on Routes 67 and 70 during the PM peak period were given a LOS score based on seating availability, a measure of passenger comfort. Passenger loads were assessed at project corridor screenlines; the results are shown in Table 4-5 (see Figures 3-1 and 3-2 for maps of the screenlines). Currently, both Routes 67 and 70 experience a passenger load LOS of A or B. These loads are averaged over all transit vehicle trips within the PM peak. Passenger loads can vary widely between individual vehicle trips at different times or on different days.

> **Transit Passenger Load Definition & LOS Scores**
>
> Transit passenger load is the average number of people in a transit vehicle at a given location during a given period. Higher passenger loads indicate that the transit service is effectively moving large numbers of people in a space-efficient and cost-effective manner, but excessively high loads reduce passenger comfort and can impact service reliability. Transit passenger loads are assessed at the project screenlines and assigned a LOS score based on seating availability, which primarily measures passenger comfort. LOS A indicates many seats are available. At LOS D or E some or most people may be standing. LOS F indicates standing passengers are very crowded; this level of passenger load can reduce reliability of service.
>
> (Adapted from Transportation Research Board, 2013)
>
> Refer to Appendix B for more information on the LOS

Average loads exceeding the seated capacity of articulated trolleybuses (47 seats) occur during peak periods in peak directions on both Routes 67 and 70. Route 70 also experiences standing average loads during the midday and evening periods. KCM has established a crowding threshold of 83 passengers for articulated trolleybuses. This threshold is higher than the threshold for LOS F used for the above passenger load analysis and is based on standing space available in the articulated trolleybuses. KCM provides additional service on a given route to alleviate overcrowding when loads exceed the 83-passenger threshold. Neither Route 67 nor Route 70 has current average passenger loads that exceed this threshold, but some individual trips on Route 70 exceed this amount during peak periods.

Table 4-5. Existing Average PM Peak Transit Passenger Load Level of Service at Screenlines

DIRECTION	AVERAGE PASSENGER LOAD LOS PER TRIP (PM PEAK PERIOD)		
	SCREENLINE A - NORTH OF NE 55TH ST (ROUTE 67)	SCREENLINE B - SOUTH OF E LYNN ST (ROUTE 70)	SCREENLINE C - SOUTH OF MERCER ST (ROUTE 70)
Northbound	B (26)	B (36)	B (33)
Southbound	A (10)	A (22)	B (30)

Source: KCM APC, Spring 2017

4.2.5 Travel Times

Transit trips between the northern half of the corridor, including Roosevelt and the University District, and the southern half of the corridor, including Eastlake, South Lake Union, and Downtown Seattle, require riders to transfer between Route 67 and Route 70 near NE Campus Pkwy in the University District. Table 4-6 shows average PM peak travel times and speeds for the segments of Routes 67 and 70 that serve the RapidRide Roosevelt project alignment. The average existing travel time between NE 68th St and 3rd Ave is 51.4 minutes in the northbound direction and 50.0 minutes in the southbound direction. These travel times include an estimate of the time that would be required to transfer between Routes 67 and 70 during the PM peak; this takes approximately 5.8 minutes in the southbound direction and 7 minutes in the northbound direction. Transfer time varies by direction because peak headways for Routes 67 and 70 are different, resulting in longer wait time for riders transferring from Route 70 to Route 67 to complete a northbound than riders transferring to complete a southbound trip. Transfers in either direction require riders to walk 300 to 600 feet between different bus stops located on NE Campus Pkwy.

Table 4-6. Existing PM Peak Transit Travel Times (NE 65th St to 3rd Ave)

ROUTE	SEGMENT	TIME (MINUTES)	LENGTH (MILES)	AVERAGE VEHICLE SPEED[a] (MPH)
NORTHBOUND				
70	3rd Ave to Mercer St	14.9	1.1	4.4
70	Mercer St to E Roanoke St	10.8	1.5	8.3
67 & 70	E Roanoke St to NE 45th St	11.6	1.7	8.8
67	NE 45th St to NE 65th St	7.1	1.0	8.5
Total	**3rd Ave to NE 65th St (In-Vehicle Travel Time Only**	**44.4**	**5.3**	**7.2**

Table 4-6. Existing PM Peak Transit Travel Times (NE 65th St to 3rd Ave)

ROUTE	SEGMENT	TIME (MINUTES)	LENGTH (MILES)	AVERAGE VEHICLE SPEED[a] (MPH)
Transfer	Transfer Time	7.0[b]	–	–
Total	**3rd Ave to NE 65th St (Including Transfer Time)**	**51.4**	**5.3**	**7.2**
SOUTHBOUND				
67	NE 65th St to NE 45th St	9.1	1.0	6.6
67 & 70	NE 45th St to E Roanoke St	10.5	1.7	9.7
70	E Roanoke St to Mercer St	11.9	1.5	7.6
70	Mercer St to 3rd Ave	12.7	1.1	5.2
Total	**NE 65th St to 3rd Ave (In-Vehicle Travel Time Only**	**44.2**	**5.3**	**7.2**
Transfer	Transfer Time	5.8[c]	–	–
Total	**NE 65th St to 3rd Ave Including Transfer Time**	**50.0**	**5.3**	**7.2**
BOTH DIRECTIONS (AVERAGE OF NORTHBOUND AND SOUTHBOUND)				
Total	**NE 65th St to 3rd Ave (In-Vehicle Time Only)**	**44.3**	**5.3**	**7.2**
Total	**NE 65th St to 3rd Ave (Including Transfer Time)**	**50.7**	**5.3**	**7.2**

[a] Average vehicle speed does not include transfer time between routes

[b] Estimated 7-minute PM peak transfer time includes 2 minutes walking plus 5 minutes waiting for Route 67

[c] Estimated 5.8-minute PM peak transfer time includes 2 minutes walking plus 3.8 minutes waiting for Route 70

Source: KCM Automated Vehicle Location (AVL) Data, 2016-2017

Note: Due to rounding of time and speed numbers, some totals may not equal the sum of the individual numbers.
mph = miles per hour

4.2.6 Reliability

4.2.6.1 Transit Operations and Headway Adherence

Bus service in the project corridor currently operates with general purpose traffic on high-volume, congested streets except on 3rd Ave and Stewart St in Downtown Seattle. Along 3rd Ave, transit is prioritized from 6 AM to 7 PM on all days of the week, although general purpose traffic is still allowed on 3rd Ave in a limited capacity during restricted hours. Stewart St includes a peak period BAT lane Boren Ave and 3rd Ave. Other than 3rd Ave and Stewart St, the corridor currently includes no transit lanes. Additionally, there is no transit signal priority provided for buses along the corridor except for a queue jump signal at the intersection of Stewart St and 7th

Ave. As a result, transit service reliability is currently poor in the corridor, with buses subject to significant delay and travel time variations.

Analysis of May 2017 performance data for Routes 67 and 70 shows that actual headways between buses typically deviate from scheduled headways by more than 5 minutes in the northbound direction during the PM peak. Southbound service is more reliable with headway deviations ranging from 2.5 to 4.2 minutes, depending on location, but reliability scores indicate irregular headways and frequent bus bunching in both directions. Current PM peak transit reliability as measured by headway adherence is shown in Table 4-7, showing LOS ranges between D and F. This indicates that bus bunching is common on Routes 67 and 70 during the PM peak period, particularly for northbound service.

Transit Reliability Definition & LOS Scores

Transit service reliability indicates how consistently transit service operates. For service that operates every 10 minutes or better on average, reliability is measured and assigned a score based on how well the scheduled headways, or time between vehicles, is maintained. This is known as headway adherence. LOS A indicates headways are precisely maintained, while LOS F indicates most buses are bunched and arrival times vary widely.

(Adapted from Transportation Research Board, 2013)

Refer to Appendix B, for more information on the LOS thresholds used for this measure.

Table 4-7. Existing PM Peak Period Transit Reliability Level of Service

SCREENLINE	PM PEAK HEADWAY ADHERENCE			
	NORTHBOUND		SOUTHBOUND	
	LOS	AVERAGE DEVIATION FROM SCHEDULED HEADWAY[a]	LOS	AVERAGE DEVIATION FROM SCHEDULED HEADWAY
North of NE 55th St (Route 67)	E	5.1 minutes	D	2.5 minutes
South of E Lynn St (Route 70)	F	6.2 minutes	D	3.0 minutes
South of Mercer St (Route 70)	F	5.7 minutes	E	4.2 minutes

[a] The LOS score is determined by calculating the coefficient of variation in headways (standard deviation of headways/average headway). However, the average deviation from scheduled headways during the PM peak period is presented as this number can be more easily compared against the average scheduled headway, which is approximately 10 minutes for Routes 67 and 70 during the PM peak period.

Source: KCM AVL Data, May 2017

Note: Adapted from Transportation Research Board, 2013.

4.2.6.2 University Bridge Operation

Route 70 operates over a drawbridge, the University Bridge, to cross the Lake Washington Ship Canal between the University District and Eastlake neighborhoods. The Ship Canal is a navigable waterway, and therefore the University Bridge is subject to oversight by the United States Coast Guard. Federal rules governing the operation of Lake Washington Ship Canal bridges (33 Code of Federal Regulations 117.1051) stipulates that the University Bridge may remain closed (i.e., open to vehicular traffic) during the hours of 7 AM to 9 AM and 4 PM to 6 PM on weekdays except to commercial vessels of over 1,000 tons, which are rare at this crossing. During other hours of the day, the bridge opens at the request of marine traffic. The University Bridge opens an average of 100 to 300 times per month, with most bridge openings occurring from 9 AM to 4 PM and 6 PM to 8 PM. During most hours, bridge operators observe traffic and may take into account traffic conditions, including approaching buses, prior to opening the bridge for marine traffic.

Because openings of the University Bridge are not typically scheduled, they can influence traffic delays on the corridor. However, bridge openings during peak hours are rare due to restrictions on vessel size. In 2017, the University Bridge opened three times during the AM peak restricted hours and 18 times during PM peak restricted hours. Outside of peak hours, bridge openings are relatively infrequent compared to bus trips over the University Bridge. On average, the bridge opened fewer than 6 times per weekday between 9 AM and 4 PM and between 6 PM and 11 PM in 2017 (frequency of openings is for both time periods combined). By comparison, Route 70 has over 100 bus trips crossing the University Bridge during these time periods. Bridge openings were most common between 6 PM and 7 PM, but still occurred fewer than once per weekday. In 2017 the average duration of an opening during normal hours of operation was 4.6 minutes.

Additional travel time and reliability analysis of Route 70 crossing University Bridge was performed for the period between 6 PM and 7 PM during the months of May and June in 2017. This two-month period was selected because it had the highest number of bridge openings in 2017, and the 6 PM hour had the highest frequency of bridge openings during those two months. Of the 45 weekdays included in May and June 2017, seven days did not have any University Bridge openings during the 6 PM hour, while 38 have one or more bridge openings.

To determine the effect of bridge openings on transit performance, Route 70 travel times and reliability on weekdays with no bridge openings were compared to travel times and reliability on the weekdays that did have a bridge opening. Comparing Route 70 travel times between the University District (near NE 50th St) and Eastlake (near E Howe St) on these days shows that average travel times did not differ substantially between days with a bridge opening and days without a bridge opening. Specifically, both Route 70 northbound and southbound trips take an average of 15-16 minutes on days without any bridge openings and average 16-17 minutes on days with bridge openings between the University District and Eastlake areas. Reliability also does not change substantially on days with bridge openings; travel time variability as measured by standard deviation increased by approximately 30-50 seconds in the southbound and northbound directions, respectively. Therefore, this analysis indicates that overall, the University Bridge does not substantially impact the travel times and variability of Route 70.

4.2.7 Layover Areas

There are two existing bus layover locations within the RapidRide Roosevelt project corridor. These locations and the routes that use them are:

- **Virginia St between Westlake Ave and 3rd Ave:** This stretch of Virginia St contains six layover spaces that are currently used by KCM Routes 7 and 36. All layover spaces are along the southern (right) curb, and combinations of passenger loading zones, paid parking spaces, and bus stops are located between individual layover spaces. These layover spaces are wired for trolleybus operation.

- **S Main St between 2nd Ave S and 4th Ave S:** KCM Route 70 has three layover spaces along the southern (right) curb of S Main St. The RapidRide E Line also has three layover spaces along this portion of S Main St, with two on the north (left) side of the street and one on the south (right) side.

The existing northern layover location for Route 70 and both layover locations for Route 67 are not along the RapidRide Roosevelt project alignment:

- **Route 67:** Layover for Route 67 occurs north of the RapidRide Roosevelt project corridor at the Northgate Transit Center. At the other end, Route 67 is through-routed with Route 65, with all southbound Route 67 buses switching signage to Route 65 at NE 45th St. Route 65 layover occurs northeast of the RapidRide Roosevelt project corridor near Jackson Park in the Lake City neighborhood.
- **Route 70:** The current northern layover for Route 70 is located north of NE 50th St on Brooklyn Ave NE in the University District neighborhood, with three layover spaces provided. This layover location is approximately 530 feet east of the project alignment on 11th Ave NE.

4.2.8 Other Existing Transit Services and Facilities

Additional transit services and facilities in or near the corridor include:

- **Green Lake Park & Ride:** Less than ¼ mile from the corridor, this facility provides free parking and transfers to KCM Routes 45, 62, 63, 64, 76, and 316 and Sound Transit Route 542.
- **Link Light Rail:** Sound Transit's Central Link light rail line provides high-capacity transit service from the University of Washington to Downtown Seattle via Capitol Hill, with service extending south to Seattle-Tacoma International Airport and Angle Lake.
- **South Lake Union Streetcar:** The streetcar intersects with Route 70 in South Lake Union and Downtown Seattle and provides local service for 1.3 miles. It is assumed that the Center City Connector will extend this route through Downtown Seattle to connect to the First Hill Streetcar prior to the opening of the RapidRide Roosevelt project.
- **3rd Avenue Transit Corridor:** 3rd Ave is restricted to buses from 6 AM to 7 PM between Stewart St and Yesler Way. This north-south corridor is the main transit pathway through Downtown Seattle. Over 40 KCM bus routes serve 3rd Ave, including the RapidRide C, D, and E Lines. Route 70 currently uses 3rd Ave; proposed RapidRide Roosevelt service would also operate on 3rd Ave using existing stations. All transit stops along the 3rd Ave Transit corridor between Stewart St and Yesler Way will be upgraded to allow the use of off-board fare payment for all buses in 2019.
- **Downtown Seattle Transit Tunnel:** This transit-only tunnel is currently shared by Link light rail and several regional bus routes. Joint train and bus operations will end in 2019 when the tunnel is converted to light rail operations only.
- **Westlake Intermodal Hub:** This hub includes a terminus for the Seattle Monorail and a Downtown Seattle Transit Tunnel station for Link light rail and buses. Most local and regional bus service to Downtown Seattle, including Route 70, stops at or near the Westlake hub.

- **First Hill Streetcar:** This streetcar line operates on S Jackson St, less than ⅛ mile from the southern terminus of Route 70 and the RapidRide Roosevelt corridor, providing service to First Hill and Capitol Hill. It is assumed that the Center City Connector project will extend this route through Downtown Seattle to connect to the South Lake Union Streetcar prior to the opening of the RapidRide Roosevelt project.

4.3 Arterial and Local Streets

4.3.1 Roadway System

Table 4-8 summarizes the classifications, number of lanes, and average annual weekday traffic (AAWDT) volumes for the roadways that make up the project corridor, except for 3rd Ave per the analysis methodology (see Section 3.2). This includes seven principal arterials and one minor arterial.

Table 4-8. Roadways Comprising the Project Alignment

ROADWAY	SEATTLE ARTERIAL CLASSIFICATION	SEATTLE STREET TYPE	SEATTLE TRANSIT MASTER PLAN CLASSIFICATION	NUMBER OF LANES	AAWDT[a]
Roosevelt Way NE	Principal Arterial	Urban Village Main	Frequent Transit Network	2 One-Way	10,000
12th Ave NE	Principal Arterial	Urban Village Main	Frequent Transit Network	2 One-Way	8,100
11th Ave NE	Principal Arterial	Urban Village Main	Frequent Transit Network	2 One-Way	5,700-11,500
Eastlake Ave E	Principal Arterial	Urban Village Main	Frequent Transit Network	2-4	6,600-28,700
Fairview Ave N	Principal Arterial	Urban Village Main	Frequent Transit Network	3-4	8,900-15,600
Boren Ave	Principal Arterial	Downtown	Frequent Transit Network	4	20,400
Virginia St	Minor Arterial	Downtown Neighborhood	Frequent Transit Network	2-3 One-Way	5,000
Stewart St	Principal Arterial	Downtown	Frequent Transit Network	2-4 One-Way	12,100-24,000

[a] Source: SDOT, 2017a.

Roosevelt Way NE is a one-way principal arterial passing through the Roosevelt and University District neighborhoods in the project corridor. It represents the southbound half of a one-way couplet with 11th Ave NE and 12th Ave NE. The speed limit on Roosevelt Way NE in the study area is 25 mph. Roosevelt Way NE has a continuous PBL and sidewalks between NE 65th St and the University Bridge. Bus stops are located at NE 65th St, NE Ravenna Blvd, NE 55th St, NE 50th St, NE 45th St, and NE 42nd St.

Together, 11th Ave NE and 12th Ave NE form the northbound half of the couplet. They are one-way principal arterials that pass through the Roosevelt and University District neighborhoods and have speed limits of 25 mph. There is a continuous bicycle lane and sidewalks from north of NE 65th St to the University Bridge. Bus stops are located along 11th Ave NE at NE 42nd St, NE 45th St, NE 47th St, NE 50th St, NE 52nd St, NE 55th St, and NE Ravenna Blvd. Bus stops are located along 12th Ave NE at NE 61st St and NE 65th St.

Eastlake Ave E is a north-south principal arterial connecting the University District to South Lake Union through the Eastlake neighborhood, via the University Bridge. The speed limit on Eastlake Ave E is 30 mph; however, prior to this project, the City plans to reduce the speed limit to 25 mph per city-wide Vision Zero efforts. There is no bicycle facility on Eastlake Ave E in the study area, but there are continuous sidewalks. Bus stops are located in both directions of Eastlake Ave E at Harvard Ave E, E Allison St, E Hamlin St, E Louisa St, E Lynn St, E Newton St/E Howe St, and E Garfield St.

Fairview Ave N is a north-south principal arterial connecting South Lake Union to Downtown Seattle with a speed limit of 25 mph. There is no bicycle facility, but there is continuous sidewalk throughout the study area on Fairview Ave N. Bus stops on Fairview Ave N are located in both directions at E Nelson Pl, Yale Ave N, Aloha St, Mercer St (southbound only), Harrison St (northbound only), Thomas St (southbound only), and Denny Way.

Boren Ave is an east-west principal arterial located within Downtown with a speed limit of 25 mph. There is no bicycle facility, but there is a continuous sidewalk throughout the study area on Boren Ave. A bus stop on Boren Ave is located at Virginia St (southbound).

Virginia St is a north/eastbound one-way minor arterial in Downtown Seattle with a speed limit of 25 mph. There are shared lane markings (sharrows) but no dedicated bicycle facility. There is continuous sidewalk on Virginia St in the study area. Bus stops on Virginia St are located at 4th Ave, 6th Ave, and 9th Ave.

Stewart St is a south/westbound one-way principal arterial in Downtown Seattle with a speed limit of 25 mph. There is an existing BAT lane on Stewart St (Boren Ave to 3rd Ave) in the study area that is operational during the PM peak period. This lane is also marked with sharrows, and effectively becomes a bicycle lane during off-peak periods, when parking is allowed curbside. There is continuous sidewalk in the study area on Stewart St. Bus stops on Stewart St are located at 9th Ave, 7th Ave, and 3rd Ave.

4.3.2 Property Access and Circulation

There are minimal property access and circulation restrictions along the corridor. Roosevelt Way NE, 11th Ave NE, 12th Ave NE, Virginia St, and Stewart Ave are one-way streets. Along the corridor, midblock left turns are allowed, and Eastlake and Fairview Avenues both provide a two-way left-turn lane that provides a refuge for vehicles entering or leaving adjacent properties. Additionally, intersections generally allow all turn movements without restrictions (except one-way streets).

4.3.3 Vehicle and Person Throughput

Vehicle throughput is the number of vehicles that can travel through a location or area of the transportation system during a time period. An example would be the number of cars, buses, and trucks that can travel across the University Bridge during the PM peak hour. Person throughput is the number of people that pass through that location, regardless of vehicle mode. While pedestrian and bicycle volumes are expected to slightly increase with the project (see Sections 5.4.4 and 5.4.6), pedestrians and bicycles are not included in person throughput because the magnitude of those changes are not expected to substantially affect the overall person throughput.

Existing PM peak hour vehicle and person throughput at study screenlines is presented in Table 4-9 (for a map of screenlines, see Figures 3-1 and 3-2). Traffic volumes are approximately 20% higher in the southern portion of the study area (screenline C), reflecting the higher-density land uses in South Lake Union and Downtown.

Most of the persons traveling along the corridor do so in personal vehicles with 78% or more of the trips in the corridor taken by automobile. Between 11 and 22% of trips in the corridor are taken using transit.

Table 4-9. Existing PM Peak Hour Vehicle and Person Throughput

SCREENLINE LOCATION	PERSONS (VEHICLES)			% OF PERSONS	
	AUTO	TRANSIT	TOTAL	AUTO	TRANSIT
A - Roosevelt Way NE and 11th Ave NE north of NE 55th St	1,863 (1,250)	229 (13)	2,092 (1,263)	89%	11%
B - Eastlake Ave E south of E Lynn St	1,944 (1,305)	379 (13)	2,323 (1,318)	84%	16%
C - Fairview Ave N south of Mercer St	2,444 (1,640)	689 (20)	3,133 (1,660)	78%	22%
Average	**2,084 (1,398)**	**432 (15)**	**2,516 (1,414)**	**83%**	**17%**

Note: Auto throughput estimated using 2017 counts and a 1.49 person/vehicle occupancy factor (source: PSRC travel demand forecast model). Transit throughput estimated using schedule data, 2017 load data, and Vissim operational analysis. Due to rounding, some totals may not equal the sum of values shown.

4.3.4 Intersection Level of Service

Intersection LOS is a qualitative measurement of the overall delay experienced by motorists due to the intersection controls (e.g. traffic signals or stop signs), with LOS A indicating minimal delay and LOS F indicating "breakdown flow" or heavy traffic congestion. The study intersections were analyzed to estimate existing LOS at the PM peak hour; see Table 4-10 and Figure 4-1.

Most of the congestion in the study area is south of the Eastlake neighborhood in South Lake Union and Downtown. Two intersections are currently operating at LOS F during PM peak: Fairview Ave N and Mercer St and Fairview Ave and Denny Way, both of which are on major east-west corridors in the highly congested South Lake Union neighborhood. Queues at those intersections during the PM peak are predominantly in the eastbound direction. Intersection operations are LOS A through D along the rest of the project corridor.

Table 4-10. Existing Intersection Level of Service for Study Intersections (PM Peak)

INTERSECTION NAME	TRAFFIC CONTROL	DELAY (SEC/VEH)	LOS
Roosevelt Way NE & NE 66 St	Two-Way Stop Controlled	11	B
Roosevelt Way NE & NE 67th St	Two-Way Stop Controlled	10	A
Roosevelt Way NE & NE 68th St	Two-Way Stop Controlled	9	A
12th Ave NE & NE 68th St	Two-Way Stop Controlled	11	B
Roosevelt Way NE & NE 65th St	Signal	19	B
12th Ave NE & NE 65th St	Signal	18	B
Roosevelt Way NE & NE 64th St	Signal	11	B
Roosevelt Way NE & NE Ravenna Blvd Westbound	Signal	25	C
12th Ave NE & NE Ravenna Blvd Westbound	Signal	25	C
Roosevelt Way NE & NE 55th St	All-Way Stop Controlled	9	A
Roosevelt Way NE & NE 50th St	Signal	21	C
NE 50th St & 11th Ave NE	Signal	18	B
Roosevelt Way NE & NE 47th St	Signal	17	B
11th Ave NE & NE 47 St	Signal	9	A
Roosevelt Way NE & NE 45th St	Signal	35	D
11th Ave NE & NE 45th St	Signal	35	D
11th Ave NE & NE 43rd St	Signal	6	A
11th Ave NE & NE 42nd St	Signal	10	B
Roosevelt Way NE & NE 42nd St (north)	Signal	12	B
Roosevelt Way NE & NE 42nd St (south)	Signal	17	B
11 Ave NE & NE Campus Pkwy & Roosevelt Way NE	Signal	13	B
Eastlake Ave E & Fuhrman Ave E	Signal	34	C
Eastlake Ave E & Harvard Ave E	Signal	15	B
Eastlake Ave E & E Allison St	All-Way Stop Controlled	18	C
Eastlake Ave E & E Hamlin St	Signal	9	A
Eastlake Ave E & E Roanoke St	Signal	19	B
Eastlake Ave E & E Louisa St	Signal	6	A
Eastlake Ave E & E Lynn St	Signal	14	B
Eastlake Ave E & E Boston St	Signal	3	A
Eastlake Ave E & E Howe St	Two-Way Stop Controlled	10	A
Eastlake Ave E & E Blaine St	Two-Way Stop Controlled	16	C
Eastlake Ave E & E Garfield St	Signal	8	A
Fairview Ave N & Eastlake Ave E/E Galer St	Signal	15	B
Fairview Ave N & Yale Ave N	Two-Way Stop Controlled	9	A

Table 4-10. Existing Intersection Level of Service for Study Intersections (PM Peak)

INTERSECTION NAME	TRAFFIC CONTROL	DELAY (SEC/VEH)	LOS
Fairview Ave N & Ward St	Two-Way Stop Controlled	11	B
Fairview Ave N & Aloha St	Signal	12	B
Fairview Ave N & Valley St	Signal	39	D
Fairview Ave N & Mercer St	Signal	153	F
Fairview Ave N & Republican St	Signal	50	D
Fairview Ave N & Harrison St	Signal	37	D
Fairview Ave N & Thomas St	Signal	53	D
Fairview Ave N & John St	Signal	29	C
Fairview Ave & Denny Way	Signal	115	F
Fairview Ave & Virginia St	Signal	32	C
Boren Ave & Stewart St	Signal	2	A
Terry Ave & Virginia St	Signal	28	C
Terry Ave & Stewart St	Signal	17	B
9th Ave & Virginia St	Signal	14	B
9th Ave & Stewart St	Signal	17	B
8th Ave & Virginia St	Signal	14	B
8th Ave & Stewart St	Signal	14	B
7th Ave & Virginia St	Signal	8	A
7th Ave & Stewart St	Signal	12	B
Westlake Ave & Virginia St	Signal	10	B
6th Ave & Virginia St	Signal	22	C
6th Ave & Stewart St	Signal	23	C
Westlake Ave & Stewart St	Signal	14	B
5th Ave & Virginia St	Signal	46	D
5th Ave & Stewart St	Signal	57	E
4th Ave & Virginia Street	Signal	18	B
4th Ave & Stewart St	Signal	23	C
3rd Ave & Virginia St	Signal	15	B
3rd Ave & Stewart St	Signal	22	C
2nd Ave & Virginia St	Signal	43	D
2nd Ave & Stewart St	Signal	54	D
6th Avenue & Westlake Avenue	Signal	4	A
7th Avenue & Westlake Avenue	Signal	19	B

Note: Shaded values indicate intersections with a LOS of F.

sec/veh = seconds per vehicle

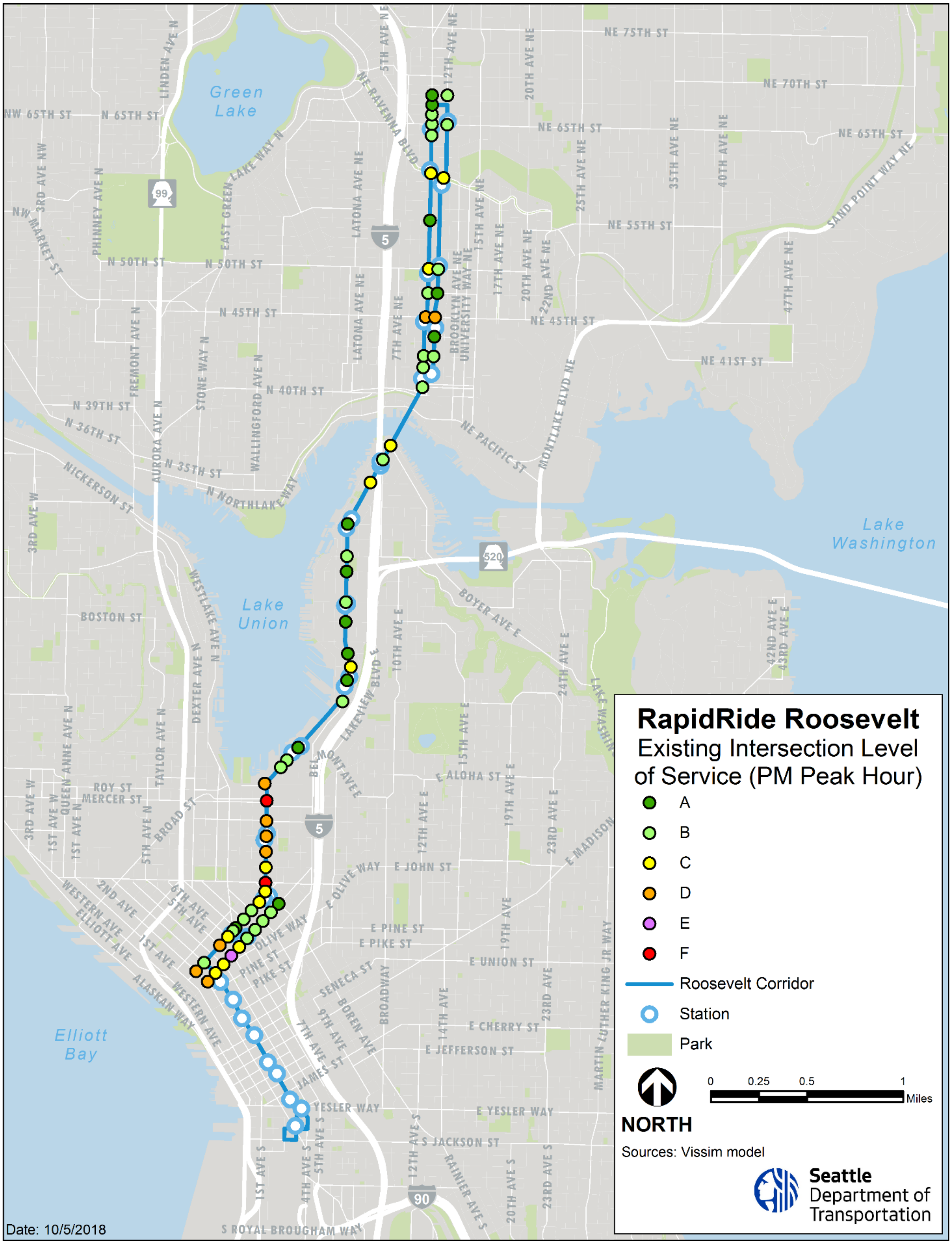


Figure 4-1. Existing Intersection Level of Service (PM Peak Hour)

4.3.5 General Purpose Travel Times

Existing travel times in the corridor were developed from Vissim software and calibrated to field-collected data. PM peak hour vehicle travel times and vehicle speeds for existing conditions are presented in Table 4-11 for the traffic analysis portion of the corridor (NE 65th St to 3rd Ave). Overall, it takes a vehicle between approximately 25 and 30 minutes to travel the corridor from end-to-end. The slowest general purpose travel times are on the section of the alignment between 3rd Ave and Mercer St (6 mph in the northbound direction and 8 mph in the southbound direction. The Eastlake Ave E segment has the highest average travel speeds: 17 mph in the northbound direction and 13 mph in the southbound direction.

Table 4-11. Existing 2017 PM Peak Hour General Purpose Travel Times (NE 65th St to 3rd Ave)

STREET	SEGMENT	SEGMENT LENGTH (MILES)	TRAVEL TIME (MIN)	AVERAGE SPEED (MPH)
NORTHBOUND				
Virginia St/Fairview Ave	3rd Ave to Mercer St	1.0	10.5	6
Fairview Ave N/Eastlake Ave E	Mercer St to E Roanoke St	1.4	4.9	17
Eastlake Ave E/Roosevelt Way NE	E Roanoke St to NE 45th St	1.4	4.9	17
Roosevelt Way NE	NE 45th St to NE 65th St	1.0	5.1	12
	Total	**4.8**	**25.4**	**11**
SOUTHBOUND				
Roosevelt Way NE	NE 65th St to NE 45th St	1.0	6.0	10
Roosevelt Way NE/Eastlake Ave E	NE 45th St to E Boston St	1.7	9.9	10
Eastlake Ave E/Fairview Ave N	E Boston St to Mercer St	1.1	4.9	13
Fairview Ave/Boren Ave/Stewart St	Mercer St to 3rd Ave	1.1	8.3	8
	Total	**4.9**	**29.1**	**10**
BOTH DIRECTIONS (AVERAGE OF NORTHBOUND AND SOUTHBOUND)				
		4.9	**27.3**	**10.5**

4.4 Pedestrians and Bicyclists

4.4.1 Pedestrian System

The project corridor spans diverse land uses, from the higher density commercial and mixed uses in Downtown Seattle in the south to single-family residential neighborhoods in the north, and the pedestrian environment varies accordingly. Sidewalks are widest in Downtown Seattle, where they frequently exceed 10 feet to accommodate the large volumes of pedestrians. Sidewalks are narrower on Eastlake Ave E in the Eastlake neighborhood with typical widths of 6 feet. Along 11th Ave NE and 12th Ave NE and Roosevelt Way NE in the University District and Roosevelt neighborhoods there are sidewalk widths of 6 feet with many sidewalks narrower than 6 feet. Figure 4-2 shows existing effective sidewalk widths (considering obstructions).

Figure 4-2. Existing Corridor Pedestrian System

Sidewalks are present along both sides of the roadway for the entire corridor and in most locations meet or exceed the City's typical 6-foot minimum sidewalk width per Seattle Streets Illustrated, the Seattle Right-of-Way Improvements Manual (City of Seattle, 2017a). Segments of sidewalks with effective widths of less than 48 inches (4 feet) can be found in the University District. In these areas the typical sidewalk width is 4 to 5 feet, but utilities in the walkway area reduce the effective width to below 4 feet.

4.4.2 Sidewalk Maintenance Condition

The maintenance condition of sidewalks along the corridor was inspected in the field (SDOT, 2015). Most are in good condition (little to no cracking). Some segments along the corridor were found to have fair sidewalk maintenance conditions (some cracking); these segments were more common in the northern section of the corridor in the University District and Roosevelt neighborhoods, and through the commercial center of the Eastlake neighborhood centered at E Lynn St (Figure 4-3). A few locations were in poor maintenance condition (cracking and raised panels), most short in length. These include Eastlake Ave E south of E Lynn St and a section of Fairview Ave N in South Lake Union.

4.4.3 Intersection Treatments

4.4.3.1 Signals and Crosswalks

Intersection treatments were evaluated at the study intersections listed in Section 3.3. In Downtown and South Lake Union most of the intersections are signal-controlled and have marked crosswalks with pedestrian crossing signals (see Figure 4-4). In Eastlake, University District, and Roosevelt, most of the study intersections are marked with crosswalks and have pedestrian signal heads. All of the other intersections have marked crosswalks except for Roosevelt Way NE and NE 41st St, where there is no pedestrian crossing.

4.4.3.2 Curb Ramps

In 2015-2016 the City of Seattle assessed curb ramps across the city for ADA compliance, including 53 intersections along the project alignment where curb ramps would be modified as a consequence of project-related capital improvements. Of the curb ramps at those intersections 130 (40%) are ADA-compliant and 194 (60%) are non-ADA compliant (see Table 4-12). Figure 4-5 depicts the 53 intersections affected by project improvements and the percentage of curb ramps at each intersection that are currently-ADA compliant. Curb ramps were most likely to be compliant in Downtown Seattle and South Lake Union because of recent developments. In the other neighborhoods, curb ramps are almost always present at intersections but were of an older design and did not meet current ADA design standards.

Figure 4-3. Sidewalk Maintenance Condition

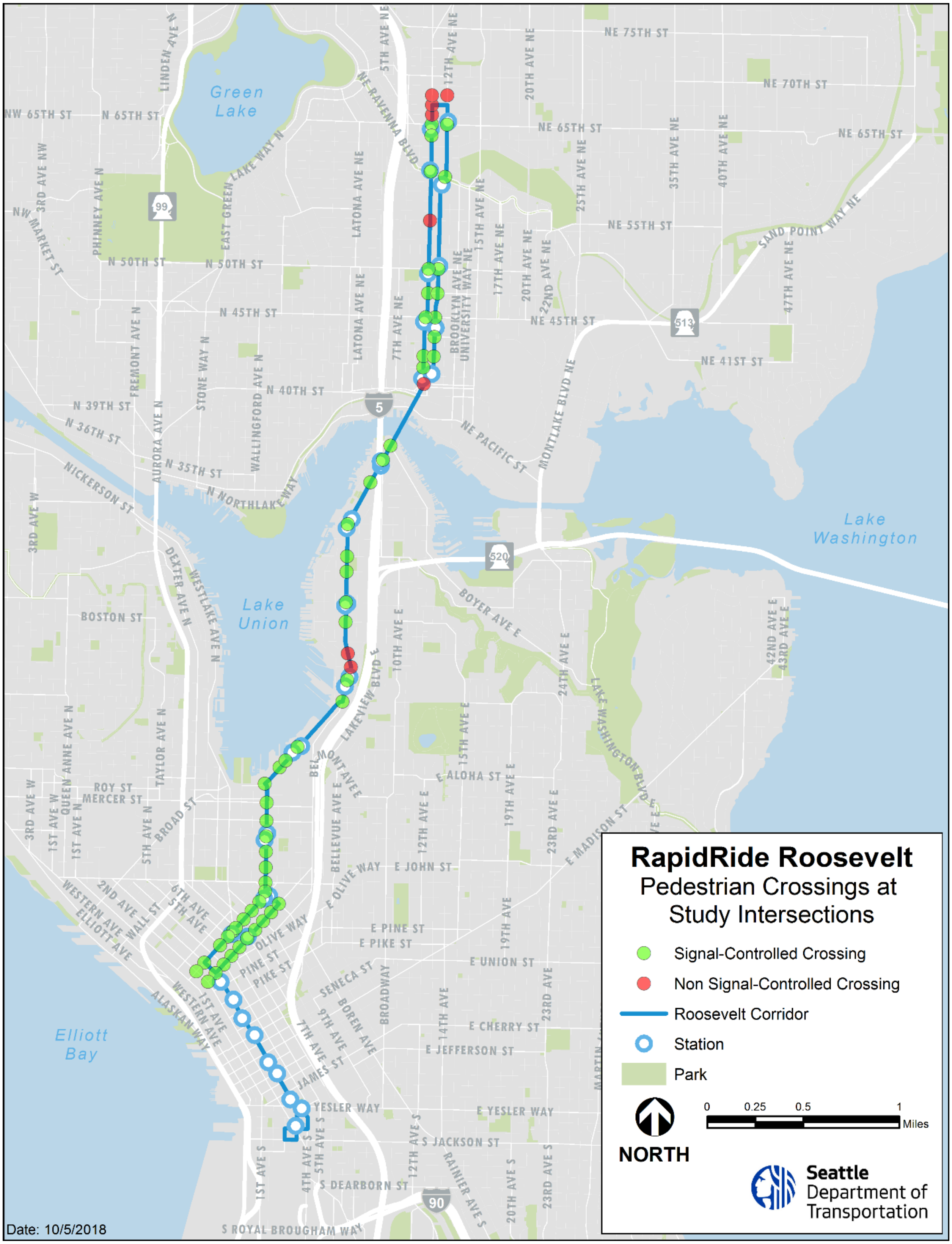


Figure 4-4. Existing Pedestrian Crossing Types

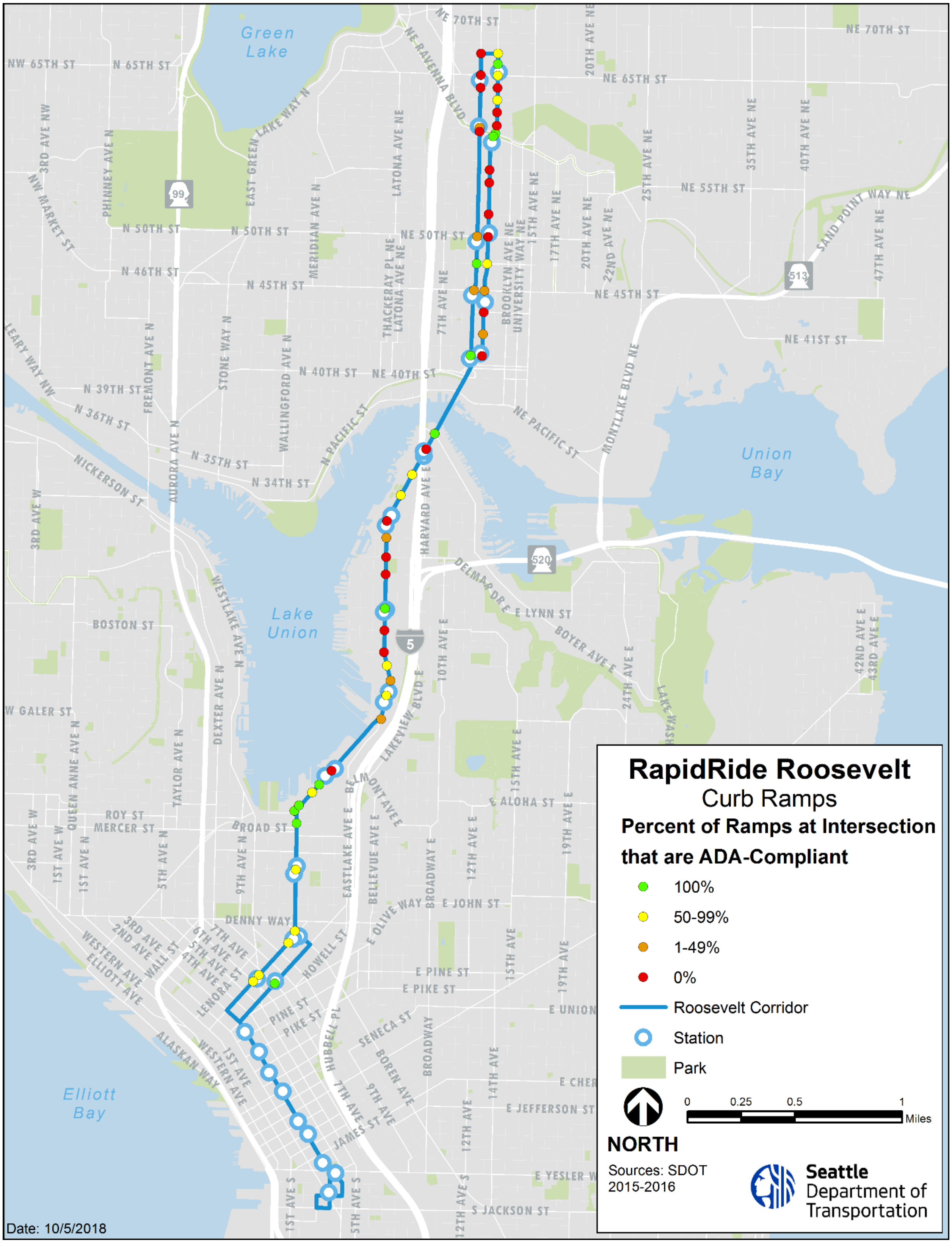


Figure 4-5. Existing Curb Ramp ADA-Compliance

Table 4-12. Existing Curb Ramp ADA-Compliance (2015-2016)

CURB RAMP ADA-COMPLIANCE STATUS	NUMBER	PERCENT
Compliant	130	40%
Non-Compliant	194	60%
Total	**324**	**100%**

Note: Includes only intersections where project-related capital improvements would result in modifications to curb ramps.

4.4.4 Pedestrian Volumes

Based on field counts performed in the spring of 2017, PM peak hour pedestrian volumes are highest at the intersections in the southern portion of the corridor, in Downtown Seattle and South Lake Union. As shown in Figure 4-6, most intersections Downtown exceed 1,000 pedestrians per hour, followed by South Lake Union, where volumes are typically between 500 and 1,000 pedestrians. Most other intersections along the corridor have fewer than 500 pedestrians per hour. For more detail, see Appendix G – Existing Pedestrian and Bicycle Volumes.

4.4.5 Bicycle Facilities

Existing bicycle facilities near and along the project corridor are shown on Figure 4-7. Most of the corridor is relatively well served by protected bicycle facilities, including recent projects that constructed PBLs on NE Ravenna Blvd (in 2015) and Roosevelt Way NE (in 2016). The PBL on Roosevelt Way NE extends for 1.4 miles between NE 65th St and the University Bridge. The University Bridge also includes PBLs in both directions. Access to the project corridor from surrounding neighborhoods occurs via protected bicycle facilities at numerous points along the corridor, including:

- NE Ravenna Blvd protected bikeway
- Burke-Gilman Trail
- Valley St (Cheshiahud Loop)
- Westlake Ave N protected bikeway
- 7th Ave protected bikeway
- 2nd Ave protected bikeway

Eastlake Ave E represents a gap in the string of dedicated and protected bicycle facilities connecting northeast Seattle neighborhoods to Downtown Seattle via the University Bridge. On Eastlake Ave E south of Harvard Ave E there are no dedicated facilities along the street or intersecting with the corridor until the intersection of Eastlake Ave E and Fairview Ave N, at the southern edge of the Eastlake neighborhood. There is a signed bicycle route, the Cheshiahud Lake Union Loop, that directs north- or southbound cyclists through the residential streets to the west of the project corridor, although this is not a dedicated bicycle facility and there are several steep hills for bicyclists to negotiate.

The 2014 *Seattle Bicycle Master Plan* (City of Seattle, 2014) recommends numerous additions to the bicycle network on and around the proposed corridor. However, given that the Bicycle Master Plan is fiscally constrained, the only projects assumed to have been completed by 2024 are those with funding or a stated timeline.

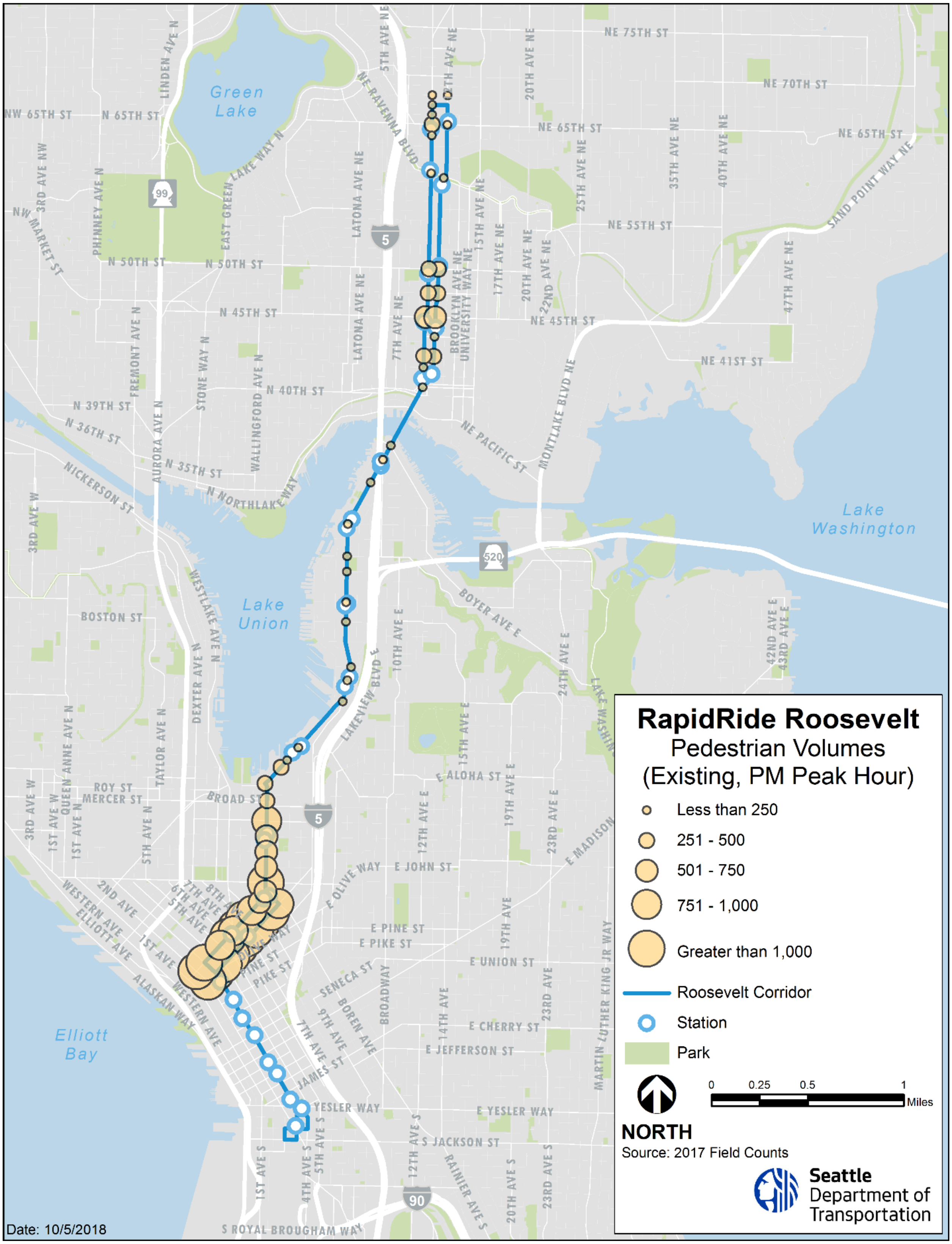


Figure 4-6. Pedestrian Volumes – Existing

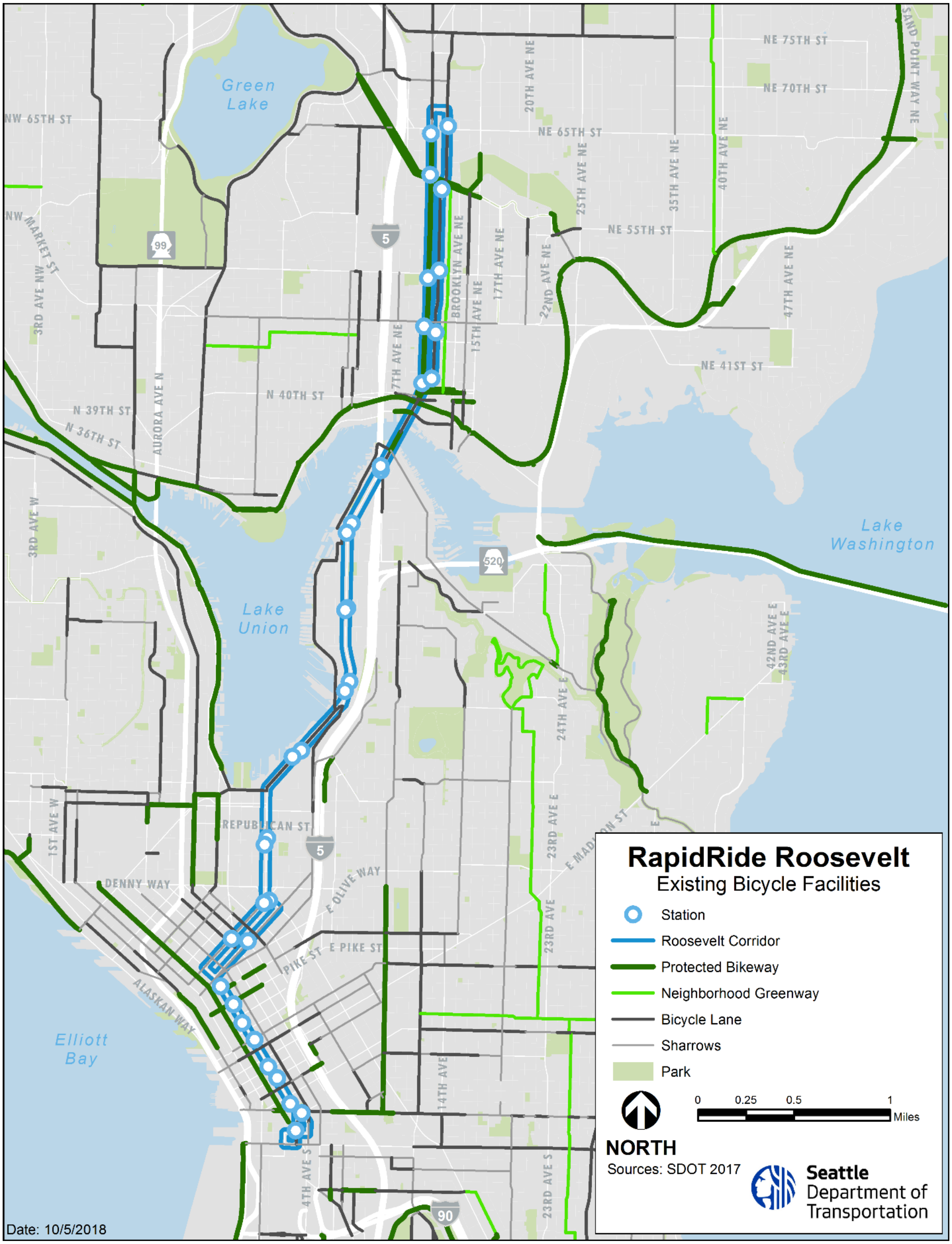


Figure 4-7. Existing Bicycle Facilities

4.4.6 Bicycle Volumes

The project corridor serves as a major bicycle route linking Downtown Seattle with neighborhoods on the northeast side of the University Bridge, despite a lack of bicycle facilities in the Eastlake neighborhood. According to the City of Seattle's *2017 Traffic Report* (SDOT, 2017a), which published data collected in 2016, Roosevelt Way NE south of NE 45th St carries 370 daily riders which is the 19th highest count out of 116 locations. The University Bridge carries 1,720 riders per day—the second-highest number of daily cyclists among all sites counted in the city, after the Fremont Bridge (see Figure 4-8 and Figure 4-9).

The City did not publish average daily bicycle volumes for Eastlake Ave E in the *2017 Traffic Report* (SDOT, 2017a), but a round of one-time bicycle counts was conducted there as part of this transportation analysis in May 2018. During the 14-hour count period, 1,462 cyclists were observed at the intersection of Eastlake Ave E and Fairview Ave N which, due to the configuration of the roadway network, provides a reasonable estimate of the total number of cyclists passing through the Eastlake neighborhood. Of those, 900 (62%) used Eastlake Ave E—which lacks bicycle facilities—versus 260 (18%) who used the parallel Cheshiahud Lake Union Loop, which follows a calmer but hillier and more circuitous route using side streets to the west of Eastlake Ave E. The remaining bicyclists use other parallel neighborhood streets.

Daily count data was also not published for the South Lake Union segment of the proposed project alignment, but PM peak counts conducted in 2017 indicate an average peak hour volume of 39 cyclists at intersections along Fairview Ave N, compared to an average of 116 at Eastlake Ave E intersections, and 48 at intersections along the Roosevelt Way NE and 11th/12th Ave NE couplet (Figure 4-10).

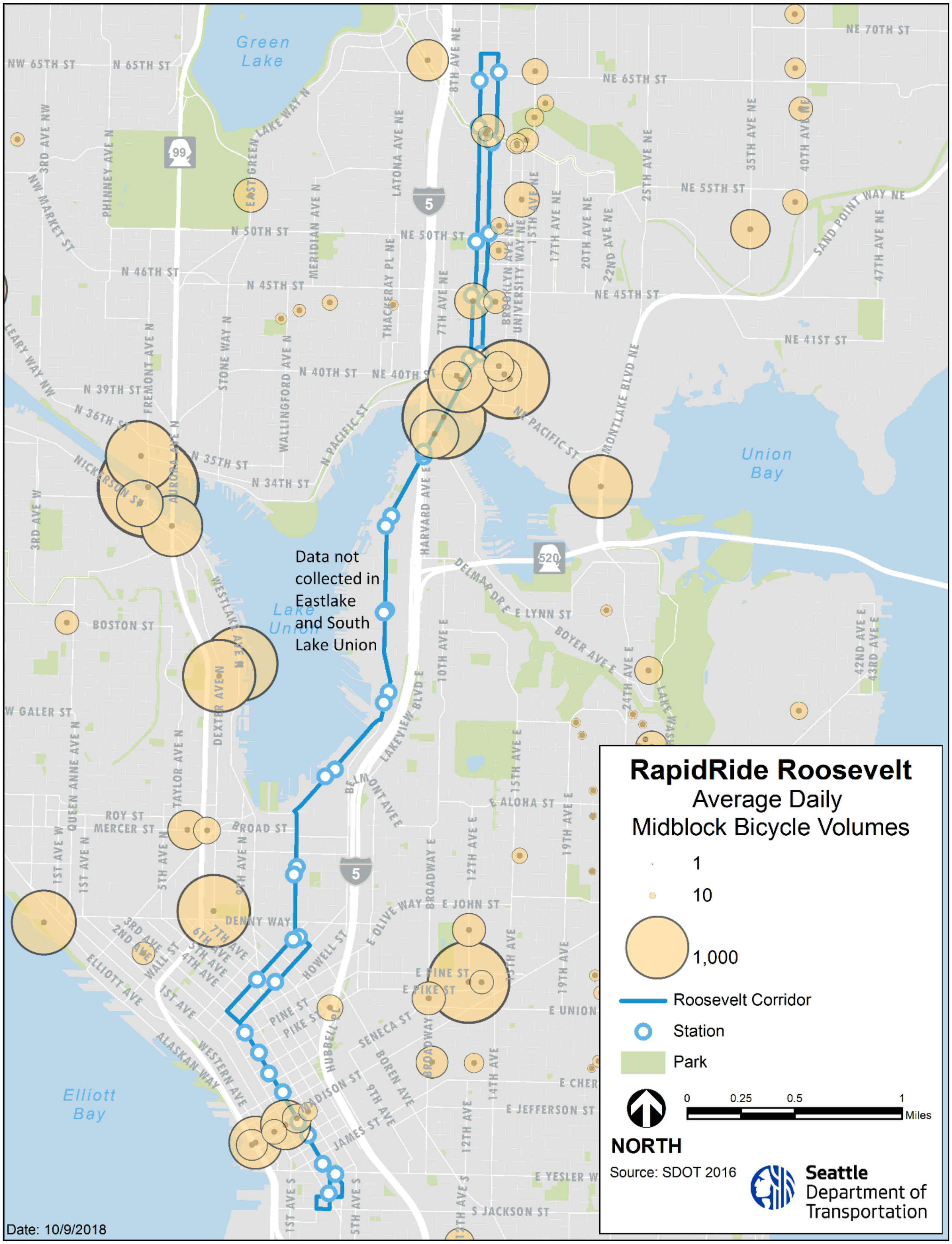


Figure 4-8. Midblock Daily Existing Bicycle Volumes (2016)

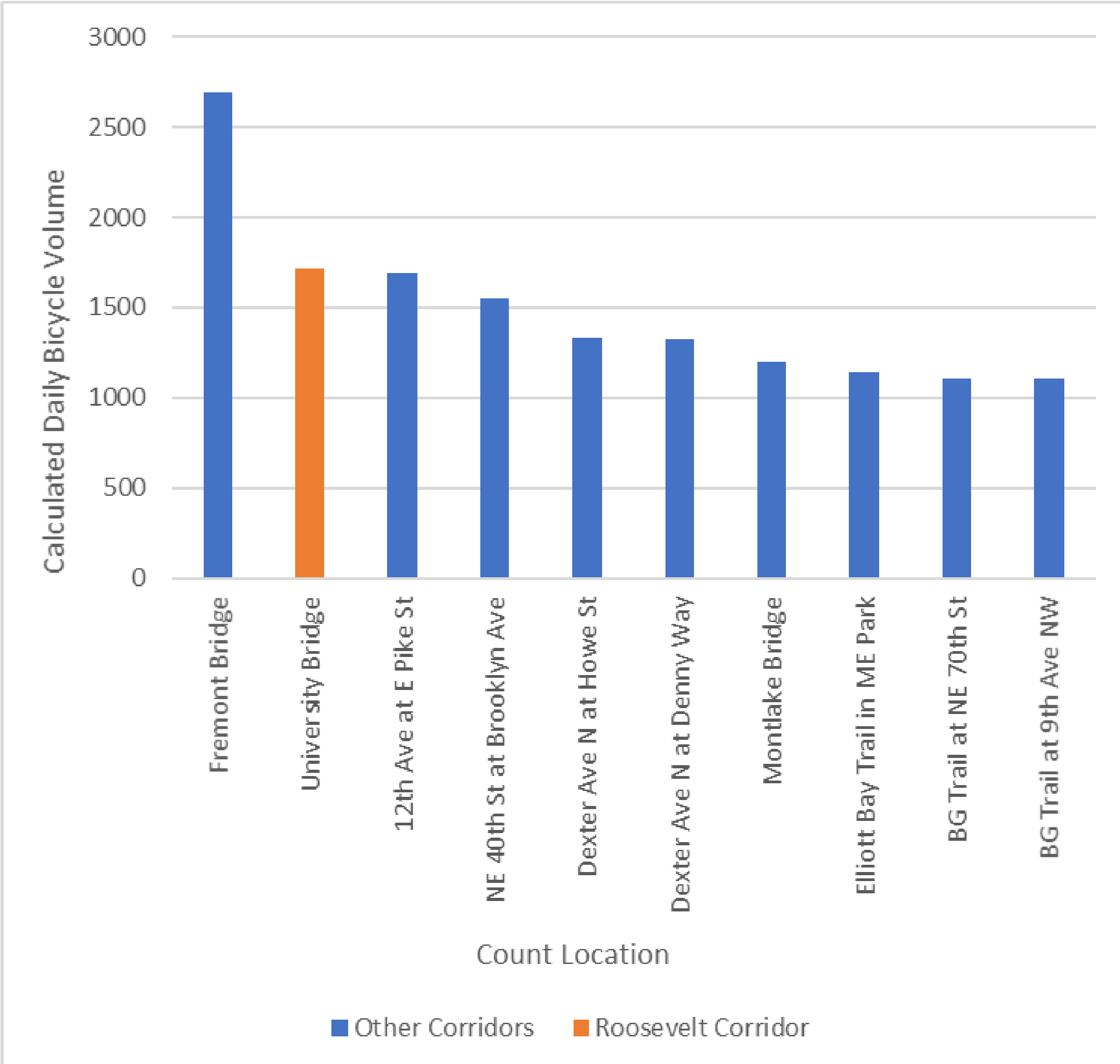


Figure 4-9. Top Ten Bicycle Count Sites in Seattle (2016)

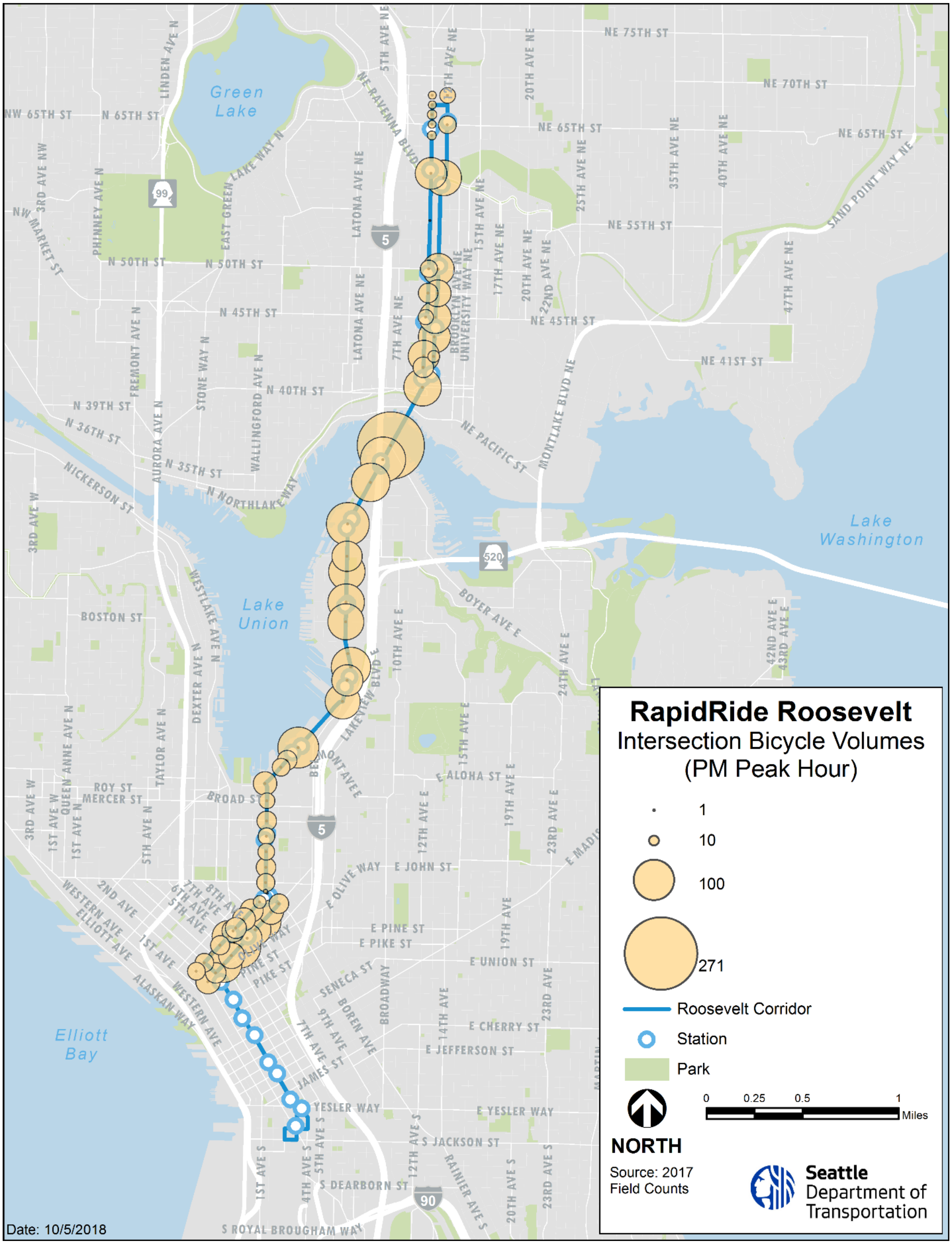


Figure 4-10. Existing Intersection PM Peak Hour Bicycle Volumes (2017)

4.5 Parking

This section describes the existing curb space conditions. The curb space management study conducted for the project is described in detail in Appendix C, Curb Space Management Study.

> **Definitions**
>
> **Curb space** is the space between the area exclusively used by bikes, cars, buses, streetcars, and trucks (streets) and the area used by pedestrians (sidewalks). Curb space has a variety of flexible transportation uses, also including socializing or doing business in parklets and streateries are also increasingly happening in curb spaces. Because there is a high demand for using these spaces, the City's Comprehensive Plan establishes policies that set priority to manage the use of curb spaces/flex zones.
>
> A **block face** is defined as one side of a street between two consecutive features intersecting that street. The features can be other streets or boundaries of standard geographic areas.
>
> **Complete streets** are streets that provide appropriate accommodation for pedestrians, bicyclists, transit riders, and people of all abilities, while promoting safe operation for all users.

4.5.1 Study Area

The study area for curb space management was defined as all the block faces along the RapidRide Roosevelt corridor except for 3rd Ave and Virginia St/Stewart St. Because there are no project improvements in the area south of 3rd Ave and Virginia/Stewart Streets, these streets were not included in the parking study area. The parking study area also includes cross streets and parallel streets one block away (east and west directions) from the RapidRide Roosevelt corridor to account for available parking within a reasonable walking distance to and from the corridor. In response to the Eastlake neighborhood requests about the parking availability overnight, an additional parking study and data collection was conducted which covers a larger set of block faces along Eastlake Ave E to understand parking conditions in the overnight, early morning hours.

To analyze the parking and loading zone data, the study area was divided into 10 study zones. These zones were determined based on the street and parking network within the transportation system. However, it is assumed in many cases people park in one zone and access a destination in another zone. Figure 4-11 shows the parking study area and zones (a figure showing the overnight parking extended study area is provided as Figure 2 in Appendix C of this report).

4.5.2 City of Seattle Curb Space Policies

This section discusses the City of Seattle policies for curb space use in the *Seattle 2035 Comprehensive Plan* (City of Seattle, 2019) and the "Seattle Streets Illustrated" Right-of-Way Improvements Manual (City of Seattle, 2017a).

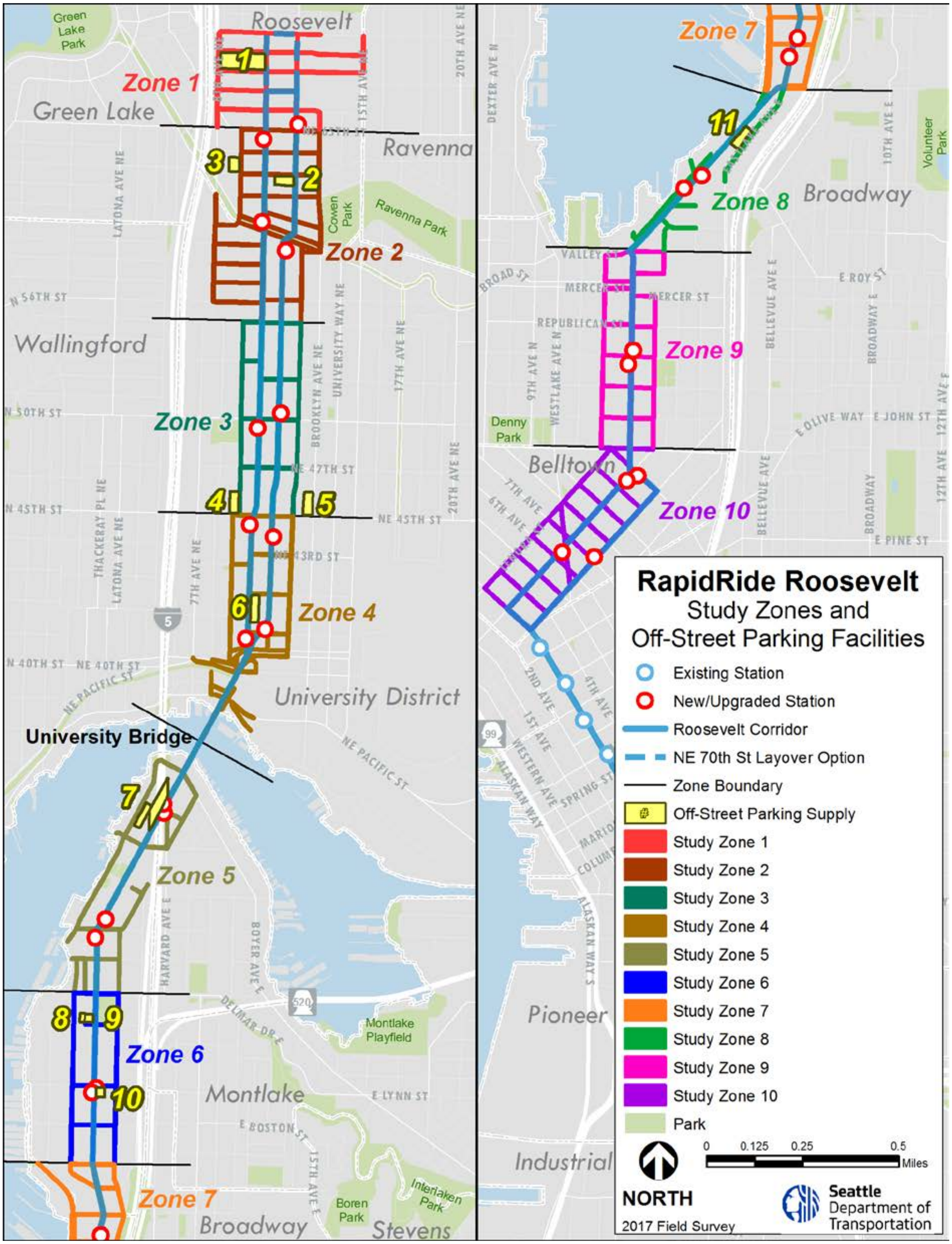


Figure 4-11. Curb Space Management Study Zones and Off-Street Parking Facilities

4.5.2.1 City of Seattle Comprehensive Plan

Curb space is part of the right-of-way street system and is considered by SDOT a public good available to all users. The use of curb space in Seattle is regulated and managed by SDOT. The Transportation element of the City's Comprehensive Plan establishes policies to address the competing and diverse needs of transportation to assist in more efficiently moving people and goods, support the vitality of business districts, and create livable neighborhoods. Curb space is considered a flex area or zone by the City of Seattle.

The City's adopted Comprehensive Plan (City of Seattle, 2019), refers to curb space as the flex zone that provides parking, bus stops, and loading for passenger and urban goods delivery. The flex zone has six essential functions to provide: support for modal plan priorities; access for commerce; access for people; activation; greening; and, storage. This curb space policy works to address the competing and diverse needs of transportation, economic development, and growth in the city, including modes and users at the curb. Definitions and examples of these different functions for flex zone use are shown in Table 4-13.

Because not every function can fit on every block, the Comprehensive Plan establishes a framework policy to prioritize and determine how to meet functions on each corridor or nearby. Specifically, T 2.6 states:

> Allocate space in the flex zone to accommodate access, activation, and greening functions, except when use of the flex zone for mobility is critical to address safety or to meet connectivity needs identified in modal master plans. When mobility is needed only part of the day, design the space to accommodate other functions at other times.

The right-of-way functions to accommodate mobility, and the modal plan priorities ensure that the street network accommodates multiple travel modes.

Table 4-13. Definitions and Examples of Functions for Curb Space Use

FUNCTION	DEFINITION	EXAMPLES OF USES
Support for modal plan priorities	Moves people and goods	• Sidewalks • Bus or streetcar lanes • Bike lanes • General purpose travel lanes (includes freight) • Right- or left-turn only lanes
Access for People	People arrive at their destination, or transfer between different ways of getting around.	• Bus or rail stops • Bike parking • Curb bulbs • Passenger loading zones • Short-term parking • Taxi zones
Access for Commerce	Goods and services reach their customers and markets.	• Commercial vehicle loading zone • Truck loading zone
Activation	Offers vibrant social spaces.	• Food trucks • Parklets and streateries • Public art • Street festivals

Table 4-13. Definitions and Examples of Functions for Curb Space Use

FUNCTION	DEFINITION	EXAMPLES OF USES
Greening	Enhances aesthetics and environment health.	• Plantings - Boulevards - Street trees - Planter boxes • Rain gardens and bio-swales
Storage	Provides storage for vehicles or equipment.	• Bus layover • Long-term parking • Reserved spaces (e.g., for police or other public use) • Construction

Source: SDOT, 2018a

4.5.2.2 Seattle Streets Illustrated

Seattle Streets Illustrated is Seattle's Right-of-Way Improvements Manual and was adopted in 2017. It provides design guidance and standards for various street type designations and rights-of-way within Seattle. The manual is based on a guiding principle of complete streets and balancing the needs of all travel modes and users, including pedestrians, bicyclists, transit riders, freight, and motor vehicle drivers. The design guidance provided in Seattle Streets Illustrated is consistent with applicable City of Seattle plans and regulations, including the Seattle Comprehensive Plan, the *City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction* (City of Seattle, 2017b), and the Seattle Municipal Code.

4.5.3 Existing On-Street Parking Inventory

Existing on-street parking was inventoried to understand the amount of on-street parking that is provided in the project area. This on-street parking data was gathered for three analysis time periods; mid-day, PM peak, and late evening. The data inventoried the total number of on-street parking spaces including commercial vehicle loading zones (CVLZ) and passenger loading zones (PLZ) for each of the analysis time periods.

Because on-street parking spaces are not marked or delineated within the existing right-of-way, the following parking inventory was estimated in the field using the methodology described in the Seattle Department of Construction and Inspections (SDCI) Tip 117: Parking Waivers for Accessory Dwelling Units, as recommended by City staff (City of Seattle, 2011). The following curb space measurements for required clear distances from common street features were used from Tip 117:

- No parking within 15 feet of a fire hydrant on either side
- No parking within 5 feet of a driveway or alley on either side
- No parking within 30 feet of a marked intersection
- No parking within 20 feet of an unmarked intersection

Table 4-14 summarizes the total number of parking spaces and loading zones by type for each of the analysis time periods, as of May 2017. The midday and late evening time periods have the same numbers, but the number of spaces in the PM peak is reduced in most of the zones due to existing PM peak period parking restrictions. A peak period parking restriction indicates parking and stopping are not allowed during morning and afternoon commute times to improve roadway capacity and traffic flow.

Table 4-14. Summary of Existing On-Street Parking and Loading Zone Inventory

STUDY ZONE	MIDDAY/LATE EVENING[a]			PM PEAK[b]		
	PARKING SPACES	LOADING ZONES		PARKING SPACES	LOADING ZONES	
		CVLZ	PLZ		CVLZ	PLZ
1	573	20	6	571	20	6
2	930	21	3	857	14	3
3	538	14	7	538	14	7
4	302	20	11	283	20	8
5	579	11	2	504	9	1
6	506	14	2	442	8	2
7	411	10	0	388	9	0
8	188	2	3	188	2	3
9	283	26	16	260	24	14
10	279	32	50	240	28	45
Total	**4,589**	**170**	**100**	**4,271**	**148**	**89**

[a] The inventory is the same for midday and late evening time periods.

[b] The on-street parking and loading zone inventory is reduced in some locations by peak period parking restrictions.

Figures 4-12 to 4-16 show the locations of loading zones along the study corridor. Different types of parking (i.e., time-limited, unrestricted, restricted parking zone [RPZ], and disabled parking) within the study area are shown in Appendix C, Curb Space Management Study.

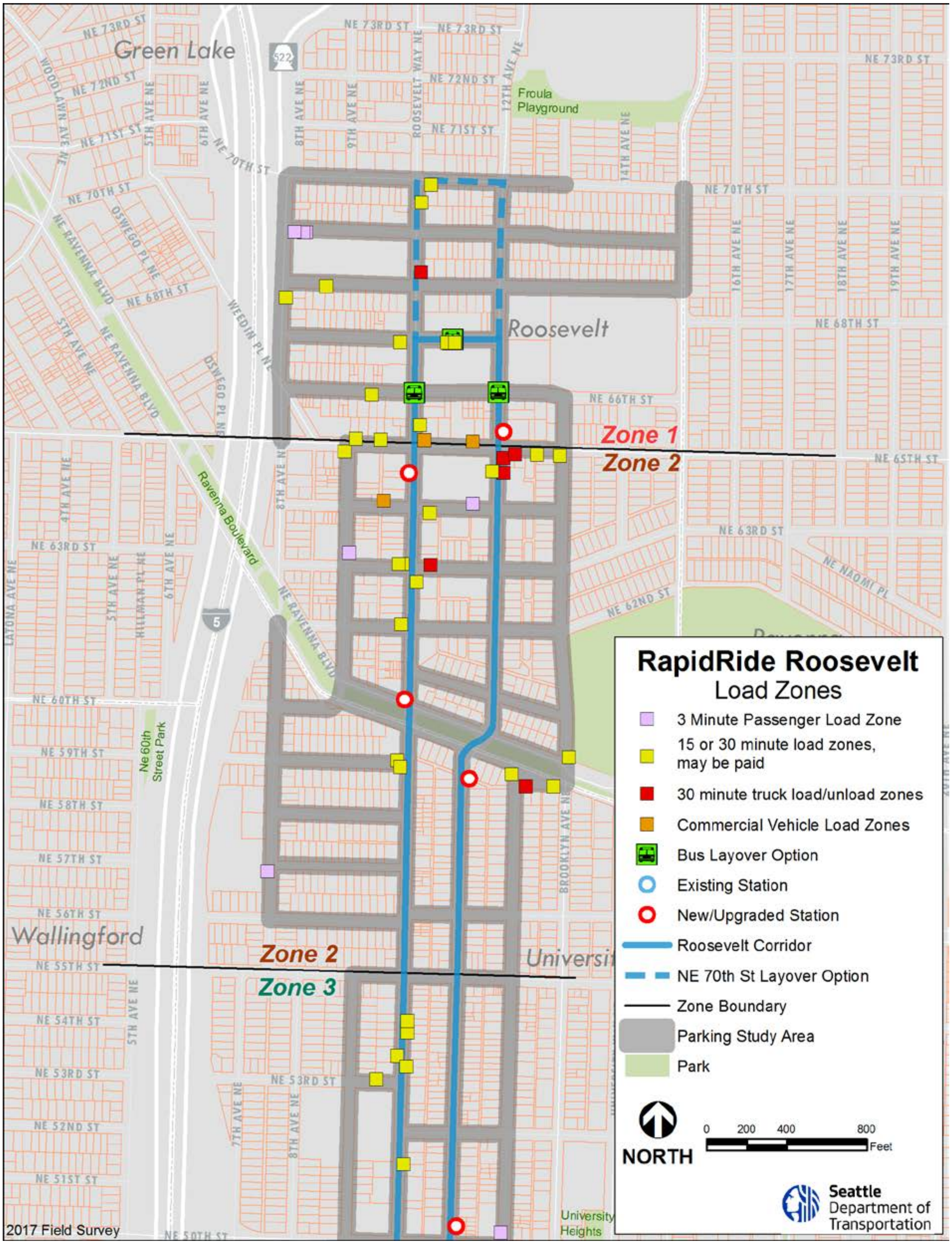


Figure 4-12. Location of Loading Zones along the Study Corridor in Study Zones 1, 2

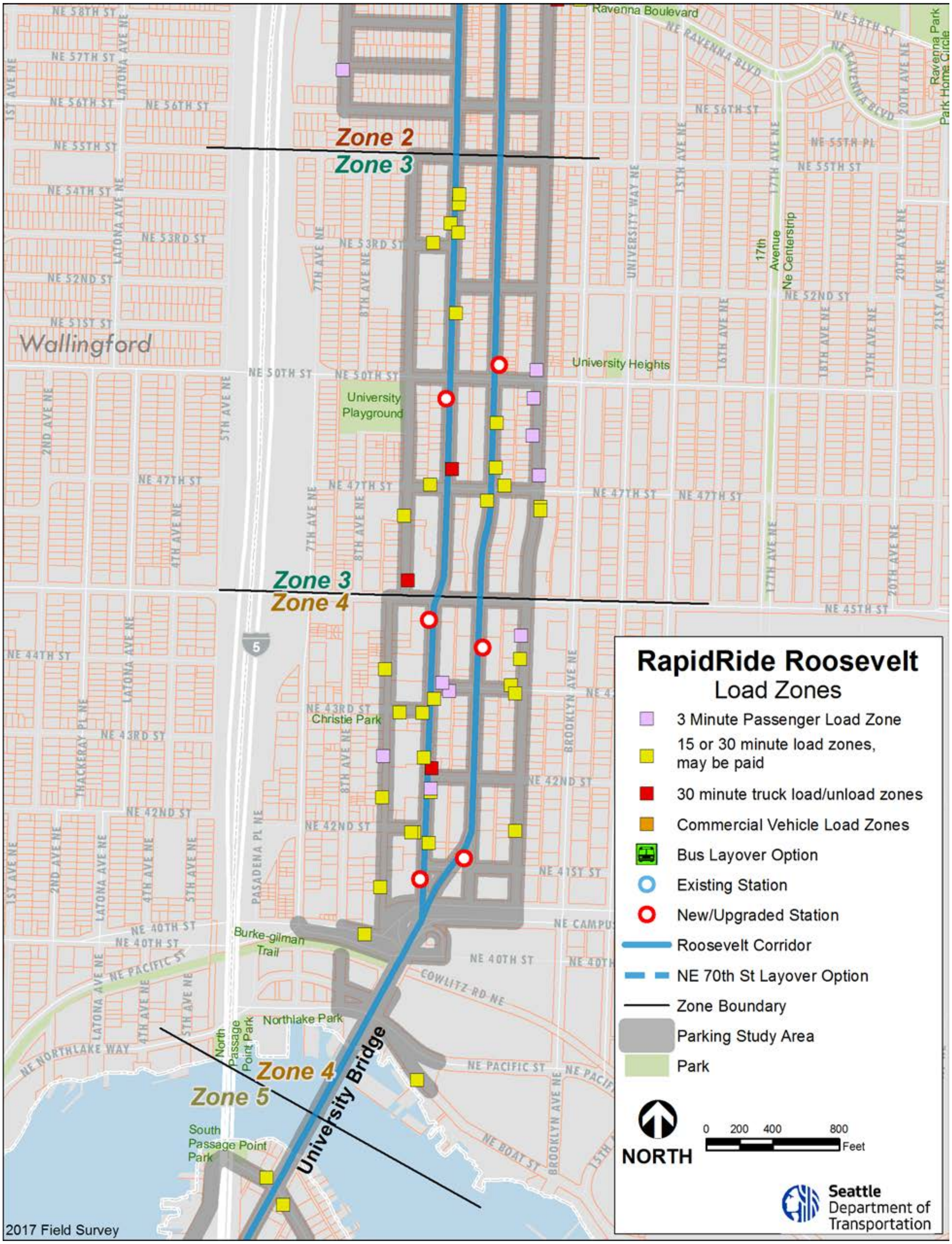


Figure 4-13. Location of Loading Zones along the Study Corridor in Study Zones 3, 4

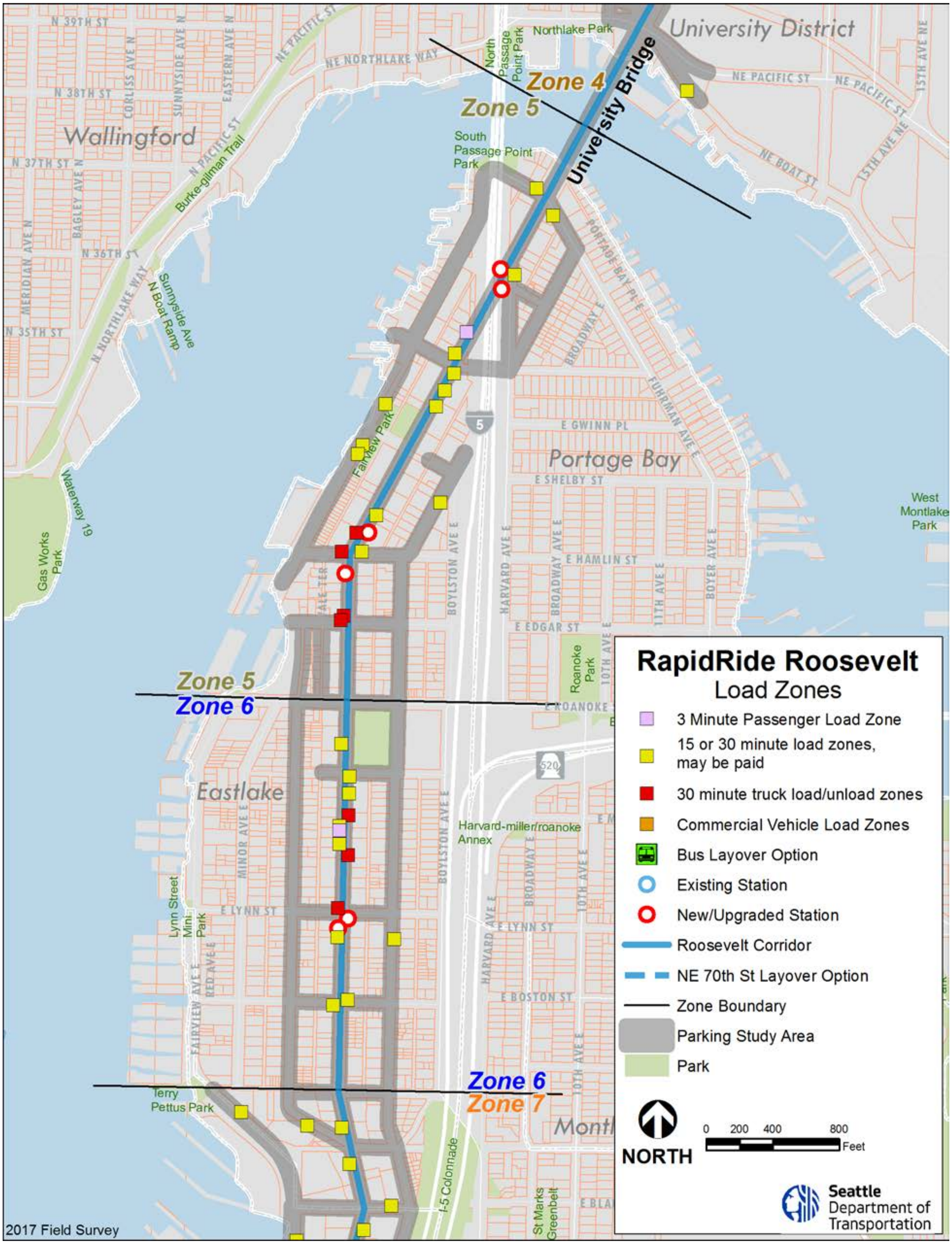


Figure 4-14. Location of Loading Zones along the Study Corridor in Study Zones 5, 6

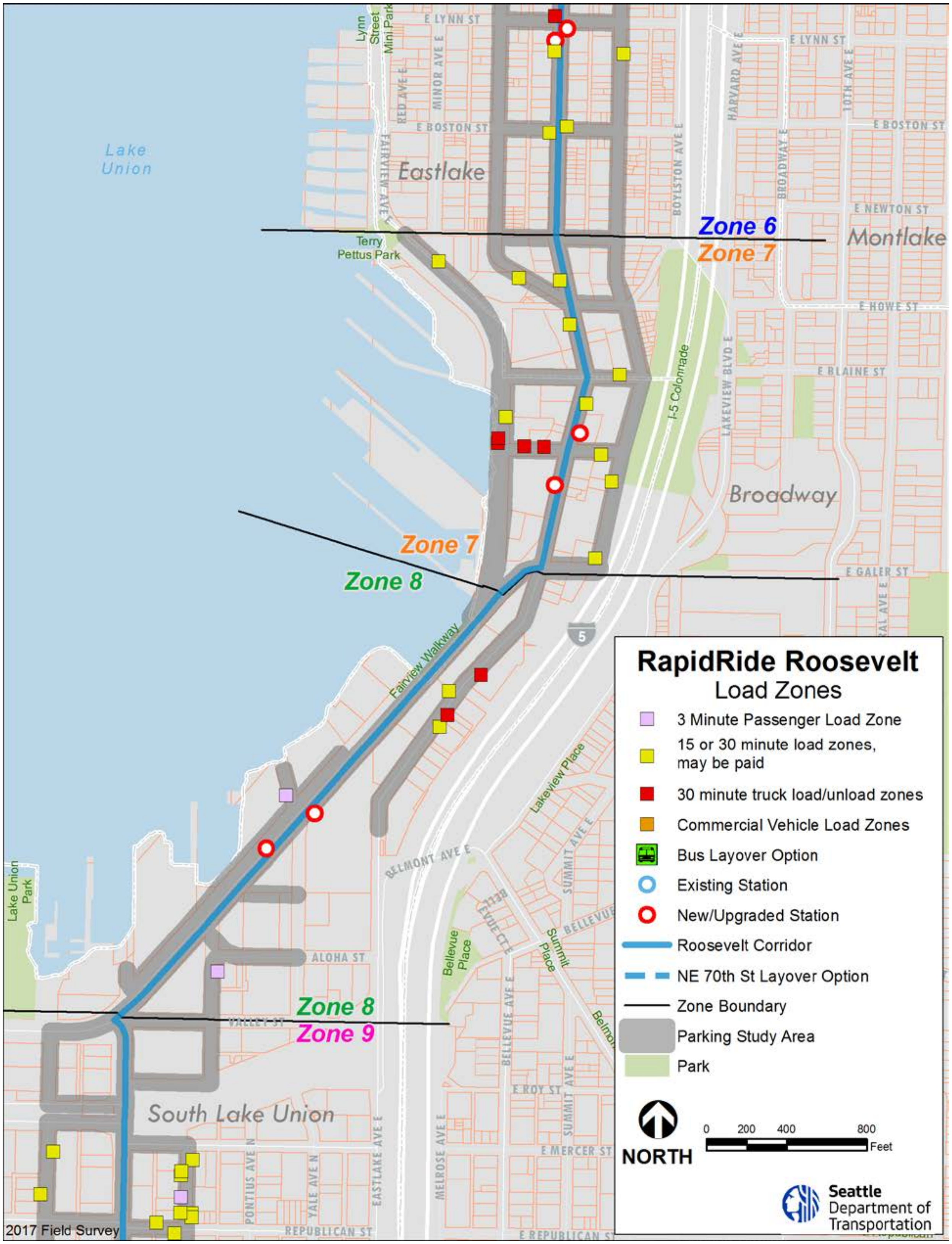


Figure 4-15. Location of Loading Zones along the Study Corridor in Study Zones 7, 8

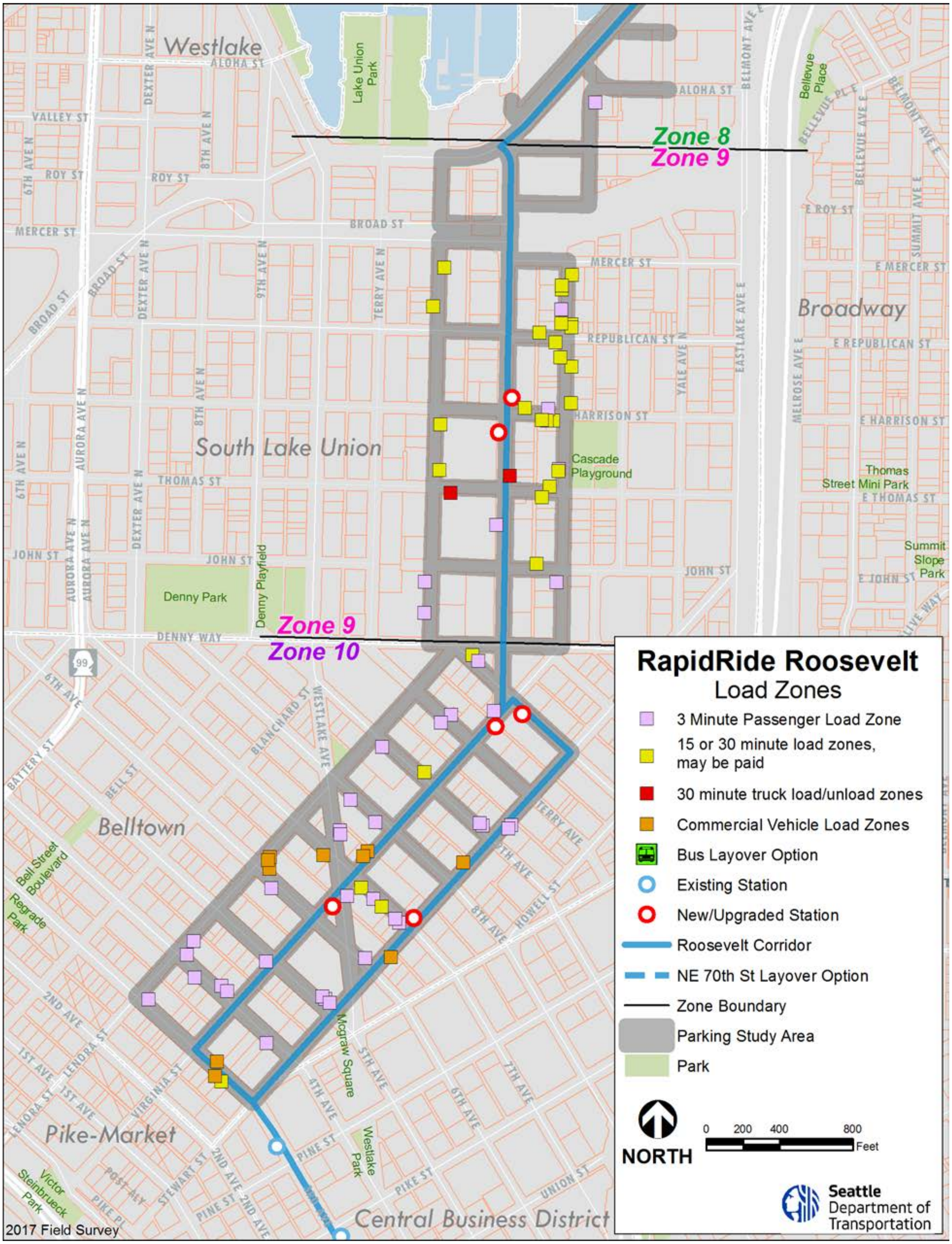


Figure 4-16. Location of Loading Zones along the Study Corridor in Study Zones 9, 10

4.5.4 Existing On-Street Parking Occupancy and Utilization

On-street parking utilization describes the number of vehicles parked (the occupancy) in an area, compared to the available inventory. It is calculated by dividing the occupancy by the inventory in the area. SDOT provided the inventory and utilization data for paid on-street parking and loading zone areas in the study area. For unpaid on-street parking areas and off-street parking, the project team performed a parking inventory and occupancy survey. Parking data were collected in April and May 2017 on typical weekdays (Tuesday, Wednesday, or Thursday) to represent average parking conditions. Collection dates were chosen to not overlap with significant area events, such as spring break periods for schools, so that typical parking conditions were represented. Hourly occupancy observations were made in the areas from 8 AM to 10 PM. Even though data was collected on a typical, average condition the parking supply and occupancy can frequently change.

The existing on-street parking utilization percentages for each zone are summarized in Table 4-15. An occupancy rate of 85% or below is considered to be an acceptable threshold for available parking by the City of Seattle. Utilization rates over 85% generally indicate conditions where people find it difficult to find parking spaces and often result in increased circulation as people look for spaces. Utilization rates over 100% may indicate vehicles parked illegally, closely spaced vehicles, or other similar situations. For loading zones, utilization data were not collected due to the limited durations of occupation.

As shown in Table 4-15, on-street parking utilization was observed as approaching or exceeding the 85% threshold in several study zones. During midday, which has the highest demand for on-street parking, zones 1, 4, 5, 7, 9, and 10 have utilization rates equal to or greater than 85%. Figures 17 through 31 in Attachment A-1 to Appendix C, Curb Space Management Study, illustrate the parking utilization by block face to highlight where parking demand is greatest.

4.5.5 Off-Street Parking Inventory and Occupancy

The numbers of parking spaces and the numbers of occupied spaces were surveyed at 11 public paid parking facilities along the corridor, shown on Figure 4-17. The facilities were selected in coordination with SDOT to represent a sampling of the public off-street parking facilities located close to the main corridor. This information was used to evaluate whether there would be enough parking to meet parking demand after the project was constructed. The parking survey was conducted during two non-consecutive days (Thursday, January 18, 2018, and Tuesday, January 23, 2018) for three 1-hour time periods: (1) midday from noon to 1 PM, (2) PM peak from 5 PM to 6 PM, and (3) late evening from 8 PM and 10 PM.

The 11 paid parking facilities selected for the study have a capacity of 596 spaces. As shown in Table 4-16, these facilities were highly utilized during the midday period, with six facilities approaching or over 85% with limited available parking. Utilization rates drop for the PM peak and late evening time periods, with most facilities less than 50% utilized and having ample available parking.

Besides the 11 facilities inventoried, the University District (zones 3 and 4) and South Lake Union and Downtown neighborhoods (zones 9 and 10) have numerous other parking facilities within the project corridor that were not inventoried. It is assumed that the overall occupancies in these other parking facilities would be similar to the facilities that were inventoried.

Block face No.	Parking Inventory	Parking Type	Parking Restriction
1A	16	Unrestricted	AM Peak
1B	13	Unrestricted	PM Peak
2A	25	Time Limited (2 hrs)	AM Peak
2B	20	Time Limited (2 hrs)	PM Peak
3A	16	Time Limited (2 hrs)	AM Peak
3B	14	Time Limited (2 hrs)	PM Peak
4A	21	RPZ Time Limited (2 hrs)	AM Peak
4B	22	Unrestricted	PM Peak

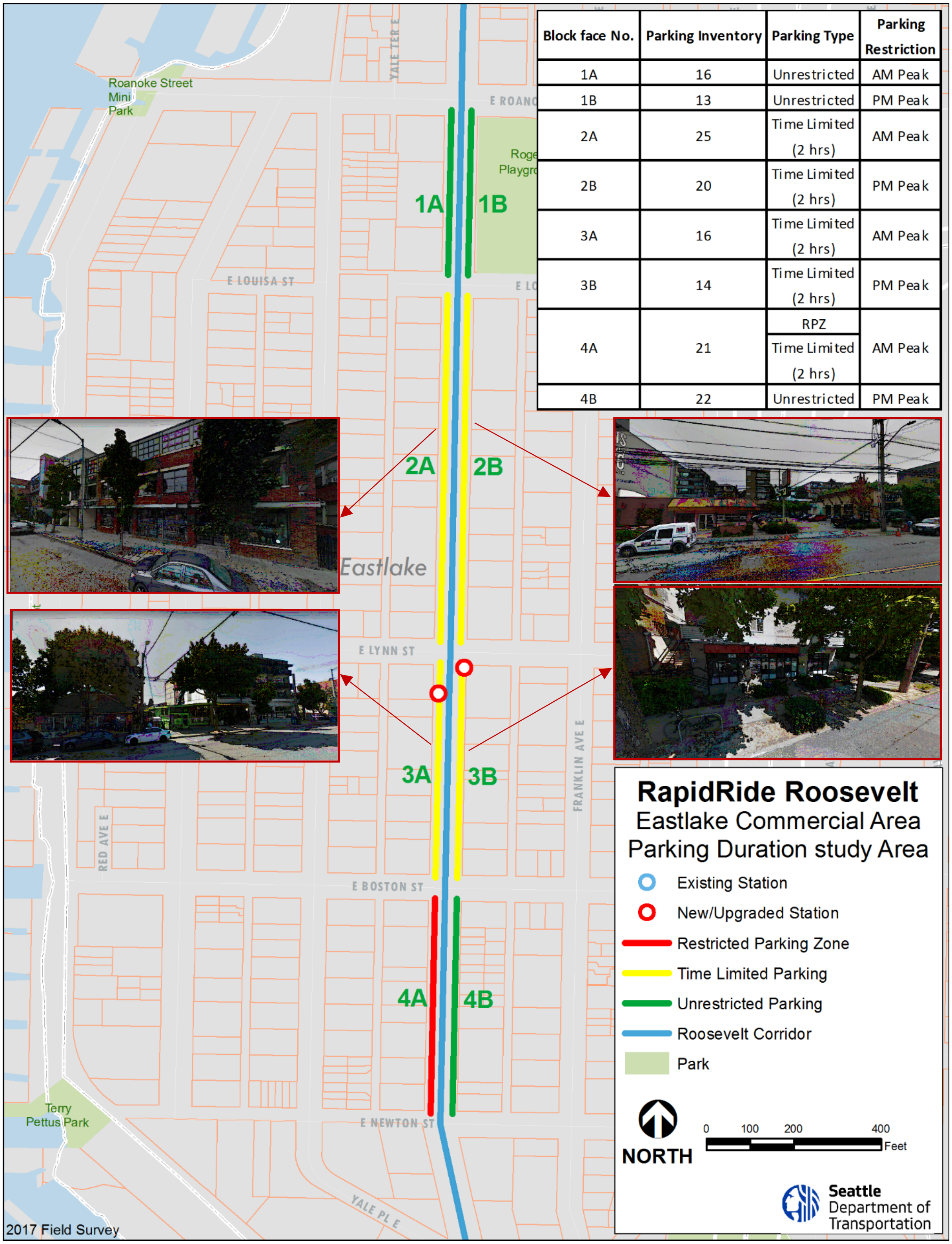


Figure 4-17. Eastlake Commercial Area Study Area Parking Inventory and Type of Parking per Block Face

Table 4-15. Summary of Existing On-Street Parking Inventory and Utilization Rates by Time Period

STUDY ZONE	MIDDAY			PM PEAK			LATE EVENING		
	PARKING SPACES	OCCUPANCY	UTILIZATION	PARKING SPACES	OCCUPANCY	UTILIZATION	PARKING SPACES	OCCUPANCY	UTILIZATION
1	573	540	94%	571	425	74%	573	447	78%
2	930	632	68%	857	644	75%	930	664	71%
3	538	437	81%	538	389	72%	538	422	78%
4	302	299	99%	283	248	88%	302	272	90%
5	579	524	91%	504	415	82%	579	404	70%
6	506	426	84%	442	362	82%	506	398	79%
7	411	415	101%	388	254	65%	411	254	62%
8	188	141	75%	188	80	43%	188	58	31%
9	283	240	85%	260	177	68%	283	173	61%
10	279	258	92%	240	180	75%	279	214	77%
Total	**4,589**	**3,912**	**85%**	**4,271**	**3,174**	**74%**	**4,589**	**3,306**	**72%**

Table 4-16. Summary of Existing Off-Street Parking Inventory and Utilization

STUDY ZONE	LOT #	INVENTORY	MIDDAY			PM PEAK			EVENING		
			OCCU-PANCY	UTILIZA-TION	AVAIL-ABLE	OCCU-PANCY	UTILIZA-TION	AVAIL-ABLE	OCCU-PANCY	UTILIZA-TION	AVAIL-ABLE
1	1	184	137	74%	47	28	15%	156	26	14%	158
2	2	16	14	84%	2	6	38%	10	3	19%	13
2	3	55	37	67%	18	28	50%	27	22	39%	33
3	4	59	51	86%	8	43	72%	16	37	62%	22
3	5	109	105	96%	4	46	42%	63	28	25%	81
4	6	26	11	42%	15	8	31%	18	6	21%	20
5	7	31	13	40%	18	10	31%	21	7	21%	24
6	8	10	9	85%	1	4	40%	6	4	40%	6
6	9	5	3	60%	2	3	50%	2	1	20%	4
6	10	22	19	84%	3	7	30%	15	3	11%	19
8	11	79	74	93%	5	37	46%	42	17	22%	62
	Total	**596**	**473**	**79%**	**123**	**220**	**37%**	**376**	**154**	**26%**	**442**

These other parking facilities are shown on the Figure 9 to Figure 13 in the RapidRide Roosevelt Corridor Curb Space Management Study in Appendix C.

4.5.6 Eastlake Commercial Area Parking Duration Study

In response to the business community's concerns about parking availability, a parking duration study was conducted for the Eastlake commercial area. The Eastlake commercial area is defined as the area along Eastlake Ave E between E Roanoke St and E Newton St. Many of the businesses in this area do not have dedicated off-street parking for customers, and this area has limited access to additional on-street parking on the adjacent block faces, because of the proximity to South Lake Union and I-5.

The purpose of this study was to determine the parking occupancy and the average duration of parking in the commercial area. On-street parking duration was surveyed hourly from 7 AM to 7 PM, to represent the peak activity times for businesses in the area. The data were collected on two non-consecutive days (Tuesday, December 12, 2017, and Thursday, December 14, 2017).

The curb space analysis included a parking duration study for the project corridor through the Eastlake commercial area. Figure 4-16 provides information on the parking inventory, type of parking for each block face, and the peak period parking restriction (AM Peak: 7-9 AM, PM Peak: 4-6 PM). The presence of Zone 8 RPZ stickers for vehicles on Block Face 4A was also noted, which is important because the duration study provides an understanding of how the parking is being used in the corridor. The results in terms of the average turnover (vehicles per spot) and the average, minimum, and maximum parking duration (hours per spot) for each block face are shown in Table 4-17.

> **Definitions**
>
> **Parking turnover** - indicates the rate of use of a given parking space and the average number of vehicles parking at a given space or group of spaces during a specified time (vehicles per spot).
>
> **Parking duration** - the length of time vehicles are parked in a given space (hours per spot). The higher percentage of the parking being occupied for a longer duration indicates that it is less available for turnover and business patrons.

The parking duration survey noted the length of time cars were parked in the Eastlake commercial area in the 12-hour period from 7 AM to 7 PM. The durations that vehicles were parked varied by inventory type. The results are summarized in Table 4-18. The results show that approximately 16% of cars were parked in time-limited parking for longer than 2 hours. For unrestricted parking spaces, more than half of the cars were parked for 2 hours or more, and the average parking time was approximately 4 hours. For RPZs, more than half of the cars were parked for 2 hours or more and the average parking time was approximately 6 hours.

Table 4-17. Eastlake Commercial Area Duration Study Average Turnover and Parking Duration

BLOCK FACE NO.	STREET NAMES	PARKING TYPE	AVERAGE TURNOVER (VEH/SPOT)	AVERAGE PARKING DURATION (HR/SPOT)
1A	Eastlake Ave E between E Louisa St and E Roanoke St - west side	Unrestricted	1.9	4.3
1B	Eastlake Ave E between E Louisa St and E Roanoke St - east side	Unrestricted	2.0	4.1
2A	Eastlake Ave E between E Lynn St and E Louisa St - west side	Time Limited (2 hour)	2.4	3.4
2B	Eastlake Ave E between E Lynn St and E Louisa St - east side	Time Limited (2 hour)	2.7	2.0
3A	Eastlake Ave E between E Boston St and E Lynn St - west side	Time Limited (2 hour)	3.3	1.8
3B	Eastlake Ave E between E Boston St and E Lynn St - east side	Time Limited (2 hour)	1.7	2.4
4A	Eastlake Ave E between E Newton St and E Boston St - west side	RPZ Time Limited (2 hour)	1.8	3.4
4B	Eastlake Ave E between E Newton St and E Boston St - east side	Unrestricted	1.4	4.0

Table 4-18. Summary of Average Length of Stay along Eastlake Commercial Area for Different Types of On-street Parking

TIME INTERVALS (HOURS)	TOTAL % (NUMBER OF CARS PARKED)	TIME-LIMITED	UNRESTRICTED	RPZ	OTHER
<1	42% (145)	29%	12%	<1%	<1%
1-2	20% (68)	14%	6%	<1%	<1%
2-3	9% (29)	5%	3%	0%	<1%
3-4	3% (12)	2%	1%	0%	<1%
4-5	6% (19)	3.%	2%	0%	<1%
5-6	3% (13)	1%	3%	0%	0%
6-7	5% (17)	2%	4%	0%	<1%
7-8	6% (21)	2%	4%	<1%	0%
8-9	4% (14)	2%	2%	<1%	0%
9-10	2% (5)	<1%	1%	0%	0%
10-11	0% (0)	0%	0%	0%	0%
11-12	0% (0)	0%	0.%	0%	0%
Total	**100% (342)**	**60%**	**38%**	**1%**	**1%**

According to the Seattle Municipal Code, short-term parking is defined as parking for less than 4 hours (Seattle Municipal Code 23.84A.030). In the study area, 26% of the cars are considered long-term parked vehicles. Figure 4-18 shows the percentage of long-term and short-term parked vehicles.

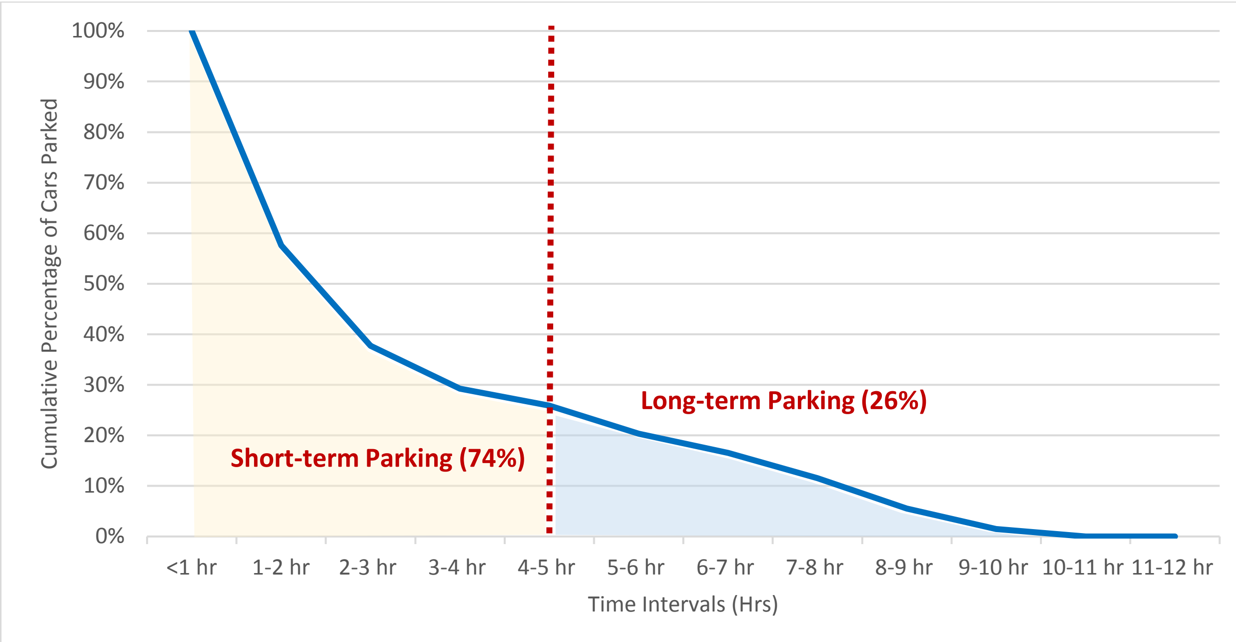


Figure 4-18. Percentage of Long-term and Short-term Parking during Eastlake Commercial Area Parking Duration Study

4.5.7 Eastlake Overnight Extended Area Study

In response to requests about the parking availability overnight in the Eastlake neighborhood and the limits of the data collection, an additional parking study in this neighborhood was conducted. The purpose of this overnight study was to determine the availability of additional parking options for all of the Eastlake neighborhood. This extended area included all block faces located along the Eastlake Ave E (east and west directions) between South Lake Union and I-5 within study zones 5, 6 and 7.

This extended overnight study collected parking utilization data on July 17, 2019 for one-hour period between 3 AM to 4 AM to determine the overnight parking needs during weekdays; a second data collection was performed on July 31 (for collecting data for a few blackfaces that were missing from the first collection). The overnight time period has a larger number of spaces compared to other data collection periods (midday and late evening) due to the additional block faces where data was collected. Therefore, the total number of existing on-street parking spaces in the Eastlake neighborhood are 2,110 during the overnight time period, compared to 1,496 spaces during midday and late evening. The additional 614 on-street parking spaces (including 10 CVLZ and 0 PLZ) inventoried during the overnight time period is the parking along the additional block faces beyond the primary parking study area inventoried for the other time periods.

During the overnight time period, extended study zone 6 has a high on-street parking utilization rate (90%), compared to the utilization rate during late evening time period for primary study zone 6 (79%). The higher utilization rate for the extended study zone 6 during the overnight period occurs as residents park their vehicles along the additional residential streets where overnight data was collected.

For the other two study zones (5 and 7), the utilization rates during late evening for primary study area are almost the same as the utilization rates during overnight period for extended study area. The utilization along Eastlake Ave E is relatively low compared to the other streets in the neighborhood with the on-street parking 34% utilized. This could be because residents may not use the available parking along Eastlake Ave E after businesses and restaurants close in the evenings or because of the early morning parking restricted zones for the southbound curb lane.

Refer to Appendix C, Curb Space Management Study, for more information on the existing inventory and utilization rates for the extended overnight study.

4.6 Safety

4.6.1 Total Collisions

Data records for all collisions (vehicle, pedestrian, and bicycle) were obtained from SDOT for a 5-year period between January 2012 and December 2016 for the midblock segments and intersections along the project corridor. Table 4-19 summarizes the 10 midblock segments and intersections along the corridor with the highest crash frequency during the 5-year study period.

All these locations are high vehicle volume locations, which is likely a key factor in the crash frequencies. Geometry also likely plays a role in a couple of these intersections. At 5th Ave and Virginia St, along 5th Ave, the monorail structure divides the road and may contribute to the higher crash frequency. This intersection has the most injury crashes and non-injury crashes. The intersection of Virginia St and Westlake Ave also has atypical geometry, with a substantial skew angle as well as proximity to two other intersections and streetcar traffic. The Roosevelt Way NE and NE 45th St intersection has high pedestrian and bicycle volumes as well as frequent transit service and is along a major route to access I-5.

Table 4-19. Top 10 Highest Crash Locations (Midblock Segments and Intersections, 2012-2016)

Location	Neighborhood	Midblock/ Intersection	Number of Crashes			
			Fatal	Injury	Property Damage Only	Total
5th Ave and Virginia St	Downtown	Intersection	0	18	23	41
Fairview Ave N and Mercer St	South Lake Union	Intersection	0	7	28	35
Roosevelt Way NE and NE 45th St	University District	Intersection	0	14	12	26
Roosevelt Way NE and NE 50th St	University District	Intersection	0	8	14	22
12th Ave NE and NE 65th St	Roosevelt	Intersection	0	10	11	21

Table 4-19. Top 10 Highest Crash Locations (Midblock Segments and Intersections, 2012-2016)

Location	Neighborhood	Midblock/ Intersection	Number of Crashes			
			Fatal	Injury	Property Damage Only	Total
Westlake Ave and Virginia St	Downtown	Intersection	0	8	13	21
University Bridge between Fuhrman Ave E	University District	Midblock	0	8	10	18
11th Ave NE and NE 45th St	University District	Intersection	0	10	8	18
Fairview Ave and Denny Way	South Lake Union	Intersection	0	7	11	18
2nd Ave and Virginia St	Downtown	Intersection	0	9	9	18
		Total	**0**	**99**	**139**	**238**

4.6.1.1 Intersection Crashes

Of the 1,158 reported vehicle collisions in the study area, 538 occurred between 2012 and 2016, at intersections (Figure 4-19). Most collisions were at signalized intersections. About 40% of intersection crashes (220 of the 1,158) resulted in an injury or fatality. South Lake Union and Downtown had the highest numbers of intersection crashes.

The City of Seattle classifies an intersection as a high collision location if it has 10 or more collisions during the previous 3 years for a signalized intersection or 5 or more collisions during the previous 3 years for an unsignalized intersection. Intersections identified as high collision locations are targeted for future safety improvements.

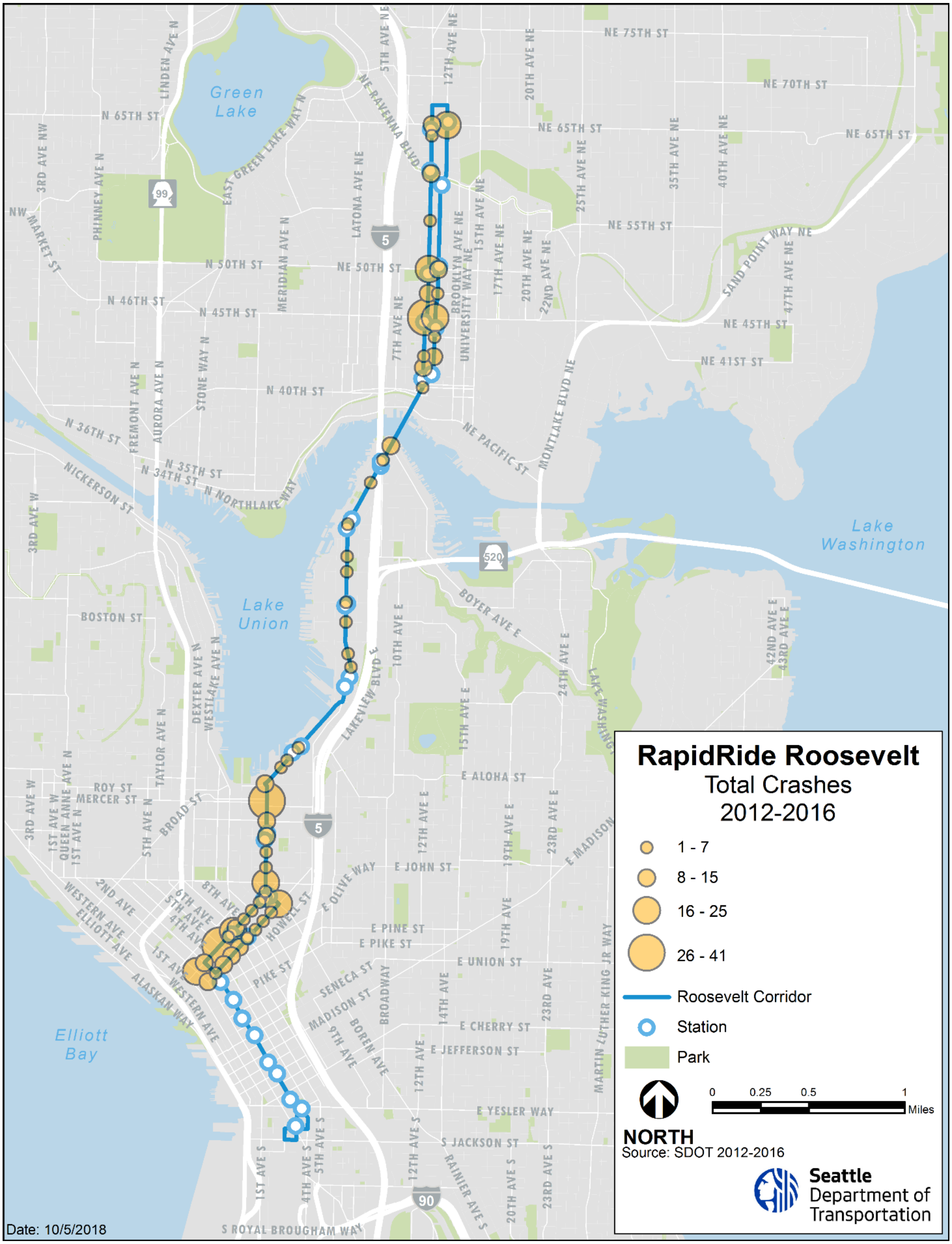


Figure 4-19. Collisions by Intersection, 2012-2016

A total of 11 intersections (3 unsignalized and 8 signalized) in the study area meet the criteria of a high collision location:

- 12th Ave NE and NE 65th St (signalized)
- Roosevelt Way NE and NE 41st St (unsignalized)
- Roosevelt Way NE and NE 43rd St (North leg) (unsignalized)
- Roosevelt Way NE and NE 43rd St (South leg) (unsignalized)
- Roosevelt Way NE and NE 45th St (signalized)
- Roosevelt Way NE and NE 50th St (signalized)
- Fairview Ave N and Mercer St (signalized)
- Denny Way and Fairview Ave (signalized)
- 2nd Ave and Virginia St (signalized)
- 5th Ave and Virginia St (signalized)
- Virginia St and Westlake Ave (signalized)

4.6.1.2 Midblock Crashes

The remaining 620 of the 1,158 crashes occurred at midblock locations (Figure 4-20). The Roosevelt and University District areas experienced the highest number of midblock crashes. In the City of Seattle, a midblock segment is classified as a high collision location if it has 10 or more collisions during the previous 3 years. A total of 9 midblock segments along the corridor meet this threshold:

- Roosevelt Way NE:
  - Between NE 42nd St (South leg) and NE 42nd St (North leg)
  - Between NE 43rd St and NE 45th St
  - Between NE 45th St and NE 47th St
  - Between NE 50th St and NE 52nd St
- University Bridge near Fuhrman Ave E
- Eastlake Ave E:
  - Between E Hamlin St and E Shelby St
  - Between E Lynn St and E Louisa St
- Fairview Ave N between Mercer St and Roy St
- Boren Ave between Stewart St and Virginia St

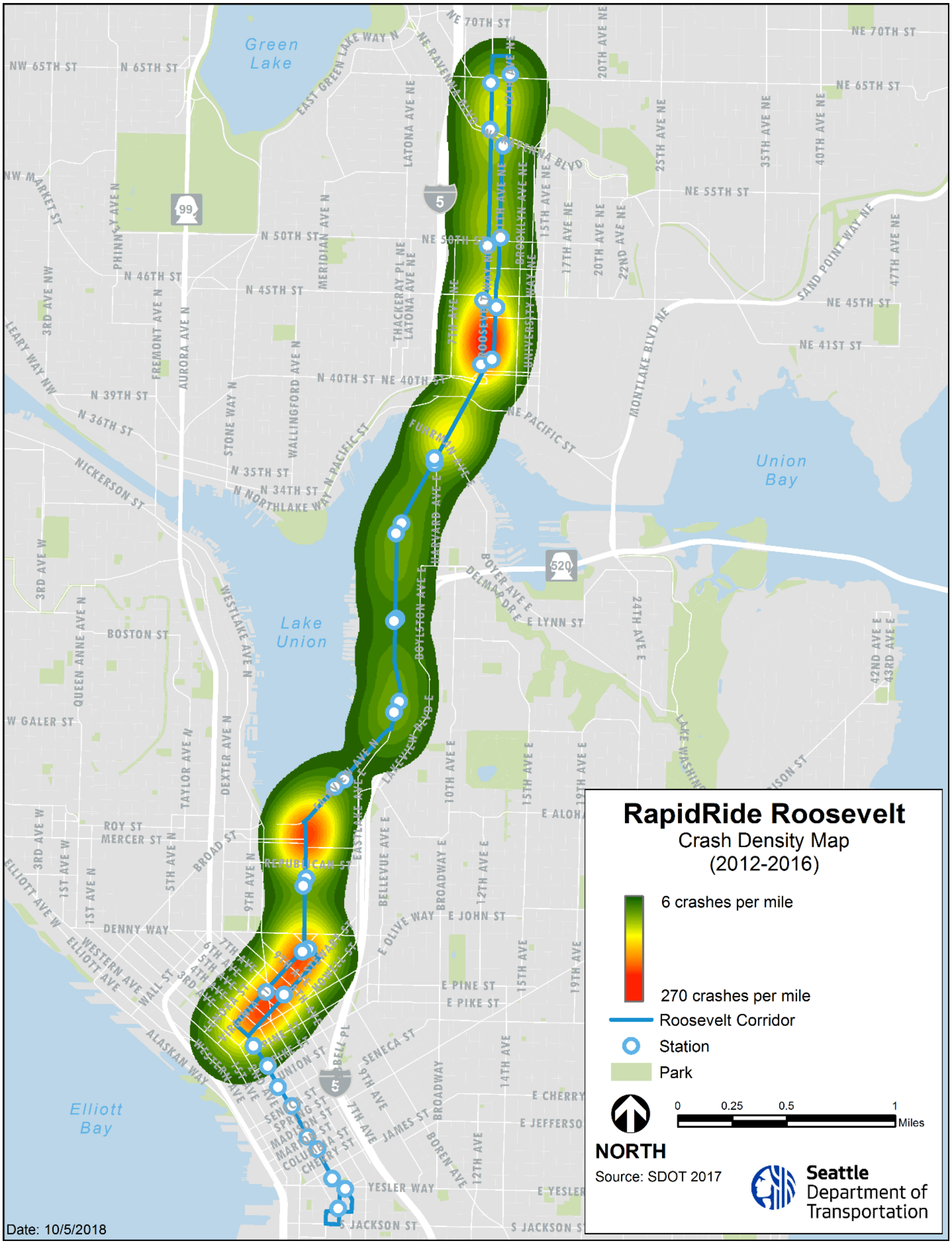


Figure 4-20. Collisions by Midblock Segment

4.6.2 Pedestrian and Bicycle Collisions

4.6.2.1 Pedestrian Collisions

Pedestrian-involved collisions were identified from data obtained from SDOT and summarized by severity for the midblock segments and intersections along the proposed corridor. A pedestrian high collision location in Seattle is defined as a location with five or more collisions over the prior 5 years. Three locations along the corridor meet this threshold, which are shown in bold text in Table 4-20. The top 10 pedestrian crash locations along the corridor are shown in Table 4-20.

Table 4-20. Top 10 Midblocks and Intersections with Pedestrian Collisions by Severity: 2012-2016

Location	Study Corridor Segment	Midblock/ Intersection	2012-2016 Pedestrian Crash Frequency			
			Fatal	Injury	Property Damage Only	Total
Roosevelt Way NE and NE 45th St	**University District**	**Intersection**	**0**	**8**	**0**	**8**
11th Ave NE and NE 45th St	**University District**	**Intersection**	**0**	**4**	**2**	**6**
Roosevelt Way NE and NE 65th St	**Roosevelt**	**Intersection**	**1**	**4**	**0**	**5**
Boren Ave between Stewart St and Virginia St	Downtown	Midblock	0	4	0	4
12th Ave NE and NE 65th St	Roosevelt	Intersection	0	4	0	4
Roosevelt Way NE and NE 50th St	University District	Intersection	0	2	2	4
Roosevelt Way NE and NE 47th St	University District	Intersection	0	3	0	3
Roosevelt Way NE and NE 42nd St (north leg)	University District	Intersection	0	2	1	3
Eastlake Ave E and E Hamlin St	Eastlake	Intersection	0	3	0	3
Boren Ave and Stewart St	Downtown	Intersection	0	3	0	3

Bold values indicate pedestrian high collision locations with five or more collisions reported over the previous 5 years.

Many of the pedestrian crashes are concentrated in the Roosevelt and University District area where there is a high number of pedestrians throughout the day combined with high traffic volumes. Most pedestrian crashes involve an injury.

4.6.2.2 Bicycle Collisions

Bicycle collisions were identified from the collision data obtained from SDOT and summarized by severity for the midblock segments and intersections along the proposed corridor. The 10 locations with the most bicycle collisions in the corridor are shown in Table 4-21. A bicycle high collision location in Seattle is defined as a location with five or more bicycle collisions reported over the previous 5 years. Six locations meet this threshold in the study area, which are shown in bold text in Table 4-21.

Table 4-21. Top 10 Midblock and Intersections with Bicycle Collisions by Severity: 2012-2016

Location	Study Corridor Segment	Midblock/ Intersection	Crashes			
			Fatal	Injury	PDO	Total
Roosevelt Way NE and NE 43rd St (south leg)	**University District**	**Intersection**	**0**	**7**	**0**	**7**
Roosevelt Way NE and NE 42nd St (south leg)	**University District**	**Intersection**	**0**	**7**	**0**	**7**
Eastlake Ave E and Fuhrman Ave E	**Eastlake**	**Intersection**	**0**	**6**	**1**	**7**
Fairview Ave N and Fairview Ave E	**Eastlake**	**Intersection**	**0**	**5**	**0**	**5**
Roosevelt Way NE between NE 42nd St (South Leg) and NE 42nd St (North Leg)	**University District**	**Midblock**	**0**	**5**	**0**	**5**
Roosevelt Way NE between NE 43rd N St and NE 45th St	**University District**	**Midblock**	**0**	**5**	**0**	**5**
Roosevelt Way NE between NE 42nd N St and NE 43rd S St	University District	Midblock	0	3	1	4
Eastlake Ave E between E Roanoke St and E Edgar St	Eastlake	Midblock	0	3	0	3
Eastlake Ave E between Harvard Ave E and Fuhrman Ave E	Eastlake	Midblock	0	3	0	3
Stewart St between Terry Ave and Boren Ave	Downtown	Midblock	0	3	0	3

PDO = property damage only

Bold values indicate bicycle high collision locations with five or more collisions reported over the previous 5 years.

Like pedestrian-involved collisions, many of the bicycle collisions are also concentrated in the Roosevelt and the University District. Similar to pedestrians, this is likely due to higher bicycle volumes in this area leading to more potential conflicts. The Eastlake area also has several locations with multiple bicycle collisions, which, in addition to volumes, may be attributed to a lack of bicycle facilities or intersection geometry (e.g., skew angle). Injuries frequently occur with bicycle collisions.

4.7 Freight

Freight movements along the RapidRide Roosevelt corridor are important for distributing goods to the businesses, residents, and educational institutions along and near the corridor. To facilitate this function the City of Seattle has designated a network of "Truck Streets" (Figure 4-21); streets may be "Major" or "Minor." Major Truck Streets are the highest-volume surface routes for freight (other than limited-access facilities like I-5) and are intended to serve through trips. A Major Truck Street designation is an important criterion for decisions related to street design, traffic management, curb space management (e.g. location of loading zones; see Section 4.5, Parking), and pavement design and repair. Minor Truck Streets have lower freight volumes and serve to connect local urban villages and commercial districts to the freight network, and to serve as secondary routes for regional through trips in case of disruption to the Major Truck Street system. On Minor Truck Streets, the importance of freight operations is recognized but not emphasized to the same degree as Major Truck Streets with respect to street design and management.

The majority of the corridor is designated as a Minor Truck Street, including Fairview Ave, Eastlake Ave E, 11th Ave NE, and 12th Ave NE (Figure 4-21). The project alignment also runs along one block of Boren Ave (between Stewart St and Virginia St), which is a Major Truck Street at that location. The University Bridge is shown as a "medium" severity freight bottleneck in the *City of Seattle Freight Master Plan* (City of Seattle, 2016).

Table 4-22 presents 2017 PM peak heavy vehicle volumes at study intersections, grouped by neighborhood. Heavy vehicles—which include both trucks and buses—represent about 2 to 3% of the traffic in the project neighborhoods outside of Downtown. In Downtown, heavy vehicles are 8.7% of traffic, which is likely due to the high number of buses operating Downtown in the PM peak. These heavy vehicle values also include trips that cross the corridor and do not travel along it. This is particularly common in the University District, where east-west heavy vehicle trips represented more than 50% of the total heavy vehicle volumes at four of the 11 study intersections in that area.

Table 4-22. PM Peak Hour Heavy Vehicle Volumes by Neighborhood (2017)

NEIGHBORHOOD	AVERAGE NUMBER OF VEHICLES PER INTERSECTION	AVERAGE NUMBER OF HEAVY VEHICLES PER INTERSECTION	PERCENT HEAVY VEHICLES
Downtown	2,001	100	8.7%
South Lake Union	2,373	60	2.5%
Eastlake	1,506	40	2.7%
University District	1,870	39	2.1%
Roosevelt	1,283	22	1.7%
Total	**1,519**	**58**	**3.8%**

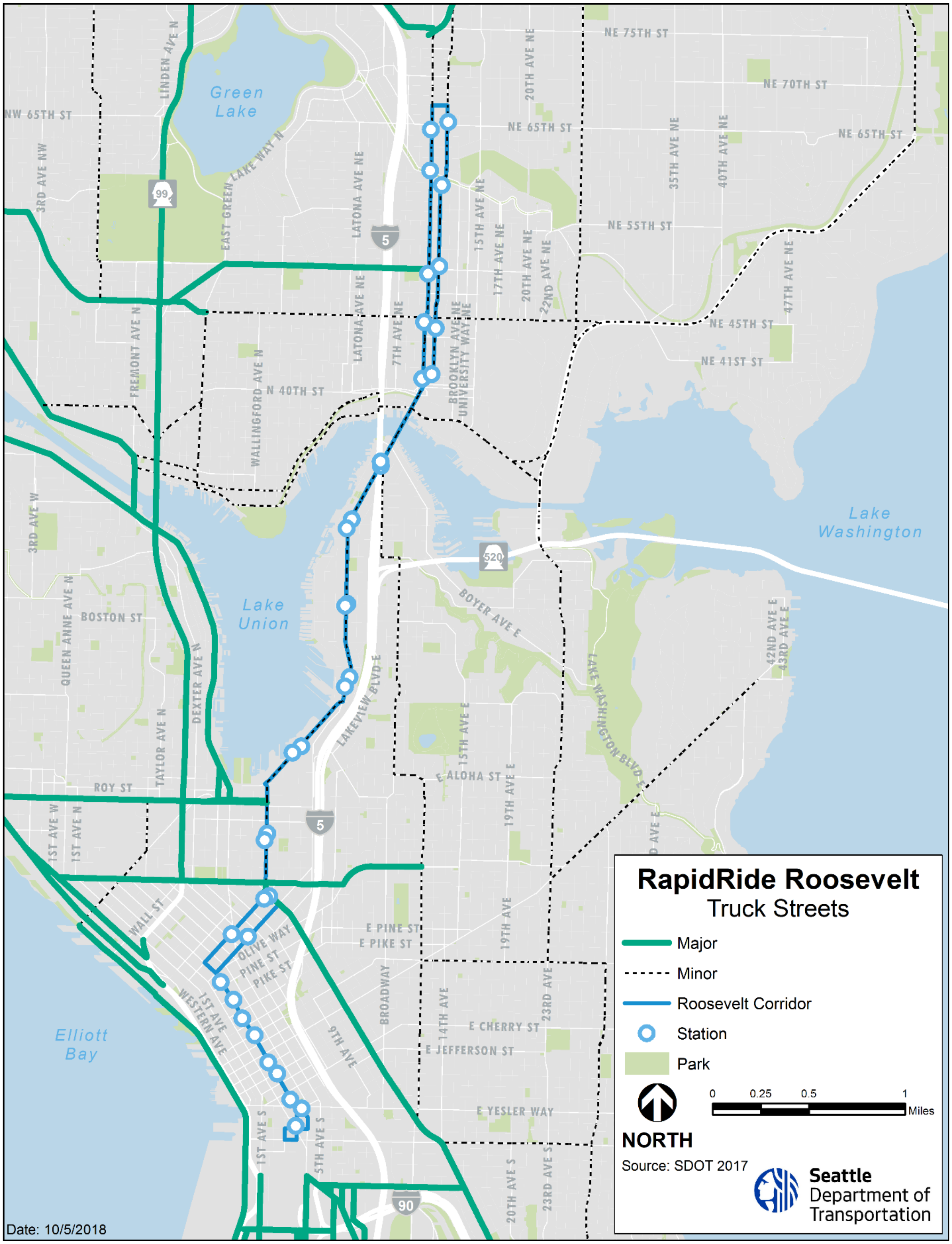


Figure 4-21. Seattle Truck Streets

5.0 ENVIRONMENTAL CONSEQUENCES

This section of the Transportation Technical Report describes the Environmental Consequences (also called future conditions) for the RapidRide Roosevelt transportation elements. This section compares the No Build and Build alternatives for the year of opening (2024) and horizon year (2040). The transportation elements include:

- Regional Traffic and Roadways
- Transit System
- Arterial and Local Streets
- Pedestrians and Bicyclists
- Parking
- Safety
- Freight

Section 4 provides the Affected Environment (also called existing conditions) for these same transportation elements.

5.1 Regional Traffic and Roadways

5.1.1 Vehicle Miles Traveled

Table 5-1 shows VMT forecasts for the in the opening year (2024), and horizon year (2040) under the No Build and Build alternatives. By year 2040, up to a 16% growth in VMT is expected in the No Build condition compared to the existing conditions shown in Table 5-1. As a result of the project, the FTA STOPS model predicts an additional 872 daily transit riders in 2024 and an additional 1,582 daily transit riders in 2040. The model calculates the distance of these trips based on their origin and destination and uses that to calculate vehicle miles of travel saved as a result of the project. As shown in Table 5-1, the project is anticipated to result in a slight reduction of daily VMT in 2024 and 2040.

Table 5-1. Daily Vehicle Miles Traveled for the Study Area (Existing, 2024, 2040)

EXISTING (2014)	2024 NO BUILD	EXISTING TO 2024 NO BUILD CHANGE (%)	2024 BUILD	2024 BUILD/ NO BUILD CHANGE (%)	2040 NO BUILD	EXISTING TO 2040 NO BUILD CHANGE (%)	2040 BUILD	2040 BUILD/ NO BUILD CHANGE (%)
8,596,000	9,458,000	+10%	9,452,000	-0.1%	9,975,000	+16%	9,966,000	-0.1%

Note: Trips are the total trips produced in and attracted to the study area.

5.1.2 Regional Roadway Volumes

Travel demand forecasts were estimated at representative points along I-5 coincident with the northern and southern halves of the study area (NE 45th St and Mercer St, respectively) in 2024 and 2040 with and without the project using the PSRC travel demand forecast model. Within the study area, no roadway modifications to I-5 are assumed in 2024 or 2040. As shown Table 5-2, the volume difference between the Build and No Build conditions on I-5 is -0.1% to 0.7%; which is considered negligible.

Table 5-2. Traffic Volumes on Regional Roadways (2024 and 2040, PM peak hour)

ROADWAY	2014 EXISTING	2024 NO BUILD	2024 BUILD	% CHANGE 2024 BUILD VS. NO BUILD	2040 NO BUILD	2040 BUILD	% CHANGE 2040 BUILD VS. NO BUILD
I-5 northbound between NE 45th St and NE 50th St	11,930	13,270	13,290	+0.2%	12,210[a]	12,250[a]	+0.3%
I-5 southbound between NE 45th St and NE 50th St	6,620	8,680	8,670	-0.1%	7,610[a]	7,600[a]	-0.1%
I-5 northbound north of Mercer St	12,510	15,350	15,390	+0.3%	14,090	14,190	+0.7%
I-5 southbound north of Mercer St	8,270	10,770	10,770	<0.1%	9,640	9,660	+0.2%

[a] 2040 traffic volumes reflect PSRC's assumption of tolling on I-5 and other limited-access facilities in the region.

5.2 Transit System

5.2.1 Service Patterns

5.2.1.1 No Build Alternative

Transit Service

The No-Build Alternative consists of the existing transit system plus reasonably foreseeable transit projects and service changes included in transit agencies' long-range plans. Major future transit projects and operational changes with the potential to influence transportation conditions in the study area are listed in Table 2-1 and Appendix A. The key transit projects within and near the project corridor include North Link light rail extension, the Central City Connector streetcar, Seattle RapidRide corridors, such as G Line (Madison St), and the transition of bus service from the Downtown Seattle Transit Tunnel to surface streets. It assumed that KCM Routes 67 and 70 would maintain existing service with no transit improvements or changes to stop locations.

Along the project corridor, most bus transit service under the No Build Alternative would be similar to existing conditions. The extension of Link light rail service to Roosevelt would improve connections to Downtown Seattle, as shown in Figure 5-1. In association with the opening of the Link extension, bus service would be rerouted, truncated to Link stations, or eliminated entirely as new Link stations open, with a focus on connecting KCM and Sound Transit bus service to Link stations in place of current routes that provide direct service to Downtown Seattle and other regional destinations. Therefore, existing peak-period, peak-direction KCM express routes between Downtown Seattle and Roosevelt would not continue with the extension of Link to Roosevelt.

Additionally, Community Transit's and Sound Transit's long-range transit plans assume commuter bus service between Snohomish County and Downtown Seattle would be eliminated by 2040 following the opening of Link light rail service between Downtown Seattle and

Lynnwood. It is also assumed that KCM's Eastlake off-street layover facility would be open prior to 2024 in the No Build Alternative.

For more details on transit service assumptions, see Table 2 of the Transportation Technical Analysis Methodology Technical Memorandum in Appendix A. These assumptions were informed by the KCM long-range plan (KCM, 2016a) and Sound Transit Regional Long-Range Plan (Sound Transit, 2014) in consultation with KCM and Sound Transit and based on reasonably foreseeable service changes.

Transit Stops

There are no planned changes to the location of the existing transit stops along the project corridor in the No Build Alternative. Transit stops along 3rd Ave in Downtown Seattle would be enhanced to allow off-board fare payment as described in Section 4.2.8. No other improvements to stops along the project corridor are assumed in the No Build Alternative.

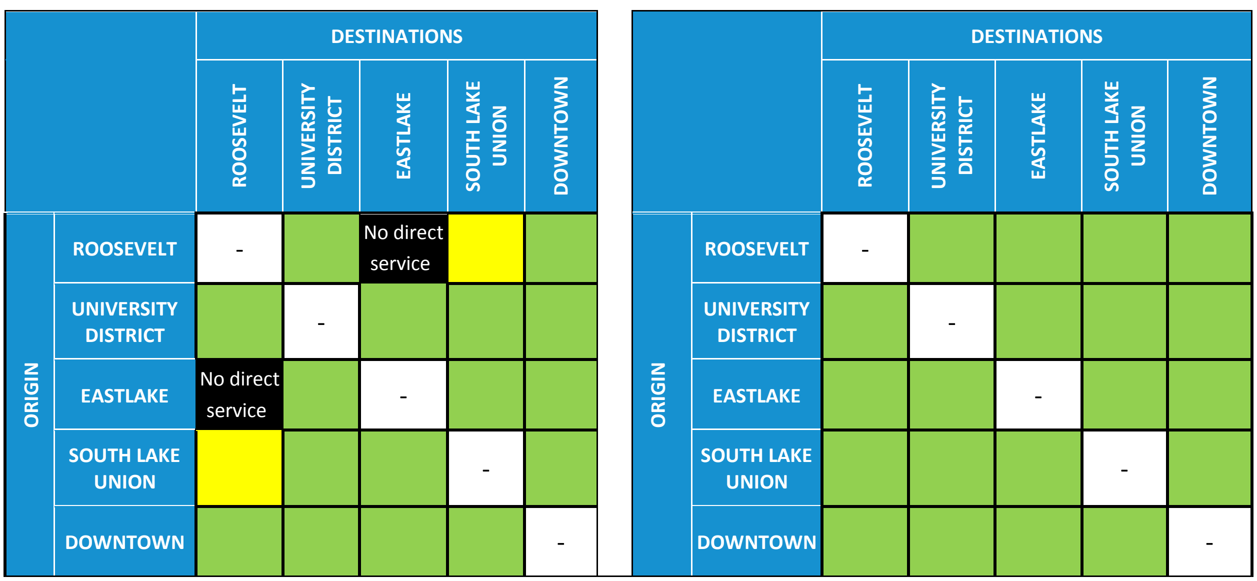
5.2.1.2 Build Alternative

Transit Service

RapidRide Roosevelt would provide frequent transit service between all the project corridor neighborhoods; including Downtown, South Lake Union, Eastlake, University District, and Roosevelt, throughout the day as shown in Figure 5-1. This is an improvement over the transit service in the No Build condition that does not provide direct and frequent service between some of the neighborhoods in the project corridor.

Figure 5-1. Future Alternative Direct Neighborhood Transit Connections (PM Peak)

No Build Alternative *Build Alternative*



Green = 10-minute headways or better Black = No direct service; transfer required
Yellow = 11- to 15-minute headways White = Not applicable, within neighborhood
Orange = 16- to 30-minute headways

As RapidRide Roosevelt would provide bus service to all the neighborhoods along the corridor, it is assumed that Route 70 would be discontinued. Route 67 is assumed to continue operating in the Build Alternative as it serves areas north and east of the project corridor. These assumptions have been confirmed by KCM. Aside from the elimination of Route 70 and the introduction of RapidRide Roosevelt service, all transit network changes described as part of the No Build condition are also assumed in the Build Alternative. Table 5-3 lists the primary transit service modifications that would occur by years 2024 and 2040 in the project corridor as a result of the RapidRide Roosevelt project.

Table 5-3. Assumed Primary Transit Service Changes on the Project Corridor

ROUTE	EXISTING	2024 AND 2040 NO BUILD	2024 AND 2040 BUILD
KCM Route 67	Existing transit service	No change	No change
KCM Route 70	Existing transit service	Rerouted to University District Link station	Route discontinued
RapidRide Roosevelt	Does not exist	Does not exist	RapidRide service to Roosevelt Link station

Transit Stops

There are 50 existing bus stops along the corridor. A total of 23 RapidRide stations would be constructed at or near existing stops. Stations constructed near existing stops would generally change from the near side of an intersection to the far side or vice versa to improve transit operations or minimize driveway conflicts. Three new RapidRide stations would be constructed where there are no bus stops today. In total, 26 new RapidRide stations would be constructed as part of the RapidRide Roosevelt project.

With the project, 13 existing stops would be closed along 11th Ave NE, Eastlake Ave E, and Fairview Ave N to optimize stop spacing and transit operations. Twelve existing bus stops along the RapidRide Roosevelt alignment would remain unchanged between NE 70th St and north of 3rd Ave. Existing stops along 3rd Ave in Downtown Seattle would remain in service. For details see Appendix B, Transit Level of Service Measures, Existing Transit Service Levels, and Proposed Stop Revisions.

Closure of existing bus stops along the project corridor is proposed as part of the project to reduce transit travel time and improve reliability, but it would require passengers currently using those stops to walk farther to reach transit service. The average stop spacing along the corridor would increase from the existing spacing of about 1/4 mile to about 1/3 mile in the Build Alternative. The increase in average stop spacing, about 790 feet, is equivalent to about a 3 to 4-minute walk. While the closure of existing bus stops may result in a longer walk time for some riders to access transit along the project corridor, the sidewalk is generally complete along the project alignment and the project is proposing to replace several sections of sidewalk along the alignment (see Section 5.4.2) as well as upgrade approximately 200 curb ramps to be ADA-compliant (see Section 5.4.3) providing people with impaired mobility, including disabled and elderly populations, accessible walkways to transit.

5.2.2 Service Levels

In the No Build Alternative, the project corridor's primary bus routes, Routes 67 and 70, are assumed to continue to operate at their existing conditions (year 2017) headways and spans of service in 2024 and 2040. Table 5-4 compares the future service levels between Routes 67 and 70 in the No Build condition to the project's RapidRide Roosevelt service.

Table 5-4. Future No Build and Build Transit Service Levels in Project Corridor

MEASURE	MONDAY – FRIDAY				WEEKEND			
	NO BUILD		BUILD		NO BUILD		BUILD	
	ROUTE 67	ROUTE 70	ROUTE 67	RAPIDRIDE ROOSEVELT	ROUTE 67	ROUTE 70	ROUTE 67	RAPIDRIDE ROOSEVELT
Service Span	5 AM – 2 AM	5 AM – 2:30 AM	5 AM – 2 AM	24 hours	5 AM – 2 AM	5 AM – 2:30 AM	5 AM – 2 AM	24 hours
Daily Hours of Operation	LOS A (21.5)	LOS A (21.5)	LOS A (21.5)	LOS A (24)	LOS A (21.5)	LOS A (21.5)	LOS A (21.5)	LOS A (24)
Daily Trips	203	198	203	260	104-137	164	104-137	220
Headways – Peak	LOS B (10 min)	LOS B (7.5 min)	LOS B (10 min)	LOS B (7.5 min)	LOS C (15 min)	LOS C (15 min)	LOS C (15 min)	LOS B (10 min)
Headways – Midday	LOS B (10 min)	LOS C (15 min)	LOS B (10 min)	LOS B (10 min)	LOS D (15-20 min)	LOS C (15 min)	LOS D (15-20 min)	LOS B (10 min)
Headways – Other	LOS D (15-30 min)	LOS C (15 min)	LOS D (15-30 min)	LOS C (15 min)	LOS D (20-30 min)	LOS C (15 min)	LOS D (20-30 min)	LOS C (15 min)

Transit service levels for some other transit routes in the study area are assumed to change under the No Build condition because of the planned changes to the transit network. These changes include the addition of new rail transit service that is planned to operate with frequent headways and the conversion of several existing bus routes to RapidRide lines. In general, these changes to the transit network would overlap the project corridor in or near Downtown Seattle. For more detail on planned changes to the transit service network, see Appendix A, the RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum.

Peak hour headways for both KCM Route 70 and RapidRide Roosevelt are the same at 7.5 minutes, but the hours of peak headway levels would be extended both earlier and later with the proposed RapidRide Roosevelt operating plan. Weekday and weekend midday headways would also be improved to 10 minutes, and overnight service would be increased to provide hourly service or better 24 hours per day. The result is an increase in total number of daily transit trips from 401 per weekday in the No Build condition to 463 trips per weekday in the Build Alternative.[4]

5.2.3 Ridership

The RapidRide Roosevelt project is expected to increase transit ridership along the project corridor. Ridership forecasts for the project were prepared using the FTA STOPS model, which includes the transit system as part of King, Kitsap, Pierce, and Snohomish counties. Therefore, this model produces both for the project specifically and for the regional transit system.

Based on FTA guidelines, STOPS model produces a transit forecast for a future horizon year of 2035. The 2035 forecast was performed for the RapidRide Roosevelt project and is used for the 2040 condition. This serves as a conservative approach because land use and transit ridership are expected to increase between 2035 and 2040. See also the Transportation Technical Analysis Methodology Technical Memorandum (Appendix A) for further information.

Transit ridership forecasts are estimated using input assumptions about future land use and transportation trends in the region. These data inputs, which are based upon the best available information at the time of model development, are developed in coordination with local jurisdictions, transit agencies and other stakeholders, including FTA, and are subject to final review and approval by FTA. They include future land use estimates, highway and transit service assumptions, and economic factors including tolling and transit fares.

As is the case with all model forecasts, estimates of future transit ridership will inevitably vary from actual ridership in the planning horizon years due to unforeseeable fluctuations in land use and transportation trends. However, the techniques used by the project team and regulatory agencies to develop the model assumptions are based on industry best practices and can be expected to provide reasonable estimates given current information and historical trends.

[4] In the future, KCM may decide to operate RapidRide Roosevelt more frequent than the planned 7.5 minute peak period headways assumed in this report. This service change would improve the transit service, frequency, ridership and passenger loading along the project corridor. Besides the transit benefits of improved headways there would be no other transportation impacts to the corridor beyond what is documented in this report.

5.2.3.1 Regional Transit System

The RapidRide Roosevelt project would slightly increase systemwide transit ridership, characterized by linked transit trips, across the four-county region (King, Kitsap, Pierce, and Snohomish). Linked transit trips are complete journeys via transit and may include transfers between several different transit routes. As shown in Table 5-5, the Build Alternative is expected to generate approximately 900 new daily linked transit trips in the project's opening year and 1,600 new daily linked transit trips by 2040. This corresponds to annual increases of 269,400 linked trips in 2024 and 488,800 linked trips in 2040 when comparing the Build Alternative to the No Build Alternative.

Table 5-5. No Build and Build Transit System Ridership (Linked Trips)

CONDITION	OPENING YEAR (2024)	FUTURE YEAR (2040)
DAILY TRANSIT RIDERSHIP (LINKED TRIPS)		
No Build Alternative	569,800	802,800
Build Alternative	570,600 (+900)	804,400 (+1,600)
ANNUAL TRANSIT RIDERSHIP (LINKED TRIPS)		
No Build Alternative	176,054,600	248,066,700
Build Alternative	176,324,100 (+269,400)	248,555,600 (+488,400)

Note: Due to rounding, some totals may not equal the sum of values shown.

Annual transit system boardings for the regional transit system, also known as unlinked transit trips, are shown in Table 5-6. Unlinked trips count each boarding of a transit vehicle separately, including transfers between routes, as separate trips. The Build Alternative is expected to increase the total number of transit boardings compared to the No Build Alternative in both 2024 and 2040.

Table 5-6. No Build and Build Transit System Ridership (Boardings/Unlinked Trips)

ALTERNATIVE	OPENING YEAR (2024)	FUTURE YEAR (2040)
ANNUAL TRANSIT RIDERSHIP (BOARDINGS)		
No Build Alternative	231,466,000	341,882,000
Build Alternative	231,574,000 (+108,000)	342,179,000 (+297,000)

5.2.3.2 Project Corridor

The RapidRide Roosevelt line is forecast to generate ridership of 17,400 daily boardings in 2024 and 22,150 in 2040. Combined with boardings on Route 67, the project corridor is forecast to have ridership of approximately 21,600 daily boardings in 2024 and 26,750 in 2040 compared to 10,250 and 12,400, respectively, for the No Build forecast, which combines Routes 67 and 70 ridership as shown in Table 5-7. Therefore, the project would increase transit ridership in the corridor by approximately 14,350 daily boardings by 2040, a 116% increase compared to the No Build Alternative. The combined ridership on Routes 67 and 70 in the No Build Alternative in both 2024 and 2040 is forecast to be lower than existing ridership on these two routes in part to some existing riders on these routes riding Link light rail and slower travel times as congestion increases in the future.

Table 5-7. No Build and Build Projected Daily and Annual Project Corridor Ridership

ALTERNATIVE	OPENING YEAR (2024)	FUTURE YEAR (2040)
No Build		
Daily Boardings – Route 67[a]	4,700	5,100
Daily Boardings – Route 70	5,600	7,300
Combined Daily Boardings	10,300	12,400
Annual Boardings - Routes 67 and 70	3,159,000	3,836,000
Build		
Daily Boardings – Route 67[a]	4,200	4,600
Daily Boardings – RapidRide Roosevelt	17,400	22,200
Combined Daily Boardings	21,600 (+11,400, +112%)	26,800 (+14,400, +116%)
Annual Project Boardings	6,682,000 (+3,523,000, +112%)	8,275,000 (+4,439,000, +116%)

Note: Due to rounding, some totals may not equal the sum of values shown.

[a] Route 67 service extends beyond RapidRide Roosevelt corridor limits.

5.2.3.3 Station Boardings

Forecast daily station boardings with the Build Alternative are shown in Table 5-8. Forecast boardings are highest at the NE 65th St station, with over 3,000 daily boardings in both future 2024 and 2040 years. This is the project's northern terminus station and is expected to be a transit hub in the future serving Link light rail and many local bus routes. This station's high predicted ridership is largely a result of people transferring between these other transit services and RapidRide Roosevelt. This station would have approximately 3,100 daily boardings in 2024 and 3,300 daily boardings in 2040. Other areas with high station boardings include University District, Eastlake, and Downtown.

Table 5-8. Projected Daily Project Ridership by Station (Build Alternative)

STATION	OPENING YEAR (2024)	FUTURE YEAR (2040)
NE 65th St	3,080	3,290
NE Ravenna Blvd	360	400
NE 50th St	720	980
NE 45th/43rd St	830	1,120
NE 41st St	1,160	1,410
Harvard Ave E	750	1,090
E Hamlin St	330	380
E Lynn St	540	670
E Garfield St	800	1,010

Table 5-8. Projected Daily Project Ridership by Station (Build Alternative)

STATION	OPENING YEAR (2024)	FUTURE YEAR (2040)
Yale Ave N	520	680
Harrison St	850	1,170
Terry Ave/Virginia St	1,100	1,410
Westlake/7th Ave	1,230	1,770
Pine/Pike St	1,790	2,380
Union/Seneca St	1,780	2,620
Marion/Columbia St	830	910
Yesler Way/James St	730	880
S Main St/3rd Ave S [single southbound station; alightings only]	0	0

Note: Station in this table refers to the directional pair of RapidRide stops at one location, except for the station at S Main St and 3rd Ave S.

5.2.4 Passenger Loads

As discussed in preceding sections, RapidRide Roosevelt would increase transit service levels and ridership in the project corridor. Increased service levels will also increase passenger carrying capacity. The expected increase in ridership with the project would result in higher passenger loads compared to the No Build Alternative, reflecting more passengers on each bus. Table 5-9 compares the expected passenger loads on Routes 67 and 70 in the No Build Alternative to RapidRide Roosevelt in the Build Alternative during the PM peak. Increased passenger loads indicate high utilization of vehicles but can reduce passenger comfort. See Section 4.2.4 for more details on passenger loads and levels of service.

In opening year 2024, the buses in the Build Alternative would experience an average PM peak load less than the KCM threshold for passenger crowding and would be within the comfortable standing load range for a standard bus based on seating availability (corresponding to LOS D or better). RapidRide Roosevelt buses are designed to accommodate a higher ratio of standing passengers to seated passengers than a standard bus and would therefore perform better than the standard buses for which the passenger load LOS standard was designed. KCM sets a crowding threshold of 83 passengers for these buses, which is based on allowing four square feet of space per standing passenger. This threshold is higher than the threshold for LOS F using the more conservative passenger load LOS measure reported in Table 5-9.

With PSRC’s land use growth projections by 2040, the forecasted PM peak passenger loads in the Build Alternative would reach LOS F at the screenlines near E Lynn St and Mercer St by year 2040. All passenger loads are expected to be below KCM’s crowding threshold except for northbound service at screenline C in South Lake Union, which would be slightly above the threshold. See Section 9.1 Future Transit Service.

Table 5-9. PM Peak Passenger Load Level of Service

ALTERNATIVE	DIRECTION (NORTHBOUND/ SOUTHBOUND)	PASSENGER LOAD LOS (AVERAGE LOAD)		
		SCREENLINE A - NORTH OF NE 55TH ST	SCREENLINE B - SOUTH OF E LYNN ST	SCREENLINE C - SOUTH OF MERCER ST
OPENING YEAR (2024)				
No Build (Routes 67 and 70)	NB	B (28)	B (35)	B (32)
	SB	A (11)	A (21)	B (29)
Build (RapidRide Roosevelt)	NB	A (10)	D (57)	D (60)
	SB	B (34)	D (55)	D (58)
FUTURE YEAR (2040)				
No Build (Routes 67 and 70)	NB	B (31)	C (46)	C (43)
	SB	A (12)	B (28)	C (39)
Build (RapidRide Roosevelt)	NB	A (7)	F (82)	F (89)
	SB	C (41)	E (70)	F (74)

NB = northbound; SB = southbound

5.2.5 Station Capacity

The *Transit Capacity and Quality of Service Manual* (Transportation Research Board, 2013) includes a rating system for evaluating the capacity of a transit station area to physically accommodate the anticipated number of passengers as they wait to board transit. This LOS measure uses a LOS A through LOS F scale, with LOS A indicating ample capacity and LOS F indicating unacceptably crowded conditions at the station. To determine this LOS grade, the station area in square feet is divided by the number of estimated persons waiting to board buses (all routes) at that station during trips in the PM peak.

As shown in Table 5-10, the proposed stations are expected to remain at LOS E or better, and thus would accommodate the expected passenger volumes in both the No Build and Build conditions for years 2024 and 2040; however, additional ridership would result in less standing room per person at most stations. Differences between the Build and No Build conditions are attributable to the ridership differences previously described in this section. All routes expected to serve the stop are included in the analysis.

This calculation assumes that all persons waiting are confined to the station area, although at most locations it is expected that transit riders sometimes wait beyond the boundaries of the station into the surrounding furnishing zone without blocking the sidewalk. Also, the assumed station area is based on the length of one RapidRide bus, which corresponds to the length of the shortest proposed stations multiplied by typical sidewalk widths in Downtown Seattle and the remaining neighborhoods in the corridor.

Table 5-10. Station Capacity Level of Service in PM Peak Hour

STATION	STATION CAPACITY LOS AT PEAK DIRECTION STOP (STATION SQUARE FEET/WAITING RIDER PER PEAK HOUR TRIP)			
	2024 NO BUILD	2024 BUILD	2040 NO BUILD	2040 BUILD
Roosevelt/12th Ave NE & NE 65th St	D (6)	E (3)	D (5)	E (3)
Roosevelt/11th Ave NE & NE Ravenna Blvd	A (321)	A (38)	A (333)	A (34)
Roosevelt/11th Ave NE & NE 50th St	A (35)	A (15)	A (33)	B (12)
Roosevelt/11th Ave NE & NE 43rd St	A (21)	B (12)	A (23)	B (10)
Eastlake Ave NE & NE 41st St	NA*	A (15)	NA*	B (13)
Eastlake Ave E & Harvard Ave E	A (168)	A (24)	A (92)	A (17)
Eastlake Ave E & E Hamlin St	A (142)	A (55)	A (113)	A (47)
Eastlake Ave E & E Lynn St	A (220)	A (33)	A (184)	A (27)
Eastlake Ave E & E Garfield St	A (51)	A (22)	A (44)	A (18)
Fairview Ave N & E Yale Ave N	A (145)	A (35)	A (119)	A (27)
Fairview Ave N & E Harrison St	A (36)	A (18)	A (33)	A (15)
Virginia St & Terry St	A (104)	A (41)	A (147)	A (38)
Virginia St & Westlake Ave	A (45)	A (29)	A (32)	A (20)
3rd Ave & Pike St	A (13)	C (10)	A (14)	C (9)
3rd Ave & Seneca St	A (17)	B (12)	A (17)	B (10)
3rd Ave & Columbia St	A (44)	A (29)	A (47)	A (29)
3rd Ave & S Main St	A (701)	A (184)	A (462)	A (150)
Yesler Way & Prefontaine Pl S	A (251)	A (88)	A (283)	A (81)

Notes:

* indicates a location where there is no bus stop today and where a station would be added with the project.

5.2.6 Travel Times

Table 5-11 presents PM peak transit travel times in 2024 and 2040 under the future No Build and Build conditions. The travel times are based on existing transit AVL data and Vissim analysis of future traffic conditions and, with the Build Alternative, improvements that would be provided by the RapidRide Roosevelt project.

Transit travel times for the corridor are projected to increase in the No Build Alternative to approximately 55.9 minutes in 2024 and 66.4 minutes by 2040, compared to the existing 51-minute travel time. These increases are a result of forecasted increases in traffic volumes and congestion, which will result in additional delays to transit service in the project corridor with the No Build Alternative. These No Build travel times also include the time needed to transfer between Routes 67 and 70. In addition, Link light rail will provide service between Roosevelt and Downtown Seattle in the No Build Alternative, with travel times of approximately 15 minutes between these two areas.

Transit travel times for the project corridor in the Build Alternative are forecast to be 38.6 minutes in 2024 and 42.2 minutes in 2040, representing a decrease of 31% in 2024 and 36% in 2040 compared to the No Build Alternative bus travel times. Build Alternative bus travel times are shorter than the existing 51-minute travel time on Routes 67 and 70 despite substantial increases in congestion in the corridor by 2040.

The reduction in transit travel time reflects the time savings of a direct transit service along the full project corridor with RapidRide Roosevelt service as well as the project's speed and reliability treatments, such as signal upgrades (including transit signal priority), new BAT lanes and TOLs in congested areas, transit queue jumps in key locations, and stop consolidation. Other project elements likely to improve transit reliability and travel time include off-board fare payment at stations and PBLs, which would shift bicyclists from travelling in the vehicle lane into a separate facility; potential travel time improvements from these elements are not reflected in the transit travel time analysis. Some of these improvements would also benefit other buses on the corridor and the South Lake Union Streetcar, including the southbound TOL proposed along Fairview Avenue N.

The 3rd Ave corridor through Downtown Seattle was not included in transit travel time analysis because no changes to the roadway design or to peak period transit service levels are proposed with the project. Therefore, the No Build and Build alternatives are expected to have equivalent transit travel times. It is assumed that future travel times in the No Build and Build alternatives would be equal to existing conditions for Route 70 along 3rd Ave. Transit travel times along 3rd Ave are not included in the numbers in the preceding paragraphs or in Table 5-11.

Table 5-11. Change in PM Peak Transit Travel Time (NE 65th St to 3rd Ave)

STREET	SEGMENT EXTENT	2024			2040		
		NO BUILD TRAVEL TIME (MIN)	BUILD TRAVEL TIME (MIN)	BUILD-NO BUILD DIFFERENCE (MIN/%)	NO BUILD TRAVEL TIME (MIN)	BUILD TRAVEL TIME (MIN)	BUILD-NO BUILD DIFFERENCE (MIN/%)
NORTHBOUND							
Virginia St/Fairview Ave	3rd Ave to Mercer St	16.5	10.6	-5.9 -36%	20.1	11.7	-8.3 -42%
Fairview Ave N/ Eastlake Ave E	Mercer St to E Roanoke St	14.8	12.1	-2.7 -19%	15.8	12.8	-3.0 -19%
Eastlake Ave E/ Roosevelt Way NE	E Roanoke St to NE 45th St	8.6	8.2	-0.4 -4%	10.6	8.7	-1.9 -18%
Roosevelt Way NE	NE 45th St to NE 65th St	6.8	6.2	-0.5 -8%	7.3	6.6	-0.7 -10%
Northbound Total (In-Vehicle Travel Time Only)		**46.7**	**37.2**	**-9.5 -20%**	**53.8**	**39.9**	**-14.0 -26%**
Transfer Time		7.0	–	-7.0	7.0	–	-7.0
Northbound Total (Including Transfer Time)		**53.7**	**37.2**	**-16.5 -31%**	**60.8**	**39.9**	**-21.0 -35%**
SOUTHBOUND							
Roosevelt Way NE	NE 65th St to NE 45th St	12.3	8.9	-3.4 -28%	17.7	11.2	-6.5 -37%
Roosevelt Way NE/Eastlake Ave E	NE 45th St to E Roanoke St	12.3	10.4	-1.8 -15%	13.6	12.3	-1.3 -9%
Eastlake Ave E/ Fairview Ave N	Roanoke St to Mercer St	14.6	8.7	-5.9 -41%	18.6	8.7	-9.8 -53%
Fairview Ave/Boren Ave/Stewart St	Mercer St to 3rd Ave	13.1	12.0	-1.2 -9%	16.3	12.4	-3.8 -24%

Table 5-11. Change in PM Peak Transit Travel Time (NE 65th St to 3rd Ave)

STREET	SEGMENT EXTENT	2024			2040		
		NO BUILD TRAVEL TIME (MIN)	BUILD TRAVEL TIME (MIN)	BUILD-NO BUILD DIFFERENCE (MIN/%)	NO BUILD TRAVEL TIME (MIN)	BUILD TRAVEL TIME (MIN)	BUILD-NO BUILD DIFFERENCE (MIN/%)
Southbound Total (In-Vehicle Travel Time Only)		**52.3**	**40.0**	**-12.3** **-24%**	**66.1**	**44.6**	**-21.5** **-33%**
Transfer Time		5.8	–	-5.8	5.8	–	-5.8
Southbound Total (Including Transfer Time)		**58.1**	**40.0**	**-18.1** **-31%**	**71.9**	**44.6**	**-27.3** **-38%**
BOTH DIRECTIONS (AVERAGE OF NORTHBOUND AND SOUTHBOUND)							
NE 65th St to 3rd Ave (In-Vehicle Travel Time Only)		**49.5**	**38.6**	**-10.9** **-22%**	**60.0**	**42.2**	**-17.7** **-29.5%**
NE 65th St to 3rd Ave (Including Transfer Time)		**55.9**	**38.6**	**-17.3** **-31%**	**66.4**	**42.2**	**-24.1** **-36%**

5.2.7 Reliability

5.2.7.1 Transit Operations and Headway Adherence

As discussed in Section 4.2.6, there are no transit priority provisions in the project corridor today other than those on 3rd Ave and Stewart St. As a result, current reliability in the corridor is poor, with PM peak reliability ranging from LOS D to F. The RapidRide Roosevelt project includes several elements that would benefit transit reliability in the project corridor, including:

- Transit lanes in congested areas of the project corridor
- Improved traffic signal operations including transit signal priority along most of the project corridor
- Transit queue jumps at key locations
- Station facility upgrades, such as off-board fare payment
- PBLs reducing interactions between buses and bicycles in shared lanes

In addition to the above transit priority elements, the projected reduction in transit travel time of about 30% by year 2040 provides a strong indication that transit reliability in the corridor would also be improved with the project, including improvement to peak period headway adherence.

5.2.7.2 University Bridge Operation

The RapidRide Roosevelt project would increase the number of buses on the corridor by about 30%, with approximately 60 additional buses per day compared to Route 70 service in the No Build condition, as shown in Table 5-6. As described in Section 4.2.6.1, most Route 70 buses are currently not affected by the University Bridge openings, but the project would increase the total number of buses crossing the University Bridge. This would not change the probability that an individual bus trip would encounter a bridge opening, but may result in a slight increase in the total number of buses that are delayed due to a bridge opening. The average increase in travel time on Route 70 trips that encounter University Bridge openings is approximately 1 minute. The proposed transit improvements in the rest of the corridor would improve transit reliability considerably, potentially offsetting any lower reliability caused by a bridge opening.

Bridge openings are currently not allowed in the peak morning and afternoon periods, except for commercial vessels over 1,000 tons and this is not expected to change in the future, which limits the impact of potential openings during the period of maximum demand. A northbound BAT lane would be provided approaching the bridge, to serve as a queue bypass when the bridge was open to marine traffic. Furthermore, transit signal priority features being implemented at the intersections adjacent to the bridge with the project could prioritize buses that had been delayed by a bridge opening.

5.2.8 Layover Areas

5.2.8.1 Layover Locations

Southern Layover

Buses would use the current bus layover areas located in the area bounded by S Jackson St to S Main St and 2nd Ave S to 5th Ave S. The southern layover does not affect existing bus routes and would use existing comfort station.

Northern Layover

Two bus turnaround options (NE 67th St and NE 70th St) are being evaluated to accommodate between 3 or 4 bus layover spaces. The bus layover spaces would be on either NE 67th St, Roosevelt Way NE, or 12th Ave NE. For the NE 67th St turnaround option, NE 67th St would be converted to one-way westbound. Compared to the NE 67th St turnaround option, the NE 70th St turnaround option would require additional OCS poles and wire. These bus turnaround options and potential layover space locations are shown in Figure 5-2.

- **NE 67th St.** Up to four bus layover spaces are being considered along NE 67th St.
- **Roosevelt Way NE**. Up to four bus layover spaces are being considered along the west curb on Roosevelt Way NE
- **12th Ave NE.** Up to four bus layover spaces are being considered along the east curb on 12th Ave NE.

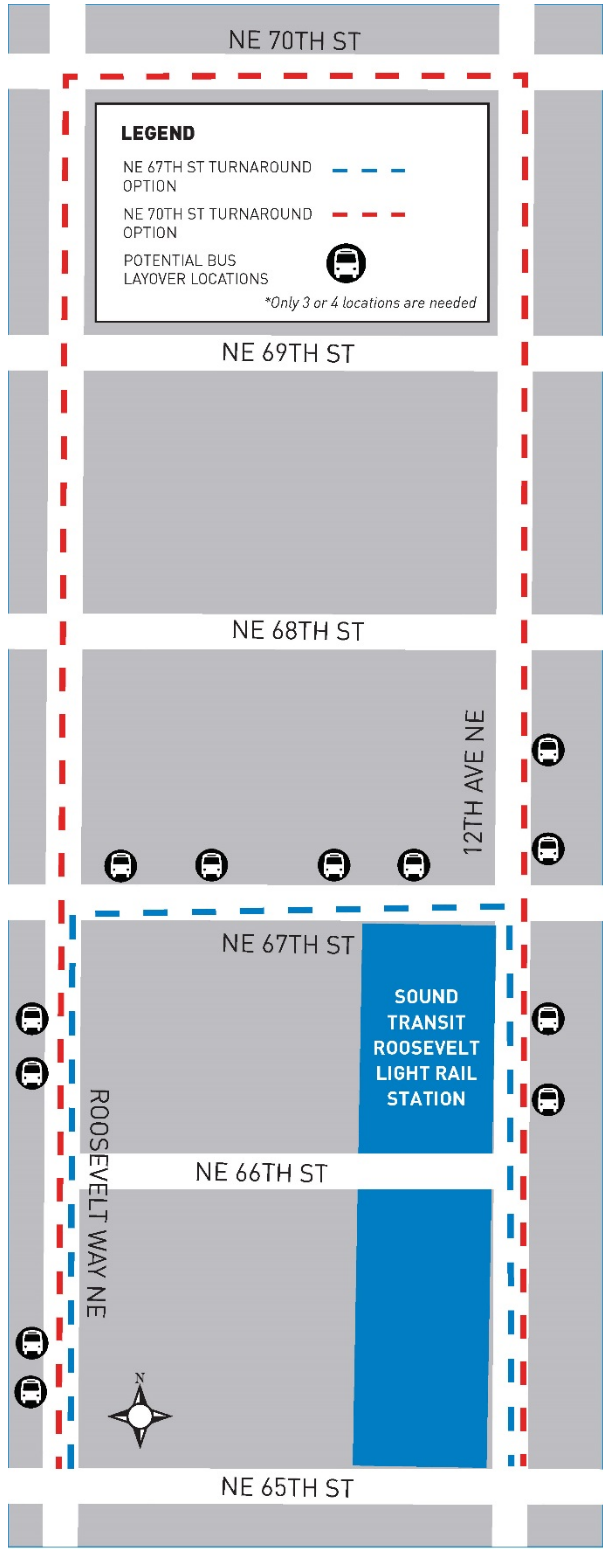


Figure 5-2. Northern Layover Options

Virginia Street Layover

The existing layover for Routes 7 and 36 is assumed to remain unchanged under the No Build Alternative. These routes currently serve the Downtown Seattle and Chinatown-International District.

The Build Alternative includes the relocation of one layover space used by Route 36 from north of 6th Ave to south of 6th Ave, allowing consolidation of existing layover spaces and simplifying transit operations in this area. The number of layover spaces available on Virginia St would not change. No other changes to layover on Virginia St are anticipated as part of the Build Alternative.

S Main Street Layover

The southern terminus for Route 70 would remain unchanged in the No Build Alternative, with buses laying over on S Main St between 2nd Ave S and 4th Ave S.

This location would also serve as the southern terminus for RapidRide Roosevelt service in the Build Alternative. No capital improvements are planned for this layover area; it is assumed that three layover spaces would provide for either Route 70 or RapidRide Roosevelt in the No Build and Build alternatives, respectively.

Other Layover Areas

The existing termini and layover locations for Route 67 are outside the project corridor. No changes to Route 67 layover are anticipated under the No Build or Build conditions.

5.2.8.2 Layover Capacity

Layover Capacity for Primary Corridor Routes

The northern layover location for the No Build Alternative is assumed to be unchanged.

The Build Alternative would have a new layover location at the north end of the project corridor. Both No Build and Build alternatives would continue to use the existing S Main St location at the south end of the corridor. Table 5-12 shows the anticipated layover space requirements at each end of the corridor for the No Build and Build alternatives as well as the existing conditions for comparison.

Required layover capacity depends on peak hour headways and scheduled layover and recovery time, which is the time buses are parked at each end of the route. Layover and recovery time allow for driver breaks and provides a cushion for late buses to start their next trip on time. Layover needs shown in Table 5-12 assume a layover and recovery ratio of 20% of the end-to-end transit travel time. Future layover requirements are estimated based on the anticipated change in transit travel time in Section 5.2.6. Peak hour headways are assumed to be 7.5 minutes in the No Build and Build alternatives as discussed in Section 5.2.2.

Table 5-12. PM Peak Layover Capacity Requirements in the No Build and Build Alternatives

CONDITION	PROJECTED TRAVEL TIME (MIN) [a, b]	LAYOVER & RECOVERY RATIO	LAYOVER & RECOVERY TIME (MIN)	REQUIRED LAYOVER SPACES [c]
NORTH TERMINUS – LAYOVER IN THE UNIVERSITY DISTRICT OR ROOSEVELT NEIGHBORHOODS				
Existing (Route 70)	53	20%	11	3
2024 No Build (Route 70)	56	20%	12	3
2024 Build	46	20%	10	3
2040 No Build (Route 70)	63	20%	13	3
2040 Build	49	20%	10	3

Table 5-12. PM Peak Layover Capacity Requirements in the No Build and Build Alternatives

CONDITION	PROJECTED TRAVEL TIME (MIN) [a, b]	LAYOVER & RECOVERY RATIO	LAYOVER & RECOVERY TIME (MIN)	REQUIRED LAYOVER SPACES [c]
SOUTH TERMINUS – LAYOVER ALONG S MAIN ST				
Existing (Route 70)	56	20%	12	3
2024 No Build (Route 70)	64	20%	13	3
2024 Build	54	20%	11	3
2040 No Build (Route 70)	77	20%	16	4
2040 Build	58	20%	12	3

[a] Travel times in Table 5-13 differ from those reported in Tables 4-6 and 5-13 because layover calculations require using the end-to-end travel time for a full transit route. Travel times shown in Table 5-13 include travel along 3rd Ave between Stewart St and S Main St in Downtown Seattle.

[b] Existing travel times for Route 70 shown in Table 5-13 include the full route from Brooklyn Ave NE in the University District neighborhood to S Main St in Downtown Seattle.

[c] Layover requirement assumes 7.5-minute peak headways and one additional space required beyond the scheduled minimum to accommodate bus movements and schedule deviations.

min = minutes

Route 70 currently requires three layover spaces at each end of the route based on the existing end-to-end travel time and the current 7.5-minute peak headway. The No Build Alternative could require one additional layover space at the southern terminus for a total of four layover spaces, in both the opening year and future years. This is a result of the estimated increase in southbound travel time during the PM peak in the No Build condition, which would require additional schedule recovery time. Under the Build Alternative, the current three layover spaces at the southern terminus could be maintained for the opening year and the future years based on the travel time during the PM peak in the Build condition.

The northern terminus is expected to require three layover spaces in both the No Build and Build alternatives in the opening year and the future years, assuming 7.5-minute peak headways. The No Build and Build alternatives are not expected to impact layover capacity for other routes in either the University District or Roosevelt neighborhoods. While all three northern terminus layover options are expected to require the same number of layover spaces in the Build Alternative, the use of split layover locations in Option 2 may result in the need for a fourth layover space to allow for scheduling of layover movements. Four layover spaces are included in the design of all three northern terminus options.

Layover Capacity for Other Routes

Layover along S Main St at the south end of the project corridor is currently shared between Route 70 and the RapidRide E Line. The Build Alternative is not expected to increase the number of layover spaces required compared to existing or No Build conditions, and thus would not affect layover capacity for the E Line.

Comfort Stations

SDOT and KCM will identify the location of a comfort station for the northern layover area during final design. Per KCM guidelines, the comfort station must be located within 1,020 feet of the layover area. The comfort station must also be connected to local sewer system, have access to water system for hand washing and flushing, and have electrical connection for lighting and heating (KCM, 2018). KCM may negotiate agreements with adjacent properties to meet these requirements or a stand-alone facility may be constructed within public right-of-way.

5.2.9 Other Transit Services and Facilities

The RapidRide Roosevelt project will not result in changes to other transit services and facilities in or near the corridor.

5.3 Arterial and Local Streets

5.3.1 Roadway System

5.3.1.1 No Build Alterative

The No-Build Alternative consists of the existing roadway system plus reasonably foreseeable future transportation projects. These projects are a part of various agencies' long-range plans. Table 2-1 lists and describes the major roadway and transit projects that are assumed to be in place by 2024 and 2040 and that have the potential to influence transportation conditions in the study area. Of the eight listed, five are roadway projects: SR 520, SR 99 Central Waterfront Viaduct Replacement, SR 99 Surface Restoration, Waterfront Seattle Program, and I-5 Seneca to Mercer St additional lane.

None of these projects would directly modify the streets in the project corridor, but because they are nearby, they have the potential to influence traffic patterns in the study area. The SR 99 viaduct replacement projects in particular are expected to affect the travel patterns in the southern end of the project corridor. These effects are captured in the transportation modeling and analysis presented in this section and in Section 5.1, Regional Traffic and Roadways. A complete list of future roadway projects assumed to be in place by 2024 and/or 2040 is included in Appendix A - RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum.

5.3.1.2 Build Alternative

The Build Alternative includes all the background projects included in the No Build condition in addition to the project, which includes roadway channelization modifications, pedestrian and bicycle facilities, signal upgrades and transit facilities/treatments. The changes to the study area streets and intersections that are included in the Build Alternative are summarized in Table 5-13. More detailed information is shown on the project drawings included in Appendix D, Preliminary Design Drawings of Locally Preferred Alternative.

Table 5-13. Transportation Network Changes with the Build Conditions

CATEGORY	TYPE OF CHANGE	LOCATIONS
Intersections	Lengthen SB right-turn lane	• Roosevelt Way NE/NE 50th St • Roosevelt Way NE/NE 45th St • Roosevelt Way NE/NE 42nd St
	Lengthen SB left-turn lane	• Eastlake Ave E/E Louisa St • Eastlake Ave E/E Lynn St • Eastlake Ave E/E Garfield St • Fairview Ave/Denny Way
	Lengthen NB right-turn lane	• 12th Ave NE/NE 65th St
	Lengthen NB left-turn lane	• Eastlake Ave E/E Louisa St • Eastlake Ave E/E Lynn St • Eastlake Ave E/E Garfield St • Fairview Ave N/Republican St
	Shorten SB left-turn lane	• Roosevelt Way NE/NE 45th St • Fairview Ave N/Republican St
	Shorten NB left-turn lane	• Fairview Ave N/John St
	Add NB right-turn lane	• 12th Ave NE/NE 50th St
	Add WB right-turn pocket, extend the SB left-turn pocket, and provide protected-only phasing for NB/SB approaches	• Eastlake Ave E/Fuhrman Ave E
	Restrict NB left-turn movements	• Fairview Ave N/Harrison St • Fairview Ave N/Thomas St
	Restrict EB traffic	• NE 67th St between Roosevelt Way NE and 12th Ave NE if bus layover is provided on NE 67th St.
	Eliminates NB thru lane and converts NB left-turn lane to thru/left-turn lane	• Fairview Ave N/Mercer St
	Converts SB thru lane to SB right-turn lane	• Fairview Ave N between Republican St and Denny Way
	Converts NB thru lane to NB right-turn lane	• Fairview Ave N between Thomas St and Boren Ave
	Install adaptive signal control technology and/or transit signal priority	• Overall corridor
Transit	Reduce the number of bus stops	• Overall corridor
	Install a BAT lane	• NB Virginia St (3rd Ave to 6th Ave) • NB Fairview Ave N (Valley St to Yale Ave N) • NB Fairview Ave N (Boren Ave to Valley St)

Table 5-13. Transportation Network Changes with the Build Conditions

CATEGORY	TYPE OF CHANGE	LOCATIONS
		• SB Fairview Ave N (Republican St to Denny Way) • NB Eastlake Ave E (Harvard Ave to E Allison St)
	Install a TOL lane	• SB Fairview Ave N (Aloha St to Valley St)
	Make transit queue jump improvements	• Virginia St/Terry Ave (NB) • Fairview Ave N/Mercer St (NB) • Fairview Ave N/Valley St (SB) • Midblock Fairview Ave N near Ward St (SB)
Bicycle	Create protected bicycle lanes	• Portions of corridor (see Section 5.4, Pedestrians and Bicyclists)

5.3.2 Traffic Forecasts

Traffic volumes were developed for the future year 2024 and 2040 conditions for both No Build and Build alternatives. The forecasts were developed using the PSRC regional travel demand model and include the No Build background transit and roadway projects previously described and included in Appendix A, RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum, as well as the project improvements as part of the Build Alternatives. Refer to Appendix A for more information on the travel demand forecasts assumptions and methodology

In both the No Build and Build alternatives, with the land use growths expected for the City of Seattle and Puget Sound region, traffic volumes at the three project screenlines are expected to grow on average by about 2% per year by 2024 and by 1% per year by 2040. The overall traffic volume growth is similar between the No Build and Build alternatives, but with the project, drivers may choose to travel on different streets in some segments of the project than in the No Build condition because of the project changes.

Traffic diversion in the University District and Roosevelt neighborhoods is expected to be negligible as no changes in roadway capacity are proposed with the project in these areas. Along Fairview Ave N in South Lake Union, the conversion of general purpose lanes to BAT lanes or TOLs would result in a reduction of general purpose vehicle capacity. Based on the traffic modeling, most of these trips would spread themselves among nearby streets, such as, Dexter Ave N, 9th Ave N, Westlake Ave N, Terry Ave, and Eastlake Ave. The total potential increase in traffic on these streets is less than 5% during the PM peak and is therefore not expected to substantially impact those streets' operations (this assessment included the impact of background projects in the area such as the SR 99 Bored Tunnel Project and proposed bus layover facility on Eastlake Ave E north of Republican St). In the Eastlake neighborhood, even a smaller amount of diversion is forecasted with the conversion of parking lanes (these lanes currently convert to general purpose lanes in the peak direction during the AM and PM peaks) to PBLs. This is because there is relatively less congestion in this area than in other areas of the project corridor.

5.3.3 Vehicle and Person Throughput

Table 5-14 presents estimated future vehicle (auto, trucks, and buses) throughput at the three project screenlines. The number of vehicles crossing the study screenlines is expected to increase in the 2024 and 2040 No Build conditions when compared to the existing conditions due to increased travel demand from population and employment growth.

With the project, which re-channelizes some roadway segments of the corridor for transit and provides transit speed and reliability improvements, vehicle throughput at the screenlines are expected to decrease by about 8% on average when compared to the No Build condition in both 2024 and 2040. The changes range from no change at screenline A (north of NE 55th St) to a 14 to 17% decrease at screenline C (south of Mercer St), where the project would convert travel lanes to TOL or BAT lanes in some roadway segments.

This reduction in traffic volumes in the project corridor is the result of some people choosing to use transit instead of a personal auto, and of some personal auto trips shifting to different routes (diversion). See Section 5.2.3 for transit ridership increases with the project and Section 5.3.2 for traffic forecasts in the project corridor.

Person throughput for the auto and transit modes was estimated at the three project screenlines for both future year conditions (Tables 5-15 and 5-16). Overall, even though vehicle throughput slightly decreases with the project, the project's transit speed, reliability, and service level improvements are expected to increase transit ridership in the corridor and therefore increase the person-carrying throughput. This estimate of person throughput only includes people in vehicles and does not include pedestrian and bicycle volumes.

Table 5-14. Vehicle Throughput at Screenlines (PM Peak Hour)

SCREENLINE	EXISTING	2024 NO BUILD	2024 BUILD	2024 NO BUILD % CHANGE FROM EXISTING	2024 BUILD % CHANGE FROM NO BUILD	2040 NO BUILD	2040 BUILD	2040 NO BUILD % CHANGE FROM EXISTING	2040 BUILD % CHANGE FROM EXISTING	2040 BUILD % CHANGE FROM NO BUILD
A – Roosevelt Way NE/11th Ave NE north of NE 55th St	1,263	1,352	1,354	+7%	0%	1,676	1,658	+33%	+31%	-1%
B - Eastlake Ave E south of E Lynn St	1,318	1,473	1,400	+12%	-5%	1,768	1,600	+34%	+21%	-10%
C - Fairview Ave N south of Mercer St	1,660	1,759	1,462	+6%	-17%	1,746	1,502	+5%	-10%	-14%
Average	1,414	1,528	1,405	+8%	-8%	1,730	1,587	+22%	+12%	-8%

Note: Due to rounding, some totals may not equal the sum of values shown.

Source: Vissim model.

Table 5-15. 2024 Person Throughput

SCREENLINE LOCATION	NO BUILD PERSONS (VEHICLES)			NO BUILD % OF PERSONS		BUILD PERSONS (VEHICLES)			BUILD % OF PERSONS		% CHANGE IN PERSON THROUGHPUT BUILD VS. NO BUILD		
	AUTO	TRANSIT	TOTAL	AUTO	TRANSIT	AUTO	TRANSIT	TOTAL	AUTO	TRANSIT	AUTO	TRANSIT	TOTAL
A - Roosevelt Way NE and 11th Ave NE north of NE 55th St	1,997 (1,340)	218 (12)	2,215 (1,352)	90%	10%	1,974 (1,325)	556 (29)	2,530 (1,354)	78%	22%	-1%	+155%	+14%
B- Eastlake Ave E south of E Lynn St	2,175 (1,460)	369 (13)	2,544 (1,473)	85%	15%	2,064 (1,385)	837 (15)	2,901 (1,400)	71%	29%	-5%	+127%	+14%
C- Roosevelt Way NE and 11th Ave NE north of NE 55th St	2,593 (1,740)	639 (19)	3,232 (1,759)	80%	20%	2,146 (1,440)	1,178 (22)	3,324 (1,462)	65%	35%	-17%	+84%	+3%
Average	2,255 (1,513)	409 (15)	2,664 (1,528)	85%	15%	2,061 (1,383)	857 (22)	2,918 (1,405)	71%	29%	-9%	+110%	+10%

Note: Due to rounding, some totals may not equal the sum of values shown.

Table 5-16. 2040 Person Throughput

SCREENLINE LOCATION	NO BUILD PERSONS (VEHICLES)			NO BUILD % OF PERSONS		BUILD PERSONS (VEHICLES)			BUILD % OF PERSONS		% CHANGE PERSON THROUGHPUT BUILD VS. NO BUILD		
	AUTO	TRANSIT	TOTAL	AUTO	TRANSIT	AUTO	TRANSIT	TOTAL	AUTO	TRANSIT	AUTO	TRANSIT	TOTAL
A - Roosevelt Way NE and 11th Ave NE north of NE 55th St	2,481 (1,665)	225 (11)	2,706 (1,676)	92%	8%	2,429 (1,630)	592 (28)	3,021 (1,658)	80%	20%	-2%	+163%	+12%
B - Eastlake Ave E south of E Lynn St	2,615 (1,755)	489 (13)	3,104 (1,768)	84%	16%	2,362 (1,585)	1,139 (15)	3,501 (1,600)	67%	33%	-10%	+133%	+13%
C - Roosevelt Way NE and 11th Ave NE north of NE 55th St	2,578 (1,730)	651 (16)	3,229 (1,746)	80%	20%	2,205 (1,480)	1,544 (22)	3,749 (1,502)	59%	41%	-14%	+137%	+16%
Average	2,558 (1,717)	455 (13)	3,013 (1,730)	85%	15%	2,332 (1,565)	1,092 (22)	3,424 (1,587)	68%	32%	-9%	+140%	+14%

5.3.4 Intersection Level of Service

Intersection LOS was calculated for the 63 study area intersections for the 2024 and 2040 No Build and Build conditions in the PM peak hour (see Tables 5-17 and 5-18).

5.3.4.1 2024 No Build

Future population and employment growth along the corridor is expected to increase travel demand under the No Build condition, leading to higher general purpose traffic volumes and delays. In the No Build condition, intersection delay is expected to increase throughout the corridor in 2024, although most intersections remain at LOS C or better. Compared to existing conditions, where two intersections currently operate at LOS F, four additional intersections would also operate at LOS F in year 2024 in the PM peak in the 2024 No Build condition, for a total of six. The four additional LOS F intersections are:

- 5th Ave & Stewart St
- 2nd Ave & Virginia St
- Fairview Ave N & Harrison St
- 5th Ave & Virginia St

5.3.4.2 2024 Build

In the PM peak, the project is expected to increase delay for general purpose traffic at some intersections and reduce it at others; see Table 5-17 for the change in intersection LOS between No Build and Build conditions. Most intersections that experience increased delays would continue to operate at LOS D or better. Three intersections in South Lake Union would degrade from LOS E to LOS F as a result of converting general purpose lanes on Fairview Ave N to BAT lanes. These intersections are:

- Fairview Ave N & Valley St
- Fairview Ave N & Republican St
- Fairview Ave N & Thomas St

One intersection in Downtown Seattle would improve from LOS F to E:

- 2nd Ave & Virginia St

In sum, three intersections would degrade to LOS F with the project and one intersection would improve from LOS F, for a net change of two additional intersections at LOS F when compared to the No Build condition.

Table 5-17. Intersection Level of Service Change between No Build and Build Conditions (2024)

INTERSECTION	DELAY		LEVEL OF SERVICE					
	NO BUILD	BUILD	A	B	C	D	E	F
Roosevelt Way NE & NE 66th St	17	19			●			
Roosevelt Way NE & NE 67th St	16	11		←	—			
Roosevelt Way NE & NE 68th St	15	13		←	—			
12th Ave NE & NE 68th St	10	12		●				
Roosevelt Way NE & NE 65th St	22	29			●			
12th Ave NE & NE 65th St	18	25		—	→			
Roosevelt Way NE & NE 64th St	11	12		●				
Roosevelt Way NE & NE Ravenna Blvd WB	26	29			●			
12th Ave NE & NE Ravenna Blvd WB	26	28			●			
Roosevelt Way NE & NE 55th St	10	9	●					
Roosevelt Way NE & NE 50th St	35	24			←	—		
11th Ave NE & NE 50th St	24	33			●			
Roosevelt Way NE & NE 47th St	54	13		←	—	—		
11th Ave NE & NE 47th St	15	23		—	→			
Roosevelt Way NE & NE 45th St	45	44				●		
11th Ave NE & NE 45th St	57	55				←	—	
11th Ave NE & NE 43rd St	27	21			●			
11th Ave NE & NE 42nd St	23	13		←	—			
Roosevelt Way NE & NE 42nd St - north leg	20	25		—	→			
Roosevelt Way NE & NE 42nd St - south leg	22	27			●			
11th Ave NE & NE Campus Pkwy & Roosevelt Way NE	24	23			●			
Eastlake Ave E & Fuhrman Ave E	39	46				●		
Eastlake Ave E & Harvard Ave E	18	39		—	—	→		
Eastlake Ave E & E Allison St	20	26			—	→		
Eastlake Ave E & E Hamlin St	11	13		●				
Eastlake Ave E & E Roanoke St	21	18		←	—			
Eastlake Ave E & E Louisa St	6	8	●					
Eastlake Ave E & E Lynn St	14	19		●				
Eastlake Ave E & E Boston St	4	7	●					
Eastlake Ave E & E Howe St	15	11		●				
Eastlake Ave E & E Blaine St	40	27				←	—	
Eastlake Ave E & E Garfield St	8	12	—	→				
Fairview Ave N & Eastlake Ave E/E Galer St	17	15		●				
Fairview Ave N & Yale Ave N	9	10	●					
Fairview Ave N & Ward St	13	17		—	→			
Fairview Ave N & Aloha St	21	43			—	→		
Fairview Ave N & Valley St	78	85					—	→
Fairview Ave N & Mercer St & I-5 Ramps	170	160						

Table 5-17. Intersection Level of Service Change between No Build and Build Conditions (2024)

INTERSECTION	DELAY		LEVEL OF SERVICE					
	NO BUILD	BUILD	A	B	C	D	E	F
Fairview Ave N & Republican St	72	111					red arrow →	→
Fairview Ave N & Harrison St	83	154						●
Fairview Ave N & Thomas St	60	82					red arrow →	→
Fairview Ave N & John St	51	62				gray arrow →	→	
Fairview Ave & Denny Way	144	146						●
Fairview Ave & Boren St	35	45				●		
Boren Ave & Stewart St	24	67			gray arrow →	→	→	
Terry Ave & Virginia St	33	23			●			
Terry Ave & Stewart St	17	15		●				
9th Ave & Virginia St	12	16		●				
9th Ave & Stewart St	18	16		●				
8th Ave & Virginia St	11	14		●				
8th Ave & Stewart St	15	15		●				
7th Ave & Virginia St	8	9	●					
7th Ave & Stewart St	13	10		●				
Westlake Ave & Virginia St	11	11		●				
6th Ave & Virginia St	20	17		←	gray arrow ←			
6th Ave & Stewart St	23	23			●			
Westlake Ave & Stewart St	18	18		●				
5th Ave & Virginia St	137	126						●
5th Ave & Stewart St	98	94						●
4th Ave & Virginia St	27	29			●			
4th Ave & Stewart St	44	35				●		
3rd Ave & Virginia St	19	25		gray arrow →	→			
3rd Ave & Stewart St	19	20		●				
2nd Ave & Virginia St	104	67					←	green arrow ←
2nd Ave & Stewart St	71	61					●	
6th Ave & Westlake Ave	5	6	●					
7th Ave & Westlake Ave	23	24			●			

Notes:
Gray dot indicates no change in intersection LOS between No Build and Build.
Gray arrow indicates a change in intersection LOS from one non-F rating to another non-F rating.
Red arrow indicates the intersection would degrade to LOS F with the project.
Green arrow indicates the intersection would improve from LOS F to a higher rating with the project.

At the Fairview Ave N & Mercer St & I-5 Ramps intersection, the traffic volumes, intersection vehicle delays, and LOS are similar between the No Build and Build alternatives. Specific to the westbound approach (I-5 off-ramps), the vehicle delay improves from LOS F in the No Build Alternative to LOS E with the project. Therefore, the project is not expected to impact I-5 ramps or mainline (through lanes) in year 2024.

With both of the northern bus turnaround options, up to eight buses, in each direction, would circulate during the PM peak hour. This is not expected to affect intersection operations and therefore the intersection LOS results are expected to be similar between each option and the No Build condition. If layover is provided on NE 67th St only westbound traffic would be allowed on NE 67th St between 12th Ave NE and Roosevelt Way NE to accommodate the bus layover; however, the intersection LOS results are not expected to substantially adjust due to the expected low traffic volumes.

In addition to the intersection LOS results, vehicle queues at study area intersections were estimated using Vissim software and are qualitatively assessed for intersections expected to operate at LOS F with the project (a queue is the line of vehicles waiting to travel through the intersection). Project-related changes to vehicle queues vary by location, with some intersections experiencing shorter queues and other intersections experiencing longer queues. Under the 2024 Build condition eight intersections are expected to operate at LOS F during PM peak.

- Fairview Ave N & Valley St: The LOS at this intersection changes from LOS E in No Build to LOS F in Build. Queue lengths increase by one or two car lengths on the northbound approach due to the conversion of one northbound through lane to a BAT lane. Southbound queue lengths have a similar small increase due to transit signal priority at the intersection.
- Fairview Ave N & Mercer St: This intersection operates at LOS F with similar average vehicle delay in both the No Build and Build conditions. Queue lengths increase on the northbound approach due to the conversion of one northbound through lane to a TOL and one left-only lane to a through-left lane. Northbound buses require an exclusive signal phase to travel through the intersection which increases delay and queue lengths for northbound general purpose vehicles as they have shorter green time from the signal. Vehicle queues on the westbound, I-5 off-ramp, approach would not be longer in the Build condition than in the No Build condition. Therefore, the project is not expected to impact I-5 ramps or mainline at this location.
- Fairview Ave N & Republican St, Fairview Ave N & Harrison St, Fairview Ave N & Thomas St: Each of these intersections operate at LOS F in the Build condition. These intersections have an increase in queue length on the eastbound and westbound side street approaches as vehicles find limited gaps to turn onto Fairview Ave N.
- Fairview Ave & Denny Way: This intersection operates at LOS F with about the same delay between No Build and Build conditions. Northbound and southbound queue lengths increase in the Build condition due to the conversion of a general purpose through lane to a BAT lane in each direction. There are long queue lengths on the eastbound and westbound approaches in both Build and No Build conditions.
- 5th Ave & Virginia St and 5th Ave & Stewart St: Both intersections operate at LOS F in the No Build and Build conditions. Similar queue lengths between the No Build and Build conditions are expected at these locations.

5.3.4.3 2040 No Build

Delay would continue to increase along the corridor in 2040 under the No Build condition, although most intersections are expected to operate at LOS D or better. The following 10 intersections would degrade to LOS F when compared to the 2024 No Build condition:

- Roosevelt Way NE & NE 68th St
- Roosevelt Way NE & NE 55 St
- Roosevelt Way NE & NE 50 St
- Roosevelt Way NE & NE 47th St
- Roosevelt Way NE & NE 42nd St (north leg)
- Eastlake Ave E & Fuhrman Ave E
- Fairview Ave N & Valley St
- 6th Ave & Stewart St
- 6th Ave & Westlake Ave
- 4th Ave & Stewart St

Two intersections that were at LOS F in the 2024 No Build condition improve in the 2040 No Build condition, resulting in a total of 14 intersections at LOS F in this 2040 No Build condition.

- 5th Ave & Virginia St
- 5th Ave & Stewart St

5.3.4.4 2040 Build

By year 2040, the project is expected to change the LOS for many intersections in the study area during the PM peak. Four intersections would degrade to LOS F with the project:

- Fairview Ave N & Republican St
- Fairview Ave N & Thomas St
- Fairview Ave N & John St
- 5th Ave & Stewart St

Five intersections would improve from LOS F to LOS E or better with the project:

- Roosevelt Way NE & NE 68th St
- Roosevelt Way NE & NE 55th St
- Roosevelt Way NE & NE 50th St
- Roosevelt Way NE & NE 47th St
- Roosevelt Way NE & NE 42nd St (north leg)

The net result of the project is a net reduction of one intersection at LOS F compared to the No Build, for a total of 13 at LOS F in the Build Alternative.

In addition to the intersections listed above that improve from or degrade to LOS F, 16 intersections with LOS E or better would improve by at least one LOS letter rating with the project when compared to the No Build condition (Table 5-18). This is due to signal upgrades and transit priority signal modifications that have the beneficial side effect of reducing delay for general purpose traffic using the corridor. These improvements were most pronounced in the Roosevelt neighborhood and along Virginia St and Stewart St in Downtown.

Table 5-18. Intersection Level of Service Change in PM Peak between No Build and Build Conditions (Year 2040)

INTERSECTION	DELAY		LEVEL OF SERVICE					
	NO BUILD	BUILD	A	B	C	D	E	F
Roosevelt Way NE & NE 66th St	38	26						
Roosevelt Way NE & NE 67th St	32	43						
Roosevelt Way NE & NE 68th St	77	20						
12th Ave NE & NE 68th St	16	13						
Roosevelt Way NE & NE 65th St	36	44						
12th Ave NE & NE 65th St	35	27						
Roosevelt Way NE & NE 64th St	18	12						
Roosevelt Way NE & NE Ravenna Blvd WB	50	33						
12th Ave NE & NE Ravenna Blvd WB	34	31						
Roosevelt Way NE & NE 55th St	115	22						
Roosevelt Way NE & NE 50th St	83	48						
11th Ave NE & NE 50th St	46	58						
Roosevelt Way NE & NE 47th St	93	74						
11th Ave NE & NE 47th St	32	57						
Roosevelt Way NE & NE 45th St	61	61						
11th Ave NE & NE 45th St	58	58						
11th Ave NE & NE 43rd St	24	17						
11th Ave NE & NE 42nd St	49	21						
Roosevelt Way NE & NE 42nd St (north leg)	95	54						
Roosevelt Way NE & NE 42nd St (south leg)	49	31						
11th Ave NE & NE Campus Pkwy & Roosevelt Way NE	43	26						
Eastlake Ave E & Fuhrman Ave E	109	93						
Eastlake Ave E & Harvard Ave E	33	27						
Eastlake Ave E & E Allison St	26	44						
Eastlake Ave E & E Hamlin St	10	19						
Eastlake Ave E & E Roanoke St	24	23						
Eastlake Ave E & E Louisa St	7	10						
Eastlake Ave E & E Lynn St	14	23						
Eastlake Ave E & E Boston St	4	11						
Eastlake Ave E & E Howe St	20	19						
Eastlake Ave E & E Blaine St	36	33						
Eastlake Ave E & E Garfield St	10	13						
Fairview Ave N & Eastlake Ave E/E Galer St	24	20						
Fairview Ave N & Yale Ave N	10	30						
Fairview Ave N & Ward St	19	39						
Fairview Ave N & Aloha St	68	62						

Table 5-18. Intersection Level of Service Change in PM Peak between No Build and Build Conditions (Year 2040)

INTERSECTION	DELAY		LEVEL OF SERVICE					
	NO BUILD	BUILD	A	B	C	D	E	F
Fairview Ave N & Valley St	93	89						●
Fairview Ave N & Mercer St & I-5 Ramps	175	170						●
Fairview Ave N & Republican St	71	116						E → F (red)
Fairview Ave N & Harrison St	82	164						●
Fairview Ave N & Thomas St	63	99						E → F (red)
Fairview Ave N & John St	70	87						E → F (red)
Fairview Ave & Denny Way	179	195						●
Fairview Ave & Boren St	45	65					D → E (gray)	
Boren Ave & Stewart St	2	2	●					
Terry Ave & Virginia St	73	27			E → C (gray)			
Terry Ave & Stewart St	32	20			●			
9th Ave & Virginia St	53	29			D → C (gray)			
9th Ave & Stewart St	24	26			●			
8th Ave & Virginia St	54	34			D → C (gray)			
8th Ave & Stewart St	21	28			●			
7th Ave & Virginia St	17	13		●				
7th Ave & Stewart St	27	11		C → B (gray)				
Westlake Ave & Virginia St	27	18		C → B (gray)				
6th Ave & Virginia St	44	26			D → C (gray)			
6th Ave & Stewart St	113	172						●
5th Ave & Virginia St	22	37				C → D (gray)		
4th Ave & Virginia St	18	30			B → C (gray)			
Westlake & Stewart St	20	23			●			
5th Ave & Stewart St	39	90						D → F (red)
4th Ave & Stewart St	199	209						●
3rd Ave & Virginia St	76	79					●	
3rd Ave & Stewart St	24	23			●			
2nd Ave & Virginia St	199	209						●
2nd Ave & Stewart St	76	79					●	
6th Ave & Westlake Ave	83	105						●
7th Ave & Westlake Ave	27	13		C → B (gray)				

Notes:
Gray dot indicates no change in intersection LOS between No Build and Build.
Gray arrow indicates a change in intersection LOS from one non-F rating to another non-F rating.
Red arrow indicates the intersection would degrade to LOS F with the project.
Green arrow indicates the intersection would improve from LOS F to a higher rating with the project.

At the Fairview Ave N & Mercer St & I-5 Ramps intersection, the traffic volumes, intersection vehicle delays, and LOS are similar between the No Build and Build alternatives. Therefore, the project, in year 2040, is not expected to impact I-5 ramps and mainline.

Similar to year 2024 conditions, the two northern bus turnaround options are expected to have similar intersection LOS results between them.

Delay increases would be concentrated on Fairview Ave N where two general purpose lanes would be converted to BAT lanes with the project. Four intersections are expected to degrade from LOS E or better and operate at LOS F because of the project:

- Fairview Ave N & Republican St
- Fairview Ave N & Thomas St
- Fairview Ave N & John St
- 4th Ave & Stewart St

Following is a qualitative assessment of the 12 intersections expected to operate at LOS F in the 2040 Build condition:

- Eastlake Ave E & Fuhrman Ave E: This intersection operates at LOS F in both No Build and Build conditions but with lower average vehicle delay (reduced by 16 seconds) and shorter queue lengths in the Build condition. This is due to project improvements related to signal optimization and addition of a right turn pocket for the westbound approach. These improvements reduce the queues on the northbound, southbound, and westbound approaches compared to No Build.

- Fairview Ave N & Valley St: This intersection operates at LOS F in both the No Build and Build condition. Queue lengths are similar between the two conditions except for the northbound queues, which slightly increase with the Build condition, due to converting one northbound through lane to a BAT lane.

- Fairview Ave N & Mercer St: This intersection operates at LOS F with similar overall vehicle delay in both the No Build and Build conditions. Queue lengths increase on the northbound approach with the Build condition, due to converting one northbound through lane to a TOL. Northbound buses require an exclusive signal phase to travel through the intersection which increases delay and queue lengths for northbound general purpose vehicles. Vehicle queues on the westbound, I-5 off-ramp, approach would not be longer in the Build condition than in the No Build condition. Therefore, the project is not expected to impact I-5 ramps or mainline at this location.

- Fairview Ave N & Republican St, Fairview Ave N & Harrison St, Fairview Ave N & Thomas St, Fairview Ave N & John St: Each of these intersections operate at LOS F in the Build condition. These intersections have an increase in queue length on the eastbound and westbound side street approaches as vehicles find limited gaps to turn onto Fairview Ave N.

- Fairview Ave & Denny Way: This intersection operates with roughly the same delay and LOS F between No Build and Build conditions. Northbound and southbound queue lengths increase in Build due to converting a general purpose through lane to a BAT lane in each direction. There are long queue lengths on the eastbound and westbound approaches in the Build and No Build conditions.

- 5th Ave & Virginia St and 5th Ave & Stewart St: Both intersections operate at LOS F in the No Build and Build conditions. Similar queue lengths between the No Build and Build conditions are expected at these locations.
- 4th Ave & Virginia St: This intersection's LOS degrades from LOS D in the No Build condition to LOS F in the Build condition. The increase in delay is caused by re-purposing a northbound through lane to a TOL. Queue lengths increase on the northbound approach because of the lane re-purposing.

5.3.5 General Purpose Travel Times

Traffic volumes and congestion are expected to grow in the future under the 2024 and 2040 No Build conditions, leading to slower travel speeds when compared to existing conditions. Northbound and southbound No Build travel times are expected to grow by 3 minutes and 6 minutes, respectively. By year 2040, northbound and southbound No Build travel times are expected to grow by 8 to 19 min, respectively, when compared to the existing condition (Table 5-19).

The travel time impacts of the project vary by direction and by year. In the northbound direction, travel times are expected to increase as a result of the project by 3 and 2 minutes in 2024 and 2040, respectively, due to the conversion of a general purpose lane to a BAT lane or TOL along Virginia St and Fairview Ave between 3rd Ave and Mercer St and along Eastlake Ave E between E Allison St and Harvard Ave E.

In the southbound direction total travel times along the corridor are expected to see no change under the 2024 Build condition, although there are segments within the alignment in that direction and period that would see variations. Southbound travel times would increase in South Lake Union because of the removal of a general purpose lane from the Fairview Ave N bridge to Valley St, and because of transit signal priority at the Fairview Ave N & Valley St intersection, which improves transit performance but leads to higher auto delay. However, the project would substantially reduce southbound travel times on Roosevelt Way NE between NE 68th St and NE 45th St in 2024 and 2040 due to longer right-turn lanes along Roosevelt Way NE at NE 50th St, NE 45th St, and NE 42nd St, which provide more vehicle storage. In 2040 the total southbound travel time would decrease by 8 minutes with the project.

5.3.6 Property Access and Circulation

The project would result in some localized changes to circulation and property access within the study area. However, these changes are expected to have minimal impacts on overall traffic operations and circulation. The project would not restrict access to properties.

Landscaped medians would replace sections of the center turn lane on Eastlake Ave E in locations where existing driveways do not exist. The addition of landscaped medians would not restrict access to existing driveways.

With a new station proposed in the southeast corner of the intersection of Virginia St & Terry Ave, the existing driveway at that location is proposed to be closed with the project. However, the driveway is nonfunctional due to a ramp blocking the driveway, so overall impacts to the vehicular access would be minimal. The property does have another driveway access on Terry Ave, east of Virginia St, which would continue to be open. Besides this driveway closure, no other property access would be eliminated along the corridor with the project.

1 **Table 5-19. General Purpose Travel Times (PM Peak)**

STREET	EXTENT	EXISTING (2017, (MIN)	2024 NO BUILD (MIN)	EXISTING TO 2024 NO BUILD CHANGE (MIN, %)	2024 BUILD (MIN)	2024 NO-BUILD TO BUILD CHANGE (MIN, %)	2040 NO BUILD (MIN)	EXISTING TO 2040 NO BUILD CHANGE (MIN, %)	2040 BUILD (MIN)	2040 NO-BUILD TO BUILD CHANGE (MIN, %)
NORTHBOUND										
Virginia St/Fairview Ave	3rd Ave to Mercer St	10.5	12.6	+2.1 (+20%)	15.2	+2.6 (+21%)	15.2	+4.7 (+45%)	16.9	+1.7 (+11%)
Fairview Ave N/Eastlake Ave E	Mercer St to E Roanoke St	4.9	5.1	+0.2, (+4%)	5.1	+0.0 (+0%)	6.0	+1.0 (+21%)	5.7	-0.2, (-3%)
Eastlake Ave E/Roosevelt Way NE	E Roanoke St to NE 45th St	4.9	5.6	+0.7, (+14%)	5.7	+0.1, (+2%)	6.9	+2.0, 40%	7.0	+0.1 (+1%)
Roosevelt Way NE	NE 45th St to NE 68th St	5.1	5.0	-0.1 (-2%)	5.5	+0.5, (+10%)	5.7	+0.6 (+12%)	6.1	+0.4 (+7%)
	Total	**25.4**	**28.4**	**+2.9 (+12%)**	**31.5**	**+3.2, (+11%)**	**33.8**	**+8.3, 33%**	**35.7**	**+2.0, 6%**
SOUTHBOUND										
Roosevelt Way NE	NE 68th St to NE 45th St	6.0	9.3	+3.3 (+55%)	6.0	-3.3 (-35%)	17.8	+11.7 (+136%)	8.4	-9.3 (-52%)
Roosevelt Way NE/Eastlake Ave E	NE 45th St to Roanoke St	8.6	10.1	+1.4 (+17%)	10.3	+0.3 (+3%)	11.8	+3.2 (+51%)	10.8	-1.0, (-9%)
Eastlake Ave E/Fairview Ave N	E Roanoke St to Mercer St	6.2	7.2	+1.0 (+17%)	8.2	+1.0 (+14%)	8.3	+2.1 (25%)	9.5	+1.2 (+14%)
Fairview Ave/ Boren Ave/Stewart St	Mercer St to 3rd Ave	8.3	8.5	+0.2 (+2%)	10.2	+1.7 (+21%)	10.7	+2.4 (+8%)	11.9	+1.2 (+11%)
	Total	**29.1**	**35.1**	**+5.9 (+20%)**	**34.8**	**-0.3 (-0.8%)**	**48.5**	**+19.4 (+66%)**	**40.6**	**-8.0 (-16%)**
BOTH DIRECTIONS (AVERAGE OF NORTHBOUND AND SOUTHBOUND)										
-		**27.3**	**31.7**	**+4.4 (+16%)**	**33.2**	**+1.7 (+5%)**	**41.1**	**+13.9 (+51%)**	**38.1**	**-3.0 (-7%)**

Note: Due to rounding, some totals may not equal the sum of values shown.

2

Additionally, exclusive northbound and southbound left-turn pockets/movements would be eliminated with the project at the intersections of Fairview Ave N & Thomas St and Fairview Ave N & Harrison St in order to accommodate a TOL/BAT lane on Fairview Ave N. These left-turn-restricted locations have relatively low traffic volumes compared to other turn movements in the area. Therefore, the circulation impacts of these two left-turn restrictions with the project are anticipated to be minimal, as other opportunities to turn left are provided at adjacent intersections. In addition, one of the northern layover options requires NE 67th St to be converted from a two-way street to a one-way westbound only street between 12th Ave NE and Roosevelt Way NE. Selecting that layover option would eliminate the southbound left-turn from Roosevelt Way NE to NE 67th St and the eastbound left-turn from NE 67th St to 12th Ave NE. Besides the elimination of these two or four left-turns, the project would not eliminate any other movements that currently occur at intersections along the corridor.

At the north-end, if bus layover is provided on NE 67th St, with the NE 67th St bus turnaround option, only westbound traffic on NE 67th St between 12th Ave NE and Roosevelt Way NE would be allowed to accommodate these layover spaces. This would require eastbound traffic that would use this street in the No Build condition to use other streets. This is expected to have minimal impact on access and circulation in the area because the traffic volumes are expected to be low on this street and there are adjacent streets to accommodate this traffic.

5.4 Pedestrians and Bicyclists

5.4.1 Pedestrian System

A number of pedestrian projects are assumed to have been completed near or intersecting with the project alignment under the 2024 and 2040 No Build conditions (see Appendix A – Methods and Assumptions Technical Memorandum). At these locations, sidewalks already meet or exceed the standard sidewalk width threshold established in Section 4.4.1, so no change is expected between the existing and No Build conditions along the project corridor.

The RapidRide Roosevelt project would maintain pedestrian access to and around the proposed stations; no removals of pedestrian walkways are proposed with the project. The RapidRide stations would be designed to meet ADA, *Seattle Right-of-Way Improvements Manual* (City of Seattle, 2017a), and *King County Metro Transit Passenger Facilities Improvements Standard Details* (KCM, 2011) standards; typical station platform widths will be 9 to 10 feet in the neighborhoods north of South Lake Union and generally wider than 10 feet in South Lake Union and Downtown. At stations along Eastlake Ave E and the station at Eastlake Ave E and Roosevelt Way NE, the landscape buffer between the roadway and sidewalk would be removed to accommodate the pedestrian island and bicycle facilities.

The project will also provide the following amenities for pedestrian use at stations:

- Shelters
- Benches
- Pedestrian-scale lighting
- Trash receptacles

Overall, these changes would enhance the existing pedestrian environment, increase pedestrian connectivity, and improve the overall appearance of the street for all users.

5.4.2 Sidewalk Maintenance Condition

The project would either maintain or improve the maintenance condition of sidewalks in the project area. The sidewalks within the footprint of each station would be replaced, eliminating any existing maintenance or access deficiencies. This is the case for one segment of sidewalk with poor maintenance condition (east side of Eastlake Ave E, south of E Lynn St), part of which coincides with a proposed station and would be replaced. Sidewalks at the remainder of the stations are in either fair or good condition, and any spot maintenance deficiencies within the station footprints would be eliminated.

In addition, several sections of sidewalk on intersecting streets would be replaced, including at NE 67th St, Fuhrman Ave E, Eastlake Ave E at Harvard Ave E, and Fairview Ave N at Aloha St (see Figure 4-3 for existing conditions).

5.4.3 Intersection Treatments

All existing pedestrian crossing movements would be maintained with the project; no crosswalks or pedestrian signal phases would be removed. Curb ramps would be replaced at most intersections, resulting in the upgrading of 191 ramps from ADA-non-compliant to ADA-compliant status and the addition of two new ramps (Table 5-20). No ramps would be eliminated or replaced with non-compliant ramps without Maximum Extent Feasible documentation (SDOT, 2017b).

Table 5-20. Curb Ramp Status with Project at Project Intersections

CURB RAMP STATUS WITH PROJECT	NUMBER OF CURB RAMPS	PERCENT OF CURB RAMPS
Existing Non-ADA-compliant Ramps to be Upgraded	191	59%
Existing ADA-compliant Ramps to be Replaced	45	14%
New ADA-Compliant Ramps Where Previously Non-existent	2	1%
Subtotal - Ramps Added or Modified by the Project	**238**	**73%**
Non-ADA-compliant Ramps Unaffected by Project	3	1%
ADA-compliant Ramps Unaffected by Project	85	26%
Subtotal - Curb Ramps Not Modified by the Project	**88**	**27%**
Total (After Project)	**326**	**100%**

5.4.4 Pedestrian Volumes

Walking is the predominant method of accessing transit in Seattle, with 77% of riders arriving at bus stops on foot (KCM, 2016b), and the projected growth in population and employment plus the additional transit ridership resulting from the project is expected to bring more pedestrians to the proposed stations.

Pedestrian volumes in the No Build condition were estimated for 2024 and 2040 by applying a growth factor derived from the PSRC model's nonmotorized trips forecasts. Pedestrian trips resulting from the project were then estimated using the STOPS ridership forecasting model and adding these trips to the 2024 and 2040 No Build estimates to generate pedestrian volumes for the Build conditions.

In general, the project would result in increased pedestrian volumes (Table 5-21); however, these would have a negligible impact on pedestrian facilities surrounding the proposed station locations: at most, the project would lead to an additional 76 pedestrians at adjacent intersections per hour, or slightly more than one per minute on average (includes pedestrians both approaching and leaving the station). This particular increase in pedestrian volumes is forecasted in the Roosevelt neighborhood, where current pedestrian volumes are relatively low, compared to intersections in other parts of the corridor like South Lake Union and Downtown. In those neighborhoods the average increases in pedestrian with the project are estimated to be 44 and 45 per hour, respectively. Pedestrian LOS calculations were also performed at the station areas and determined the station areas are of sufficient size to accommodate the expected ridership volumes (see Section 5.2.5, Station Capacity).

Table 5-21. Average Pedestrian Crossings at Intersections Adjacent to Stations (PM Peak Hour)

NEIGHBOR-HOOD[a]	EXISTING (2017, #)	2024 NO BUILD (#)	2024 BUILD (#)	2024 BUILD CHANGE FROM NO BUILD (#)	2040 NO BUILD (#)	2040 BUILD (#)	2040 BUILD CHANGE FROM NO BUILD (#)
Roosevelt	226	245	315	+70	302	379	+76
University District	340	459	488	+28	673	710	+37
Eastlake	158	159	187	+29	221	257	+36
South Lake Union	699	863	895	+32	1132	1176	+44
Downtown	1,210	1573	1607	+34	3327	3372	+45

[a] Neighborhoods:
Roosevelt: north of NE 55th St
University District: NE 55th St to University Bridge
Eastlake: University Bridge to Aloha St
South Lake Union: Valley St to Denny Way
Downtown: south of Denny Way

5.4.5 Bicycle Facilities

The project would result in substantial improvements to the bicycle environment along the project corridor by adding approximately 5 lane-miles of new protected bicycles lanes along the project alignment. Current and assumed future bicycle facilities in the project corridor and adjacent connections are shown on Figure 5-3.

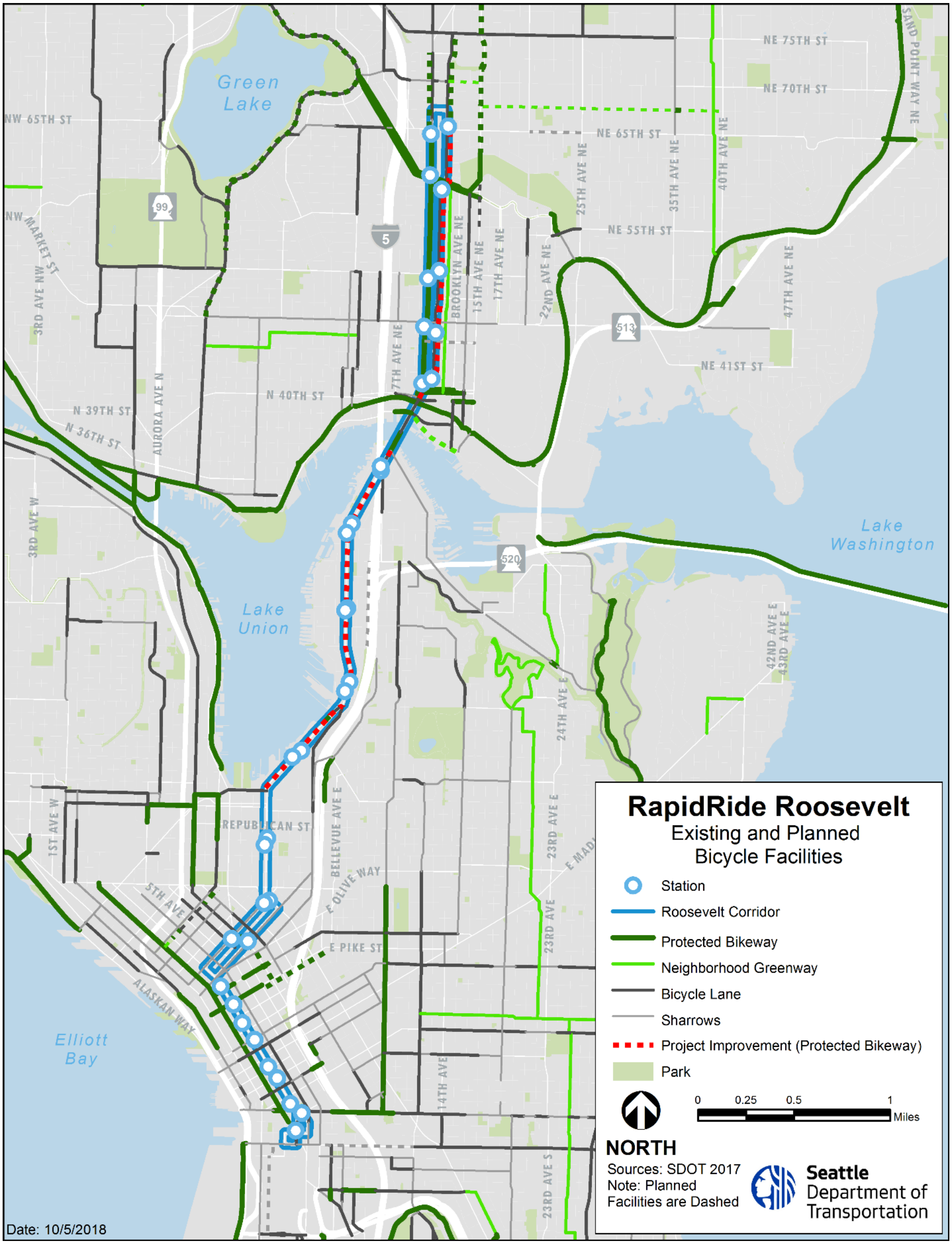


Figure 5-3. Existing and Planned Bicycle Facilities

This project would improve the bicycle conditions and connections in the corridor by providing these new facilities:

5.4.5.1 Northbound Protected Bicycle Lane on 11th and 12th Ave NE

A northbound curbside PBL on 11th/12th Avenues NE between NE Campus Pkwy and NE 67th St would serve as the couplet to the existing southbound PBL on Roosevelt Way NE. The PBL would be located on the east curbside between NE Campus Pkwy and NE 43rd St to connect more safely with the University District Link station near NE 43rd St, then shift to the west curbside between NE 43rd St and NE 67th St to connect with the Roosevelt Link station near NE 67th St. Having the PBL on the west curbside locates the PBL on the left side of a one-way street consistent with City guidance for one-way streets with transit service and bicycle lanes.[5] A transit island for one in-lane northbound station in each direction would route the PBL between the bus island and the east curbside at NE 41st St but remaining stations would be along the east curbside on the opposite side of the street from the PBL.

This facility would also provide connections to existing PBLs on NE Ravenna Blvd and NE Campus Pkwy, as well as other planned facilities.

5.4.5.2 Northbound and Southbound Protected Bicycle Lanes on Eastlake Ave E

PBLs on Eastlake Ave E would be provided on both street curbsides between the Fairview Ave N Bridge and Harvard Ave E. Transit islands for four in-lane stations in each direction would route the PBLs between the bus island and the curb. Between Harvard Ave E to the University Bridge, bicycle lanes would not be protected from vehicular traffic and would connect to the existing PBLs across the bridge. Clearly marked pedestrian crossings of the PBLs would be provided adjacent to stations, similar to the existing island bus stops on Roosevelt Way NE.

The new PBLs and bicycle lanes on Eastlake Ave E would connect to the existing PBLs on the University Bridge to the north. At the south end, the PBLs would connect to existing bicycle lanes continuing south on Eastlake Ave E. Additionally, the Eastlake Ave E PBLs would connect to the Fairview Ave N bridge and proposed two-way protected cycle track along Fairview Ave N. These PBLs on Eastlake Ave E would provide a critical connection between northeast Seattle and Downtown. A detailed evaluation of bicycle treatment concepts in the Eastlake neighborhood is presented in the Eastlake Bicycle Facility Evaluation Memorandum in Appendix E.

5.4.5.3 Two-way Protected Cycle Track along Fairview Ave N

Two-way cycle track on north side of Fairview Ave N would connect Valley St to the Fairview Ave N Bridge. The cycle track would be separated from road by proposed sidewalks and landscaping between Valley St and Yale Ave N and separated by a buffer from vehicular traffic on Yale Ave N up to the planned PBLs on north side of bridge (except between Yale Ave N and Ward St where there would not be a cycle track and bicycles and pedestrians would both use a shared use path that is separated from vehicular traffic by a landscaped strip).

Along with the Fairview Bridge replacement project, this facility would connect PBLs on Eastlake Ave E proposed as part of the project to bicycle lanes continuing on Valley St. The 2017 *Seattle Bicycle Master Plan* update recommends PBLs on Valley St. The planned Valley St PBLs would link the Fairview Ave N facility with existing and planned PBLs continuing to and through

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[5] Seattle Right-of-Way Improvements Manual - https://streetsillustrated.seattle.gov/design-standards/bicycle/bike-lanes-and-transit-service/

Downtown Seattle, ultimately creating a complete protected bicycle route between northeast Seattle and Downtown.

Shared lane markings (bike sharrows) would be removed from Stewart St and Virginia St with the project in Downtown, although this would not represent the loss of a bicycle facility because sharrows are intended to assist with lane placement and are not considered to be bicycle facilities per the *Seattle Bicycle Master Plan* (City of Seattle, 2014). Cyclists entering Downtown Seattle from Eastlake would have the option of using the 7th Ave PBL or continuing south on Eastlake Ave E, which would continue to have a mixture of bike lanes and sharrows.

5.4.6 Bicycle Volumes

As shown in Section 4.4.6, Bicycle Volumes, the project corridor—and particularly Eastlake Ave E—is one of the two primary cycling corridors between Downtown Seattle and North Seattle. The project would provide protected bicycle facilities where there are currently gaps in the protected bikeway network. The bicycle improvements proposed as part of the project may attract additional bicycle trips to the corridor, and the facilities proposed would be designed to meet the City's "Seattle Streets Illustrated" standards (City of Seattle, 2017a), with the capacity and configuration sufficient to meet expected volumes.

5.5 Parking

The future No Build conditions assume no change from the existing condition with respect to curb space management within the study area. The off-street parking facility at Eastlake Ave E and Harvard Ave E is scheduled to be closed from 2019 to 2029 for use as construction staging for the SR 520 project, so it will be unavailable at the time of project opening (2024) but available after year 2029.

Under the Build conditions, the project would provide enhanced multimodal transportation system improvements which would include dedicated space for transit and bicycle activities in many parts of the corridor. This would result in a change in curb space use following the City of Seattle priorities for managing curb space/flex zone functions based on surrounding land uses along this corridor.

5.5.1 On-street Parking Inventory and Loading Zone Changes

The on-street parking and loading zone inventory along portions of the RapidRide Roosevelt corridor would be reduced by the project; the project would not impact off-street parking facilities. Table 5-22 summarizes the proposed changes in the parking inventory from the existing conditions for each parking study zone and period. The curb space use in zone 1 would only be affected by the selection of the northern bus layover site.

Table 5-22. Summary of Change in Future On-Street Parking Inventory by Type

Study Zone	Midday/Late Evening/OvernightPeriod[a,b]			PM Peak Period[c]		
	Parking	Loading Zones		Parking	Loading Zones	
		CVLZ	PLZ		CVLZ	PLZ
1[d]	-15 (-3%)	0 (0%)	0 (0%)	-15 (-3%)	0 (0%)	0 (0%)
2	-67 (-7%)	-3 (-14%)	0 (0%)	-45 (-5%)	-1 (-7%)	0 (0%)
3	-107 (-20%)	-2 (-14%)	-1 (-14%)	-107 (-20%)	-2 (-14%)	-1 (-14%)
4	-52 (-17%)	-2 (-10%)	-4 (-36%)	-33 (-12%)	-2 (-10%)	-1 (-13%)
5[e]	-144 (-21 to -25%)	-5 (-42 to -45%)	-2 (-100%)	-69 (-14%)	-3 (-33%)	-1 (-100%)
6[e]	-142 (-15 to-28%)	-10 (-43 to -71%)	-2 (-100%)	-78 (-18%)	-4 (-50%)	-2 (-100%)
7[e]	-38 (-8 to -9%)	-3 (-30%)	0 (0%)	-15 (-4%)	-2 (-22%)	0 (0%)
8	-70 (-37%)	0 (0%)	0 (0%)	-70 (-37%)	0 (0%)	0 (0%)
9	-21 (-7%)	-4 (-15%)	-3 (-19%)	-6 (-2%)	-3 (-13%)	-1 (-7%)
10	-43 (-15%)	-5 (-16%)	-12 (-24%)	-33 (-14%)	-4 (-14%)	-9 (-20%)
Total	-699 (-15%)	-34 (-20%)	-24 (-24%)	-471 (-11%)	-21 (-14%)	-15 (-17%)

Note: Negative numbers show the number of parking spots that would be removed.

[a] The inventory is the same for midday and late evening time periods.

[b] When range is stated, the lower value belongs to overnight period and higher value represents midday/late evening periods.

[c] The PM peak period has less inventory than in other times of the day due to peak period parking restrictions.

[d] Zone 1 parking assumes the NE 67th St bus turnaround option utilizing layover along NE 67th St, which removes up to 15 stalls. The NE 70th St bus turnaround option would remove up to 14 parking stalls.

[e] Parking and loading zone data for overnight period (3 AM to 4 AM) is only collected for study zones 5, 6, and 7 (Eastlake Neighborhood) for the extended study area. The on-street parking and loading zone inventory is increased with the additional block faces collected beyond the primary study area.

CVLZ = commercial vehicle loading zone

PLZ = passenger loading zone

Because the parking inventory changes by time of day due to curb space controls, the reduction in on-street parking inventory would vary by time of day. For example, the on-street parking spaces would be reduced by 471 during the PM peak, compared to 699 spaces during midday and late evening. This is because current PM peak parking controls already restrict on-street parking in parts of the corridor.

As shown in Table 5-22, 699 parking spaces would be removed as a result of the RapidRide Roosevelt project along the corridor. None of these parking spaces are marked for exclusive use by vehicles with a disabled parking permit. The locations of the disabled parking spots in the study area are shown on the maps in Appendix C, Attachment A-3.

Table 5-22 also shows that loading zones are reduced by 58 (34 CVLZs and 24 PLZs) during midday and late evening. Most of the zones would have a few CVLZs and PLZs removed, except zones 6 and 10 which would have 10 CVLZs removed and between 9 to 12 PLZs removed, depending on the time of day. The removal of these loading zones and their relocations would be addressed, as feasible, by the City of Seattle.

Table 5-22 summarizes the proposed changes in the parking inventory compared to the existing conditions for each parking study zone and time period in Eastlake neighborhood. As shown in the table, the reduction in the number of on-street parking and loading zone inventory during the overnight time period for the extended study area is the same as other off-peak time periods (midday and PM peak) for the primary study area. This is because on-street parking and load zones would only be removed along Eastlake Ave E as a result of the RapidRide Roosevelt project. However, the overall percent reduction in the on-street parking and loading zones during overnight time period is lower than during midday/late evening due to the additional on-street parking inventoried as part of the extended study area.

Results of the Eastlake neighborhood extended overnight study show relatively high demand for residential on-street parking during overnight period as the overall utilization rate for the block faces added to the primary study area is more than 85%. Overnight utilization along Eastlake Ave E is relatively low (34%), likely because residents may not use the available parking along Eastlake Ave E after businesses and restaurants close in the evenings and because of early morning parking restricted zones for southbound curb lane. The additional loading zones that are available in the extended study zones (mainly in study zone 6) are serving local business and are not within a reasonable distance to serve the Eastlake commercial area.

Regarding the northern layover, 3 or 4 layovers spaces would be required with the project. If all of the layover is located along NE 67th St, up to 15 on-street parking spaces would be removed; including passenger load zones associated with developments along NE 67th St as part of the Roosevelt Link light rail station.

Two potential layover spaces are identified along 12th Ave NE between NE 67th St and NE 68th St which would remove up to 5 on-street parking stalls. Moreover, two school bus zones (1 PM to 4 PM) would be affected by implementing layover along 12th Ave NE, south of NE 68th St. Along 12th Ave NE, there are two other potential layover spaces identified between NE 67th St and NE 66th St. These spaces would remove up to 6 on-street parking stalls including one school bus zone (1 PM to 4 PM) located near NE 67th St.

Along Roosevelt Way NE, two potential layover spaces are identified between NE 67th St and NE 66th St. These would remove up to 8 on-street paid parking stalls. There are also two potential layover spaces along Roosevelt Way NE between NE 66th St and NE 65th St. These spaces would remove up to 4 paid parking stalls and one commercial/passenger load zone.

5.6 Safety

5.6.1 Vehicular Collisions

Under the No Build condition, no substantial geometric changes are planned to the roadway conditions and the pedestrian and bicycle facilities other than those included in the project; therefore, the number of crashes in relationship to traffic volume is expected to be similar to existing conditions. Traffic volumes are expected to increase in the future and may result in additional crashes along the project corridor.

In the Build condition vehicular safety is likely to improve or remain the same along the project corridor due to channelization improvements, turn restrictions, and the reduction of on-street parking. With parking removed from 12th Ave NE, 11th Ave NE and Eastlake Ave E, it is anticipated that the collision rate would decline, because there would be fewer conflict points with vehicles entering or leaving parking spaces.

With minimal changes to the roadway configuration on Roosevelt Way NE, conflict points and collision rates would likely stay the same. Along Eastlake Ave E, several left-turn pockets would be lengthened to allow for additional vehicle storage. This would likely improve safety by reducing the spillback of vehicles into the through lanes. In addition, raised medians would be added in some sections, removing the two-way left-turn lane. These include sections between E Edgar St and E Roanoke St, E Roanoke St and E Louisa St, and E Howe St and E Blaine St.

Between the Fairview Ave N bridge and Yale Ave N on Fairview Ave N, one southbound lane and one northbound lane would be removed (to add two-way PBLs), which could reduce crashes by eliminating conflict points. Northbound between Yale Ave N and Valley St, the curb lane would be converted into a BAT lane, limiting general purpose traffic to a shared lane with the streetcar. Since general purpose traffic already travels with the streetcar in this lane, safety performance in this section would likely remain about the same. Removing parking to add a northbound and southbound BAT lane between Denny Way and Republican St would also likely reduce crashes.

Removing on-street parking along Virginia St and Stewart St would also likely reduce conflict points and crashes.

5.6.2 Pedestrian and Bicycle Collisions

The No Build condition includes several pedestrian and bicycle safety projects (see Section 5.4); therefore, the nonmotorized safety is expected to improve with the No Build Alternative.

With the Build Alternative, some segments of substandard sidewalk in Eastlake would be replaced, reducing trip hazards. The upgrading of non-ADA-compliant curb ramps would improve the safety of disabled pedestrians by improving the detectability and geometry of the ramps. From a pedestrian crossing safety standpoint, the Build scenario would remain similar to existing conditions in most areas along the proposed corridor. While vehicle lanes, both general purpose and transit, would be added, removed, or reclassified in some locations, the crossing distances (curb-to-curb) would remain the same, and new signalized or marked crossings are not proposed. The exception is along Fairview Ave N between Yale Ave N and Valley St, where the roadway would be widened to accommodate an additional transit lane. This would increase the pedestrian crossing distance at intersections through this roadway section, but this change is expected to have minimal impacts to pedestrian-related collisions, because the number of conflict points and the complexity of interactions among general purpose vehicles would remain unchanged.

Bicycle facilities would be added along much of the project corridor. On 12th Ave NE, 11th Ave NE, and Eastlake Ave E, bicycle lanes would be added with a buffer between the travel lanes and the bicycle lane. In addition, along Eastlake Ave E, the bicycle lanes would be aligned behind the stations to minimize conflicts with stopping buses. Two-way PBLs would be added along Fairview Ave N between Eastlake Ave E and Valley St, which would connect to other bicycle facilities. All these bicycle facilities would be predicted to reduce the number of crashes along these portions of the corridor by removing bicycles from mixed traffic as well as providing a buffer from other modes.

5.7 Freight

5.7.1 Freight Operations

The portion of the project alignment between the north terminus to Denny Way is designated by the City of Seattle as a Minor Truck Street. On that segment, general purpose PM peak travel times are projected to increase marginally in the 2024 No Build condition, but substantially in the 2040 No Build condition, due to background growth in travel demand (Table 5-23).

Under the 2024 Build condition, southbound travel times would remain similar to the No Build condition, and northbound travel times would increase by 2 minutes. Under the 2040 Build condition, northbound travel times would be approximately 2 minutes longer when compared to the No Build condition, but southbound travel times would be over 6 minutes shorter. Northbound travel time increases are mainly due to the conversion of a general purpose lane to BAT lane along Fairview Ave N between Denny Way and Mercer St. Southbound travel times remain same or are reduced, due to longer southbound right-turn lanes (more vehicle storage) along Roosevelt Way NE at NE 50th St, NE 45th St, and NE 42nd St reducing blockage of southbound through volume, including freight. When these changes are averaged bidirectionally (reflecting the fact that the street is classified for local distribution and is intended to carry shorter trips that are likely to use the corridor in both directions), the 2024 Build condition would result in an additional 1.1 minutes of travel time along the Minor Truck Street section and the 2040 travel times would be 2.1 minutes shorter under the Build condition.

The project alignment is also on a short block (about 500 feet) of Boren Ave, which is a Major Truck Street. The project does not propose any substantial changes to this section of Boren Ave and therefore does not expect impacts to freight travel times.

5.7.2 Freight Access

There are no reasonably-foreseeable projects planned that would affect freight access under the No Build conditions.

The project was designed to accommodate freight access, considering street type and freight volumes when determining roadway geometry under the Build condition. Additionally, the project would not restrict any freight movements in the corridor. Raised medians would replace sections of the center turn lane on Eastlake Ave E but would not restrict access to any existing driveways. The City would locate potential commercial vehicle loading zones areas near the removed commercial vehicle loading zones areas, where feasible, to facilitate deliveries. See Section 5.5, Parking, for further discussion of changes to commercial vehicle loading zones.

Table 5-23. Freight Travel Times on Minor Truck Street Portions of the Corridor (PM Peak Hour)

Segment	Existing (2017)	2024 No Build Travel Time (Minutes)	2024 No Build/Existing Difference (Minutes, %)	2024 Build Travel Time (Minutes)	2024 Build/ No Build Difference (Minutes, %)	2040 No Build Travel Time (Minutes)	2040 No Build/Existing Difference (Minutes, %)	2040 Build Travel Time (Minutes)	2040 Build/No Build Difference (Minutes, %)
Denny Way to NE 65th St (Northbound)	20.2	22.2	+2.1 (+11%)	24.2	+1.9 (+9%)	25.0	+4.9 (+24%)	26.9	+1.9 (+8%)
NE 65th St to Denny Way (Southbound)	23.4	29.1	+5.7 (+24%)	28.9	-0.2 (-1%)	40.3	+16.9 (+72%)	34.1	-6.2 (-15%)
Average (Northbound and Southbound)	21.8	25.7	+3.9 (+18%)	26.5	+0.9 (+3%)	32.7	+10.9 (+50%)	30.5	-2.1 (-7%)

6.0 CONSTRUCTION

This section discusses the potential impacts that would be caused by RapidRide Roosevelt construction.

6.1 Construction Duration and Phasing

Project construction would require approximately 24 months to complete, but construction would be phased to minimize construction impacts along the alignment. A construction phase is the duration in which the contractor would work within a given active work area. To minimize the duration of construction activities adjacent to individual businesses along the corridor, it could be beneficial to phase the active work areas along the corridor. A larger active construction work area may have the benefit of a shorter overall construction duration, but it could result in a longer duration impact on individual properties. In general, each station location would typically have a 4- to 6-week construction phase to construct and install the transit amenities. Multiple station areas can be located within the active work area, but the impacts and benefits would need to be coordinated with the surrounding community. Separating the overall project into separate smaller construction efforts would allow for multiple segments to be constructed concurrently. Because of the length of the project corridor, the overall construction duration could be shortened by breaking the project up into two or more separate work zones. Separate zones would allow the contractor(s) to focus their resources over a smaller area. For example, a logical separation to create two zones would be at the University Bridge.

Construction is planned to be limited to existing right-of-way but may require temporary construction easements. Paving work, roadway re-channelization, signal improvements, OCS construction, and station construction would require closure of one or more lanes along the project corridor in the areas where construction is underway. Major signal improvements would also require temporary signal deactivation. Construction would affect on-street parking and require temporary closures of travel lanes when traffic would be detoured. Temporary sidewalk closures with signage noting detour routes would be necessary when constructing around stations and installing utilities or OCS poles.

The construction of the project would affect all modes of travel that use this corridor. Construction would involve utility installations and relocations, roadway reconstruction and restoration, and traffic signals and intelligent transportation system (ITS) installation. It is anticipated that the first phase of construction would include utility relocation and installation of new utilities. This would be followed by paving along 11th and 12th Avenues NE and on Eastlake Ave E, and would include the installation of the concrete pads in front of stations, where required. The stations and amenities would be installed during paving, and the last construction element would be the installation of the OCS poles and wiring and the TPSS.

The equipment used in construction would include graders, bulldozers, concrete trucks, flatbed trucks, and dump trucks. Any debris or spoil materials would be hauled away from the work sites to approved disposal sites. Haul routes connecting the site with I-5 and SR 520 would use arterials, avoiding the use of smaller side streets. These arterials include NE 65th St, NE Ravenna Blvd, NE 50th St, NE 45th St, Harvard Ave E, Mercer St, Denny Way, Stewart St, and Howell St.

Staging areas for construction would be established in the vicinity of the project and used for storage of equipment and materials. The staging areas would generally be located within the roadway right-of-way and would be selected to minimize impacts on adjacent uses. Depending on timing, the area under I-5 in the Eastlake neighborhood could be used for staging. The property is owned by WSDOT and is also proposed for the staging of the SR 520 project. Other staging locations could include vacant or underutilized lots; if required, these would be identified during final design.

6.2 Construction Scope and Activities

Construction of the project would involve the following activities:

- Installation of temporary traffic control measures
- Removal of existing pavement
- Construction of new pavement, curbs, sidewalks, and curb ramps
- Relocation, modification, or protection of utilities in conflict with or affected by elements of the project
- Installation of drainage systems such as collection locations and detention facilities
- Construction of bus stop islands, including RapidRide amenities
- Construction of one TPSS option
- Installation of traffic signal improvements
- Installation of OCS poles, wires, support brackets, feeder cables, and other components
- Signage and pavement markings

6.3 Construction Impacts

6.3.1 Regional Traffic and Roadways

Construction of the RapidRide Roosevelt project would require temporary, short-term partial closures of the streets along the project corridor, but none of these closures would be on regional roadways. Full long-term closures are not expected, but lane closures could influence what streets drivers travel on within the study area.

A travel demand forecast was prepared that incorporated temporary lane closures along Eastlake Ave E—the neighborhood with the fewest route alternatives and the most potential to act as a bottleneck—to understand the potential diversion to other streets, including I-5. This was conducted for the PM peak period to understand the conditions during the most congested period of travel. Even so, there would be minimal traffic diversion to I-5 (less than 1% of change in traffic volumes). This level of volume change would be within the typical daily fluctuation in volumes experienced on this type of facility.

6.3.2 Transit System

Construction of the RapidRide Roosevelt project would result in short-term impacts to existing transit service along the corridor, including delays to buses resulting from lane closures and temporary stop closures.

6.3.2.1 Transit Service Impacts

Construction activities are not expected to require full long-term road closures, so current transit routes in the corridor would likely continue to travel their routes and not require construction reroutes or detours. Lane closures would likely delay buses along with general traffic, resulting in longer transit travel times and reduced reliability in the project corridor during construction. Because construction would likely be sequenced, the delays would only occur for a portion of the corridor and would not be long-term.

Some construction work may require temporary suspension of trolleybus operation. Diesel or hybrid buses could be used during these construction activities. Some construction activities may also require temporary suspension of streetcar operations on Fairview Ave N and Stewart Street. Construction would be coordinated with streetcar operations to minimize disruptions of streetcar service. Access to the streetcar maintenance facility in South Lake Union would be maintained during construction.

6.3.2.2 Transit Stops and Stations Impacts

Eighteen existing bus stops along the project corridor would be upgraded to RapidRide stations with additional amenities, which would require temporary relocation of those bus stops during construction activities. Typical construction duration is anticipated to be 4 to 6 weeks for each individual station. Some stops may be closed for a short period, depending on the construction activity and whether the stop can be relocated to a nearby location. In these cases, riders would be required to walk to the nearest existing stop. This could increase walk distances to transit stops by up to ¼ mile.

6.3.3 Arterial and Local Streets

In general, one lane of traffic adjacent to the sidewalk at each station location would be closed for construction and installation of the station. Local travel patterns for all modes of transportation are anticipated to remain relatively unchanged during the construction period. A modeling forecast of construction conditions indicated traffic diversion of less than 5% on nearby surface streets, which is within normal day-to-day variation.

If full road closures are required, they would be limited to night or weekend hours as much as possible, which would further minimize the impacts to local travel patterns. If full road closures occur, an appropriate and alternative detour route(s) would be provided in accordance with traffic control plans.

For some elements of work, half of the roadway section would need to be closed for limited durations, narrowing the roadway to one lane in each direction. These elements include traffic signal work, paving, utility work, and bus stop islands. When a signal was turned off or countermanded, a uniformed police officer would direct traffic through the intersection.

At intersections with substantial cross-street traffic, excavations would typically be completed at night or on weekends, and the affected road surface would be covered with steel plates until construction is completed to allow traffic to continue to flow through the intersections.

It is anticipated that emergency vehicle routing would not be affected by construction activity because at least two lanes (one lane in each direction) would be maintained along the project corridor. In case of the occasional off-peak hour road closures, detours may affect emergency vehicle routing, depending on actual routes selected by the responders.

Some special events in Seattle may conflict with construction activities. These could include the Seattle Marathon, the Rock 'n Roll Marathon, Bumbershoot, and the Seafair Torchlight Parade. Construction would be sequenced or restricted to minimize impacts on these events.

6.3.4 Pedestrians and Bicyclists

6.3.4.1 Pedestrian Impacts

Station construction would generally require the closure of the surrounding sidewalk near that station. At intersections where construction work would take place, one or more crossing movements could be temporarily closed. In these conditions, the pedestrian would need to use an adjacent crossing or cross the street using the other intersection crossings.

Station-related construction on the west side of Roosevelt Way NE north of the University Bridge, and on the west side of Fairview Ave N at Yale Ave N may create detours for pedestrians. In the case of Roosevelt Way NE, pedestrians may need to detour via 9th Ave NE (an additional 900 feet), assuming no temporary walkway is provided. At Fairview Ave N, pedestrians would need to cross to the east side of the street and use it between Yale Ave N and Valley St.

6.3.4.2 Bicyclist Impacts

Bicycles would be required to detour from existing bicycle facilities to general purpose travel lanes where those facilities overlap with station and signal construction work. Cyclists continuing to ride on the corridor may need to ride over ground asphalt and/or steel plates and general purpose traffic. Alternatively, they would have the option of using parallel streets, which in the Roosevelt, University District, and Eastlake neighborhoods include designated neighborhood greenways and signed bicycle routes.

6.3.5 Parking

During construction, most of the activities would likely remove the current parking along the segment being constructed. Parking along the cross-streets or on parallel streets is less likely to be affected by the project construction. In cases where the long-term curb space management is to not replace the parking, this removal would be permanent. In some segments, the loss of parking during construction would only be temporary for the duration of the construction in that area, which would typically be short-term.

CVLZs and PLZs would also be removed in the areas where on-street parking is removed during construction and temporarily relocated where feasible.

6.3.6 Safety

6.3.6.1 Vehicle

During construction, traffic work zone control measures would help to ensure vehicles are able to navigate construction areas safely. Traffic diversions and detours could lead to minor traffic volume increases on some parallel arterial streets (see Section 6.3.3). This could shift some crashes to those parallel streets, although the overall number of crashes is not expected to increase. In locations where there would be no physical change to the roadway, the types of crashes would likely remain similar to existing conditions.

6.3.6.2 Pedestrian and Bicycle

Sidewalks, crosswalks, and some bicycle facilities might be closed temporarily during construction. Detours would be provided where necessary, which would temporarily shift trips to these detour routes. The overall crash rate in the study area is not expected to change as a result of project construction, but the temporary travel pattern changes may be accompanied by an associated decrease in collisions on the project alignment and an increase on the detour routes.

6.3.7 Freight

As with general vehicle travel, freight movements would likely be maintained along the corridor during construction. In some street segments, temporary re-channelization could occur to accommodate construction work zone areas, but traffic would continue to move through those areas. Major cross streets would likely remain open during construction, but short-term temporary closures of some minor street approaches may occur when construction is occurring at intersections.

Short-term temporary closures of driveways would be required when major roadway reconstruction (e.g. paving) is adjacent to affected properties or when driveway replacements or relocations are required. For properties with multiple driveways, it is anticipated that only one driveway would be closed at a time to maintain property access. For parcels with only one driveway, where feasible, the driveway would be constructed in two phases so that half of the driveway remains operational for property access. The City would, where feasible, locate temporary commercial vehicle loading zones (depending on construction activity and loading needs) to maintain commercial loading in reasonable distance to businesses (i.e., on side streets or on the other side of the street under construction). See Section 5.5, Parking, for a discussion of impacts to loading zones.

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7.0 POTENTIAL MITIGATION MEASURES

This section describes the potential mitigation measures that would be implemented as part of operation and construction of the RapidRide Roosevelt project. Potential mitigation has been identified for parking and construction. No mitigation beyond what the project is proposing is anticipated during operation for these transportation elements: regional traffic and roadways, transit system, arterial and local street operations, pedestrians and bicyclists, safety, and freight, because there are no impacts or the project results in benefits during operations. This is described further in the subsequent subsections.

7.1 Regional Traffic and Roadways

The project is anticipated to result in a slight reduction of daily VMT in 2024 and 2040.Within the study area, no roadway modifications to I-5 are assumed in 2024 or 2040 and the volume difference between the Build and No Build conditions on I-5 is less than 1 percent. As a result, no mitigation would be required for regional roadways.

7.2 Transit System

The RapidRide Roosevelt project is expected to see higher average passenger loads in the opening and design years compared to the No Build Alternative. This would not be considered an adverse impact, as it reflects the RapidRide Roosevelt project serving additional latent demand for transit travel compared to existing Routes 67 and 70 service. Passenger load projections are based on peak frequencies of 7.5 minutes. However, KCM and SDOT would continue to monitor passenger loads and add additional transit service in the Roosevelt corridor if ridership warrants, regardless of whether the RapidRide Roosevelt project is implemented.

7.3 Arterial and Local Streets

The RapidRide Roosevelt project is a transit project that includes roadway elements that improve general traffic operations. Overall, the project would result in a net increase in the person-carrying capacity of the roadway, and vehicle travel times would be similar or better in the corridor by year 2040. Also, while congested areas in the corridor may shift with the project elements, there are a similar number of intersections that operate at LOS F between the No Build and Build conditions. Therefore, no mitigation would be required to further improve arterial and local street operations beyond the project elements.

7.4 Pedestrians and Bicyclists

The project would improve the pedestrian and bicycle environment and no bicycle or pedestrian facilities would be removed (shared lane markings would be removed from Stewart St and Virginia St, but these are not considered facilities per the *Seattle Bicycle Master Plan* (City of Seattle, 2014). Project elements include existing walkways replaced with new concrete built to City of Seattle and other design standards, construction of curb ramp that are ADA-compliant, and new protected bicycle facilities along sections of the corridor. As a result, no mitigation would be required for pedestrians or bicyclists.

7.5 Parking

The RapidRide Roosevelt project would improve transit service and offer new and upgraded pedestrian and bicycle facilities to provide alternatives to driving and parking in the corridor. The project is planning to provide frequent, all-day transit service that would have shorter travel times and better reliability that would attract new transit riders.

Within the Roosevelt, University District, South Lake Union, and Downtown neighborhoods (zones 1 through 4 and zones 8 through 10), additional parking strategies would not be proposed as either the parking removed is not substantial or there is available parking (on-street or off-street) to accommodate the loss of the parking removed by the project, as identified in Tables 4-16, 4-17, and 5-22. Along the entire project corridor, the City would relocate potential loading zones near the removed loading zone areas, where feasible, to facilitate deliveries and other functions for those activities.

Within the Eastlake neighborhood (zones 5 through 7), the project would remove all the on-street parking and loading zones along Eastlake Ave E between Fairview Ave N and Fuhrman Ave E. The Eastlake commercial area is constrained by limited on-street parking on the adjacent block faces and the fact that, unlike the other study zones, there are relatively few off-street parking facilities that would provide additional parking options. Results of the parking duration study in Eastlake commercial area show that about 25% of the vehicles parked on Eastlake Ave E (zone 6) are parking long-term (over 4 hours). These longer-term parked vehicles most likely belong to employees or residents in the area.

Beyond the relocation of loading zones throughout the project corridor, the City would coordinate with the Eastlake neighborhood on parking and access strategies, which may include:

- Working with the businesses and neighborhood to communicate the parking regulations and the available commute options.
- Considering adjustments to the RPZ to better ease parking congestion in the residential area and to address the needs of all curb space users in the area.
- Facilitating a discussion, and if desired, seeking funding to work with private businesses that may be interested, or able to, allow parking lots to be shared parking for other uses.

The City will evaluate the costs, timing, issues, and opportunities with these potential mitigation strategies throughout the rest of the project design and development.

7.6 Safety

Under the Build condition, vehicular safety is likely to improve or remain the same along the project corridor due to channelization improvements, turn restrictions, and the reduction of on-street parking. With parking removed from 12th Ave NE, 11th Ave NE, and Eastlake Ave E, it is anticipated that the collision rate would decline, because there would be fewer conflict points with vehicles entering or leaving parking spaces. As a result, no safety-related mitigation would be required with the project.

7.7 Freight

On the Minor Truck Street portion of the project alignment (the entirety of the alignment north of Denny Way), travel times would be 1.1 minutes longer in the year of opening (2024), while in the planning horizon year (2040) travel times would be 2.1 minutes shorter under the Build condition. Additionally, the project would not restrict any freight movements in the corridor. As a result, no mitigation would be required for freight.

7.8 Construction Mitigation

Prior to construction, SDOT would finalize detailed construction plans during final design and permitting phases. All mitigation associated with constructing RapidRide Roosevelt would comply with SDOT-approved/coordinated traffic control plans and, if required, construction management plan and haul-route plan. Potential mitigation measures for impact during construction would include the following, as appropriate:

- Construction activities would be coordinated with any other ongoing construction projects and would be scheduled to reduce their impacts at periods of high travel demand, including peak weekday commute hours and during special events.
- SDOT and KCM would work together to monitor the impact of construction on transit service through the corridor. If needed, the following additional actions could be taken:
  - Establish temporary roadway changes to improve roadway capacity during periods of lane closure, such as restricting parking to provide an additional travel lane.
  - Establish temporary transit reroutes or detours around construction sites.
  - Limit work requiring signal deactivation to off-peak, when practical, and provide a uniformed police officer for traffic control while signals are deactivated.
- Establish temporary bus stops near closed stops, when practical, to reduce the distance that transit passengers need to walk to catch the bus.
- Avoid concurrent closure of adjacent bus stops unless temporary stops can be established. This would minimize the additional distance that passengers must walk to catch the bus.
- Establish and maintain ADA-accessible pedestrian access routes to adjacent open bus stops.
- If traffic signals need to be temporarily disabled, the work associated with those signals would be conducted with uniformed police officers directing traffic.
- Coordinate with the City's Special Events Committee and Seattle Police Department traffic control to provide enhanced public awareness of congestion and alternative modes for accessing events; post traveler's advisories on the SDOT Blog and website ("On the Move"); and include special events on the City Traveler's Map.
- Provide signing and wayfinding to help travelers locate key destinations.
- Provide flaggers and/or uniformed police officers at key intersections when needed to facilitate the movements of freight and general purpose traffic and expedite emergency vehicles.

- Coordinate traffic management through the SDOT Project & Construction Coordination Office.
- If an existing pedestrian route is blocked by construction or other temporary conditions, a pedestrian detour route would be provided to maintain the continuity of movement. The existing facility would be replaced with a reasonably safe, convenient, and accessible temporary pathway. Proper signage meeting *Manual on Uniform Traffic Control Devices* (Federal Highway Administration, 2009) requirements would be in place during construction.
- If a safe bicycle facility cannot be provided on the corridor, then a bicycle detour route would be provided, which along most of the corridor would likely consist of a neighborhood greenway or existing signed bicycle route.
- For areas where parking space losses are short-term (during construction only), the parking would be re-established once the construction is completed in that area. The City would provide information to the neighborhood and businesses about other parking opportunities in the area and the available transportation options in lieu of driving.
- The City would, where feasible, create temporary loading zones (depending on construction activity and loading needs) to maintain commercial and passenger loading in reasonable close proximity to businesses (i.e., on side streets or on the other side of the street under construction).
- Temporary roadway re-channelization during construction would be implemented in accordance with standard City of Seattle procedures, and traffic movements would be maintained where feasible. The closures of minor street approaches for construction at intersections would be prioritized for weekend or nighttime periods to minimize disruptions to local circulation when feasible.
- Where driveways would be replaced or relocated, the City would coordinate with property owners to maintain, where feasible, access during construction. If access is not feasible for limited durations, the City would attempt to schedule the construction to minimize access disruptions.

8.0 INDIRECT IMPACTS

Indirect effects result from one project but, unlike direct effects, typically involve a chain of cause-and-effect relationships that can take time to develop and can occur at a distance from the project site. Induced growth or growth-inducing effects are terms used to mean indirect effects related to changes in land use, population density, or growth rate.

The base land use assumptions used to develop the future travel demand forecasts for this project (using the PSRC travel demand forecast model) are consistent with the *City of Seattle Comprehensive Plan* (City of Seattle, 2019), which includes goals for substantial increases in transit utilization and density in the neighborhoods served by the project. Therefore, the potential for "induced growth" is already incorporated into the forecasts as "planned growth" consistent with the Comprehensive Plan.

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9.0 CUMULATIVE IMPACTS

This section discusses potential consequences of the RapidRide Roosevelt project combined with other future transportation system changes. The analysis of the No Build Alternative and the proposed project is inherently cumulative because it is based on regional forecasts that assume future funded projects and future population and employment growth that is consistent with adopted land use plans. However, other planned, but not funded, regional and local transportation and development projects could have some effects on transit ridership and travel patterns within the study area.

9.1 Future Transit System

As described in Section 5.2.4, with PSRC's land use growth projections by 2040 the forecasted PM peak passenger loads in the southern area of the project corridor would be slightly above KCM's crowding threshold. KCM actively monitors passenger loads and typically increases service levels to provide additional passenger carrying capacity when warranted by demand. In opening year 2024, the buses in the Build Alternative would experience an average PM peak load less than the KCM threshold for passenger crowding and would be within the comfortable standing load range for a standard bus based on seating availability.

The Sound Transit Long Range Plan (Sound Transit, 2014) includes a potential east-west light rail extension from Ballard to the University District, and the Sound Transit 3 funding package includes funding for a study to explore a second extension to the Eastside. If one or both projects are completed, ridership on the RapidRide Roosevelt can be expected to increase as more transit users would connect to the corridor and transfer to and from surface bus service. Similarly, project ridership would likely increase if the region continues to increase funding for bus service in the alignment with the KCM METRO CONNECTS long-range plan (KCM, 2016a). Future bus system restructuring associated with METRO CONNECTS could also change ridership patterns, increasing boardings at some stations and decreasing them at others.

9.2 Automated Vehicles and Rideshare Services

Rideshare services like Uber and Lyft as well as driverless vehicle technologies are likely to continue to expand and influence the nature of patterns of travel in the study area. Transportation network services (also known as transportation network companies) are already providing a new way for users to access transit, and transit agencies nationwide are providing increased amounts of curb space for pick-ups and drop-offs as a result. Automated vehicle technology—whether as part of shared services or individually owned vehicles—is likely to accelerate this trend, increasing demand for pick-up/drop-off curb space at transit stations and reducing demand for parking. In the future, the City of Seattle may need to reevaluate curb space allocation around the project stations to ensure optimal use of this limited resource and to avoid neighborhood spillover effects.

Some evidence suggests that rideshare services are increasing vehicle miles traveled in cities, and automated vehicles may contribute to this trend by lowering the effective cost of driving. If traffic in general purpose lanes increases in the future due to these factors, additional system management in the form of dedicated transit lanes and transit signal priority may be necessary to maintain the project's speed and reliability. The ridership forecasts included in Section 5.2.3 consider anticipated changes in population and employment in the region as well as funded transportation system projects, but do not consider potential changes in the availability of rideshare services and automated vehicles. These changes may result in changes to demand for transit service in the future, including altering ridership demand on the project.

9.3 Bicycle System Enhancements

The nonmotorized analysis in this report included limited assumptions about future expansions of the bicycle network, based on currently available information about project funding and planning status. Future expansions of the bicycle network are likely between now and the opening year (2024) and horizon year (2040) and would increase access between surrounding neighborhoods and project stations. In turn, this would increase ridership and potentially demand for bicycle parking at stations. To respond to growing demand for bike parking, new standards have been proposed (May 2018) using the Association of Pedestrian and Bicycle Professionals best practices guide. These guidelines include key considerations, best practices, and resources for selecting and installing bike racks for public and private use.

In addition, demand for bike parking may be mitigated by the continued adoption of dockless bicycle share systems, but these services would have the side effect of occupying sidewalk space that would otherwise be used by waiting transit patrons or pedestrians. Lessons-learned during the pilot phase of Seattle's bike share pilot program have been applied to a new, ongoing regulatory structure: the 2018-2019 Free-Floating Bike Share Program Permit Requirements (SDOT, 2018b). Permit requirements were approved by the City Council in July 2018 and SDOT is currently reviewing applications from vendors. According to these requirements, vendors must develop a parking and fleet management plan that describes how they will keep sidewalks clear. Further, vendors must inform riders on how to park bike share devices responsibly. Devices may not be parked in pedestrian clear zones, on corners, at transit stops, in loading or disabled parking zones, or block access to buildings, curb ramps, benches and other street features. These regulations should reduce the conflict between parked bicycles and waiting bus passengers and other pedestrians.

9.4 Parking

As noted in Section 5.5, on-street parking is already heavily utilized in the corridor under existing conditions and the supply is not likely to increase in the future. The Project would remove on-street parking along the corridor, and the construction of private development projects could increase or decrease off-street parking supply. It is anticipated that in the near term WSDOT will end private lease agreement with businesses that allows off-street parking underneath east side of I-5 bridge in the Eastlake neighborhood due to the SR 520 project. Private developments in the corridor would benefit from access to RapidRide and future Link light rail stations. This transit oriented development of residential and commercial space within walking distance of public transit is consistent with the City's goals and policies related to the best use of curb space.

9.5 General Population and Employment Growth

The future transportation impacts discussed in Section 5.1, Regional Traffic and Roadways, Section 5.2, Transit System, and Section 5.3, Arterial and Local Street Operations, were based on the results of modeling that incorporates funded and approved future actions as well as projected growth that would include development in the region. Unforeseen changes to the pace and pattern of development projects could affect transit ridership and travel patterns within the study area, including traffic operations and parking near the RapidRide Roosevelt stations. These changes could affect how people access the stations. An increase in development intensity would probably be accompanied by an increase in people walking or biking to the station as nearby development occurs and planned nonmotorized facilities are implemented. If development slows, the reverse would likely occur.

9.6 Construction

Section 6, Construction, covers the impacts of RapidRide Roosevelt construction, which is currently anticipated to begin in 2022 through 2024. Based on the current project construction schedules of the projects listed in Table 2-1 ("Key Transportation Improvements Assumed in the No Build Alternative"), RapidRide Roosevelt construction would coincide with the SR 520 Bridge Replacement and HOV Program (Montlake Project, 2019-2024; SR 520/I-5 Express Lanes Connection Project 2020-2023), and the Waterfront Seattle Program. RapidRide Roosevelt construction may also occur simultaneously with construction related to the Market, Fremont, and 23rd Transit-Plus Multimodal Corridor Program projects although construction schedules for those projects are not yet published.

Depending on their construction plans for these projects, construction-related truck traffic on major roadways may coincide with RapidRide Roosevelt truck activity, increasing overall truck volumes which could impact roadway capacity and transit service reliability on affected routes. None of the concurrent projects are expected to result in roadway closures within the RapidRide Roosevelt project study area. As project designs advance, the City of Seattle would coordinate amongst its departments (for the Waterfront Seattle and Transit-Plus projects) and with WSDOT (for the SR 520 projects) to minimize concurrent construction impacts where feasible.

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Appendix A
RapidRide Roosevelt Project Transportation Technical Analysis Methodology Technical Memorandum

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DRAFT TECHNICAL MEMORANDUM

RAPIDRIDE ROOSEVELT PROJECT TRANSPORTATION TECHNICAL ANALYSIS METHODOLOGY

Prepared for

Seattle Department of Transportation

Seattle Department of Transportation

August 2018

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Tables

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Attachments

ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
FTA	Federal Transit Administration
GIS	Geographic Information System
GTFS	General Transit Feed Specification
I-	Interstate
KCM	King County Metro
LOS	Level of Service
N/A	Not Applicable
PSRC	Puget Sound Regional Council
SDOT	Seattle Department of Transportation
SR	State Route
STOPS	Simplified Trips-on-Project Software
TRB	Transportation Research Board
WSDOT	Washington State Department of Transportation

1. INTRODUCTION

This transportation technical analysis methodology technical memorandum is provided for review and comment by participating and cooperating agencies for the Seattle Department of Transportation (SDOT) RapidRide Roosevelt Project. The purpose of this memorandum is to document the methods, procedures, and assumptions that will be used for the transportation analysis. It is important for stakeholders to define and agree upon the transportation analysis methods and assumptions early in the process. This helps minimize the risk of methodology changes (and potential re-analysis) later in the environmental process, and it supports acceptance of analysis results.

The transportation analysis will assess changes to transportation operations resulting from project elements that could include changes to channelization, signal timing, curb space management, bus stop locations, pedestrian and bicycle facilities, implementation of transit signal priority, and other roadway modifications in the study area. The transportation analysis will identify and evaluate the changes resulting from project elements on the following:

- Regional transit system, including ridership and mode share
- Regional traffic, including project corridor traffic
- Transit service, including transit travel times
- Street operations, including intersection level of service and vehicular travel times
- Property access and traffic circulation, including freight
- Bicycle and pedestrian circulation along the corridor
- On- and off-street parking
- Construction activities
- Vehicular and nonmotorized safety

Travel demand, ridership modeling, and operational microsimulation will be conducted using Puget Sound Regional Council's (PSRC's) EMME-based travel demand model, the Federal Transit Administration (FTA) Simplified Trips-on-Project Software (STOPS) tool, and Vissim microsimulation software, respectively.

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2. PROJECT DESCRIPTION

SDOT and the FTA, in partnership with King County Metro (KCM), are proposing the RapidRide Roosevelt Project. The project would provide electric trolley bus rapid transit service along a 6-mile corridor between downtown Seattle and the Roosevelt neighborhood in northeast Seattle. The RapidRide Roosevelt Project would also serve the Belltown, South Lake Union, Eastlake, and University District neighborhoods.

Project improvements would only be provided north of 3rd Ave along Virginia and Stewart Streets to the northern end of the route and would include:

- Constructing 26 new RapidRide stations (13 per direction of travel) from 3rd Ave to NE 65th St with service to 9 existing stations in downtown Seattle. Stations would be identifiable as part of the RapidRide system and include real-time arrival information and off-board payment.
- New overhead contact system poles and overhead wires added north of the University Bridge to power trolley buses.
- A new traction power substation (source of electric power) in the northern portion of the project.
- A northern bus layover, where buses would park between runs.
- Protected bicycle lanes along sections of 11th/12th Avenues, Eastlake Ave, and Fairview Ave.
- Sidewalk improvements to meet Americans with Disabilities Act (ADA) accessibility requirements.
- Paving along sections of 11th and 12th Avenues NE and Eastlake Ave roadways.

No improvements are proposed along 3rd Ave south of Virginia and Stewart Streets. However, bus service would be provided using existing RapidRide stations and the existing southern layover location.

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3. STUDY AREA

Figures 1, 2, and 3 illustrate the general study area for the transportation technical analysis. Figure 1 illustrates the project alignment and study intersections, which will be used for the travel time, delay, and safety analyses. Travel time and delay will also be reported at screenlines (Figure 2 and Figure 3). All signal-controlled and major stop-controlled intersections on the corridor will be included as study intersections, as well as other nearby intersections that would be indirectly affected by changes in volume because of trips accessing the system. All intersections are in City of Seattle jurisdiction; however, the intersection of Fairview and Mercer is managed jointly by the City and Washington State Department of Transportation (WSDOT).

Transit ridership will be forecast at the regional and station levels. Vehicular travel demand will be forecast for the region, at screenlines, and on surrounding streets to measure diversion. Transit reliability and travel times, as well as travel times for general purpose traffic, will be analyzed for the corridor. Transit boardings and nonmotorized volumes will be estimated for station and immediate station areas, respectively (Figure 1). Impacts to pedestrian and bicycle facilities will be analyzed for station areas. Parking impacts will be assessed for segments along and approximately one block removed from the proposed alignment (Figure 2 and Figure 3). Circulation and access issues will be identified where appropriate based on the qualitative analysis. Freight impacts will be analyzed along those sections of the corridor identified as freight routes by the City of Seattle (see Section 7.3.7, Freight). The geographies of indirect and cumulative impacts will be analyzed as applicable.

Note that the corridor segment along 3rd Ave south of Virginia St through Downtown Seattle to the southern terminus will not be included in the transportation analysis because the project proposes no roadway configuration changes in this area and transit headways will remain unaltered.

Intersections were identified for analysis based on expected impacts of the Build Alternative (Table 1).

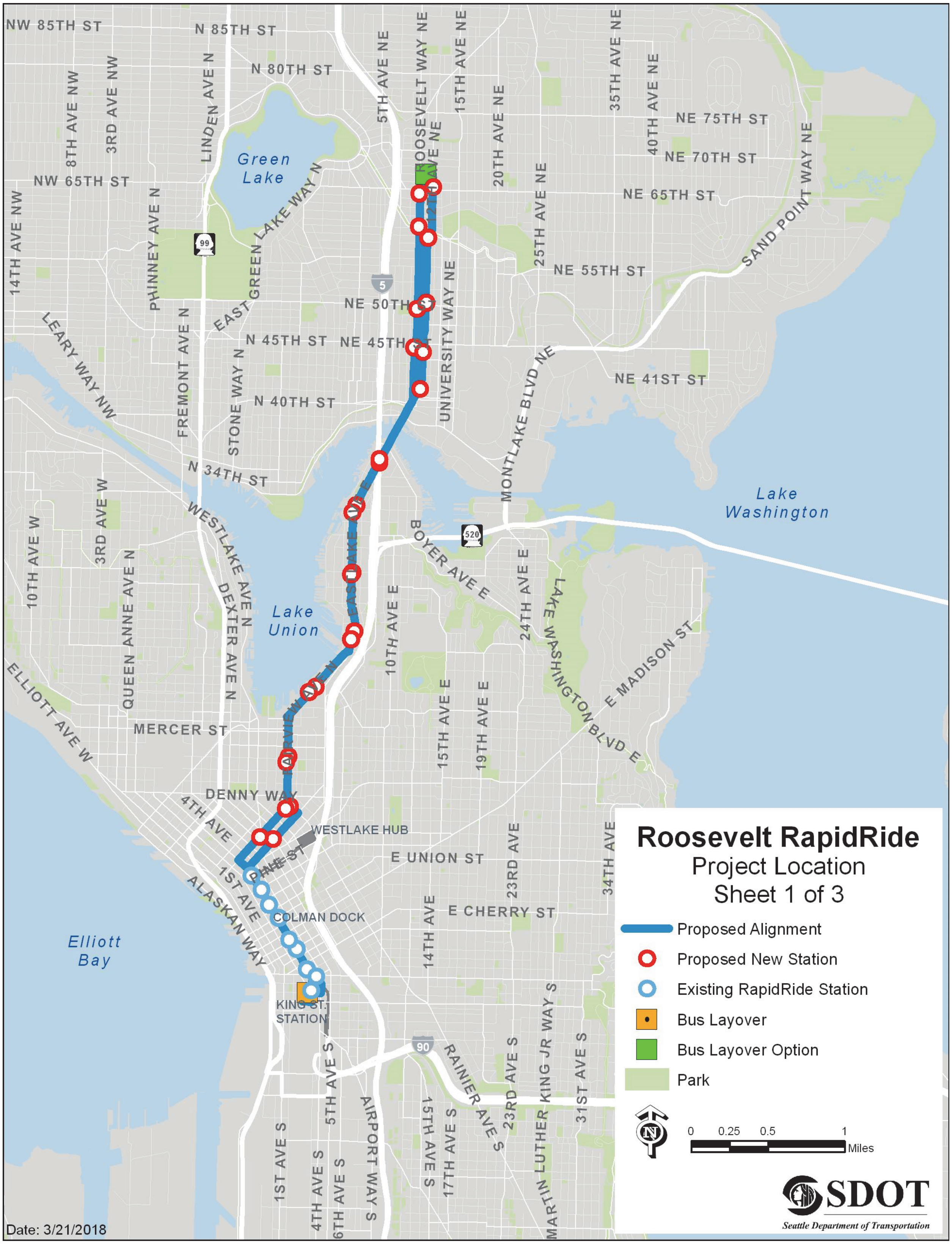

Figure 1. Study Area – Project Alignment

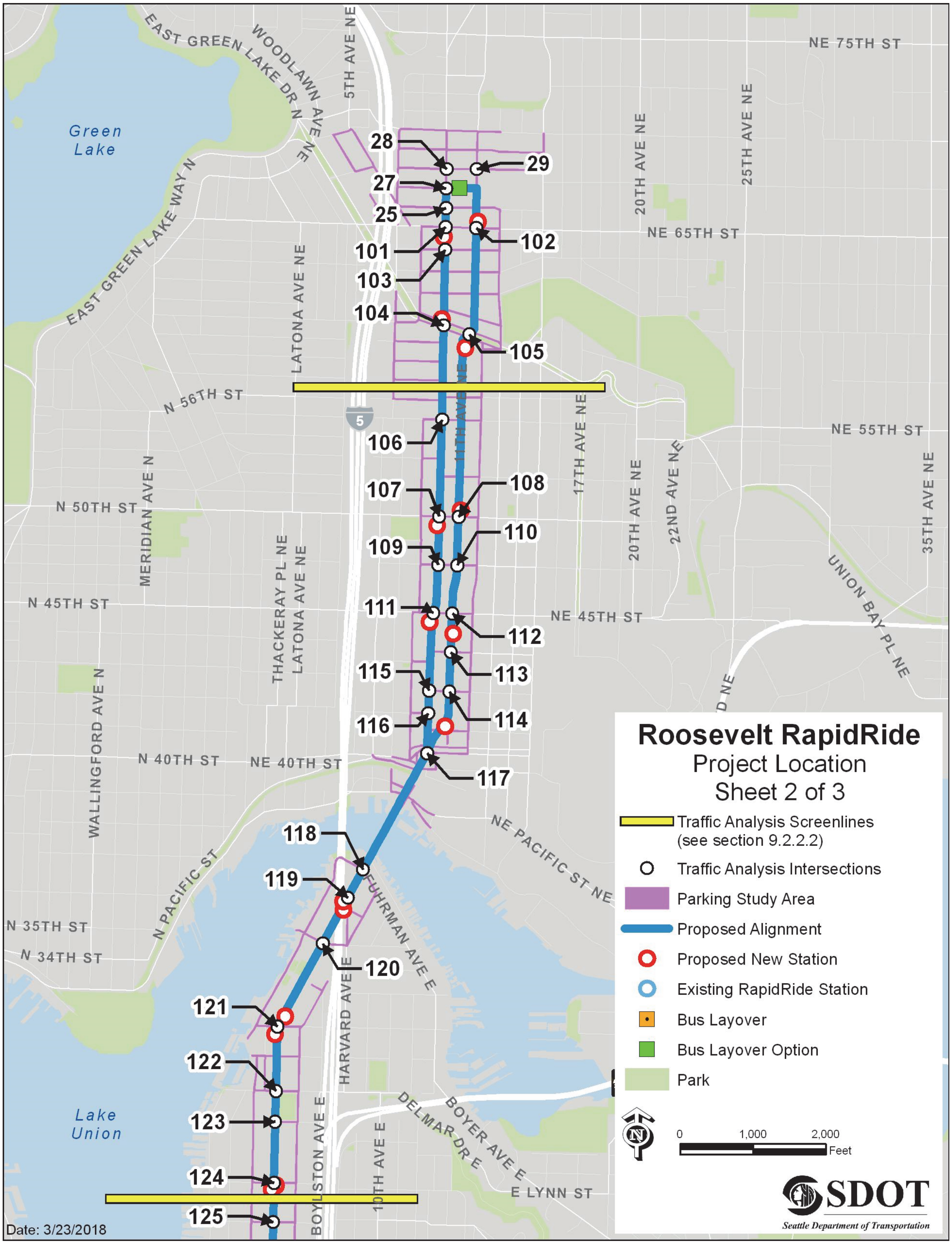

Figure 2. Study Area - North Detail

Figure 3. Study Area - South Detail

Table 1. RapidRide Roosevelt Study Intersections

INTERSECTION NUMBER	INTERSECTION NAME
25	Roosevelt Way NE and NE 66 St
27	Roosevelt Way NE and NE 67th St
28	Roosevelt Way NE and NE 68th St
29	12th Ave NE and NE 68th St
101	Roosevelt Way NE and NE 65th St
102	12th Ave NE and NE 65th St
103	Roosevelt Way NE and NE 64th St
104	Roosevelt Way NE and NE Ravenna Blvd
105	12th Ave NE and NE Ravenna Blvd
106	Roosevelt Way NE and NE 55th St (All-Way-Stop Flashing Red Beacon)
107	Roosevelt Way NE and NE 50th St
108	11th Ave NE and NE 50th St
109	Roosevelt Way NE and NE 47th St
110	11th Ave NE and NE 47th St
111	Roosevelt Way NE and NE 45th St
112	11th Ave NE and NE 45th St
113	11th Ave NE and NE 43rd St
114	11th Ave NE and NE 42nd St
115	Roosevelt Way NE and NE 42nd St (north leg)
116	Roosevelt Way NE and NE 42nd St (south leg)
117	Eastlake Ave NE and NE Campus Parkway and Roosevelt Way NE
118	Eastlake Ave E and Fuhrman Ave E
119	Eastlake Ave E and Harvard Ave E
120	Eastlake Ave E and E Allison St
121	Eastlake Ave E and E Hamlin St
122	Eastlake Ave E and E Roanoke St
123	Eastlake Ave E and E Louisa St
124	Eastlake Ave E and E Lynn St
125	Eastlake Ave E and E Boston St
126	Eastlake Ave E and E Howe St

Table 1. RapidRide Roosevelt Study Intersections

INTERSECTION NUMBER	INTERSECTION NAME
127	Eastlake Ave E and E Blaine St (Rectangular Rapid Flash Beacon)
128	Eastlake Ave E and E Garfield St
129	Fairview Ave N and Eastlake Ave E/E Galer St
130	Fairview Ave N and Yale Ave
131	Fairview Ave N and Ward St
132	Fairview Ave N and Aloha St
133	Fairview Ave N and Valley St
134	Fairview Ave N and Mercer St
135	Fairview Ave N and Republican St
136	Fairview Ave N and Harrison St
137	Fairview Ave N and Thomas St
138	Fairview Ave N and John St
139	Fairview Ave and Denny Way
140	Fairview Ave and Boren Ave
142	Boren Ave and Stewart St
143	Terry Ave and Virginia St
144	Terry Ave and Stewart St
145	9th Ave and Virginia St
146	9th Ave and Stewart St
147	8th Ave and Virginia St
148	8th Ave and Stewart St
149	7th Ave and Virginia St
150	7th Ave and Stewart St
168	7th Ave and Westlake Ave
151	Westlake Ave and Virginia St
152	6th Ave and Virginia St
153	6th Ave and Stewart St
154	Westlake Ave and Stewart St
155	5th Ave and Virginia St
156	5th Ave and Stewart St

Table 1. RapidRide Roosevelt Study Intersections

INTERSECTION NUMBER	INTERSECTION NAME
157	4th Ave and Virginia St
158	4th Ave and Stewart St
159	3rd Ave and Virginia St
160	3rd Ave and Stewart St
161	2nd Ave and Virginia St
162	2nd Ave and Stewart St
163	6th Ave and Westlake Ave
168	7th Ave & Westlake Ave

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4. TRANSPORTATION ANALYSIS FRAMEWORK

This section provides an overview of the framework used to evaluate the project's transportation impacts.

4.1 Analysis Years and Time Periods

Based on the project's schedule and available traffic forecasting data, the transportation analysis will focus on the following three time horizons:

- Existing Year: 2017
- Year of Opening: 2021
- Future Design Year: 2040. This is the proposed design year, approximately 20 years after the project's year of opening and consistent with the adopted regional forecasts by the PSRC.

In all three analysis years, the PM peak hour will be analyzed. A preliminary review of traffic volumes along the corridor with SDOT and KCM determined that the PM period generally had the highest volumes along the corridor. Therefore, the PM peak (as opposed to the AM peak) period was selected for the analysis as it will be the worst-case traffic conditions with highest traffic impacts. For the purposes of traffic operations modeling, the PM peak hour is defined as the 60 continuous minutes with the highest traffic volume between the hours of 4 and 6 PM (in this case, 5 to 6 PM was selected).

4.2 Transportation Measures

Measures for assessing the transportation elements in the region and the study area (Table 2) will be both quantitative and qualitative and will be displayed in both graphical and tabular formats. These measures are broken out into three geographic scales (regional, corridor and sub-area, and arterials and local streets) and are discussed in more detail in Section 7, Assessment Methods and Analysis Thresholds.

4.3 Scenarios to be Evaluated

The environmental analysis will include:

- Existing conditions (2017)
- No Build Alternative
- Build Alternative (Locally Preferred Alternative)

The future year of opening (2021) and design year (2040) conditions will provide points of comparison between the No Build and Build alternatives. This comparison will identify the project benefits and impacts based on the measures described in Section 7, Assessment Methods and Analysis Thresholds.

Table 2. Transportation Measures

ASSESSMENT LEVEL	TYPE OF ANALYSIS	MEASURES
Regional (Sec. 7.1)	Transit	Annual and daily transit system trips Annual transit system boardings
	Traffic	Regional roadway volumes Vehicle miles traveled
Corridor and Sub-Area (Sec 7.2)	Transit	Annual and daily project ridership Transit travel times Transit reliability
	Traffic	PM peak hour vehicle volumes Mode share General purpose traffic travel times Person throughput
Arterials and Local Streets (Sec 7.3)	Transit	Daily bus stop boardings Bus routing changes Transit service level changes Bus layover
	Property Access/ Circulation	Property access Traffic circulation
	Intersection Operations	PM peak hour intersection level of service PM peak hour intersection delay
	Safety	Collisions Safety impacts
	Parking	Occupancy Supply impacts
	Nonmotorized	Existing and planned pedestrian system Sidewalk maintenance condition Crossing features Existing and planned bikeways Pedestrian and bicycle volumes
	Freight	Freight travel times Freight access
	Construction	Qualitative assessment of construction impacts
Indirect Effects (Sec. 7.4)	Indirect Effects	Qualitative assessment of changes to mobility and access due to project-related land use changes
Cumulative Effects (Sec. 7.5)	Cumulative Effects	Qualitative assessment of the incremental impacts of all the project's effects

5. DATA NEEDS AND SOURCES

A variety of data will be collected and assembled to analyze the transportation-related effects of the alternatives. These data sets will include the following:

- Existing 2017 peak-period turning-movement counts will be taken at the intersections identified in Table 1. The counts will include automobiles, trucks, pedestrians, and bicyclists.
- Physical characteristics of the existing street system, including functional use, lane geometry, traffic signal timing and phasing patterns, and other parameters necessary to conduct traffic operations analysis (such as the proximity of stations, speed limits, transit signal priority, presence of on-street parking, etc.) will be identified. Where available, these data will be obtained from the City of Seattle and KCM and field-verified as appropriate.
- Travel times along several segments of the study corridors, obtained from INRIX, will be used for the Vissim model calibration. The data will be collected between 4 and 6 PM in 15-minute intervals on three weekdays of May 2017. These data will be supplemented by field visits by team analysts.
- Existing signal timings will be obtained from SDOT staff and from a Synchro model provided by a previous corridor effort (CDM Smith, 2015).
- On- and off-street public parking supply and weekday parking utilization survey data will be collected where the alignment might have direct impacts on parking. Data will be obtained from the City of Seattle and augmented by field visits where appropriate. Future parking utilization will not be estimated.
- Pedestrian and bicycle volumes will be collected at the intersections identified in Table 1.
- Existing and planned pedestrian and bicycle facilities within an approximately 0.5-mile radius of the corridor will be inventoried by available information from agencies (such as geographic information system [GIS] data). This distance was chosen to reflect a 10-minute walk (a common metric in transit walkshed analyses) and to capture bicycle facilities that could be involved in bicycle access to transit. The general sidewalk condition immediately surrounding bus stop areas will be qualitatively assessed.
- Existing transit route and stop information in the study area will be obtained from the local and regional transit agencies. This task includes information on selected routes that serve the project corridor. The bus route information includes service areas, hours of service (including schedule/frequency), and passenger load.
- Collision data for a 5-year period (2011 through 2016) will be obtained from the City of Seattle for the study area intersections (signalized and unsignalized) and along the study corridor. Numbers of crashes and severity will be reported for intersections and midblock segments for vehicles, pedestrians, and cyclists.
- Existing truck routes will be identified, and truck volume data will be collected at the intersections to be studied.

- Local, regional, and state agency transportation improvement plans/capital improvement programs or transportation facilities plans, and other planned improvements in proximity to the study corridor with known schedules will be reviewed and summarized. This effort includes identifying all “committed” improvements assumed for the Build and No Build alternatives.
- Regional transit network route and schedule information coded in the General Transit Feed Specification (GTFS) format from all transit agencies operating service in the region will be collected for transit ridership forecasting.
- Automated passenger counter data from KCM for all routes operating in the project study area will be collected for the spring 2017 period.
- Automatic vehicle location data from KCM for selected routes operating in the project study area (#67 and #70) will be collected for portions of the years 2016 and 2017.
- The ADA-compliance status of curb ramps along the project alignment will be supplied by SDOT.
- Records of openings for the University Bridge covering the year 2017.

6. TRANSPORTATION ANALYSIS TOOLS AND PARAMETERS

6.1 Travel Demand Forecasting

This section describes the software tools that will be used to generate estimates of roadway and transit travel demand.

6.1.1 Roadway Travel Demand Forecasts

The highway model that will be used to prepare underlying travel demand forecasts is the most current version of the PSRC 4K model. Version 4.05 will be used, and was provided by PSRC in April 2017. The model base year is 2014; model results will be used as a baseline for growth rate calculations used in future conditions analysis. The model will be used to provide travel pattern and volume information, as well as input for other environmental disciplines including environmental justice analysis. It will also provide travel time information that will be used in transit ridership forecasting.

6.1.1.1 Existing Condition

The base year model was run as provided by PSRC.

6.1.1.2 2021 No Build Condition

Since no network or inputs currently exist for the PSRC model for the project's opening in 2021, model runs for 2025 will be completed for use along with the 2014 base year to interpolate 2021 PM peak hour trip tables, using the following steps:

- Modify the 2025 PSRC highway model network to remove projects that are not completed in 2021 but are included in the 2025 network to allow for the appropriate representation of 2021 conditions. Table 3 lists the modifications that were made to the 2025 highway network to develop the 2021 network, and Attachment A contains a complete list of network assumptions. In addition to specific larger-scale projects, project corridor links will be reviewed to ensure that any lane changes or capacity improvements that should not be in place by 2021 are removed to ensure the accuracy of the No Build network. The 2025 PSRC model that was provided for use initially includes trip suppression that was incorporated to account for regionwide tolling, but this results in a decline in vehicle trips from 2014 to 2025. Because regional tolling or tolling of Interstate (I) 5 has not been authorized by the state Legislature and is unlikely by 2021, trip ends that reflected conditions without trip suppression were provided by PSRC for use in the model runs. This model does include tolling of State Route (SR) 520 and I-405.
- Interpolate PM peak hour trip tables between 2014 and 2025 from the PSRC model to create 2021 trip tables.
- Run PM peak hour assignments to create 2021 vehicle demand for the No Build condition.

For a list of projects included in the 2021 No Build Condition, see Appendix A.

Table 3. Highway Network Modifications to 2025 Model Year to Create 2021 Network

FACILITY	2014 EXISTING	2021 NO BUILD	2021 BUILD
I-405: Renton to Bellevue Project SR 169 to I-90	In most cases, there are two lanes in each direction.	Reduced number of lanes to match the existing condition.	Reduced number of lanes to match the existing condition.
SR 167 Tacoma to Edgewood New Freeway Construction Project	Does not exist.	Removed from 2025 network.	Removed from 2025 network.
SR 509 Corridor Completion and Freight Improvement Project	Does not exist.	Removed from 2025 network.	Removed from 2025 network.
Corridor Local Facilities	Not applicable.	Removed lanes as needed to reflect existing conditions in corridor.	Modified lanes to reflect lane channelization plans/business access and transit lanes as defined by the project team.

6.1.1.3 2021 Build Condition

The 2021 Build network was coded to reflect changes on top of the 2021 No Build network with adjustments to lane configuration and capacity changes that would be in place with the inclusion of the project in the Roosevelt corridor.

6.1.1.4 2040 No Build Condition

For the year 2040, PSRC provided all model inputs needed to run the travel demand model. For the purpose of this analysis and to be consistent with modeling completed for 2014 and 2025, tolling is not assumed.

Network modifications will be made to reflect any lane changes or capacity improvements that should not be in place as part of the No Build network, and PM peak period assignments will be completed using trip tables from the full four-step PSRC model run.

For a list of projects included in the 2040 No Build condition, see Attachment A.

6.1.1.5 2040 Build Condition

The 2040 Build condition begins with the 2040 No Build network. The network will be modified to reflect changes to roadway channelization and the transit network as a result of the project, and the assignments will be re-run.

6.1.1.6 Assumptions and Input Data

Current and future population and employment data include:

- Current: 2014 base year, interpolated to estimate 2017 conditions
- Future: PSRC Land Use Vision 2 (LUV.2) forecasts, released in 2017

6.1.1.7 Construction Condition Forecasts

The effect of construction on traffic operations will be evaluated qualitatively. See Section 7.3.8, Construction.

6.1.1.8 Post-Processing

Traffic forecasting for a traffic analysis is developed by taking the predicted travel demand volumes from the PSRC model and post-processing them using the National Cooperative Highway Research Program 765 – Analytical Travel Forecasting Approaches for Project-Level Planning and Design methodology. This allows raw traffic volumes and model volumes to be converted into future forecast volumes, which are more suitable for planning, operational studies, and design of new facilities. Post-processed forecast volumes will be used for the analysis of the 2021/2040 No Build and Build conditions. Volume imbalances between intersections will be addressed through manual adjustments of individual turning movements, or through balancing at mid-block access points. Volumes will be rounded to the nearest five vehicles for each intersection movement value.

6.1.2 Transit Travel Demand

Transit ridership forecasts will be generated using the FTA STOPS, version 2.01. STOPS will be used to forecast average weekday transit boardings and trips, both for the regional transit network and for the project specifically, in the opening year (2021) and the horizon year (2040). STOPS forecasts for project ridership will also be used to estimate ridership by station.

The underlying population and employment forecasts that will be used in the STOPS model are based on demographic estimates provided by PSRC for 2014 and for a 2035 horizon year. For the purposes of this analysis, the 2035 horizon year will be used as a proxy for 2040 and will be reported as such. This allows the analysis to be consistent with the FTA Small Starts application and represents a conservative approach to ridership estimation.

The 2016 current year baseline uses 2014 land use and demographic data, which is the most up-to-date version available from PSRC, the region’s Municipal Planning Organization, and is reflective of PSRC’s Land Use Vision set of demographic information. Opening-year demographic data will be interpolated between the current year and horizon year estimates provided by PSRC.

Existing and future transit networks in STOPS were developing using spring 2017 GTFS data. Changes necessary to develop the future No Build and Build scenarios were identified in consultation with KCM staff (Table 4). The changes include revisions that are reasonably foreseeable and are likely to influence ridership in the project corridor; they do not necessarily include all the changes that would be necessary to implement the *METRO CONNECTS* long-range plan (KCM, 2016), since many are not yet committed. This yields a conservative estimate of potential project ridership.

Through the development of the STOPS model, the project team coordinated with FTA to ensure the model was built upon the most current information and best practices to forecast ridership in the corridor. As previously mentioned, this model was enhanced from previous versions of the STOP model by incorporating, at the time of model development, the most recent GTFS files to better calibrate and forecast the Link system as well as streetcar operations in the downtown area. This was conducted by utilizing recent transit ridership in the area, including boarding information at the new Capitol Hill, Angle Lake, and University Washington LRT stations. Finally, in an effort to present a conservative estimate of ridership, the RapidRide service was coded in the model as a standard bus service rather than a premium transit service so that the model would rely on performance (travel time) rather than other factors such as visibility.

Table 4. Transit Network Modifications to Existing

ROUTE	EXISTING	2021 NO BUILD	2021 BUILD	2040 NO BUILD	2040 BUILD
Downtown Seattle Transit Tunnel	N/A	Exclusive rail operations			
Link Light Rail Angle Lake - University of Washington	Existing light rail service between Angle Lake and University of Washington	N/A	N/A	N/A	N/A
Link Light Rail Angle Lake – Northgate	N/A	6-minute peak and 10-minute off-peak headways	6-minute peak and 10-minute off-peak headways	Line replaced by ST3 system	Line replaced by ST3 system
Link Light Rail Ballard - Tacoma via new Downtown Seattle Transit Tunnel	N/A	N/A	N/A	6-minute peak and 10-minute off-peak headways	6-minute peak and 10-minute off-peak headways
Link Light Rail Everett - West Seattle	N/A	N/A	N/A	6-minute peak and 10-minute off-peak headways	6-minute peak and 10-minute off-peak headways
Link Light Rail Lynnwood - Downtown Redmond	N/A	N/A	N/A	6-minute peak and 10-minute off-peak headways	6-minute peak and 10-minute off-peak headways
KCM Routes 41, 74, 76, 77, 316, and 522	Existing transit service	Routes either truncated or eliminated	Routes either truncated or eliminated	Routes either truncated or eliminated	Routes either truncated or eliminated
KCM Route 49	Existing transit service	Eliminated with opening of 36_49 RapidRide service	Eliminated with opening of 36_49 RapidRide service	Eliminated with opening of 36_49 RapidRide service	Eliminated with opening of 36_49 RapidRide service
KCM Route 36	Existing transit service	Eliminated with opening of 36_49 RapidRide service	Eliminated with opening of 36_49 RapidRide service	Eliminated with opening of 36_49 RapidRide service	Eliminated with opening of 36_49 RapidRide service
RapidRide Route 1064	N/A	RapidRide Service from Othello to University District	RapidRide Service from Othello to University District	RapidRide Service from Othello to University District	RapidRide Service from Othello to University District

Table 4. Transit Network Modifications to Existing

ROUTE	EXISTING	2021 NO BUILD	2021 BUILD	2040 NO BUILD	2040 BUILD
KCM Routes 111, 114, 210, 212, 214, 215, 216, 217, 218, 219	Existing transit service	Existing transit service	Existing transit service	Routes either truncated or eliminated with East Link Light Rail	Routes either truncated or eliminated with East Link Light Rail
Sound Transit Routes 550, 554	Existing transit service	Existing transit service	Existing transit service	Routes either truncated or eliminated with East Link Light Rail Extension	Routes either truncated or eliminated with East Link Light Rail Extension
Community Transit Routes 402, 405, 410, 412, 413, 415, 416, 417, 421, 422, 424, 425, 435	Existing transit service	Existing transit service	Existing transit service	Routes either truncated or eliminated with Lynnwood and Everett Light Rail Extensions	Routes either truncated or eliminated with Lynnwood and Everett Light Rail Extensions
Sound Transit Routes 510, 511, 512, 513	Existing transit service	Existing transit service	Existing transit service	Routes either truncated or eliminated with Lynnwood and Everett Light Rail Extensions	Routes either truncated or eliminated with Lynnwood and Everett Light Rail Extensions
Madison Bus Rapid Transit/RapidRide G	Not open until 2019	6-minute peak and midday headways, 10-minute evening headways	6-minute peak and midday headways, 10-minute evening headways	6-minute peak and midday headways, 10-minute evening headways	6-minute peak and midday headways, 10-minute evening headways
KCM Route 11	15-minute headways	Reduced to 30-minute headways	Reduced to 30-minute headways	Reduced to 30-minute headways	Reduced to 30-minute headways
KCM Route 12	10-minute headways	Service shifted to Pike St/Pine St west of 16th Ave, reduced to 30-minute headways	Service shifted to Pike St/Pine St west of 16th Ave, reduced to 30-minute headways	Service shifted to Pike St/Pine St west of 16th Ave, reduced to 30-minute headways	Service shifted to Pike St/Pine St west of 16th Ave, reduced to 30-minute headways
Center City Connector Streetcar	Not open until 2020	5-minute peak headways, 7.5-minute off-peak headways	Service shifted to Pike St/Pine St west of 16th Ave, reduced to 30-minute headways	Service shifted to Pike St/Pine St west of 16th Ave, reduced to 30-minute headways	Service shifted to Pike St/Pine St west of 16th Ave, reduced to 30-minute headways

Table 4. Transit Network Modifications to Existing

ROUTE	EXISTING	2021 NO BUILD	2021 BUILD	2040 NO BUILD	2040 BUILD
KCM Route 99	Existing transit service	Route eliminated	Route eliminated	Route eliminated	Route eliminated
KCM Route 120	Existing transit service	Existing transit service	Existing transit service	Route eliminated with opening of Delridge RapidRide	Route eliminated with opening of Delridge RapidRide
Delridge RapidRide H	N/A	N/A	N/A	Routed to 3rd Ave via Columbia St northbound, RapidRide service	Routed to 3rd Ave via Columbia St northbound, RapidRide service
KCM Routes 21, 37, 55, 56, 57, 113, 121, 123, and 125, and RapidRide C	Existing transit service	Rerouted to 3rd Ave via Columbia St	Rerouted to 3rd Ave via Columbia St	Rerouted to 3rd Ave via Columbia St	Rerouted to 3rd Ave via Columbia St
KCM Route 8	Existing transit service	Rerouted off Denny Way to Fairview Ave/Harrison St west of Fairview Ave through South Lake Union	Rerouted off Denny Way to Fairview Ave/Harrison St west of Fairview Ave through South Lake Union	Rerouted off Denny Way to Fairview Ave/Harrison St west of Fairview Ave through South Lake Union	Rerouted off Denny Way to Fairview Ave/Harrison St west of Fairview Ave through South Lake Union
KCM Route 40	Existing transit service	Existing transit service	Existing transit service	Route eliminated with opening of Fremont RapidRide	Route eliminated with opening of Fremont RapidRide
RapidRide Fremont	N/A	N/A	N/A	RapidRide Service	RapidRide Service
KCM Route 44	Existing transit service	Existing transit service	Existing transit service	Route eliminated with opening of Market/45th RapidRide	Route eliminated with opening of Market/45th RapidRide
Market/45th RapidRide	N/A	N/A	N/A	RapidRide Service	RapidRide Service
KCM Route 7	Existing transit service	Route eliminated with Rainier RapidRide	Route eliminated with Rainier RapidRide	Route eliminated with Rainier RapidRide	Route eliminated with Rainier RapidRide

Table 4. Transit Network Modifications to Existing

ROUTE	EXISTING	2021 NO BUILD	2021 BUILD	2040 NO BUILD	2040 BUILD
RapidRide Rainier	N/A	New RapidRide Service	New RapidRide Service	New RapidRide Service	New RapidRide Service
KCM Route 48	Existing Transit Service	Existing Transit Service	Existing Transit Service	Route eliminated with opening of 23rd RapidRide	Route eliminated with opening of 23rd RapidRide
23rd RapidRide	N/A	N/A	N/A	RapidRide Service	RapidRide Service
KCM Route 71	Existing transit service	Route eliminated	Route eliminated	Route eliminated	Route eliminated
KCM Route 73	Existing transit service	Extended north to city of Shoreline, 15-minute headways	Extended north to city of Shoreline, 15-minute headways	Extended north to city of Shoreline, 15-minute headways	Extended north to city of Shoreline, 15-minute headways
KCM Route 67	Existing transit service	Existing transit service	Existing transit service	Existing transit service	Existing transit service
KCM Route 70	Existing transit service	Rerouted to University District Station	Route deleted	Rerouted to University District Station	Route deleted
RapidRide Roosevelt	Does not exist	Does not exist	RapidRide service to Roosevelt Station	Does not exist	RapidRide service to Roosevelt Station

N/A = not applicable

ST3 = Sound Transit 3

6.2 Traffic Operations Analysis

To assess corridor and intersection operations, the traffic microsimulation analysis tool Vissim (version 8.00-15) will be used. Operational parameters and assumptions for Vissim are listed in Table 5. The 2017 existing Vissim model will be calibrated and validated based on guidelines presented in the Federal Highway Administration's *Traffic Analysis Toolbox Volume III* (2004) and *WSDOT Vissim Protocol* (WSDOT, 2014). These guidelines provide specific direction on issues like network coding, model adjustments, analysis methods, and assumptions.

Two primary measures of effectiveness will be used to validate the Vissim model: throughput volumes at key intersections (traffic counts versus model throughput volumes) and travel times along several segments of the study corridors (field-measured versus model).

Table 5. Vissim Operations Parameters/Assumptions

PARAMETER	EXISTING YEAR 2017	YEAR 20213	YEAR 2040
Time period (includes seeding interval)	1.5 hours: 4:30 – 6 PM	Same as existing year model	Same as existing year model
Time steps/second	10 time steps/second	Same as existing year model	Same as existing year model
Number of random seeds	10	Same as existing year model	Same as existing year model
Vehicle acceleration and deceleration	Vissim default parameters	Same as existing year model	Same as existing year model.
Traffic composition	Based on existing traffic data	Based on forecast results and post-processed	Based on forecast results and post-processed
Routing decisions	Static routes based on turning movement counts	Same as existing year model	Same as existing year model
Percent heavy vehicles	From existing counts	Same as existing year model	Same as existing year model
Seeding interval	30 minutes (1,800 seconds)	Same as existing year model	Same as existing year model
Driving behavior and car following	Wiedemann 74, additional changes may occur during calibration	Same as existing year model	Same as existing year model
Volume interval	15-minute intervals	Same as existing year model.	Same as existing year model.
Signal timings	From SDOT's Signal Timing Plans or previously developed Synchro model used for previous corridor study effort	Same as existing but splits and offsets optimized	Same as existing but splits and offsets optimized
Adaptive signal systems and transit signal priority	Not present in corridor	Assume up to 10 % benefit in transit travel time (Section 7, Assessment Methods and Analysis Thresholds)	Assume up to 10 % benefit in transit travel time (Section 7)
Bus stop dwell times	Based on existing automatic vehicle location data provided by KCM (fall 2016)	Based on calculation of off-board fare payment benefits	Based on calculation of off-board fare payment benefits

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7. ASSESSMENT METHODS AND ANALYSIS THRESHOLDS

This section describes how analysis tool outputs and the results of other data-collection efforts will be interpreted to determine the effects of the No Build and Build alternatives (which include the alignment and bus stop locations). The transportation analysis that will be presented in the Transportation chapter of the Environmental Assessment, and the supporting Transportation Technical Report will be divided into three levels: Regional, Corridor and Sub-Area, and Arterials and Local Streets. Within these three levels a variety of measures will be analyzed and documented.

Table 2 (in Section 4, Transportation Analysis Framework) provides a summary list of the transportation analysis measures by assessment level.

7.1 Regional Transportation System

7.1.1 Regional Transit

7.1.1.1 Evaluation Criteria

- **Annual and daily transit trips:** The number of linked transit trips taken per year and per day on the regional transit system.
- **Annual transit system boardings:** The number of unlinked transit boardings on the regional transit system.

7.1.1.2 Evaluation Approach

The FTA STOPS model will be used to produce data related to regional transit forecasts associated with the Build Alternative for the four-county region (King, Pierce, Kitsap, and Snohomish). The model will be coded to reflect the Build Alternative and then run to produce summary data tables. Ridership data will be provided as direct outputs from the ridership model. The change in overall transit trips and boardings will be reported for the regional transit system.

7.1.2 Regional Traffic

7.1.2.1 Evaluation Criteria

- **Traffic growth rate**: The annual growth rate for vehicle traffic on regional facilities in the study area that are affected by the project.
- **Vehicle miles traveled**: The change in total average daily vehicle miles traveled on the regional highway system between No Build and Build.

7.1.2.2 Evaluation Approach

The FTA STOPS model produces an estimate of travel changes that are the result of the implementation of the project (Build minus No Build) based on specifically where new transit trips are added to the system with the project. Passenger miles are calculated using trip lengths within the model on a district-to-district basis (production/attraction) to arrive at the total change in automobile person miles of travel with the project. An average automobile occupancy rate of 1.15 is applied to convert this value to vehicle miles traveled. Traffic growth rate on regional roadways will be estimated using the PSRC travel demand forecast model.

7.2 Corridor and Sub-Area System

7.2.1 Transit

7.2.1.1 Evaluation Criteria

- **Annual and daily project transit ridership**: Daily project trips on the Roosevelt RapidRide line for the Build Alternative. A project trip is defined as any trip that is to/from or through a project station. For this analysis there will be no through trip component since all trips will have a boarding or alighting at a project station. For the No Build Alternative, daily trips on Route 70 will be estimated. The number of new riders will also be estimated based on the number of systemwide transit riders between the No Build and Build conditions using the FTA Stops Model. Annual ridership estimates on the project will be produced using an annualization factor established from current ridership, consistent with other Seattle region RapidRide services.
- **Transit travel times**: Transit travel times along the corridor will be documented for the existing conditions using GTFS data and estimated for the future conditions (Table 6).

Table 6. Travel Time Segments

STREET	DIRECTION	EXTENT
Virginia St	Eastbound	2nd Ave to Westlake Ave
Virginia St/Fairview Ave N	Eastbound	Westlake Ave to Fairview Ave N/Denny Way
Fairview Ave N	Northbound	Denny Way to Mercer St
Eastlake Ave E	Northbound	Mercer St to Fairview Ave N
Eastlake Ave E	Northbound	Fairview Ave to E Howe St
Eastlake Ave E	Northbound	E Boston St to E Roanoke St
Eastlake Ave E	Northbound	E Roanoke St to Fuhrman Ave E
Eastlake Ave NE/11th Ave NE	Northbound	Fuhrman Ave E to NE 45th St
11th Ave NE	Northbound	NE 45th St to NE 50th St
11th Ave NE	Northbound	NE 50 St to Ravenna Blvd
12th Ave NE	Northbound	Ravenna Blvd to NE 68th St
Roosevelt Way NE	Southbound	NE 68th St to Ravenna Blvd
Roosevelt Way NE	Southbound	Ravenna Blvd to NE 50th St
Roosevelt Way NE	Southbound	NE 50th St to NE 45th St

Table 6. Travel Time Segments

STREET	DIRECTION	EXTENT
Eastlake Ave E/Roosevelt Way NE	Southbound	NE 45th St to Fuhrman Ave E
Eastlake Ave E	Southbound	Fuhrman Ave E to E Roanoke St
Eastlake Ave E	Southbound	E Roanoke St to E Boston St
Eastlake Ave E	Southbound	E Howe St to Fairview Ave N
Fairview Ave E	Southbound	Eastlake Ave E to Mercer St
Fairview Ave E	Southbound	Mercer St to Denny Way
Fairview Ave N/Boren Ave/Stewart St	Southbound/Westbound	Denny Way to Westlake Ave
Stewart St	Westbound	Westlake Ave to 2nd Ave

7.2.1.2 Evaluation Approach

As described previously, the FTA STOPS model will be used to produce ridership data related to the RapidRide Roosevelt corridor. Total daily ridership will be estimated, and PM peak period ridership will be calculated off-model based on existing diurnal percentages from RapidRide routes in service today. The assumptions used for the FTA STOPS model forecasting are listed in Section 7.1.1, Regional Transit. The Vissim models will be used to estimate transit travel times for the project in the future years.

7.2.2 Traffic

7.2.2.1 Evaluation Criteria

- **PM peak hour vehicle and person throughput**: The number of vehicles and persons crossing the analysis screenlines between 5 and 6 PM, including persons in general purpose and transit vehicles.
- **Mode share**: The percent of all trips that are taken by automobile trips and by transit
- **General purpose traffic travel times**: The amount of time in minutes that it takes general purpose traffic to travel across given segments of the corridor
- **Diversion**: The magnitude and location of traffic shifts in the corridor for the PM peak (5 to 6 PM) assignment between the No Build and Build conditions.

7.2.2.2 Evaluation Approach

The analysis of volumes and mode share will involve comparing traffic conditions on the highway and local street system at selected screenlines for each alternative. Screenlines are imaginary lines drawn across one or more roadways to compare aggregate changes in traffic conditions. The screenline comparisons will provide a snapshot of travel conditions at these locations along the corridor.

A map and table will be used to present data for the following screenlines, which were selected based on an assessment of traffic patterns, volumes, corridor characteristics, and input from SDOT staff:

- Screenline 1 – North of NE 55th St
- Screenline 2 – South of Lynn St
- Screenline 3 – South of Mercer St

Information for each screenline will be generated from the project's PSRC model in conjunction with the FTA STOPS model and will include PM peak hour and daily values. Person throughput will be calculated at screenlines based on current and forecast transit and traffic volumes, forecast auto occupancy rates, and projected transit loads. As part of the evaluation SDOT will coordinate with WSDOT if there are intersections where operations would affect access to and from I-5.

Travel times will be modeled using Vissim for the segments listed in Table 6.

Diversion will be reported for affected roadways along the segment, the extent of which will vary based on analysis results.

7.3 Arterial and Local Streets System

7.3.1 Transit

7.3.1.1 Evaluation Criteria

- **Daily bus stop boardings**: Daily boardings at each project stop for the Build Alternative will be produced from the FTA STOPS model.
- **Bus routing changes:** Potential changes to bus service or electric trolley bus routing resulting from the project will be identified with the 2021 and 2040 Build conditions. These changes could result from service duplication or new transit service network concepts allowed by RapidRide Roosevelt service.
- **Transit service level changes**: RapidRide in the Roosevelt corridor will serve new areas, provide increased service levels over current Route 70 service, and provide infrastructure improvements to increase transit speed. Changes in transit service levels, ridership, and speed with the introduction of RapidRide Roosevelt service will also affect passenger loads in the corridor. The following measures will be evaluated for comparison between Route 70 service and RapidRide Roosevelt service in the opening and future horizon years (2021 and 2040):
  - Service frequency: daily and PM peak hour (buses per hour by time of day)
  - Hours of service: daily service span
  - Passenger load: average PM peak hour passenger load per coach at screenlines identified on Figure 2 and 3 and in Section 7.2.2, Traffic
- **Bus layover:** RapidRide Roosevelt service will change layover capacity needs at both the northern and southern termini of the route relative to the current Route 70 service. The project will also change the location of the northern terminus and its associated layover

facilities. Changes to bus layover between Route 70 service and RapidRide Roosevelt service in the opening and design years will be evaluated based on the following:

  - Capacity: Number of bus spaces needed at each layover site during the PM peak hour based on proposed operating plan.
  - Impacts of layover site alternatives on existing right-of-way: In addition to the impacts below, the influence of layover changes may also be reflected in the analyses for Property Access and Local Circulation, and Parking and Loading.
  - Impacts to operation of other transit routes: Changes to routing for other transit service resulting from layover changes.
  - Impacts on layover availability for other transit routes: Where layover needs for RapidRide Roosevelt service overlap with layover space currently used by other transit service, the potential impacts on layover availability for other routes will be described.

- **Transit Reliability**: The effects of reliability-enhancing project features including transit-signal priority and off-board fare payment will be qualitatively assessed.

7.3.1.2 Evaluation Approach

Daily Bus Stop Boardings

Daily boardings at each project station will be reported based on FTA STOPS model forecasts.

Bus Routing Changes

Expected changes in transit service under the Build Alternative will be identified and compared to the transit service under No Build conditions. These changes will be based on the project definition, the *METRO CONNECTS* long-range transit plan for King County (2016), and in consultation with KCM service planners.

Transit Service Level Changes and Passenger Loads

The transit quality of service assessment will analyze the expected project effects on the existing and future bus services within the study area using both qualitative and quantitative data. The approach will follow the methodology and guidelines presented in the Transit Capacity and Quality of Service Manual (TRB, 2010). Key inputs will include the project's proposed operating plan and projected ridership from the FTA STOPS model. Existing transit service headways and spans of service are assumed to remain unchanged in the No Build scenario.

Bus Layover

Analysis of potential layover locations and number of layover spaces needed to support the RapidRide corridor will be based on Vissim-modeled peak-hour transit travel times and KCM's standards for layover and recovery ratios. Potential changes to bus routing and layover availability for other routes will also be summarized qualitatively.

Transit Reliability

Expected changes in transit service reliability under the Build Alternative will be compared to current operating performance and consider anticipated future changes to traffic conditions and operation of other transit routes. A qualitative analysis of reliability will consider changes to transit and traffic operations proposed as part of the RapidRide Roosevelt Project, including adaptive signals, transit signal priority, transit lanes, and offboard fare payment. The transit reliability implications of University Bridge openings will be assessed with a combination of qualitative and quantitative data. If impacts are identified, measures would be implemented to minimize effects on transit service reliability to the extent feasible.

7.3.2 Property Access and Local Circulation

7.3.2.1 Evaluation Criteria

- **Property access**: Qualitative assessment of locations where project-related changes would affect access to properties, including freight access.
- **Traffic circulation**: Qualitative assessment of roadway segments and intersections along the proposed alignment where project-related changes would affect traffic patterns.

7.3.2.2 Evaluation Approach

This evaluation will assess local area traffic circulation impacts including access to properties affected by the Build Alternative. The focus will be on impacts during both project construction and operations. The project design will be reviewed for such changes as the effects of potential street closures on local circulation, changes to turning movements at intersections, and changes in property access, such as prohibition of left turns from driveways.

7.3.3 Intersection Operations

7.3.3.1 Evaluation Criteria

- **PM peak hour intersection level of service (LOS)**: LOS is a measurement of intersection operation based on control delay. LOS is reported as letter grades A (low delay per vehicle, favorable traffic progression) through F (high delay per vehicle, could involve long queues).

Table 7 defines LOS for signalized and unsignalized intersections. LOS will be calculated for the PM peak hour, defined here as the 60-minute interval with the highest volumes between 4 and 6 PM (5 – 6 PM in the case of this analysis).

Table 7. Level of Service Definitions for Signalized and Unsignalized Intersections

LOS	AVERAGE CONTROL DELAY (SECONDS PER VEHICLE)		TRAFFIC FLOW CHARACTERISTICS
	SIGNALIZED INTERSECTIONS	UNSIGNALIZED INTERSECTIONS	
A	<10	<0	Virtually free flow; completely unimpeded.
B	>10 and <20	>10 and <15	Stable flow with slight delays; less freedom to maneuver.
C	>20 and <35	>15 and <25	Stable flow with delays; less freedom to maneuver.
D	>35 and <55	>25 and <35	High-density but stable flow.
E	>55 and <80	>35 and <50	Operating conditions at or near capacity; unstable flow.
F	>80	>50	Forced flow; breakdown conditions.

Source: TRB, 2010

For both criteria, outputs for signalized intersections will be based on the average delays for all motorists using the intersection. For unsignalized intersections, the result is based on the worst operating movement, which is typically on the minor street (i.e., stop) approaches. For all-way stop-controlled intersections, average intersection delay is reported. Queue lengths will be qualitatively evaluated to inform the project design. Also, queue lengths will be qualitatively discussed for the intersections operating at LOS F.

7.3.3.2 Evaluation Approach

Parameters, Assumptions, and Thresholds

Intersection delay and LOS will be reported from Vissim models. Default assumption values for the analysis will be developed for intersections where actual values are not available. These will include assumptions with respect to saturation flow rates, geometry, traffic, and signalization conditions. Table 5 in Section 6.2, Traffic Operations Analysis, provides assumptions for existing and future year (No Build and Build alternatives) input values and assumptions when data are not available. Changes in LOS will be evaluated to determine the degree of impact and the need for potential mitigation.

The analysis will not include surrounding freeway mainline or ramps and will not include the downtown grid network. To replicate existing traffic congestion that occurs at I-5 interchanges near Mercer Way, Denny Way, NE 42nd St, NE 45th St, and NE 50th St, and along several streets in the downtown, Vissim modeling techniques will be used in lieu of explicitly modeling these facilities.

Inputs

Input volumes for the existing condition will be provided by traffic counts. Volumes for the 2021 No Build condition are estimated as described in Section 6.1, Travel Demand Forecasting. For the Build condition, project-related capacity changes were coded into the No Build network and the travel demand forecast model re-run to generate new volume estimates.

Adaptive Signal Systems and Transit Signal Priority

At the time of this study, the City of Seattle is considering the use of adaptive signal systems in this corridor. The Transit Capacity and Quality of Service Manual (TRB, 2010) states that transit signal priority—a form of adaptive signaling—can provide an approximately 10% travel time benefit. However, because of the difficulty in modeling adaptive signal systems in Vissim and a general preference to present conservative analysis results, this improvement will not be assumed.

7.3.4 Safety

7.3.4.1 Evaluation Criteria

- **Collisions:** Crash histories for midblock and intersection locations throughout the corridor (severity and frequency) for vehicles, pedestrians, and bicyclists.
- **Safety impacts**: Qualitative effects of the project on vehicular and nonmotorized safety.

7.3.4.2 Evaluation Approach

A safety analysis will be used to assess crashes that have occurred within the corridor in terms of type (e.g., vehicle versus vehicle, vehicle versus pedestrian), severity, and frequency. Collision data from the most recent available 5-year period (2011 to 2016) will be compiled and summarized to identify safety deficiencies. Patterns (e.g., high frequency of a specific crash type) will be described. A qualitative intersection and midblock safety assessment will be conducted where the Build Alternative results in a physical change to a roadway. Along these streets, the discussion will focus on how the project may affect the existing collision type and frequency.

Within the roadway right-of-way, safety effects on vehicular travel will be assessed based on projected changes in traffic volumes, queue lengths, modal conflicts, and roadway design features. Safety effects on bicycle and pedestrian travel will also be assessed based on change in the number of conflicts with motorized modes, as well as change in facilities provided for their travel.

7.3.5 Parking and Loading

7.3.5.1 Evaluation Criteria

- **Occupancy**: Comparison of the supply versus utilization (excludes loading zones and other specialty parking designations such as accessible parking).
- **Supply impacts**: Project-related changes to the number of parking spaces in the corridor.

7.3.5.2 Evaluation Approach

Analysis of the impacts of the Build Alternative on existing on-street and off-street public parking will focus on the project alignment and adjacent local streets. The corridor currently has on-street paid parking areas, where the City of Seattle regularly collects supply and utilization information, and unpaid parking areas where field data will need to be collected.

The evaluation of parking impacts will include an inventory of parking supply and utilization in the locations shown on Figure 4, including one block east and west of the RapidRide corridor and 10 off-street paid lots.

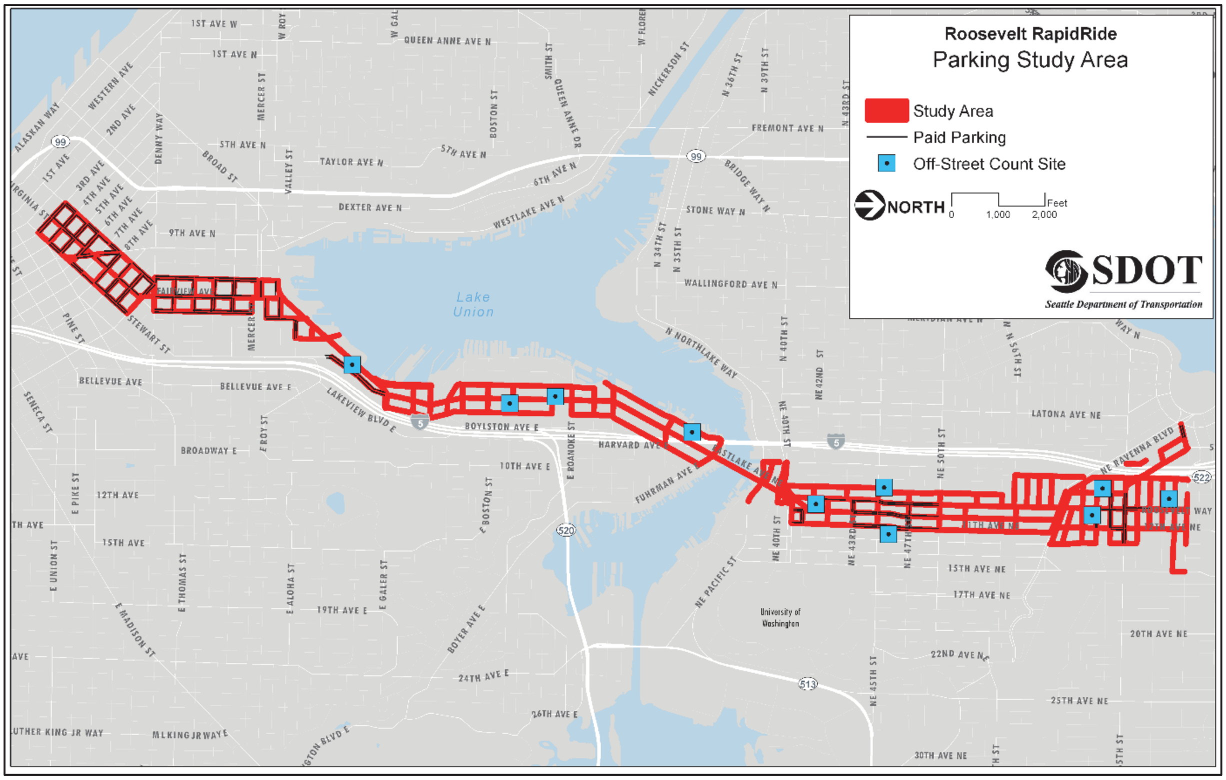

Figure 4. Parking and Loading Study Area

Inventory of Parking Supply and Utilization

The following steps will be completed as part of the on-street parking data collection:

- An inventory of on-street space parking will be completed for each block face for the types of parking (i.e., 2-hour time limit, truck load, passenger load zones) and the quantity. Measurements provided in the SDCI CAM 117 document (City of Seattle, 2011) will be used to determine the parking supply inventory study.
- The number of on-street unpaid public parking spaces on each block face in the study area will be recorded. Signage (types of parking) will be noted, but a sign location or sign inventory will not be conducted.
- An inventory of on-street unpaid parking will be conducted on two nonconsecutive days. The inventory will be done for three 1-hour time periods each day. At each of the following time slots, the number of spaces occupied will be recorded:
  - Mid-day (noon to 1 PM)
  - Early evening (5 to 6 PM)
  - Late evening (9 to 10 PM)
- Data regarding all commercial vehicle load zones, truck load zones, passenger load zones, and general load/unload zones along the entire corridor will be also collected; information on the location and type of loading zone will be collected. Information will be collected during the same time periods as the on-street parking inventory.

Off-Street Parking Data Collection

Utilization at 10 publicly accessible, paid parking facilities along the corridor was assessed. The survey collected information on the total number of spaces and utilization. Information was also collected on hourly/daily parking rates. The locations were selected in cooperation with SDOT.

Eastlake Business District Parking Duration Study

A parking duration study will be conducted within the Eastlake Business District. The study area is along Eastlake Ave E from E Roanoke to E Newton for both sides of the street. On-street parking duration will be surveyed hourly from 7 AM to 7 PM. The presence of Zone 8 restricted parking zone stickers for vehicles on the west side of Eastlake between Boston/Newton will be noted.

Assessment of Parking and Loading Impacts

The assessment of any parking and loading space losses will be based on review of the inventory of supply and utilization coupled with an evaluation of the conceptual drawings for the Build Alternative. Comparison between existing utilization and the supply remaining after construction of the Build Alternative will form the basis for identifying parking and loading space loss associated with each alternative. This comparison will also address the potential significance of that loss in relation to parking utilization, and will facilitate the identification of possible mitigation strategies. The lost parking and loading spaces will be categorized by both location and type. Off-street parking lots will be considered as additional supply for the loss of on-street supply in the analysis. In addition, urban goods delivery management strategies, transportation demand management, and similar strategies will be considered to address the loss of street parking and loading supply.

7.3.6 Nonmotorized

7.3.6.1 Evaluation Criteria

- **Existing and planned pedestrian system**: A sidewalk inventory will identify station areas where sidewalks are currently missing or are narrower than four or six feet, and whether the station area sidewalks will have sufficient capacity to accommodate anticipated pedestrian volumes under the Build conditions. Future sidewalk projects expected to be completed before 2021 or 2040 will also be included in the No Build condition.
- **Sidewalk maintenance condition:** The maintenance condition of sidewalks at station areas will be qualitatively identified through field visits and categorized as “good” (little to no cracking), “fair” (show some cracking), or “poor” (cracking and heaves).
- **Crossing features:** Crosswalk markings at unsignalized crossings of minor streets and signal-controlled crossings will be inventoried to identify barriers to pedestrian access. Curb ramps will be inventoried and assessed for ADA compliance.
- **Existing and planned bikeways**: Bicycle facilities that intersect the preferred alignment will be identified to within at least a half-mile of the corridor, as well as any projects expected to be completed before 2021.
- **Pedestrian and bicycle volumes**: The numbers of pedestrians and bicycles traveling through intersections at or near RapidRide stations will be counted during the existing PM peak hour and assessed in the future year conditions.

7.3.6.2 Evaluation Approach

To assess the existing and planned pedestrian system, block-faces along the alignment will be reviewed using City of Seattle GIS data to identify any station areas with missing sidewalks or where the sidewalk is narrower than four feet, the ADA minimum width, or six feet, the City's typical sidewalk standard (City of Seattle, 2017, Chapter 3.1). Maintenance condition will be determined through field visits. Crossing features will be inventoried by using City of Seattle GIS data and field visits, except for curb ramp ADA compliance, which will be summarized using the results of a City-led survey. Existing bicycle facilities will be identified from City of Seattle GIS data. Reasonably foreseeable future bicycle and pedestrian capital projects will be identified by reviewing project timelines on the City of Seattle website and in the PSRC *Transportation 2040* regional capacity project list (constrained) (PSRC, 2010), in consultation with City staff. Future projects will be assumed to have been completed if they are currently funded and/or in advanced stages of planning or design with implementation timelines.

Assumed future pedestrian and bicycle facilities are shown in Tables 8 and 9, respectively.

Table 8. Assumed Future Pedestrian Facilities

NAME	DESCRIPTION	EXPECTED COMPLETION YEAR
3rd Ave Belltown Paving Project - Virginia St to Broad St[a]	Roadway repair and reconstruction, curb ramp upgrades, expansion of the northbound and southbound bus zones at Virginia St.	2017
NE 65th St Vision Zero Project[b]	A package of street modifications primarily intended to improve pedestrian and bicycle safety. Includes signal enhancements, a median, crossing features, a protected bicycle lane, and other improvements.	2018
6th Ave Paving Project - Yesler St to Stewart St[c]	Roadway repair and reconstruction, curb ramp upgrades (including near proposed Stewart Station), crossing beacon at Marion St.	2018
7th Ave Mobility Improvements - Westlake St to Union St[d]	Curb ramp upgrades, new protected bike lane between Virginia St and Pike St, operational modifications.	2018
Fairview Bridge Replacement[e]	Replace decaying timber-supported bridge. New design includes widened bicycle facilities and new separated pedestrian facilities.	2019+
Green Lake Area Paving and Safety Projects[f]	Curb ramp upgrades where repaving occurs. Potential rechannelizations currently in the planning stage.	2019+
Cheshiahud Lake Union Loop Trail (Columbia Trail)[g]	Provides multi-use trail facilities for the Portage Bay area, connecting to the Burke-Gilman Trail.	2020

[a] https://www.seattle.gov/transportation/projects-and-programs/programs/maintenance-and-paving/current-paving-projects/3rd-ave-arterial

[b] https://www.seattle.gov/visionzero/projects/ne-65th-st

[c] https://www.seattle.gov/transportation/projects-and-programs/programs/maintenance-and-paving/current-paving-projects/6th-ave-paving-project

[d] https://www.seattle.gov/transportation/projects-and-programs/programs/bike-program/protected-bike-lanes/7th-ave-mobility-improvements

[e] https://www.seattle.gov/transportation/projects-and-programs/programs/bridges-stairs-and-other-structures/bridges/fairview-ave-n-bridge-replacement

[f] https://www.seattle.gov/transportation/projects-and-programs/programs/maintenance-and-paving/current-paving-projects/green-lake-area-paving-and-safety-projects

[g] https://www.psrc.org/sites/default/files/t2040webmap.html

Table 9. Assumed Future Bicycle Facilities

NAME	DESCRIPTION	EXPECTED COMPLETION YEAR
Pike-Pine Mobility Improvements[a]	Protected bike lanes that intersect with the project alignment, and other safety improvements.	Early 2018
2nd Ave Bike Improvements[b]	Protected bicycle lanes parallel to route between Pike and Virginia.	2018
7th Ave Improvements[c]	New protected bicycle lanes to east/south of Virginia St to Pike St.	2018
NE 65th St Vision Zero Project[d]	A package of street modifications primarily intended to improve pedestrian and bicycle safety. Includes signal enhancements, a median, crossing features, a protected bicycle lane, and other improvements.	2018
Bell Street Protected Bike Lane[e]	Protected bicycle lanes on Bell St between E Denny Way and 2nd Ave	2019
9th Ave N Safety Improvements Phase 3[f]	Completes protected bicycle lane between Westlake Ave and Denny Way	2019
Fairview Bridge Replacement[g]	Replace decaying timber-supported bridge. New design includes widened bicycle facilities and new separated pedestrian facilities.	2019
Cheshiahud Lake Union Loop Trail (Columbia Trail)[h]	Provides multi-use trail facilities for the Portage Bay area, connecting to the Burke-Gilman Trail.	2020

[a] https://www.seattle.gov/transportation/projects-and-programs/programs/bike-program/protected-bike-lanes/pike-pine-mobility-improvements

[b] https://www.seattle.gov/transportation/projects-and-programs/programs/bike-program/protected-bike-lanes/2nd-ave-mobility-improvements

[c] https://www.seattle.gov/transportation/projects-and-programs/programs/bike-program/protected-bike-lanes/7th-ave-mobility-improvements

[d] https://www.seattle.gov/visionzero/projects/ne-65th-st

[e] https://www.psrc.org/sites/default/files/seattle_bell-st-protected-bike-lane_web.pdf

[f] https://www.seattle.gov/transportation/projects-and-programs/programs/bike-program/protected-bike-lanes/9th-ave-n-safety-project

[g] https://www.seattle.gov/transportation/projects-and-programs/programs/bridges-stairs-and-other-structures/bridges/fairview-ave-n-bridge-replacement

[h] https://www.psrc.org/sites/default/files/t2040webmap.html

Pedestrian and bicycle counts will provide existing conditions data for intersections at or near proposed stations. 2021 No Build volumes will be estimated by applying a growth factor derived from PSRC travel demand forecast model outputs at the traffic analysis zone level. 2021 Build volumes at stations will be estimated by combining the No Build estimates with the additional ridership forecast by the FTA STOPS model.

Other projects are in the planning phase, such as the 65th Street Safety Project and the North Downtown Mobility Action Plan, but since their designs are not yet complete, they are not included in the assumed pedestrian and bicycle networks.

7.3.7 Freight

7.3.7.1 Evaluation Criteria

- **Freight travel time**: Changes to general purpose travel times on SDOT truck streets.
- **Freight access**: Impacts on truck loading zones or access to local businesses.

7.3.7.2 Evaluation Approach

Vissim-derived intersection LOS and travel time estimates will be generated for segments of the alignment that are identified as Major or Minor Truck Streets by the City of Seattle, using the same tools and procedures as described in Section 7.2.2, Traffic (the alignment is a Minor Truck Street between South Lake Union and its northern terminus). The access assessment will focus on truck movements and routing impacts, focusing on the RapidRide corridor and access to local businesses. Impacts to commercial and passenger loading zones for businesses, offices, and residents will be addressed as part of the Parking and Loading analysis (Section 7.3.5, Parking and Loading).

7.3.8 Construction

7.3.8.1 Evaluation Criteria

- **Construction Impacts:** Qualitatively assess the potential impacts of construction on traffic and transit operations, property access, safety, parking supply and operations, nonmotorized travel, and freight operations.

7.3.8.2 Evaluation Approach

The assessment of construction-related traffic impacts will focus primarily on the RapidRide corridor or on streets that could be significantly affected by construction of the Build Alternative. Construction analysis will consider and summarize the following:

- Changes in roadway capacity including potential lane closures, parking restrictions, pedestrian or bicycle facility impacts, alignment shifts, areas of construction activity adjacent to travel lanes, or other reductions to capacity due to project construction activity
- Impacts on transit, school transportation and emergency services
- Impacts on on- and off-street public parking supply
- Identification of potential construction access and truck routes and the impact of construction-related traffic on these routes
- Assessment of potential for neighborhood traffic intrusion related to road closure, and options for traffic detour
- Planning-level estimation of construction truck traffic depending on construction period and sub-area within the project corridor
- Development of mitigation measures

7.4 Indirect Effects

Indirect effects will be evaluated qualitatively. Indirect effects are impacts from a single project, but, unlike direct effects, typically involve a chain of cause-and-effect relationships that can take time to develop and can occur at a distance from the project location. Indirect effects typically involve changes to land use, population density, or growth rate.

7.5 Cumulative Effects

Cumulative effects are the incremental impacts of all effects of the project, including past and present actions in the study area, and the effects of reasonably foreseeable, planned projects in the study area. Most cumulative transportation impacts are already assumed in the future year transportation projections used for the travel demand and operational analyses. These impacts include expectations for increased growth in local and regional population and employment, as well as the resulting increases in travel. Some of the other future development actions in the area could result in other impacts that could create different cumulative effects.

The assessment of additional cumulative transportation effects will include a qualitative evaluation and discussion of reasonably foreseeable future actions that could interact with the project alternatives, and that were not included in the traffic modeling, such as: tolling of I-5 or other regional facilities, construction activities from other transportation projects that could affect or be influenced by the project construction activities, and local developments and public infrastructure projects that could contribute to cumulative traffic delays on local arterial streets over the construction period.

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Attachment A
PSRC 4K Model Highway Network Assumptions

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ATTACHMENT A
PSRC 4K MODEL HIGHWAY NETWORK ASSUMPTIONS

The models used for travel demand analysis were provided by Puget Sound Regional Council (PSRC) in May 2017 and include a 2014 base year, 2025 forecast year, and 2040 forecast year. Table A-1 lists the projects included in the No Build base highway networks for the three analysis time periods. This project list has been filtered to only include those described by PSRC as “Roadway Related – Arterial” and “Roadway Related – State Route,” since these are the types of projects that would notably affect the travel demand forecast model results. The contents of Table A-1 are reproduced here as provided by PSRC.

To create the 2021 forecast year, projects that were considered to have a significant effect on travel demand in the project area and that were expected to be completed after 2021 were removed from the PSRC-provided 2025 network.

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
AUBURN	975	M St SE Underpass	2013	x	x	x
AUBURN	1744	Auburn Way South (SR 164) Corridor Improvements, Fir St SE to Hemlock St SE and Nonmotorized Improvements	2014	x	x	x
AUBURN	976	S 272nd/277th St Corridor Capacity and Nonmotorized Trail Improvements	2015		x	x
AUBURN	4504	Grade Separated Crossing of BNSF Railyard	2030			x
AUBURN	4287	SR 164	2040			x
BELLEVUE	4523	Bel-Red Regional Connectivity - NE 4th St Extension	2015		x	x
BELLEVUE	3477	Bellevue Way High-Occupancy Vehicle (HOV) Lanes and Transit Priority	2015		x	x
BELLEVUE	4527	Bel-Red Regional Connectivity - 124th Ave NE	2019		x	x
BELLEVUE	1100	Coal Creek Parkway	2020		x	x
BELLEVUE	4526	Bel-Red Regional Connectivity - NE 15th/ NE 16th St (Phase 1)	2020		x	x
BELLEVUE	4524	Bel-Red Regional Connectivity - NE 6th St Extension	2020		x	x
BELLEVUE	4264	120th Avenue NE Corridor Widening: NE 4th St to Northup Way	2021			x
BOTHELL	4002	SR 522 West City Limits to NE 180th St Stage 1 Improvements (at 96th Ave NE) - Wayne Curve	2012	x	x	x
BOTHELL	4272	SR 522 - West City Limits to NE 180th Street Stage 2A Improvements	2013	x	x	x
BOTHELL	4271	Bothell-Everett Hwy Widening: 240th St SE to 228th St SE	2014	x	x	x
BOTHELL	5446	Bothell Way NE: Multiway Boulevard Project	2017		x	x
BOTHELL	5537	SR 522 - West City Limits to NE 180th Street Stage 2b Improvements	2019		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
BOTHELL	4254	SR 522, Stage 3	2020		x	x
BOTHELL	5536	SR 527	2030			x
BOTHELL	4262	Bothell Way NE / Bothell-Everett Hwy Improvements	2030			x
BUCKLEY	1239	SR 410/SR 165/Ryan Rd/ 112th St E Realignment, Phase 1	2012	x	x	x
BUCKLEY	4286	SR 165 Realignment, P2	2015		x	x
BURIEN	5449	1st Avenue South, Phase 2 (SW 140th Street to SW 146th Street)	2013	x	x	x
BURIEN	5450	1st Avenue South, Phase 3 (SW 128th Street to SW 140th Street)	2018		x	x
BURIEN	5451	Ambaum Boulevard SW Corridor Study (SW 116th Street to SW 153rd Street)	2030			x
COVINGTON	4288	SR 516 – Jenkins Creek to 185th Place SE	2015		x	x
DES MOINES	4459	Connecting 28th/24th Avenue South (S 208th Street to S 216th Street)	2014	x	x	x
DES MOINES	4297	S 216th Street Segment 1A	2016		x	x
DUPONT	296	DuPont-Steilacoom Rd	2030			x
ENUMCLAW	361	SR 410	2010	x	x	x
ENUMCLAW	362	SR 410	2010	x	x	x
EVERETT	547	I-5 @ 41st Street Interchange Access Improvements	2009	x	x	x
EVERETT	1879	SR 99/ Evergreen Way	2012	x	x	x
EVERETT	792	112th St - Beverly Park Rd Corridor	2013	x	x	x
EVERETT	4005	Everett Arterial Access Improvements	2018		x	x
EVERETT	621	SR 99/ Evergreen Way Transit HOV Treatments	2019		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
EVERETT	5517	Broadway Corridor Improvements	2020		x	x
Everett	4467	SR 526 Hardeson Road Half Interchange	2020		x	x
FEDERAL WAY	1200	SR 99 Phase IV	2012	x	x	x
FEDERAL WAY	2021	S 356th St	2015		x	x
FEDERAL WAY	2061	SR 99	2017		x	x
FEDERAL WAY	3660	City Center Access Phase 4A: S 320th St @ I-5 Interchange (I/C) HOV lanes	2025			x
FEDERAL WAY	3659	City Center Access Phase 3C - 32nd Ave S	2030			x
FEDERAL WAY	2103	21st Ave SW	2030			x
FEDERAL WAY	2019	S 348th St	2030			x
FIFE	122	Valley Ave E	2008	x	x	x
ISSAQUAH	265	E Lake Sammamish Pkwy	2014	x	x	x
ISSAQUAH	4113	12th Ave NW/SR 900/NW Sammamish Rd Widening	2015		x	x
ISSAQUAH	2270	Newport Way	2016		x	x
ISSAQUAH	4543	I-90 HOV Direct Access Ramp	2019		x	x
KENMORE	2292	68th Ave NE	2018		x	x
KENT	3612	East Valley Highway (84th Ave S) Improvement Project	2006	x	x	x
KENT	3643	S 228th St Grade Separation	2015		x	x
KENT	2026	West Valley Highway	2016		x	x
KENT	1563	212th St	2016		x	x
KENT	2007	S 272nd St	2016		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
KENT	5289	Willis Street Grade Separations	2016		x	x
KENT	1564	South 212th Street	2016		x	x
KENT	5538	S 228th St Grade Separation	2020		x	x
KING COUNTY/METRO	423	Avondale Rd	2000	x	x	x
KING COUNTY/METRO	4451	Seattle South End Transit Pathways	2016		x	x
KING COUNTY/METRO	447	NE 132nd/NE 128th St	2020		x	x
KING COUNTY/METRO	4554	Avondale Road	2020		x	x
KING COUNTY/METRO	4555	Issaquah Fall City/Duthie Hill Road	2020		x	x
KING COUNTY/METRO	4551	140th/132nd Avenue SE	2020		x	x
KING COUNTY/METRO	4559	Military Rd S	2020		x	x
KING COUNTY/METRO	4569	SE 212th Way/SE 208th Street	2020		x	x
KING COUNTY/METRO	4562	Novelty Hill Road	2020		x	x
KING COUNTY/METRO	4447	Madison Street Corridor	2020		x	x
KING COUNTY/METRO	4556	Issaquah Hobart Road	2030			x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
KING COUNTY/METRO	4571	Woodinville-Duvall Road	2030			x
KIRKLAND	2293	124th Ave NE Roadway Improvements (North)	2022			x
KIRKLAND	4469	124th Ave NE Roadway Improvements (South)	2040			x
KITSAP COUNTY	485	Bucklin Hill Rd Estuary Enhancement and Road Widening	2015		x	x
KITSAP COUNTY	3647	Bethel Road/Bethel Ave SE	2020		x	x
KITSAP COUNTY	491	Silverdale Way	2020		x	x
KITSAP COUNTY	1264	Newberry Hill Rd	2020		x	x
LAKEWOOD	5523	Bridgeport Way	2014	x	x	x
LYNNWOOD	4009	SR 524 (196th St SW) Widening	2016		x	x
LYNNWOOD	4631	I-5/44th Avenue Interchange Improvements	2020		x	x
LYNNWOOD	4119	44th Ave W (SR 524 Spur)	2020		x	x
MAPLE VALLEY	5445	SR 169	2020		x	x
MAPLE VALLEY	4118	SR 516 (Kent-Kangley Road), 213th Place SE to SR 169	2020		x	x
MARYSVILLE	4125	State Avenue	2010	x	x	x
MARYSVILLE	4127	Ingraham Boulevard	2011	x	x	x
MARYSVILLE	5529	Lakewood Triangle Access/156th St NE Overcrossing	2012	x	x	x
MARYSVILLE	4124	State Avenue	2015		x	x
MARYSVILLE	5534	SR 528/I-5 additional lanes under I-5 interchange	2015		x	x
MARYSVILLE	5532	40th St NE - three/five lanes on existing and new alignment: Sunnyside Blvd to SR 9	2015		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
MARYSVILLE	4126	State Avenue	2016		x	x
MARYSVILLE	4123	88th St NE	2016		x	x
MARYSVILLE	5531	Sunnyside Blvd Widening: 47th Ave NE to 52nd St NE	2017		x	x
MARYSVILLE	5533	88th St NE new WB lane: Quil Ceda Crk Bridge to I-5	2017		x	x
MARYSVILLE	5527	1st St Bypass: 3/5 lane new alignment	2017		x	x
MARYSVILLE	5528	156th St NE Widening to three/five lanes: State Ave to 51st St NE Vic.	2017		x	x
MARYSVILLE	4410	SR 529 Interchange	2017		x	x
MARYSVILLE	4411	156th St NE Interchange	2020		x	x
MILTON	1958	Milton Way	2010	x	x	x
MUKILTEO	807	Ferry Holding Lanes	2010	x	x	x
NEWCASTLE	2313	Coal Creek Pkwy (Phase I, II and III)	2010	x	x	x
PACIFIC	127	Stewart Rd (8th St E.)	2010	x	x	x
PIERCE COUNTY	131	Spanaway Loop Rd	2006	x	x	x
PIERCE COUNTY	1489	Br #36193-A / 176th St E	2012	x	x	x
PIERCE COUNTY	880	Wollochet Dr NW	2013	x	x	x
PIERCE COUNTY	116	112th St E/S	2014	x	x	x
PIERCE COUNTY	115	176th St E	2014	x	x	x
PIERCE COUNTY	113	Canyon Rd E	2020		x	x
PIERCE COUNTY	528	Canyon Rd E	2020		x	x
PIERCE COUNTY	135	Canyon Rd E	2026			x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
PIERCE COUNTY	4439	Canyon Rd E	2030			x
PIERCE COUNTY	4438	Canyon Rd E	2030			x
PIERCE COUNTY	1938	176th St E	2040			x
PIERCE COUNTY	1937	160th St E	2040			x
PIERCE COUNTY	134	Canyon Rd E	2040			x
PIERCE COUNTY	1474	96th St E	2040			x
PIERCE COUNTY	522	224th St E	2040			x
PIERCE COUNTY	1473	72nd St E	2040			x
PIERCE COUNTY	125	Military Rd S/152nd St E	2040			x
PORT OF SEATTLE	1224	E Marginal Way Grade Separation	2009	x	x	x
PORT OF SEATTLE	5347	Grade separation at Atlantic St - South End Viaduct local access: Holgate to King stage 3	2013	x	x	x
PORT OF SEATTLE	5346	North Argo Truck Roadway	2014	x	x	x
PORT OF SEATTLE	5348	Hanford and Main SIG's Entry Gate Improvements	2020		x	x
PORT OF SEATTLE	5350	West Marginal Way/Chelan Street/Spokane Street intersection	2020		x	x
PORT OF SEATTLE	2074	South Airport Link Project	2025			x
PORT OF SEATTLE	5512	South Access	2025			x
PORT OF TACOMA	4639	Port of Tacoma Road/Rail/Infrastructure	2020		x	x
PORT ORCHARD	3646	Bethel Road SE	2025			x
PUYALLUP	138	S Meridian (SR 161)	2000	x	x	x
PUYALLUP	494	Shaw Rd	2004	x	x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
PUYALLUP	141	31st Ave SW	2005	x	x	x
PUYALLUP	1222	Shaw Rd Extension in Puyallup	2010	x	x	x
PUYALLUP	129	Shaw Rd E	2030			x
REDMOND	4117	Redmond Way	2015		x	x
REDMOND	4116	Cleveland St	2015		x	x
REDMOND	5516	148th Ave NE	2022			x
REDMOND	836	Bel-Red Rd	2030			x
REDMOND	3665	West Lake Sammamish Parkway Widening	2030			x
REDMOND	840	East Lake Sammamish Pkwy	2030			x
REDMOND	3476	SR 520/Avondale Rd/Union Hill Rd Intersection	2030			x
REDMOND	3662	Redmond Way Widening	2030			x
REDMOND	830	Redmond-Woodinville Rd	2035			x
RENTON	4295	Duvall Ave NE	2009	x	x	x
RENTON	1308	Central Renton Transit Corridor - Rainier Ave S (SR 167) S Grady Way to S 2nd St	2018		x	x
RENTON	4433	Rainier Ave S Corridor Improvements – Phase 2	2018		x	x
RENTON	2328	Oakesdale Ave SW	2020		x	x
RENTON	2341	NE Sunset Blvd (SR 900) Corridor Improvements	2020		x	x
RENTON	2326	Duvall Ave NE	2020		x	x
RENTON	4165	SW 27th St/Strander Blvd Ph 2	2020		x	x
RENTON	2347	Logan Ave N	2020		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
RENTON	4164	SW 27th St / Strander Blvd Ph 1 Segment 2b	2020		x	x
RENTON	910	SE Carr RD	2030			x
SAMMAMISH	1978	Sahalee Way NE	2030			x
SEATAC	192	28th/24th Ave S	2016		x	x
SEATTLE	5448	Greenwood Avenue North Corridor Improvement	2008	x	x	x
SEATTLE	4263	Spokane Street Viaduct 4th Avenue Off-Ramp	2010	x	x	x
SEATTLE	5509	Mercer Corridor East Phase	2012	x	x	x
SEATTLE	958	Spokane Street	2012	x	x	x
SEATTLE	5510	Mercer Corridor West Phase	2014	x	x	x
SEATTLE	5187	Montlake Blvd NE HOV Lane and ITS Improvements	2020		x	x
SEATTLE	5254	South Lander Street Grade Separation	2030			x
SEATTLE	5252	SODO Rail Corridor Grade Separations	2030			x
SEATTLE	4092	Seattle Priority Bus Corridor 9: Aurora Village to Downtown via SR 99	2040			x
SHORELINE	4277	SR 99--Shoreline--North Segment	2011	x	x	x
SHORELINE	3569	Aurora Avenue North Multi-Modal Corridor Project (N 185th St to N 192nd St)	2012	x	x	x
SHORELINE	4283	Aurora Avenue North Multi-Modal Corridor Project (N 192nd St to N 205th St)	2015		x	x
SHORELINE	1028	N 175th St	2018		x	x
SHORELINE	4435	15th Ave NE Corridor Improvement	2018		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
SHORELINE	4434	145th Street Improvements	2021			x
SNOHOMISH COUNTY	1956	112th Street SW/Beverly Edmonds Road	2009	x	x	x
SNOHOMISH COUNTY	1950	Granite Falls Alternative Route (Bypass)	2011	x	x	x
SNOHOMISH COUNTY	584	Airport Way	2020		x	x
SNOQUALMIE	4409	SR 202/Tokul Road Roundabout	2014	x	x	x
SOUND TRANSIT	4110	Pacific Avenue at S 26th/South Tacoma Way Rail grade separation crossing	2010	x	x	x
SOUND TRANSIT	2372	Renton HOV Access/N 8th	2011	x	x	x
SOUND TRANSIT	4276	I-90 Two-Way Transit and HOV Operations (Stage 2)	2012	x	x	x
SOUND TRANSIT	3658	I-90 Two-Way Transit and HOV Operations (Stage 3)	2016		x	x
SUMNER	500	Traffic Ave/Puyallup River Bridge Replacement	1998	x	x	x
SUMNER	499	Stuck River Bridge	2016		x	x
SUMNER	4460	Stewart Road (8th Street) Bridge	2018		x	x
Sumner	4466	West bound ramps Highway 410 and 166th Avenue E.	2018		x	x
TACOMA	3550	Lincoln Ave Grade Separation	2011	x	x	x
TACOMA	4104	Hylebos Bridge, on E. 11th Street corridor between Taylor Way and Marine View Drive	2011	x	x	x
TACOMA	4121	Pacific Ave Safety and Mobility Improvements	2013	x	x	x
TACOMA	3648	Puyallup Bridge F16A and F16B Replacement	2015		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
TACOMA	4432	Brewery District Roadway Improvement	2019		x	x
TACOMA	4431	MLK Mixed Use Center Complete Streets Improvement Project	2019		x	x
TACOMA	4105	Puyallup River Bridge Rehabilitation (F16C, F16D, F16E).	2021		x	x
TUKWILA	3431	SR 99/ Pacific Highway South (Tukwila)	2012	x	x	x
TUKWILA	1300	Tukwila International Blvd	2018		x	x
TUKWILA	3557	Tukwila Station Access with 156th St to 16th Ave S Link	2020		x	x
TUKWILA	1299	E Marginal Way	2020		x	x
TUKWILA	1294	BNSF Intermodal Railyard Access	2020		x	x
TULALIP TRIBES	5429	I-5 @ 116th Street NE Interchange	2015		x	x
WOODINVILLE	2383	SR 202 Corridor Widening Improvement	2010	x	x	x
WOODINVILLE	2377	BNRP: Trestle Replacement and Sammamish Bridge Replacement	2011	x	x	x
WOODINVILLE	4018	Woodinville-Snohomish Rd Widening	2012	x	x	x
WOODINVILLE	4017	Woodinville-Snohomish Rd Widening	2015		x	x
WOODINVILLE	4019	SR 202 Intersection Corridor Improvement (CCRP)	2020		x	x
WSDOT	3621	SR 522 UW Bothell Campus South Access	2007	x	x	x
WSDOT	5323	US 2 "Trestle" ATM	2010	x	x	x
WSDOT	4099	SR 16	2010	x	x	x
WSDOT	1650	SR 16	2010	x	x	x
WSDOT	1630	SR 99: 244th St SW to 240th St SW - BAT Lanes	2010	x	x	x
WSDOT	4302	I-405 Corridor: I-5 to SR 169 Widening Stage 1 (SR 167 component)	2010	x	x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	4356	Corridor: SR 520 to I-5 Widening (NB NE 195th to SR 527)	2010	x	x	x
WSDOT	1866	SR 519 Intermodal Access Project - Phase 2: South Atlantic Corridor	2010	x	x	x
WSDOT	4101	SR 520	2010	x	x	x
WSDOT	5543	SR 529 - Ebey Slough Bridge 529/25 Replacement	2010	x	x	x
WSDOT	1617	SR 900	2010	x	x	x
WSDOT	4428	SR 9 Widening: SR 522 to 212th St SE	2011	x	x	x
WSDOT	4265	SR 9: SR 96 to Marsh Road	2011	x	x	x
WSDOT	1658	SR 161	2011	x	x	x
WSDOT	4311	I-405 Corridor: I-5 to SR 169 - Stg. 2 (SR 167 to SR 169: Widening)	2011	x	x	x
WSDOT	4312	I-405 Corridor: SR 515/Talbot half diamond	2011	x	x	x
WSDOT	4313	I-405 Corridor: I-5 to SR 169 - Stg. 2 (Benson Crossing)	2011	x	x	x
WSDOT	4352	I-405 Corridor: SR 520 to I-5 Widening	2011	x	x	x
WSDOT	4353	I-405 Corridor: SR 520 to I-5 Widening (NB NE 70th to NE 85th)	2011	x	x	x
WSDOT	4355	I-405 Corridor: SR 520 to I-5 Widening (NE 132nd structures)	2011	x	x	x
WSDOT	4354	I-405 Corridor: SR 520 to I-5 Widening (NE 124th to SR 522)	2011	x	x	x
WSDOT	1661	SR 410: 214th Ave E - 234th add lanes	2011	x	x	x
WSDOT	4528	Bel-Red Regional Connectivity - SR 520 @ 124th I/C	2011	x	x	x
WSDOT	5343	I-5: Port of Tacoma Rd Interchange to Pierce/King County Line	2012	x	x	x
WSDOT	2567	I-5 @ SR 18/SR 161 (Triangle) - phase 1	2012	x	x	x
WSDOT	1625	I-5 @ 196th St (SR 524) Interchange Southbound Braided Ramp Project	2012	x	x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	4341	I-405 Corridor: NE 10th ramp	2012	x	x	x
WSDOT	4340	I-405 Corridor: NE 4th to SR 520 and NE 8th to SR 520 -NB Braided Ramps	2012	x	x	x
WSDOT	4343	I-405 Corridor: NE 12th improvements	2012	x	x	x
WSDOT	3527	Tukwila Urban Access Improvement Project	2012	x	x	x
WSDOT	4267	SR 9: Lundeen Pkwy to SR 92	2013	x	x	x
WSDOT	4426	SR 16 @ Wollochet Interchange	2013	x	x	x
WSDOT	4280	SR 99: S Holgate St to S King St - Viaduct Replacement	2013	x	x	x
WSDOT	4252	SR 520: Eastside Transit and HOV	2014	x	x	x
WSDOT	4182	SR 3 @ SR 304 I/C - Ramp Modification	2015		x	x
WSDOT	4430	I-5/JBLM Corridor Planning and NEPA documentation	2015		x	x
WSDOT	4194	41st Division Dr. to Thorne Lane	2015		x	x
WSDOT	5424	I-5 HOV to HOT lane Conversion: SR 16 to Pierce/ King County Line	2015		x	x
WSDOT	5425	I-5 HOV to HOT lane Conversion: Pierce/ King County Line to S 260th	2015		x	x
WSDOT	5426	I-5 HOV to HOT lane Conversion: S 260th to I-405	2015		x	x
WSDOT	5427	I-5 HOV to HOT lane Conversion: I-405 to US 2	2015		x	x
WSDOT	1945	I-5 @ 88th St N Interchange	2015		x	x
WSDOT	1627	SR 9 Widening: 212th St SE to 176th St SE	2015		x	x
WSDOT	4209	SR 9	2015		x	x
WSDOT	5435	I-90 HOV to HOT	2015		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	1659	SR 167 Corridor Completion Phase 1	2015			x
WSDOT	4133	I-405 Corridor: SR 167 Direct HOV Ramps	2015		x	x
WSDOT	4148	I-405 Corridor: I-405 interchange at 132nd St NE	2015		x	x
WSDOT	4241	SR 512/SR 7 Interchange - Mobility	2015		x	x
WSDOT	4242	SR 512/Canyon Rd Interchange EB and WB - Mobility	2015		x	x
WSDOT	4250	SR 520	2015		x	x
WSDOT	5443	SR 520 HOV to HOT	2015		x	x
WSDOT	5430	I-5 @ SR 526 I/C	2015		x	x
WSDOT	4281	SR 99: S King Street to Roy Street – Central Waterfront Viaduct Replacement	2016		x	x
WSDOT	4237	SR 305: Bainbridge Ferry Terminal to Suquamish Way - Mobility	2016		x	x
WSDOT	4251	SR 520: I-5 to Medina - Evergreen Point Floating Bridge and Landings	2016		x	x
WSDOT	4181	SR 3: Pioneer Way to Kinman-Big Valley Rd	2016		x	x
WSDOT	4185	SR 3 @ SR 16 Interchange (Gorst)	2017		x	x
WSDOT	1644	I-5: SR 16 to Port of Tacoma Rd Interchange	2017		x	x
WSDOT	1652	SR 167 HOV lane completion	2017		x	x
WSDOT	4213	SR 16	2017		x	x
WSDOT	1812	SR 99	2017		x	x
WSDOT	3618	SR 302 Capacity Improvements--Elgin-Clifton Road to SR 16	2017		x	x
WSDOT	4282	SR 99/Viaduct Surface Restoration and Construction Transit Center	2018		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	4095	SR 303	2018		x	x
WSDOT	1613	SR 509 Extension (with I-5), Phase 1	2019			x
WSDOT	1620	US 2: Monroe Bypass phases 2 and 3	2020		x	x
WSDOT	4425	I-5 @ SR 512 Interchange (Tier 2)	2020		x	x
WSDOT	4412	US 2: Trestle Widening - Stage 1	2020		x	x
WSDOT	5444	US 2: Monroe Bypass - phase 1	2020		x	x
WSDOT	4419	I-5/JBLM Dupont-Steilacoom - New Interchange	2020		x	x
WSDOT	4420	I-5/JBLM, 41st Division Dr. I/C	2020		x	x
WSDOT	4421	I-5/JBLM, Berkeley Drive I/C	2020		x	x
WSDOT	4422	I-5/JBLM, Thorne Lane Interchange	2020		x	x
WSDOT	4423	I-5: Thorne Lane to Gravelly Lake Dr. - Frontage Road	2020		x	x
WSDOT	4190	I-5 @ SR 512 Interchange (Tier 1)	2020		x	x
WSDOT	5535	I-5 @ SR 18/SR 161 (Triangle) - phase 2	2020		x	x
WSDOT	5508	I-5: Seneca to Mercer St - Additional lane	2020		x	x
WSDOT	5336	I-5: NB Express Lanes Northgate Vic - Merge Revision	2020		x	x
WSDOT	4413	SR 9 @ SR 204 Intersection Improvement	2020		x	x
WSDOT	1651	SR 16	2020		x	x
WSDOT	4414	I-90 @ SR 18	2020		x	x
WSDOT	5436	I-90: Eastgate to West Lake Sammamish Pkwy (Lakemont) - Added Aux. Lane	2020		x	x
WSDOT	5438	I-90	2020		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	4415	SR 99/ Evergreen Way: 148th St SW to Airport Rd	2020		x	x
WSDOT	4318	I-405 Corridor: SR 169 to I-90 (widening)	2020			x
WSDOT	4326	I-405 Corridor: SR 169 to I-90 (SR 169 Direct Connection Ramp)	2020		x	x
WSDOT	4320	I-405 Corridor: SR 169 to I-90	2020		x	x
WSDOT	4327	I-405 Corridor: Sunset Blvd undercrossing	2020		x	x
WSDOT	4321	I-405 Corridor: SR 169 to I-90 (SR 900 I/C component)	2020		x	x
WSDOT	4328	I-405 Corridor: SR 900 to NE 30th	2020		x	x
WSDOT	4322	I-405 Corridor: SR 169 to I-90 (NE 30th I/C component)	2020		x	x
WSDOT	4323	I-405 Corridor: SR 169 to I-90 (NE 44th I/C component)	2020		x	x
WSDOT	4324	I-405 Corridor: SR 169 to I-90 (112th St I/C component)	2020		x	x
WSDOT	4390	I-405 Corridor: SR 520 to SR 522	2020		x	x
WSDOT	4391	I-405 Corridor: SR 520 to SR 522 (SR 522 I/C and HOV direct access)	2020		x	x
WSDOT	4392	I-405 Corridor: SR 520 to SR 522 (NB Aux lane NE 160th to NE 195th)	2020		x	x
WSDOT	4416	SR 518/Des Moines Memorial Drive Vicinity - I/C Improvements	2020		x	x
WSDOT	4418	SR 520 @ 148th Ave NE I/C Vicinity - I/C Improvements	2020		x	x
WSDOT	5440	SR 302	2020		x	x
WSDOT	4257	SR 522 @ Paradise Lake Road Interchange	2020		x	x
WSDOT	1698	SR 522: Paradise Lk Rd to Snohomish River - Widening	2020		x	x
WSDOT	4159	SR 522 (Nickel)	2020		x	x
WSDOT	5390	SR 518	2020		x	x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	4246	SR 518	2020		x	x
WSDOT	4245	SR 518	2020		x	x
WSDOT	5344	SR 161	2022			x
WSDOT	4462	SR 520 Eastbound Auxiliary Lane: NE 148th Ave to NE 40th St	2022			x
WSDOT	1803	I-5: Mounts-Old Nisqually Road to 41st Division Drive, JBLM	2025			x
WSDOT	4424	I-5/Thorne Lane to Gravelly Lake Drive - Auxiliary Lanes	2025			x
WSDOT	4189	I-5: S 96th to SR 16 - Widening (HOV/HOT)	2025			x
WSDOT	4529	I-5 @ Port of Tacoma Interchange Improvement	2025			x
WSDOT	1595	I-5 @ Airport/Industrial Way	2025			x
WSDOT	4198	I-5 @ Lake City Way	2025			x
WSDOT	4199	I-5: SR 104 to NE 175th	2025			x
WSDOT	1624	I-5: 220th St SW to 44th Ave W	2025			x
WSDOT	4229	SR 167	2025			x
WSDOT	4325	I-405 Corridor: SR 169 to I-90 (Coal Creek Pkwy Component)	2025			x
WSDOT	1821	SR 512/94th Ave WB Ramps to SR 161 - Widening	2025			x
WSDOT	4243	SR 512	2025			x
WSDOT	1714	SR 524	2025			x
WSDOT	1715	SR 525	2027			x
WSDOT	1720	I-5: Thorne Lane to SR 512.	2030			x
WSDOT	1811	SR 16	2030			x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	5325	SR 167	2030			x
WSDOT	4310	I-405 Corridor: SR 167 Interchange (SR 167 component)	2030			x
WSDOT	1832	SR 3: Kinman-Big Valley Rd to SR 104	2030			x
WSDOT	4091	I-5 @ 272nd Street Interchange	2030			x
WSDOT	4278	I-5 @ 196th St (SR 524) Interchange Northbound Braided Ramp Project	2030			x
WSDOT	4006	I-5 @ 100th and Everett Mall: South Everett Interchange Improvements	2030			x
WSDOT	4206	SR 9	2030			x
WSDOT	4106	East D Street Slip Ramps at SR 509	2030			x
WSDOT	4207	SR 9	2030			x
WSDOT	5431	SR 9: Snohomish River Bridge	2030			x
WSDOT	5432	SR 9	2030			x
WSDOT	5433	SR 9 / US 2 Interchange	2030			x
WSDOT	497	SR 162: SR 410 - 96th St E	2030			x
WSDOT	4364	I-405 Corridor: I-5 to SR 181 Widening	2030			x
WSDOT	4360	I-405 Corridor: I-5 Interchange	2030			x
WSDOT	4361	I-405 Corridor: SR 518 Interchange	2030			x
WSDOT	4363	I-405 Corridor: I-5 Improvements	2030			x
WSDOT	4330	I-405 Corridor: I-90 I/C and braided ramps	2030			x
WSDOT	5441	I-405 Corridor: I-405/I-90 HOV/HOT connections	2030			x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	4336	I-405 Corridor: I-90 to SR 520 (widening)	2030			x
WSDOT	4338	I-405 Corridor: I-90 to SR 520 (SE 8th braided ramps)	2030			x
WSDOT	4337	I-405 Corridor: I-90 to SR 520 (Main St Bridge component)	2030			x
WSDOT	4345	I-405 Corridor: NE 10th I/C	2030			x
WSDOT	4344	I-405 Corridor: NE 8th to SR 520 - SB Braided Ramps	2030			x
WSDOT	4396	I-405 Corridor: SR 522 to I-5 (widening between NE 195th St to SR 527)	2030			x
WSDOT	5442	SR 512	2030			x
WSDOT	1639	SR 531	2030			x
WSDOT	3528	Interurban Ave Capacity Expansion	2030			x
WSDOT	4183	SR 3 @ SR 304 I/C - Interchange Reconstruction	2035			x
WSDOT	1706	I-5 @ SR 96 / 128th St SW	2035			x
WSDOT	4208	SR 9	2035			x
WSDOT	112	SR 704 - Cross Base Highway, I-5 to Spanaway Loop Rd	2035			x
WSDOT	5324	US 2: Trestle Widening - Stage 2	2040			x
WSDOT	4176	US 2: Bickford to Monroe	2040			x
WSDOT	4177	US 2: Monroe to City of Sultan	2040			x
WSDOT	4178	US 2: within Sultan	2040			x
WSDOT	1704	US 2: Sultan to Goldbar	2040			x
WSDOT	5419	US 2: within Goldbar	2040			x
WSDOT	5420	US 2: within Baring	2040			x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	5422	US 3	2040			x
WSDOT	4184	SR 3: SR 16 to SR 304 - HOV Widening	2040			x
WSDOT	1828	SR 3: SR 304 to Loxie Eagens Blvd - HOV Widening	2040			x
WSDOT	4180	SR 3: SR 305 to SR 104	2040			x
WSDOT	4200	I-5 @ Mercer and SR 520 Interchanges	2040			x
WSDOT	1708	I-5: SR 2 to SR 528	2040			x
WSDOT	4204	I-5: SR 528 to SR 531	2040			x
WSDOT	5434	SR 9	2040			x
WSDOT	1833	SR 16	2040			x
WSDOT	1727	SR 16	2040			x
WSDOT	4214	SR 18	2040			x
WSDOT	4217	SR 18	2040			x
WSDOT	4223	I-90 @ SR 18	2040			x
WSDOT	5437	I-90	2040			x
WSDOT	5439	I-90	2040			x
WSDOT	1682	SR 104	2040			x
WSDOT	1711	SR 104	2040			x
WSDOT	4369	I-405 Corridor: I-5 to SR 169 (SR 167 component)	2040			x
WSDOT	4231	SR 169	2040			x
WSDOT	4232	SR 169	2040			x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	3644	SR 169 Widening SR 516 to 231st	2040			x
WSDOT	4233	SR 169	2040			x
WSDOT	5327	SR 169 Widening: I-405 to 152nd Ave SE	2040			x
WSDOT	1712	SR 204	2040			x
WSDOT	4362	I-405 Corridor: I-5/ I-405 HOV direct connector ramps	2040			x
WSDOT	4303	I-405 Corridor: SR 181 to SR 167 Widening	2040			x
WSDOT	4304	I-405 Corridor: Green River Crossing	2040			x
WSDOT	4305	I-405 Corridor: SR 181 I/C	2040			x
WSDOT	4365	I-405 Corridor: SR 181 to SR 167	2040			x
WSDOT	4366	I-405 Corridor: I-5 to SR 169 (SR 181 direct access)	2040			x
WSDOT	4367	I-405 Corridor: I-5 to SR 169 (SR 167 I/C and HOV direct access)	2040			x
WSDOT	4368	I-405 Corridor: I-5 to SR 169 (Rainier Ave HOV direct access)	2040			x
WSDOT	4306	I-405 Corridor: SR 167 Interchange	2040			x
WSDOT	4307	I-405 Corridor: SR 167 Interchange (Lind half-diamond component)	2040			x
WSDOT	4308	I-405 Corridor: SR 167 Interchange (Lind to Talbot frontage roads)	2040			x
WSDOT	4309	I-405 Corridor: SR 167 Interchange	2040			x
WSDOT	4314	I-405 Corridor: SR 167 to SR 169 Widening	2040			x
WSDOT	4315	I-405 Corridor: SR 167 to SR 169 Widening	2040			x
WSDOT	4316	I-405 Corridor: SR 167 to SR 169 Widening (Renton Hill access component)	2040			x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	4317	I-405 Corridor: SR 167 to SR 169 Widening (BNSF and Cedar Bridge crossings)	2040			x
WSDOT	4373	I-405 Corridor: SR 169 Direct Connection Ramp	2040			x
WSDOT	4376	I-405/I-90 Interchange (HOV direct connector ramps)	2040			x
WSDOT	4377	I-405/I-90 Interchange (SB bridge widening)	2040			x
WSDOT	4378	I-405/I-90 Interchange (new NB bridge)	2040			x
WSDOT	4379	I-405/I-90 Interchange (I-90 approach)	2040			x
WSDOT	4339	I-405 Corridor: I-90 to SR 520 (114th Ave NE ramps)	2040			x
WSDOT	4380	I-405 Corridor: NE 2nd St	2040			x
WSDOT	4381	I-405 Corridor: NE 8th St	2040			x
WSDOT	4382	I-405 Corridor: SR 520 Interchange (HOV direct connection ramps)	2040			x
WSDOT	4346	I-405 Corridor: SR 520 to SR 522 (aux. lanes)	2040			x
WSDOT	4348	I-405 Corridor: SR 520 to SR 522 (NE 70th I/C)	2040			x
WSDOT	4349	I-405 Corridor: SR 520 to SR 522 (NE 85th I/C connections and direct access)	2040			x
WSDOT	4351	I-405 Corridor: NE 85th - NE 124th	2040			x
WSDOT	4387	I-405 Corridor: SR 520 to SR 522 (Widening - SR 520 to NE 124th St)	2040			x
WSDOT	4388	I-405 Corridor: SR 520 to SR 522 (NE 124th I/C)	2040			x
WSDOT	4389	I-405 Corridor: SR 520 to SR 522 (NE 160th I/C)	2040			x
WSDOT	4397	I-405 Corridor: SR 522 to I-5 (SR 522 I/C braided ramps)	2040			x

Table A-1. PSRC 4K Model Highway Network Assumptions

AGENCY	T2040 ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	EXISTING (2014)	2021	2040
WSDOT	4398	I-405 Corridor: SR 522 to I-5 (NE 195th I/C)	2040			x
WSDOT	4399	I-405 Corridor: SR 522 to I-5 (240th St SE direct access ramp)	2040			x
WSDOT	4400	I-405 Corridor: SR 522 to I-5 (Direct Access to Canyon Park Park-and-Ride)	2040			x
WSDOT	4401	I-405 Corridor: SR 522 to I-5 (SR 527 I/C)	2040			x
WSDOT	4402	I-405 Corridor: SR 522 to I-5 (I-5 north/ I-405 I/C and HOV direct access ramps)	2040			x
WSDOT	2380	SR 522 @ 195th	2040			x
WSDOT	4175	US 2: SR 204 to Bickford	2040			x
WSDOT	4259	SR 524	2040			x
WSDOT	4260	SR 524	2040			x
WSDOT	4216	SR 18	2040			x
WSDOT	1722	SR 167 Corridor Completion Phases 2 and 3.	2040			x
WSDOT	4383	I-405 Corridor: SR 520 Interchange	2040			x
WSDOT	4429	SR 509 Extension (with I-5), Phase 2	2040			x

Source: PSRC T2040 Regional Capacity Projects List (Adopted 2015)

Appendix B
Transit Level of Service Measures, Existing Transit Service Levels, and Proposed Stop Revisions

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Table B-1. Transit Service Frequency Level of Service Scores

AVERAGE HEADWAY	PASSENGER EXPERIENCE	LOS SCORE
≤5 minutes	Very frequent service; schedule not needed; bus bunching likely.	A
>5-10 minutes	Frequent service; schedule not needed; bus bunching possible.	B
>10-15 minutes	Relatively frequent; schedules needed; maximum desirable wait time for next bus if one is missed.	C
>15-30 minutes	Passengers must adapt travel to transit schedule.	D
>30-60 minutes	Passengers must adapt travel to transit schedule; trips will be longer than optimal.	E
>60 minutes	Undesirable for urban transit service.	F

Note: Adapted from *Transit Capacity and Quality of Service Manual* (Transportation Research Board, 2013).

Table B-2. Reliability Level of Service Scores for Headway Adherence

HEADWAY COEFFICIENT OF VARIATION	PROBABILITY OF HEADWAY DEVIATION GREATER THAN 50% OF SCHEDULED HEADWAY	PASSENGER EXPERIENCE	LOS SCORE
0.00-0.21	≤2%	Service provided like clockwork	A
0.22-0.30	≤10%	Vehicles slightly off headway	B
0.31-0.39	≤20%	Vehicles often off headway	C
0.40-0.52	≤33%	Irregular headways with some bus bunching	D
0.53-0.74	≤50%	Frequent bus bunching	E
≥0.75	>50%	Most buses bunched	F

Table B-3. Transit Service Span Level of Service Scores

HOURS OF SERVICE	PASSENGER EXPERIENCE	LOS SCORE
>18 hours	Full range of trip purposes served; allows late-night bus travel.	A
15-18 hours	Broad range of trip purposes served; allows late-evening bus travel.	B
12-14 hours	Provides sufficient service span to serve traditional work schedules with some flexibility.	C
7-11 hours	Allows midday trips; insufficient span to allow errands after work on transit.	D
4-6 hours	Allows trip time choice for peak service; allows some trips during the day with hourly service.	E
<4 hours	Basic lifeline service; passengers must plan their day around transit schedule.	F

Note: Adapted from Transportation Research Board, 2013.

Table B-4. Passenger Load Level of Service Scores

LOAD FACTOR	PASSENGER LOAD	PASSENGER EXPERIENCE	LOS SCORE
≤50% of seated load	≤23	No passengers need to sit next to each other; perceived travel time is less than actual travel time.	A
≤80% of seated load	≤37	Passengers free to choose seats; perceived travel time is equal to actual travel time.	B
≤100% of seated load	≤47	All passengers can sit; perceived travel time is up to 1.1x actual travel time.	C
≤125% of seated load	≤58	Some passengers must stand; perceived travel time is up to 2.1x actual travel time for standees.	D
≤150% of seated load	≤70	Many passengers must stand; perceived travel time is up to 2.25x actual travel time for standees; boarding and alighting are difficult.	E
>150% of seated load	>70	Crush load conditions; perceived travel time is much greater than actual travel time for all passengers; passengers may choose to wait for next vehicle.	F

Note: Adapted from Transportation Research Board, 2013.

Table B-5. Existing Transit Service Levels in Roosevelt Project Corridor

OPERATOR/ ROUTE		SEGMENT TRAVELED	STOPS	DAILY TRIPS	SEGMENT TRAVELED	STOPS	DAILY TRIPS
		11TH/12TH AVE NE NORTHBOUND			***ROOSEVELT WAY NE SOUTHBOUND***		
KCM	45	NE 65th St to NE Ravenna Blvd	61st	89	NE 65th St to NE Ravenna Blvd	65th	86
KCM	49	NE 47th St to NE 45th St	45th	98			
KCM	65				NE 45th St to NE Campus Parkway	45th, 42nd	*103
KCM	67	NE 67th St to Eastlake Ave NE	65th, 61st, Ravenna, 55th, 52nd, 50th, 47th, 45th, 42nd	*100	NE 67th St to NE 45th St	65th, Ravenna, 55th, 50th, 45th	*103
KCM	74	NE 50th St to NE 41st St	47th, 45th, 42nd	11	NE 50th St to NE 42nd St	50th, 45th, 42nd	13
KCM	355				NE 50th St to NE 42nd St	50th, 45th, 42nd	10
KCM	984				NE 67th St to NE Campus Parkway	65th, 45th	1
		EASTLAKE AVE E NORTHBOUND			***EASTLAKE AVE E SOUTHBOUND***		
KCM	49	Fuhrman Ave E to Harvard Ave E	-	98	Fuhrman Ave E to Harvard Ave E	-	98
KCM	70	Fuhrman Ave E to Fairview Ave N	Harvard, Allison, Hamlin, Louisa, Lynn, Howe, Garfield	*97	Fuhrman Ave E to Fairview Ave N	Harvard, Allison, Hamlin, Louisa, Lynn, Newton, Garfield	*101
		FAIRVIEW AVE N NORTHBOUND			***FAIRVIEW AVE N SOUTHBOUND***		
KCM	63	Mercer St to Boren Ave	Harrison, Denny	9	Mercer St to Boren Ave	Mercer, Thomas	8
KCM	64	Mercer St to Boren Ave	Harrison, Denny	8	Mercer St to Boren Ave	Mercer, Thomas	7

Table B-5. Existing Transit Service Levels in Roosevelt Project Corridor

OPERATOR/ ROUTE		SEGMENT TRAVELED	STOPS	DAILY TRIPS	SEGMENT TRAVELED	STOPS	DAILY TRIPS
KCM	70	Eastlake Ave E to Boren Ave	Yale (N), Yale (S), Valley, Harrison, Denny	*97	Eastlake Ave E to Boren Ave	Nelson, Yale , Aloha, Mercer, Thomas	*101
KCM	309	Mercer St to Boren Ave	Harrison, Denny	4	Mercer St to Boren Ave	Mercer, Thomas	5
KCM	C Line	Aloha St to Valley St	Valley St	119			
ST	577				Harrison St to Boren Ave	Thomas	15
ST	578				Harrison St to Boren Ave	Thomas	29
		NO CORRESPONDING NORTHBOUND SEGMENT			***BOREN AVE SOUTHBOUND***		
KCM	63				Fairview Ave N to Stewart St	Virginia St	8
KCM	64				Fairview Ave N to Stewart St	Virginia St	7
KCM	70				Fairview Ave N to Stewart St	Virginia St	*101
KCM	309				Fairview Ave N to Stewart St	Virginia St	5
ST	577				Fairview Ave N to Stewart St	Virginia St	15
ST	578				Fairview Ave N to Stewart St	Virginia St	29
		VIRGINIA ST NORTHBOUND			***STEWART ST SOUTHBOUND***		
CT	402				Boren Ave to 3rd Ave	Ninth, Seventh	16
CT	405				Boren Ave to 3rd Ave	Ninth, Seventh	4
CT	410				Boren Ave to 3rd Ave	Ninth, Seventh	8
CT	412				Boren Ave to 3rd Ave	Ninth, Seventh	12

Table B-5. Existing Transit Service Levels in Roosevelt Project Corridor

OPERATOR/ ROUTE		SEGMENT TRAVELED	STOPS	DAILY TRIPS	SEGMENT TRAVELED	STOPS	DAILY TRIPS
CT	413				Boren Ave to 3rd Ave	Ninth, Seventh	14
CT	415				Boren Ave to 3rd Ave	Ninth, Seventh	13
CT	416				Boren Ave to 3rd Ave	Ninth, Seventh	5
CT	417				Boren Ave to 3rd Ave	Ninth, Seventh	5
CT	421				Boren Ave to 3rd Ave	Ninth, Seventh	8
CT	422				Boren Ave to 3rd Ave	Ninth, Seventh	3
CT	424				Boren Ave to 3rd Ave	Ninth, Seventh	2
CT	425				Boren Ave to 3rd Ave	Ninth, Seventh	5
CT	435				Boren Ave to 3rd Ave	Ninth, Seventh	7
KCM	7	Seventh Ave to 3rd Ave	-	73	Seventh Ave to 3rd Ave	-	79
KCM	36	Seventh Ave to 3rd Ave	-	110	Seventh Ave to 3rd Ave	-	112
KCM	63	Fairview Ave to 8th Ave	Ninth, Sixth	9			
KCM	64	Fairview Ave to 8th Ave	Ninth, Sixth	8			
KCM	70	Fairview Ave to 3rd Ave	Ninth, Sixth	*97	Boren Ave to 3rd Ave	Ninth, Seventh	*101
KCM	150				8th Ave to 3rd Ave	Seventh	1
KCM	216				Boren Ave to 3rd Ave	Ninth, Seventh	8
KCM	218				Boren Ave to 3rd Ave	Ninth, Seventh	8
KCM	219				Boren Ave to 3rd Ave	Ninth, Seventh	9

Table B-5. Existing Transit Service Levels in Roosevelt Project Corridor

OPERATOR/ ROUTE		SEGMENT TRAVELED	STOPS	DAILY TRIPS	SEGMENT TRAVELED	STOPS	DAILY TRIPS
KCM	252				Boren Ave to 5th Ave	Ninth, Seventh	7
KCM	257				Boren Ave to 5th Ave	Ninth, Seventh	7
KCM	268				Boren Ave to 5th Ave	Ninth, Seventh	4
KCM	304	Sixth Ave to 3rd Ave	Sixth	4	Boren Ave to 3rd Ave	Ninth, Seventh	5
KCM	308				Boren Ave to 3rd Ave	Ninth, Seventh	4
KCM	309	Fairview Ave to 8th Ave	Ninth, Sixth	4			
KCM	311				Boren Ave to 5th Ave	Ninth, Seventh	13
KCM	355				Boren Ave to 3rd Ave	Ninth, Seventh	9
ST	510				Boren Ave to 5th Ave	Ninth, Seventh	21
ST	511				Boren Ave to 5th Ave	Ninth, Seventh	18
ST	512				Boren Ave to 5th Ave	Ninth, Seventh	53
ST	513				Boren Ave to 5th Ave	Ninth, Seventh	11
ST	545				Boren Ave to 5th Ave	Ninth, Seventh	94
ST	577				Boren Ave to 3rd Ave	Ninth, Seventh	15
ST	578				Boren Ave to 3rd Ave	Ninth, Seventh	29
ST	590				Boren Ave to 3rd Ave	Ninth, Seventh	36
ST	592				Boren Ave to 3rd Ave	Ninth, Seventh	16
ST	594				Boren Ave to 3rd Ave	Ninth, Seventh	33

Table B-5. Existing Transit Service Levels in Roosevelt Project Corridor

OPERATOR/ ROUTE		SEGMENT TRAVELED	STOPS	DAILY TRIPS	SEGMENT TRAVELED	STOPS	DAILY TRIPS
ST	595				Boren Ave to 3rd Ave	Ninth, Seventh	5
		3RD AVE NORTHBOUND			***3RD AVE SOUTHBOUND***		
KCM	1	Virginia St to Yesler Way	Pike, Seneca, Columbia	57	Virginia St to Yesler Way	Pine, Union, Marion, James	3
KCM	2	Virginia St to Spring St	Pike	44	Virginia St to Spring St	Pine, Union	81
KCM	3	Virginia St to James St	Pike, Seneca, Columbia	78	Virginia St to James St	Pine, Union, Marion	78
KCM	4	Virginia St to James St	Pike, Seneca, Columbia	46	Virginia St to James St	Pine, Union, Marion	49
KCM	5	Virginia St to Yesler Way	Pine, Union, Madison, James	21	Virginia St to Yesler Way	Pike, Seneca, Columbia	86
KCM	7	Virginia St to Yesler Way	Pike, Seneca, Columbia	79	Virginia St to Yesler Way	Pine, Union, Marion, James	105
KCM	11				Pine St to Yesler Way	Pine, Union, Marion, James	1
KCM	13	Virginia St to Seneca St	Pike, Seneca, Columbia	51	Virginia St to Yesler Way	Pine, Union, Marion, James	10
KCM	14	Virginia St to Yesler Way	Pike, Seneca, Columbia	1	Virginia St to Yesler Way	Pine, Union, Marion, James	57
KCM	15	Virginia St to Yesler Way	Pike, Seneca, Columbia	10	Virginia St to Yesler Way	Pike, Seneca, Columbia	12

Table B-5. Existing Transit Service Levels in Roosevelt Project Corridor

OPERATOR/ ROUTE		SEGMENT TRAVELED	STOPS	DAILY TRIPS	SEGMENT TRAVELED	STOPS	DAILY TRIPS
KCM	17	Virginia St to Yesler Way	Pine, Union, Madison, James	8	Virginia St to Yesler Way	Pine, Union, Marion, James	8
KCM	18	Virginia St to Yesler Way	Pine, Union, Madison, James	9	Virginia St to Yesler Way	Pine, Union, Marion, James	7
KCM	19	Virginia St to Yesler Way	Pine, Union, Madison, James	6	Virginia St to Yesler Way	Pike, Seneca, Columbia	5
KCM	21	Virginia St to Seneca St	Pine, Union	11	Virginia St to Columbia St	Pike, Seneca, Columbia	78
KCM	24	Virginia St to Yesler Way	Pine, Union, Madison, James	41	Virginia St to Yesler Way	Pike, Seneca, Columbia	4
KCM	26	Virginia St to Yesler Way	Pine, Union, Madison, James	42	Virginia St to Yesler Way	Pike, Seneca, Columbia	9
KCM	27	Virginia St to Yesler Way	Pine, Union, Madison, James	20	Virginia St to Yesler Way	Pike, Seneca, Columbia	35
KCM	28	Virginia St to Yesler Way	Pine, Union, Madison, James	46	Virginia St to Yesler Way	Pike, Seneca, Columbia	15
KCM	29	Virginia St to Yesler Way	Pike, Seneca, Columbia	12			
KCM	33	Virginia St to Yesler Way	Pine, Union, Madison, James	38	Virginia St to Yesler Way	Pike, Seneca, Columbia	4
KCM	36	Virginia St to Yesler Way	Pike, Seneca, Columbia	111	Virginia St to Yesler Way	Pine, Union, Marion, James	115

Table B-5. Existing Transit Service Levels in Roosevelt Project Corridor

OPERATOR/ ROUTE		SEGMENT TRAVELED	STOPS	DAILY TRIPS	SEGMENT TRAVELED	STOPS	DAILY TRIPS
KCM	37	Virginia St to Yesler Way	Pine, Union, Madison, James	4			
KCM	40	Virginia St to Yesler Way	Pine, Union, Madison, James	87	Virginia St to Yesler Way	Pine, Union, Marion, James	87
KCM	43				Pine St to Yesler Way	Union, Marion, James	3
KCM	49	Pike St to Yesler Way	Pike, Seneca, Columbia	29	Pine St to Yesler Way	Union, Marion, James	6
KCM	55	Virginia St to Seneca St	Pine, Union	11	Virginia St to Columbia St	Pike, Seneca, Columbia	12
KCM	56	Virginia St to Seneca St	Pine, Union	9	Virginia St to Columbia St	Pike, Seneca, Columbia	8
KCM	57	Virginia St to Seneca St	Pine, Union	4	Virginia St to Columbia St	Pike, Seneca, Columbia	5
KCM	62	Virginia St to Yesler Way	Pine, Union, Marion, James	80	Virginia St to Yesler Way	Pine, Union, Marion, James	81
KCM	70	Virginia St to Yesler Way	Pike, Seneca, Columbia	*97	Virginia St to Yesler Way	Pine, Union, Marion, James	*101
KCM	116	Virginia St to Yesler Way	Pine, Union, Madison, James	10	Virginia St to Yesler Way	Pike, Seneca, Columbia	8
KCM	118	Virginia St to Yesler Way	Pine, Union, Madison, James	2	Virginia St to Yesler Way	Pike, Seneca, Columbia	2

Table B-5. Existing Transit Service Levels in Roosevelt Project Corridor

OPERATOR/ ROUTE		SEGMENT TRAVELED	STOPS	DAILY TRIPS	SEGMENT TRAVELED	STOPS	DAILY TRIPS
KCM	119	Virginia St to Yesler Way	Pine, Union, Madison, James	1	Virginia St to Yesler Way	Pike, Seneca, Columbia	1
KCM	120	Virginia St to Seneca St	Pine, Union	80	Virginia St to Columbia St	Pike, Seneca, Columbia	83
KCM	124	Virginia St to Yesler Way	Pine, Union, Madison, James	6	Virginia St to Yesler Way	Pike, Seneca, Columbia	69
KCM	131	Virginia St to Yesler Way	Pine, Union, Madison, James	2	Virginia St to Yesler Way	Pike, Seneca, Columbia	37
KCM	132	Virginia St to Yesler Way	Pine, Union, Madison, James	3	Virginia St to Yesler Way	Pike, Seneca, Columbia	39
KCM	304	Virginia St to Yesler Way	Pine, Union, Madison, James	4	Stewart St to Yesler Way	Pike, Seneca, Columbia	5
KCM	355	Stewart St to Yesler Way	Pine, Union, Madison, James	10	Stewart St to Yesler Way	Pike, Seneca, Columbia	9
KCM	994	Virginia St to Yesler Way	Union	1	Virginia St to Yesler Way	Seneca, Marion	1
KCM	C Line	Virginia St to Seneca St	Pine	119	Virginia St to Columbia St	Pike, Seneca, Columbia	116
KCM	D Line	Virginia St to Yesler Way	Pike, Seneca, Columbia	115	Virginia St to Yesler Way	Pike, Seneca, Columbia	114
KCM	E Line	Virginia St to Yesler Way	Pike, Seneca, Columbia	114	Virginia St to Yesler Way	Pike, Seneca, Columbia	112

Table B-6. Proposed Bus Stop Revisions[1]

DIRECTION	CROSS STREET	ON STREET	METRO STOP ID	RAPIDRIDE UPGRADE	PROPOSED CHANGES TO STOP
Southbound / Inbound	NE 65th St	Roosevelt Way NE	16440	Yes	Stop remains
	NE Ravenna Blvd	Roosevelt Way NE	16460	Yes	Stop remains
	NE 55th St	Roosevelt Way NE	16480	No	Stop remains for other routes
	NE 50th St	Roosevelt Way NE	9589	Yes	Stop remains
	NE 45th St	Roosevelt Way NE	9605	Yes	Stop remains
	NE 42nd St	Roosevelt Way NE	9610	No	Stop remains for other routes
	NE 41st St	Roosevelt Way NE	NEW	Yes	New stop
	Harvard Ave E	Eastlake Ave E	9141	Yes	Stop remains
	E Allison St	Eastlake Ave E	9150	No	Consolidates stop to Harvard Ave E
	E Hamlin St	Eastlake Ave E	9170	Yes	Stop remains
	E Louisa St	Eastlake Ave E	9190	No	Consolidates stop to E Lynn St
	E Lynn St	Eastlake Ave E	9200	Yes	Stop remains
	E Newton St	Eastlake Ave E	9220	No	Consolidates stop to E Garfield St
	E Garfield St	Eastlake Ave E	9240	Yes	Stop remains
	E Nelson Pl	Fairview Ave N	10170	No	Consolidates stop to Yale Ave N
	Yale Ave N	Fairview Ave N	10180	Yes	Stop remains
	Aloha St	Fairview Ave N	10190	No	Consolidates stop to Yale Ave N
	Mercer St	Fairview Ave N	10210	No	Consolidates stop to Harrison St

Table B-6. Proposed Bus Stop Revisions[1]

DIRECTION	CROSS STREET	ON STREET	METRO STOP ID	RAPIDRIDE UPGRADE	PROPOSED CHANGES TO STOP
	Thomas St	Fairview Ave N	10225	Yes	Stop remains
	Virginia St	Boren Ave	10240	Yes	Stop remains
	9th Ave	Stewart St	940	No	Stop remains for other routes
	7th Ave	Stewart St	950	Yes	Stop remains
	4th Ave	Stewart St	970	No	Stop remains for other routes
Northbound / Outbound	NE 65th St	12th Ave NE	23560	No	Stop remains
	NE 61st St	12th Ave NE	23540	No	Stop remains for other routes
	NE Ravenna Blvd	11th Ave NE	23530	Yes	Stop remains
	NE 55th St	11th Ave NE	23520	No	Stop remains for other routes
	NE 52nd St	11th Ave NE	23510	No	Stop removed
	NE 50th St	11th Ave NE	23500	Yes	Stop remains
	NE 47th St	11th Ave NE	9660	No	Stop removed
	NE 45th St	11th Ave NE	9650	No	Stop remains for other routes
	NE 43rd St	11th Ave NE	NEW	Yes	New stop
	NE 42nd St	11th Ave NE	9630	No	Stop remains for other routes
	NE 41st St	Eastlake Ave NE	NEW	Yes	New stop
	Harvard Ave E	Eastlake Ave E	9560	Yes	Stop remains
	E Allison St	Eastlake Ave E	9550	No	Stop removed

Table B-6. Proposed Bus Stop Revisions[1]

DIRECTION	CROSS STREET	ON STREET	METRO STOP ID	RAPIDRIDE UPGRADE	PROPOSED CHANGES TO STOP
	NE 65th St	12th Ave NE	23560	Yes	Stop remains
	NE 61st St	12th Ave NE	23540	No	Stop remains for other routes
	NE Ravenna Blvd	11th Ave NE	23530	Yes	Stop remains
	NE 55th St	11th Ave NE	23520	No	Stop remains for other routes
	NE 52nd St	11th Ave NE	23510	No	Consolidates stop to NE 50th St
	NE 50th St	11th Ave NE	23500	Yes	Stop remains
	NE 47th St	11th Ave NE	9660	No	Consolidates stop to NE 50th St
	NE 45th St	11th Ave NE	9650	No	Consolidates stop to NE 43rd St
	NE 43rd St	11th Ave NE	NEW	Yes	New stop
	NE 42nd St	11th Ave NE	9630	No	Stop remains for other routes
	NE 41st St	Eastlake Ave NE	NEW	Yes	New stop
	Harvard Ave E	Eastlake Ave E	9560	Yes	Stop remains
	E Allison St	Eastlake Ave E	9550	No	Consolidates stop to Harvard Ave E
	E Hamlin St	Eastlake Ave E	9530	Yes	Stop remains
	E Louisa St	Eastlake Ave E	9510	No	Consolidates stop to E Lynn St
	E Lynn St	Eastlake Ave E	9500	Yes	Stop remains
	E Howe St	Eastlake Ave E	9480	No	Consolidates stop to E Garfield St
	E Garfield St	Eastlake Ave E	9460	Yes	Stop remains

Table B-6. Proposed Bus Stop Revisions[1]

DIRECTION	CROSS STREET	ON STREET	METRO STOP ID	RAPIDRIDE UPGRADE	PROPOSED CHANGES TO STOP
	E Nelson Pl	Fairview Ave N	10350	No	Consolidates stop to Yale Ave N
	Yale Ave N	Fairview Ave N	10340	Yes	Stop remains
	Valley St	Fairview Ave N	10325	No	Stop remains for other routes
	Harrison St	Fairview Ave N	10305	Yes	Stop remains
	Denny Way	Fairview Ave N	10280	Yes	Stop remains

1 – Bus stops and RapidRide Stations along 3rd Avenue would remain unchanged with the project.

Table B-7. Station Area Pedestrian Level of Service

LEVEL OF SERVICE	AVERAGE PEDESTRIAN AREA (FT^2/PERSON)
A	>13
B	10-13
C	7-10
D	3-7
E	2-3
F	<2

Appendix C
Curb Space Management Study

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FINAL REPORT

RAPIDRIDE ROOSEVELT CORRIDOR CURB SPACE MANAGEMENT STUDY

Prepared for

Seattle Department of Transportation

Seattle Department of Transportation

October 2019

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ACRONYMS AND ABBREVIATIONS

CVLZ	commercial vehicle loading zone
PLZ	passenger loading zone
RPZ	restricted parking zone
SDOT	Seattle Department of Transportation

1. INTRODUCTION

Seattle Department of Transportation (SDOT) proposes to improve bus transit with the RapidRide Roosevelt Corridor project from the International District/Chinatown Link light rail station to the Roosevelt Link station. It will provide faster, safer, and more reliable bus service in a heavily used transit corridor in Seattle. Project improvements will be provided in the area north of 3rd Ave and Virginia/Stewart Streets to the northern end of the route and will include:

- 26 new RapidRide stations (13 per direction of travel) from 3rd Ave to NE 65th St with service to existing stations in Downtown Seattle
- New overhead contact system (OCS) poles and overhead wires added north of the University Bridge to power trolley buses
- A new traction power substation (source of electric power) in the northern portion of the project
- A northern bus layover, where buses would park between runs
- Protected bicycle lanes along 11th/12th Avenues, Eastlake Ave E, and Fairview Ave N
- Sidewalk improvements to meet Americans with Disabilities Act accessibility requirements
- Paving along sections of 11th and 12th Avenues NE and Eastlake Ave E roadways

The southern bus layover would use existing layover space. For the northern bus layover, two bus turnaround options are considered that would provide 3 or 4 layover spaces; NE 67th St turnaround option and NE 70th St turnaround option. With these two turnaround options, potential layover spaces have been identified on NE 67th St between 12th Ave NE and Roosevelt Way NE, 12th Avenue NE, and Roosevelt Way NE.

No improvements are proposed in the area south of 3rd Ave and Virginia/Stewart Streets. However, bus service would use existing stations. The effects of RapidRide Roosevelt project on on-street parking and loading zones were evaluated in this study.

2. METHODOLOGY

2.1 Study Area

The study area for curb space management was defined as all the block faces along the RapidRide Roosevelt corridor except for 3rd Ave and Virginia St/Stewart St. Because there are no project improvements in the area south of 3rd Ave and Virginia/Stewart Streets, these streets were not included in the parking study area. The parking study area also includes cross streets and parallel streets one block away (east and west directions) from the RapidRide Roosevelt corridor to account for available parking within a reasonable walking distance to and from the corridor. In response to the Eastlake neighborhood requests about the parking availability overnight, an additional parking study and data collection was conducted which covers a larger set of block faces along Eastlake Ave E to understand parking conditions in the overnight, early morning hours.

To analyze the parking data, the study area was divided into 10 study zones. These zones were generally determined based on the street and parking network within the transportation system. However, it is possible for people to park in one zone to access a destination in another zone. Figure 1 shows the overall study area and zones for the curb space management study.

> **Definitions**
>
> **Curb space** is the space between the area exclusively used by bikes, cars, buses, streetcars, and trucks (streets) and the area used by pedestrians (sidewalks). Curb space has a variety of flexible transportation uses and other uses, including socializing, using parklets, and patronizing streateries. Because there is a high demand for these spaces, the City's Comprehensive Plan establishes policies that set priorities to manage the use of curb spaces.
>
> A **block face** is defined as one side of a street between two consecutive features intersecting that street. The features can be other streets or boundaries of standard geographic areas.
>
> **Complete streets** are streets that provide appropriate accommodation for pedestrians, bicyclists, transit riders, and people of all abilities, while promoting safe operation for all users.

2.2 On-Street Parking and Loading Zone Data Collection

On-street parking utilization describes the number of vehicles parked (occupancy) in an area compared to the available inventory. It is calculated by dividing the occupancy by the inventory in the area. SDOT provided the inventory and utilization data for paid on-street parking and loading zones in the study area. For unpaid on-street parking areas and off-street parking, the project team performed a parking inventory and occupancy survey.

2.2.1 On-Street Paid Parking and Loading Zone Inventory and Utilization

SDOT provided on-street paid parking and loading zone inventory and utilization data collected as part of the Performance-Based Parking Pricing Program to the project team. Parking data were collected in April and May 2017 on typical weekdays (Tuesday, Wednesday, or Thursday) to represent average parking conditions. Even though data was collected on a typical, average condition the parking supply and occupancy can frequently change. Collection dates were chosen to not overlap with significant area events, such as spring break periods for schools, to ensure typical parking conditions were represented.

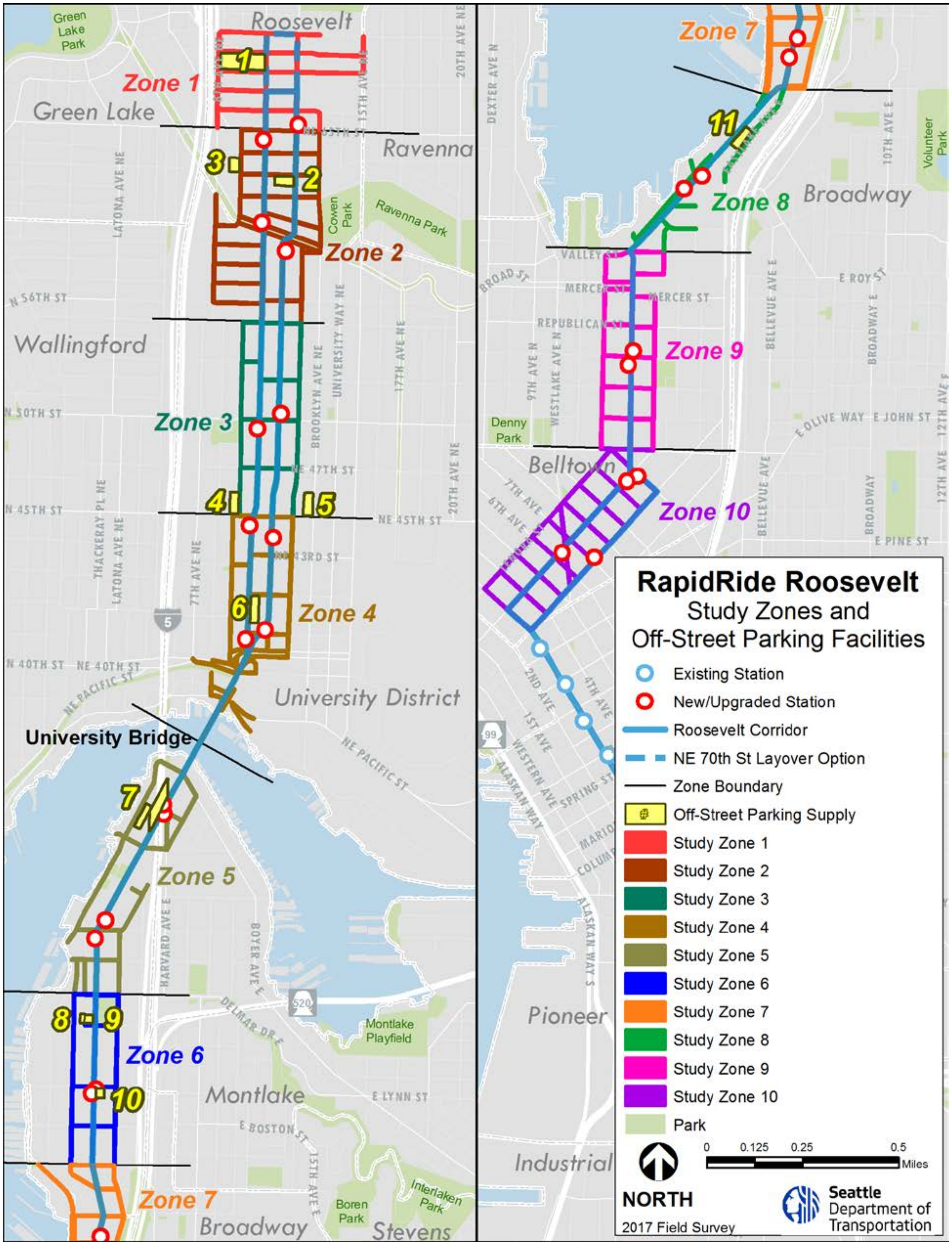


Figure 1. Curb Space Management Study Zones and Studied Off-street Parking Facilities

Hourly occupancy observations were made in the areas from 8 AM to 10 PM. Occupancy was defined as the percent of legal on-street parking spaces in which a vehicle was parked at a given time. SDOT did not formally designate or delineate individual spaces but maintained a space inventory that would exist if spaces were legally marked. These spaces were based on standard parking dimensions and reflected parking restrictions near intersections, driveways, and fire hydrants. Occupancy can be over 100% as vehicles sometimes park close together or partially in illegal areas.

2.2.2 On-Street Unpaid Parking and Loading Zone Inventory and Utilization

An inventory of on-street unpaid parking and loading zones (commercial vehicle loading zones, passenger loading zones) was completed for each block face. Parking inventory was verified in the field using the methodology described in SDOT's Tip 117: Parking Waivers for Accessory Dwelling Units, as recommended by City staff (City of Seattle, 2011).

The following curb space measurements for required clear distances from common street features were used from Tip 117:

- No parking within 15 feet of a fire hydrant on either side
- No parking within 5 feet of a driveway or alley on either side
- No parking within 30 feet of a marked intersection[1]
- No parking within 20 feet of an unmarked intersection

The inventory and utilization of on-street unpaid parking was conducted on two non-consecutive weekdays (Thursday, December 7, 2017, and Tuesday, December 12, 2017). The inventory was done for three one-hour time periods each day. Occupancy counts were a one-time count for each of the time slots and did not reflect turnover. At each of the following time slots, the number of spaces occupied was recorded:

- Midday (noon to 1 PM): Parking inventory and occupancy data were collected during this period to capture the parking demand during business hours for on-street parking during weekdays.
- PM Peak (5 PM to 6 PM): Parking inventory and occupancy data were collected during this period to capture the effects of peak parking restrictions during weekdays.
- Late evening (one hour between 8 PM and 10 PM): Parking inventory and occupancy data were collected during this period to determine the overnight parking needs during weekdays.

The locations and signed restrictions of all commercial vehicle loading zones and passenger loading zones were collected along the entire corridor.

The locations of the block faces with paid and unpaid parking within the study area are presented in Attachment A.

[1] *A marked intersection is an intersection where a traffic light, stop sign, or yield sign is installed.

2.3 Off-Street Parking Data Collection

The numbers of parking spaces and the numbers of spaces occupied were surveyed at 11 public paid parking facilities along the corridor, shown on Figure 1. The facilities were selected in coordination with SDOT to represent a sampling of the public off-street parking facilities located close to the main corridor. This information was used to evaluate whether there would be enough parking to meet parking demand after the construction of the project. The parking survey was conducted during two non-consecutive days (Thursday, January 18, 2018, and Tuesday, January 23, 2018) for three one-hour time periods: 1) midday from noon to 1 PM, 2) PM peak from 5 PM to 6 PM, and 3) late evening from 8 PM and 10 PM.

2.4 Eastlake Commercial Area Parking Duration Study

In response to the business community's concerns about parking availability, a parking duration study was conducted for the Eastlake commercial area. The Eastlake commercial area is defined as the area along Eastlake Ave E between E Roanoke St and E Newton St. Many of the businesses in this area do not have dedicated off-street parking for customers, and this area has limited access to additional on-street parking on the adjacent block faces because of the proximity to South Lake Union and I-5.

The purpose of this study was to determine the parking occupancy and the average duration of parking in the commercial area. On-street parking duration was surveyed hourly from 7 AM to 7 PM to represent the peak activity times for businesses in the area. The data were collected on two non-consecutive days (Tuesday, December 12, 2017, and Thursday, December 14, 2017).

2.5 Eastlake Overnight Extended Area Study

In response to neighborhood requests about the parking availability overnight and the limits of the data collection, an additional parking study was conducted. The purpose of this overnight study was to determine the availability of additional parking options for all of the Eastlake neighborhood. This extended area included all block faces located along the Eastlake Ave E (east and west directions) between South Lake Union and I-5.

Figure 2 shows the overnight extended study area for study zones 5 through 7. The data was collected on July 17, 2019 for one-hour period between 3 AM to 4 AM to determine the overnight parking needs during weekdays; a second data collection was performed on July 31 (for collecting data for a few blackfaces that were missing from the first collection).

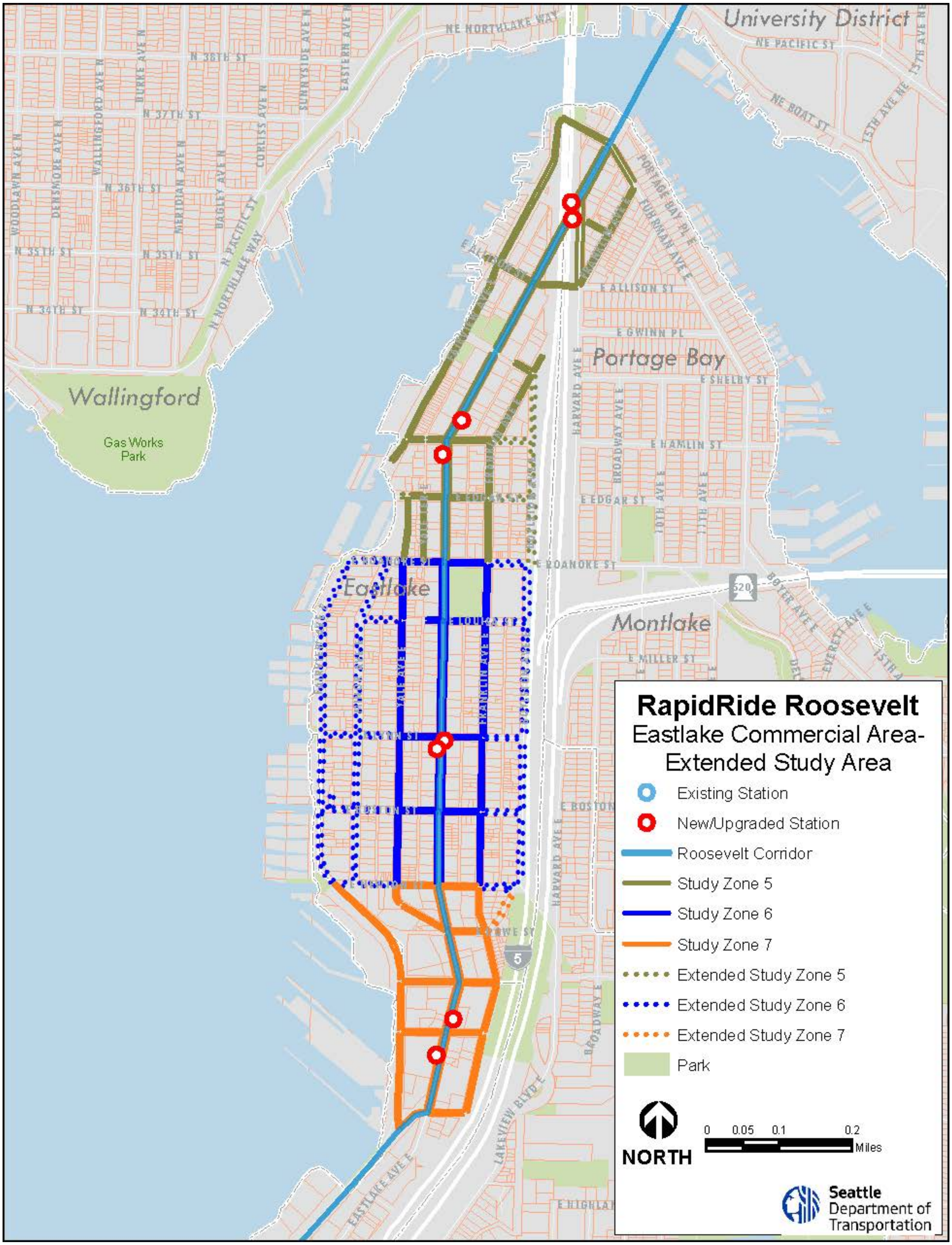


Figure 2. Eastlake Neighborhood- Extended Study Area

3. CITY OF SEATTLE CURBSPACE POLICIES

This section discusses the City of Seattle policies for curb space use in the *Seattle 2035 Comprehensive Plan* (City of Seattle, 2019) and the Right-of-Way Improvements Manual (City of Seattle, 2017a).

3.1 City of Seattle Comprehensive Plan

Curb space is part of the public right of way system and is considered by SDOT a public good available to all users. The use of curb space in Seattle is regulated and managed by SDOT. The City's Comprehensive Plan (Chapter 1) establishes policies to address the competing and diverse needs of transportation to assist in more efficiently moving people and goods, support the vitality of business districts, and create livable neighborhoods.

The City's adopted Comprehensive Plan (City of Seattle, 2019), refers to curb space as the flex zone that provides parking, bus stops, and loading for passenger and urban goods delivery. The flex zone has six essential functions to provide: support for modal plan priorities; access for commerce; access for people; activation; greening; and, storage. This curb space policy works to address the competing and diverse needs of transportation, economic development, and growth in the city, including modes and users at the curb. Definitions and examples of these different functions for flex zone use are shown in Table 1.

Because not every function can fit on every block, the Comprehensive Plan establishes a framework policy to prioritize and determine how to meet functions on each corridor or nearby. Specifically, T 2.6 states:

> Allocate space in the flex zone to accommodate access, activation, and greening functions, except when use of the flex zone for mobility is critical to address safety or to meet connectivity needs identified in modal master plans. When mobility is needed only part of the day, design the space to accommodate other functions at other times.

The right-of-way functions to accommodate mobility, and the modal plan priorities ensure that the street network accommodates multiple travel modes.

Table 1. Definitions and Examples of Functions for Curb Space Use

FUNCTION	DEFINITION	EXAMPLES OF USES
Support for modal plan priorities	Moves people and goods	• Sidewalks • Bus or streetcar lanes • Bike lanes • General purpose travel lanes (includes freight) • Right- or left-turn only lanes
Access for People	People arrive at their destination, or transfer between different ways of getting around.	• Bus or rail stops • Bike parking • Curb bulbs • Passenger loading zones • Short-term parking • Taxi zones
Access for Commerce	Goods and services reach their customers and markets.	• Commercial vehicle loading zone • Truck loading zone
Activation	Offers vibrant social spaces.	• Food trucks • Parklets and streateries • Public art • Street festivals

Greening	Enhances aesthetics and environment health.	• Plantings
		  - Boulevards
		  - Street trees
		  - Planter boxes
		• Rain gardens and bio-swales

Storage	Provides storage for vehicles or equipment.	• Bus layover • Long-term parking • Reserved spaces (e.g., for police or other public use) • Construction

Source: SDOT, 2018

3.2 Seattle Streets Illustrated

Streets Illustrated (City of Seattle, 2017a) is Seattle's Right-of-Way Improvements Manual and was adopted in 2017. Streets Illustrated provides design guidance and standards for various street type designations and right-of-way within Seattle and is based on a guiding principle of complete streets and balancing the needs of all travel modes and users including pedestrians, bicyclists, transit riders, freight, and motor vehicle drivers. The design guidance provided in Streets Illustrated is consistent with applicable City of Seattle plans and regulations, including the Seattle Comprehensive Plan (City of Seattle, 2019), the *City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction* (City of Seattle, 2017b), and the Seattle Municipal Code.

4. EXISTING CONDITIONS

4.1 Existing On-Street Parking and Loading Zones Inventory

Table 2 summarizes the total number of parking spaces and loading zones by type (i.e., commercial vehicle loading zones and passenger loading zones) for each of the analysis time periods, as of May 2017. The midday and late evening time periods have the same numbers, but the number of spaces in the PM peak is reduced in most of the zones due to existing PM peak period parking restrictions, when parking or stopping are not allowed in order to improve roadway capacity and traffic flow. As shown in Table 2, the existing on-street parking spaces are 4,271 during the PM peak, compared to 4,589 spaces during midday and late evening.

Table 2. Summary of Existing On-Street Parking and Loading Zone Inventory

STUDY ZONE	MIDDAY/LATE EVENING[a]			PM PEAK[b]		
	PARKING[c]	LOADING ZONES		PARKING[c]	LOADING ZONES	
		CVLZ	PLZ		CVLZ	PLZ
1	573	20	6	571	20	6
2	930	21	3	857	14	3
3	538	14	7	538	14	7
4	302	20	11	283	20	8
5	579	11	2	504	9	1
6	506	14	2	442	8	2
7	411	10	0	388	9	0
8	188	2	3	188	2	3
9	283	26	16	260	24	14
10	279	32	50	240	28	45
Total	**4,589**	**170**	**100**	**4,271**	**148**	**89**

[a] The inventory is the same for midday and late evening time periods. The inventory includes different types of parking (i.e., time-limited, unrestricted, restricted parking zone [RPZ], and disabled parking).

[b] The on-street parking and loading zone inventory is reduced in some locations by peak period parking restrictions.

[c] Parking data includes all types of parking – unpaid, paid, time-limited, disabled, etc.

CVLZ = commercial vehicle loading zone

PLZ = passenger loading zone

Figures 3 to 7 show the locations of loading zones along the study corridor. Different types of parking (i.e., time-limited, unrestricted, restricted parking zone [RPZ], and disabled parking) within the study area are shown in Attachment A.

Figure 3. Location of Loading Zones along the Study Corridor in Study Zones 1, 2

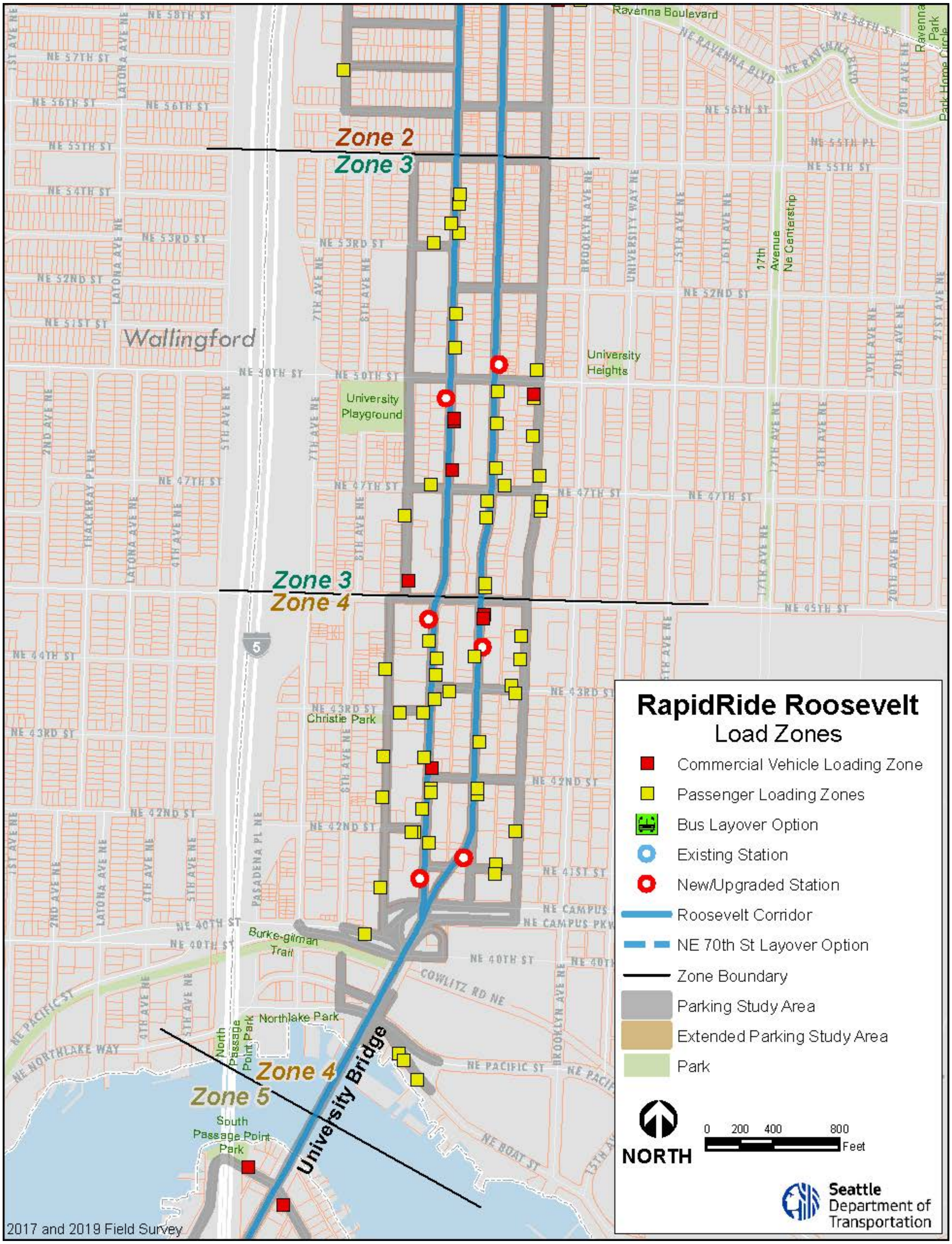


Figure 4. Location of Loading Zones along the Study Corridor in Study Zones 3, 4

Figure 5. Location of Loading Zones along the Study Corridor in Study Zones 5, 6

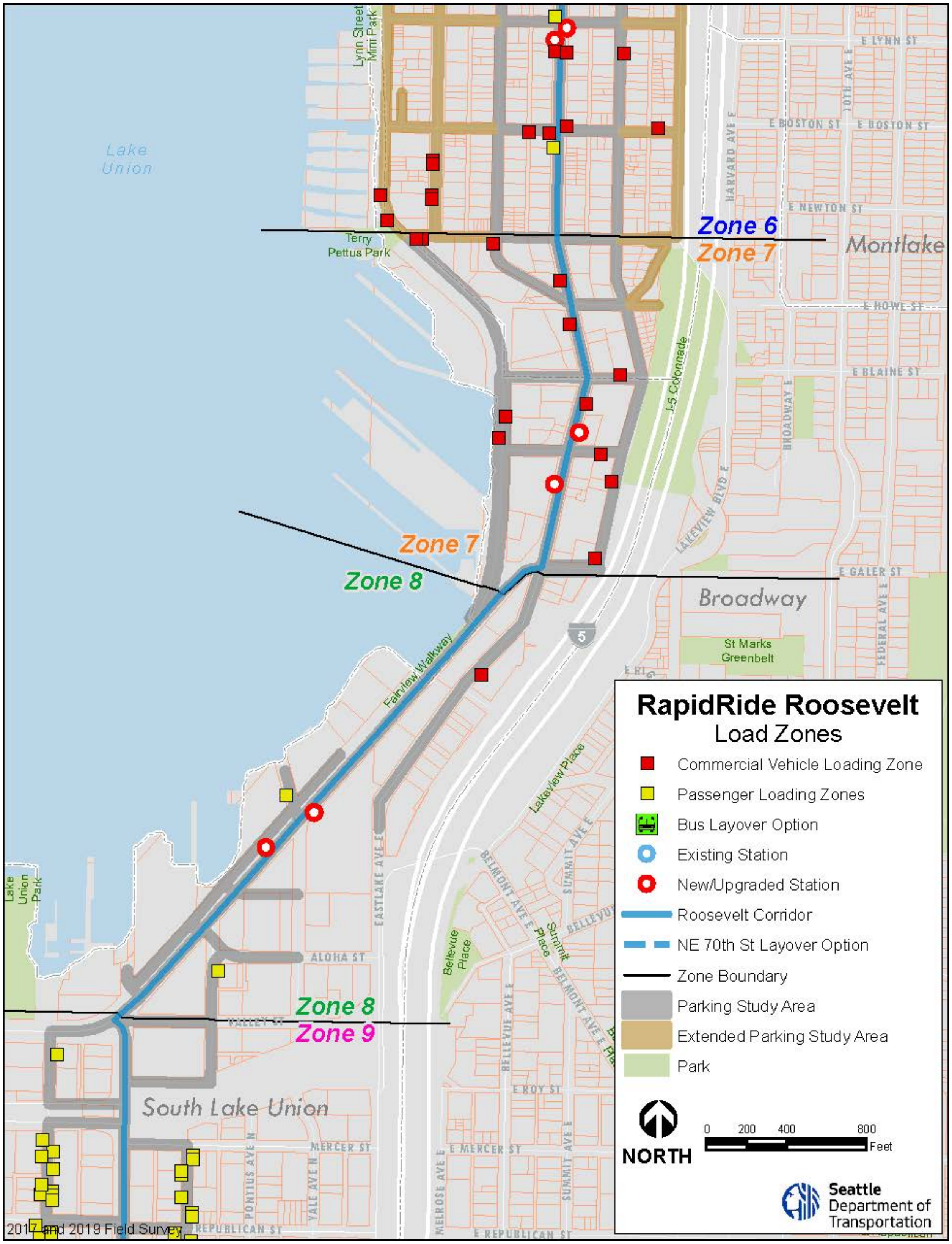


Figure 6. Location of Loading Zones along the Study Corridor in Study Zones 7, 8

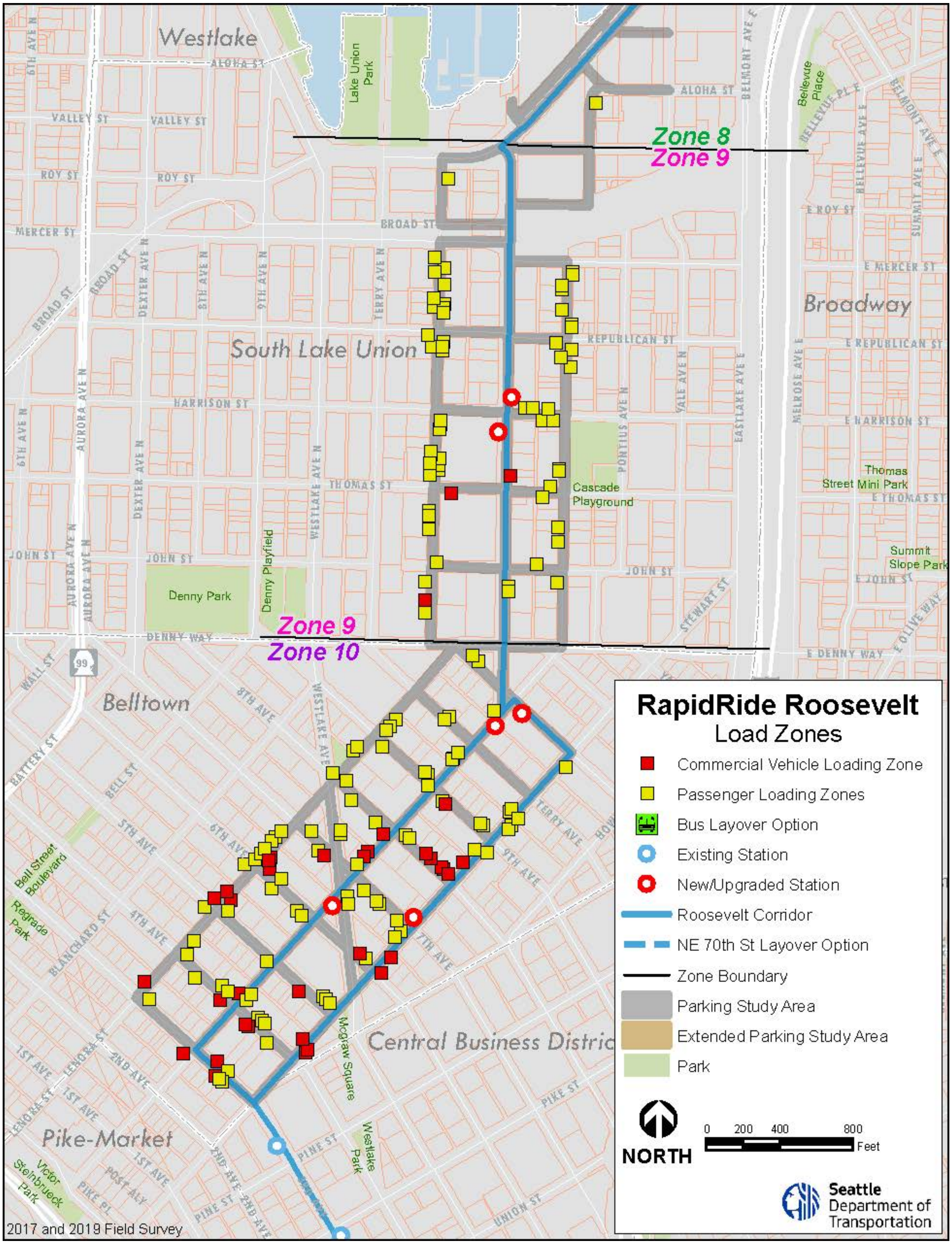


Figure 7. Location of Loading Zones along the Study Corridor in Study Zones 9, 10

4.2 Existing On-Street Parking Occupancy and Utilization

The existing on-street parking utilization percentages[2] for each zone are summarized in Table 3. An occupancy rate of 85% or below is considered to be an acceptable threshold for available parking by the City of Seattle. Utilization rates over 85% generally indicate conditions where people find it difficult to find parking spaces and often result in increased circulation as people look for spaces. Utilization rates over 100% may indicate vehicles parked illegally, closely spaced vehicles, or other similar situations. For loading zones, utilization data were not collected due to the short durations of occupation.

As shown in Table 3, on-street parking utilization was observed as approaching or exceeding the 85% threshold in a number of study zones. During midday, which has the highest demand for on-street parking, zones 1, 4, 5, 7, 9, and 10 have utilization rates equal to or greater than 85%. Attachment A-1 illustrates the figures for parking utilization by block face. The maps highlight where parking demand is greatest.

4.3 Off-Street Parking Inventory and Occupancy

The 11 paid parking facilities selected for the study have a capacity of 596 spaces, with the total capacity of individual facilities ranging from 1 to 158 spaces. As shown in Table 4, these facilities were highly utilized during the midday time period, with six facilities approaching or over 85% full. Utilization rates drop for the PM peak and late evening time periods, with most facilities less than 50% utilized.

Besides these 11 facilities inventoried, the University District (zones 3 and 4) and South Lake Union and Downtown neighborhoods (zones 9 and 10) have numerous other parking facilities within the project corridor that were not inventoried. It is assumed that the overall occupancies in these other parking facilities would be similar to the facilities that were inventoried. These other parking facilities are shown on the off-street parking facilities figures (Figures 8 through 12).

[2] Data was collected in April and May 2017 on typical weekdays (Tuesday, Wednesday, or Thursday).

Table 3. Summary of Existing On-Street Parking Inventory and Utilization Rates by Time Period

STUDY ZONE	MIDDAY			PM PEAK			LATE EVENING		
	PARKING	OCCUPANCY	UTILIZATION	PARKING	OCCUPANCY	UTILIZATION	PARKING	OCCUPANCY	UTILIZATION
1	573	540	94%	571	425	74%	573	447	78%
2	930	632	68%	857	644	75%	930	664	71%
3	538	437	81%	538	389	72%	538	422	78%
4	302	299	99%	283	248	88%	302	272	90%
5	579	524	91%	504	415	82%	579	404	70%
6	506	426	84%	442	362	82%	506	398	79%
7	411	415	101%	388	254	65%	411	254	62%
8	188	141	75%	188	80	43%	188	58	31%
9	283	240	85%	260	177	68%	283	173	61%
10	279	258	92%	240	180	75%	279	214	77%
Total	**4,589**	**3,912**	**85%**	**4, 271**	**3,174**	**74%**	**4,589**	**3,306**	**72%**

Table 4. Summary of Existing Off-Street Parking Inventory and Utilization

STUDY ZONE	LOT #	INVEN TORY	MIDDAY			PM PEAK			EVENING		
			OCCU-PANCY	UTILIZA-TION	AVAIL-ABLE	OCCU-PANCY	UTILIZA-TION	AVAIL-ABLE	OCCU-PANCY	UTILIZA-TION	AVAIL-ABLE
1	1	184	137	74%	47	28	15%	156	26	14%	158
2	2	16	14	84%	2	6	38%	10	3	19%	13
2	3	55	37	67%	18	28	50%	27	22	39%	33
3	4	59	51	86%	8	43	72%	16	37	62%	22
3	5	109	105	96%	4	46	42%	63	28	25%	81
4	6	26	11	42%	15	8	31%	18	6	21%	20
5	7	31	13	40%	18	10	31%	21	7	21%	24
6	8	10	9	85%	1	4	40%	6	4	40%	6
6	9	5	3	60%	2	3	50%	2	1	20%	4
6	10	22	19	84%	3	7	30%	15	3	11%	19
8	11	79	74	93%	5	37	46%	42	17	22%	62
Total		**596**	**473**	**79%**	**123**	**220**	**37%**	**376**	**154**	**26%**	**442**

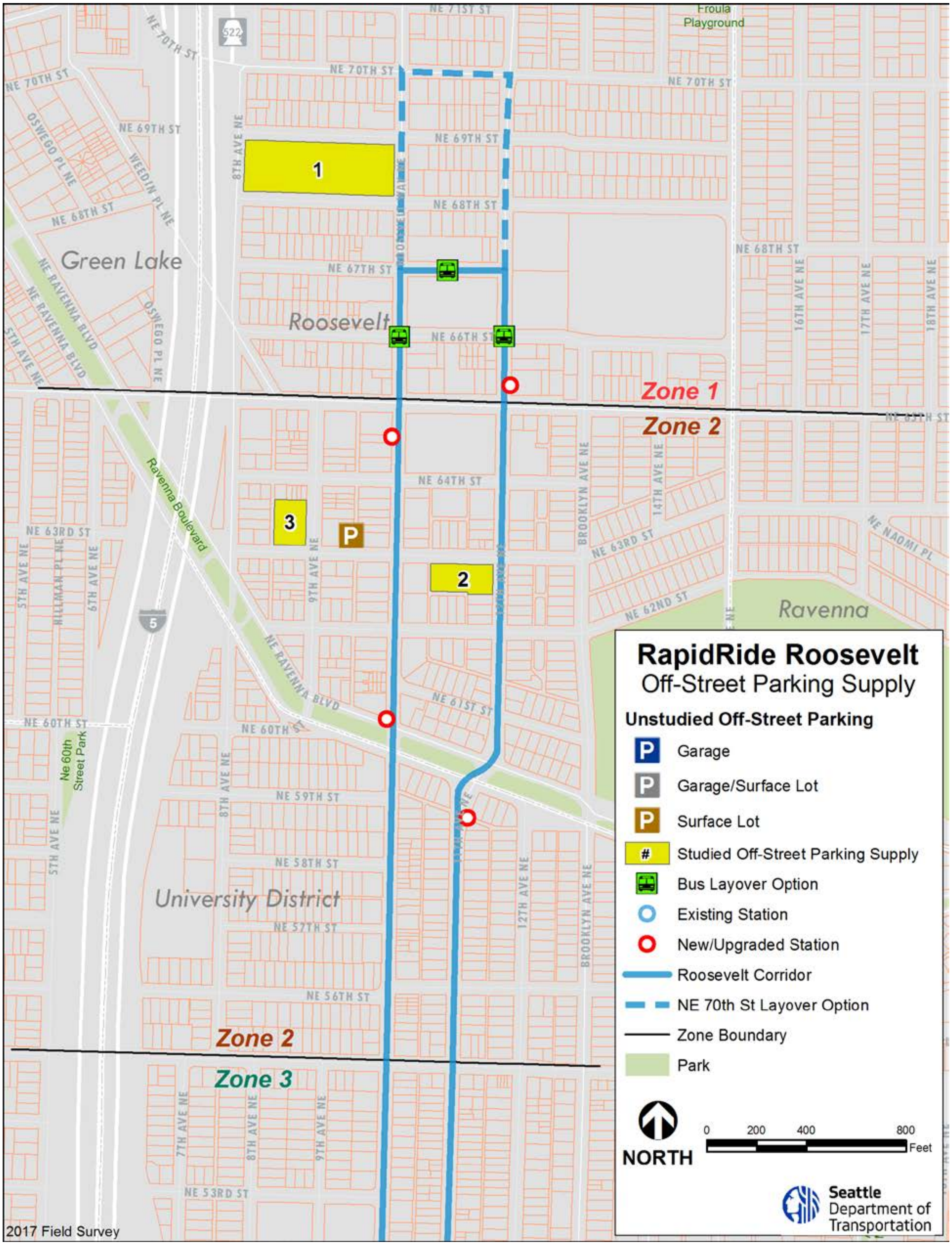


Figure 8. Off-Street Parking Facilities within and Close to the Study Area in Zones 1, 2

Figure 9. Off-Street Parking Facilities within and Close to the Study Area in Zones 3, 4

Figure 10. Off-Street Parking Facilities within and Close to the Study Area in Zones 5, 6

Figure 11. Off-Street Parking Facilities within and Close to the Study Area in Zones 7, 8

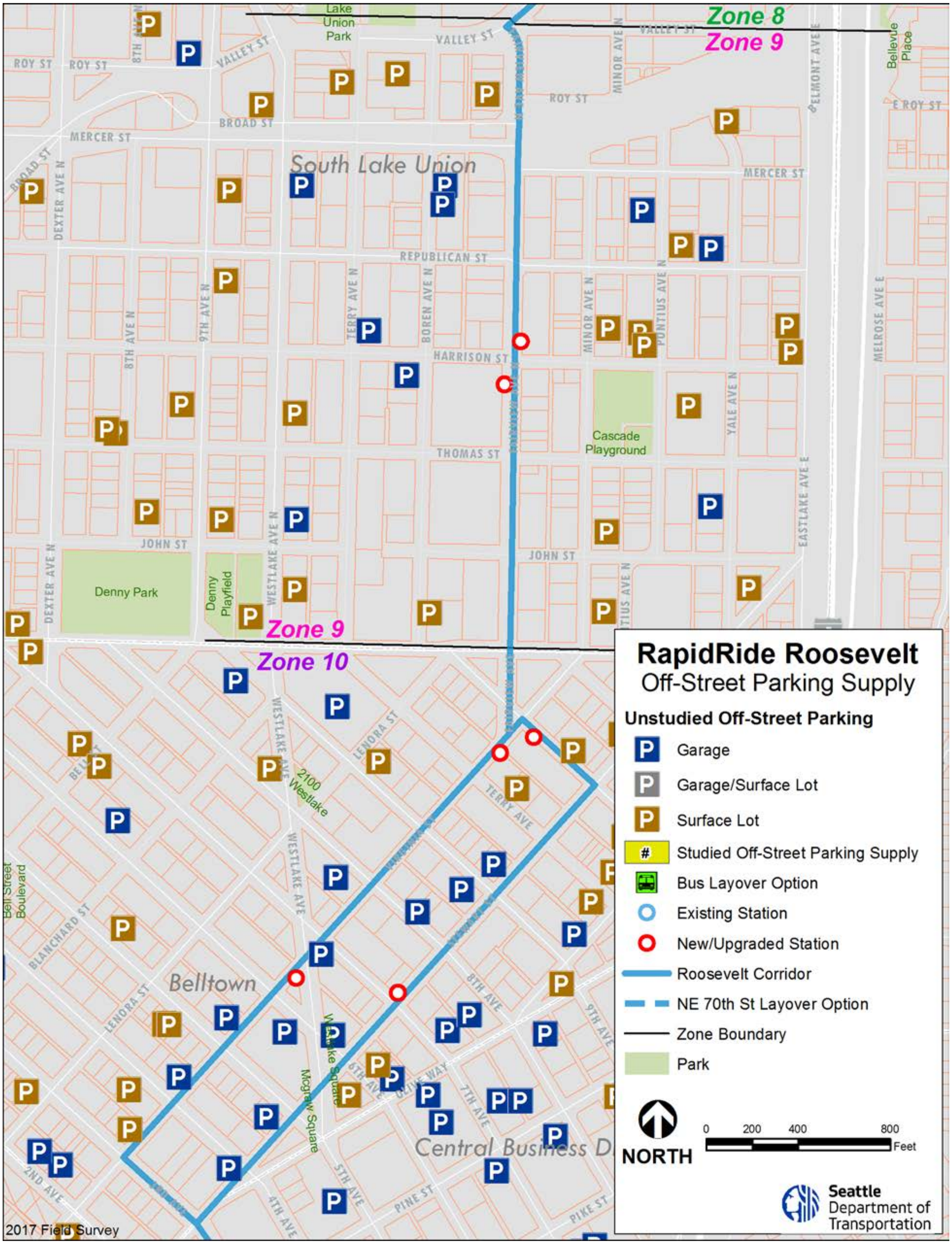


Figure 12. Off-Street Parking Facilities within and Close to the Study Area in Zones 9, 10

4.4 Eastlake Commercial Area Parking Duration Study

The curb space analysis included a parking duration study for the project corridor through the Eastlake commercial area defined as eight block faces on Eastlake Ave E from E Roanoke St and E Newton St (Table 5 and Figure 13).[3]

Figure 13 provides information on the parking inventory, type of parking for each block face, and the peak period parking restriction (AM Peak: 7-9 AM, PM Peak: 4-6 PM). The presence of Zone 8 RPZ stickers for vehicles on Block Face 4A was also noted, which is important because the duration study provides an understanding of how the parking is being used by land use activities on the corridor.

The results in terms of the average turnover (vehicles per spot) and the average parking duration (hours per spot) for each block face are shown in Table 5. In the study area, the maximum parking duration was observed for block faces with time limited parking restriction (2 hours)—Zones 2, 3, 6, 7—between 6 and 10 hours per spot, indicating illegal parking.

Definitions

Parking turnover - indicates the rate of use of a given parking space and the average number of vehicles parking at a given space or group of spaces during a specified time period (vehicles per spot).

Parking duration - the length of time vehicles are parked in a given space (hours per spot). The higher percentage of the parking being occupied for a longer duration indicates that it is less available for turnover and business patrons.

[3] The parking duration study was conducted on two non-consecutive days (Tuesday, December 12, 2017, and Thursday, December 14, 2017).

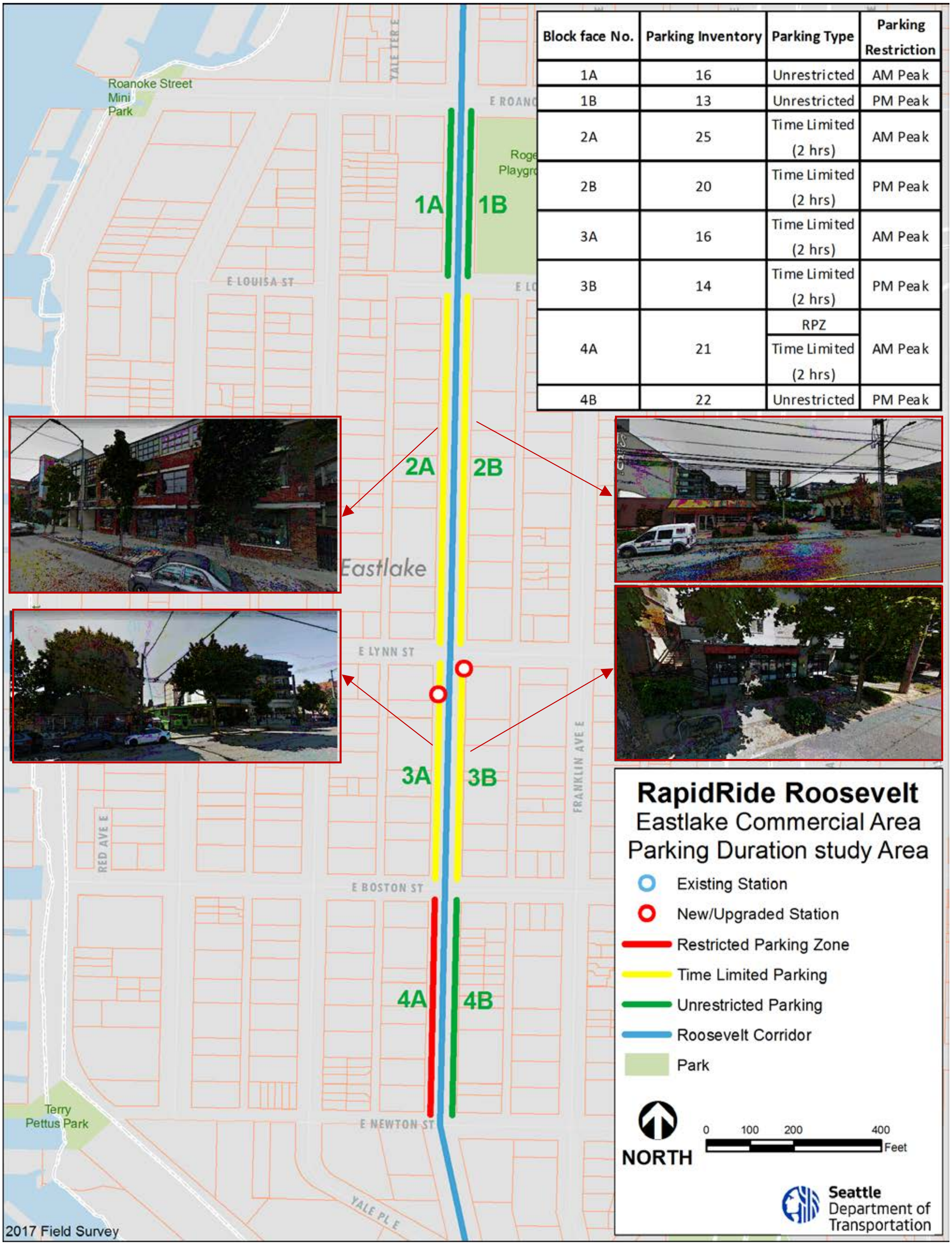
Table 5. Eastlake Commercial Area Duration Study Average Turnover and Parking Duration

BLOCK FACE NO.	STREET NAMES	PARKING TYPE	AVERAGE TURNOVER (VEH/SPOT)	AVERAGE PARKING DURATION (HR/SPOT)
1A	Eastlake Ave E between E Louisa St and E Roanoke St - west side	Unrestricted	1.9	4.3
1B	Eastlake Ave E between E Louisa St and E Roanoke St - east side	Unrestricted	2.0	4.1
2A	Eastlake Ave E between E Lynn St and E Louisa St - west side	Time Limited (2 hour)	2.4	3.4
2B	Eastlake Ave E between E Lynn St and E Louisa St - east side	Time Limited (2 hour)	2.7	2.0
3A	Eastlake Ave E between E Boston St and E Lynn St - west side	Time Limited (2 hour)	3.3	1.8
3B	Eastlake Ave E between E Boston St and E Lynn St - east side	Time Limited (2 hour)	1.7	2.4
4A	Eastlake Ave E between E Newton St and E Boston St - west side	RPZ Time Limited (2 hour)	1.8	3.4
4B	Eastlake Ave E between E Newton St and E Boston St - east side	Unrestricted	1.4	4.0

The parking duration survey noted the length of time cars were parked in the Eastlake commercial area in the 12-hour period from 7 AM to 7 PM. The durations that vehicles were parked varied by inventory type. The results are summarized in Table 6. The results show that approximately 16% of cars were parked in time-limited parking for longer than 2 hours. For unrestricted parking spaces, more than half of the cars were parked for 2 hours or more, and the average parking time was approximately 4 hours. For RPZs, more than half of the cars were parked for 2 hours or more and the average parking time was approximately 6 hours.

Table 6. Summary of Average Length of Stay along Eastlake Commercial Area for Different Types of On-street Parking

TIME INTERVALS (HOURS)	TOTAL % (NUMBER OF CARS PARKED)	TIME-LIMITED	UNRESTRICTED	RPZ	OTHER
<1	42% (145)	29%	12%	<1%	<1%
1-2	20% (68)	14%	6%	<1%	<1%
2-3	9% (29)	5%	3%	0%	<1%
3-4	3%(12)	2%	1%	0%	<1%
4-5	6% (19)	3%	2%	0%	<1%
5-6	3% (13)	1%	3%	0%	0%
6-7	5% (17)	2%	4%	0%	<1%
7-8	6% (21)	2%	4%	<1%	0%
8-9	4% (14)	2%	2%	<1%	0%
9-10	2% (5)	<1%	1%	0%	0%
10-11	0% (0)	0%	0%	0%	0%
11-12	0% (0)	0%	0%	0%	0%
Total	**100% (342)**	**60%**	**38%**	**1%**	**1%**



Block face No.	Parking Inventory	Parking Type	Parking Restriction
1A	16	Unrestricted	AM Peak
1B	13	Unrestricted	PM Peak
2A	25	Time Limited (2 hrs)	AM Peak
2B	20	Time Limited (2 hrs)	PM Peak
3A	16	Time Limited (2 hrs)	AM Peak
3B	14	Time Limited (2 hrs)	PM Peak
4A	21	RPZ Time Limited (2 hrs)	AM Peak
4B	22	Unrestricted	PM Peak

Figure 13. Eastlake Commercial Area Parking Inventory and Type of Parking per Block Face

According to the Seattle Municipal Code, short-term parking is defined as parking for less than 4 hours (SMC 23.84A.030). In the study area, 26% of the cars were long-term parkers. Figure 14 shows the long-term and short-term parker percentages.

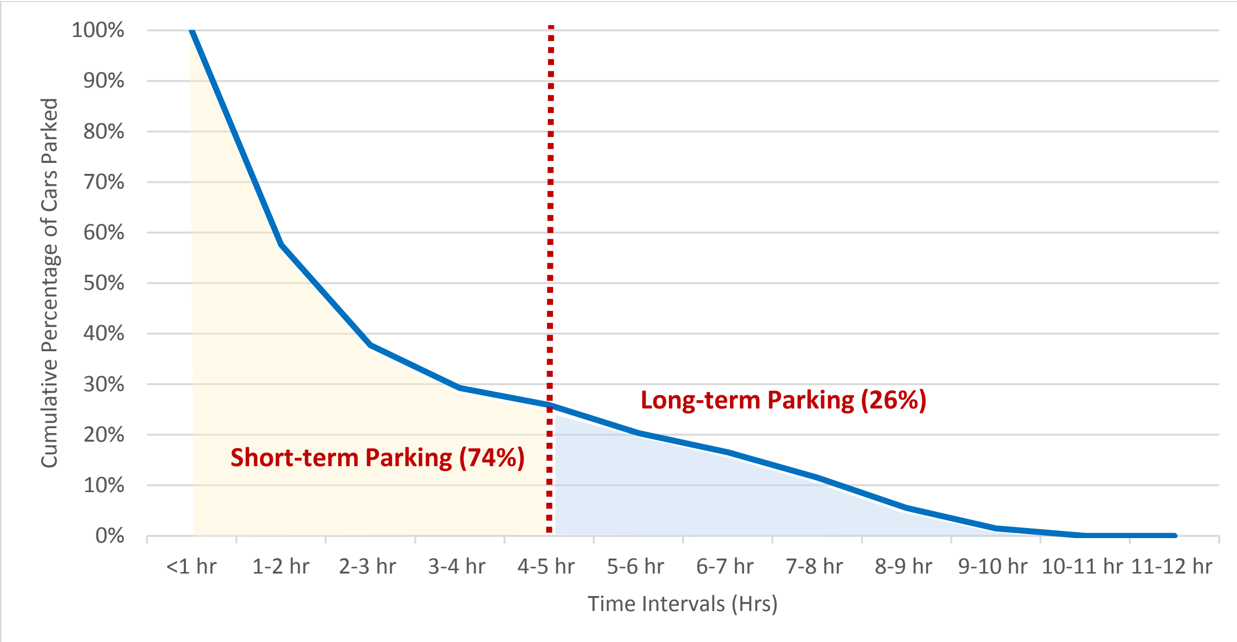


Figure 14. Percentage of Long-term and Short-term Parking during Eastlake Commercial Area Parking Duration Study

4.5 Eastlake Overnight Extended Area Study

The purpose, methodology and extended data collection area for the overnight study is described in Section 2.5 and shown in Figure 2.

4.5.1 Existing On-Street Parking and Loading Zones Inventory

Table 7 summarizes the total number of parking spaces and loading zones by type (i.e., commercial vehicle loading zones and passenger loading zones) for each of the analysis time periods for the study zones within Eastlake neighborhood.[4] The overnight time period has a larger number of spaces compared to other data collection periods (midday and late evening), due to additional block faces included in the extended study area. As shown in Table 7, the total number of existing on-street parking spaces in the Eastlake neighborhood are 2,110 during the overnight time period, compared to 1,496 spaces during midday and late evening. The additional 614 on-street parking spaces (including 10 CVLZ and 0 PLZ) inventoried during the overnight time period is the parking along the additional block faces beyond the primary parking study area inventoried for the other time periods.

Figures 5 and 6 (section 4.1) show the locations of loading zones in the Eastlake extended study area. Different types of parking (i.e., time-limited, unrestricted, restricted parking zone [RPZ], and disabled parking) within the study area are shown in Attachment A.

[4] Data was collected in 2019 for overnight period, and in 2017 for the other time periods.

Table 7. Eastlake Extended Area-Summary of Existing On-Street Parking and Loading Zone Inventory

STUDY ZONE	MIDDAY/LATE EVENING[A]			PM PEAK[B]			OVERNIGHT[D]		
	PARKING[C]	LOADING ZONES		PARKING[C]	LOADING ZONES		PARKING[C]	LOADING ZONES	
		CVLZ	PLZ		CVLZ	PLZ		CVLZ	PLZ
5	579	11	2	504	9	1	676	12	2
6	506	14	2	442	8	2	960	23	2
7	411	10	0	388	9	0	474	10	0
Total	1,496	35	4	1,334	26	3	2,110	45	4

[a] The inventory is the same for midday and late evening time periods. The inventory includes different types of parking (i.e., time-limited, unrestricted, restricted parking zone [RPZ], and disabled parking).

[b] The on-street parking and loading zone inventory is reduced due to peak period parking restrictions.

[c] Parking data includes all types of parking – unpaid, paid, time-limited, disabled, etc.

[d] Parking for overnight period (3 AM to 4 AM) is only collected for study zones 5, 6, and 7 (Eastlake Neighborhood) for the extended study area. The on-street parking and loading zone inventory is increased with the additional block faces collected beyond the primary study area.

CVLZ = commercial vehicle loading zone; PLZ = passenger load zone

4.5.2 Existing On-Street Parking Occupancy and Utilization

The existing on-street parking utilization percentages for each zone are summarized in Table 8. While comparing the occupancy rates between the extended study area during overnight time period and primary study area during other time periods can give overall understanding of the on-street parking utilization in the area, comparing the specific parking inventory and occupancy total values cannot be directly compared as the study areas are not the same.

During overnight time period, extended study zone 6 has high on-street parking utilization rate (90%), compared to the utilization rate during late evening time period for primary study zone 6 (79%). The higher utilization rate for the extended study zone 6 during the overnight period occurs as residents park their vehicles along the additional residential streets where overnight data was collected.

For the other two study zones (5 and 7), the utilization rates during late evening for primary study area are almost the same as the utilization rates during overnight period for extended study area. Attachment A-1 presents the figures (Figures A-10, A-11 and A-15) for parking utilization by block face. These figures highlight where the parking demand is the highest and lowest during the overnight period. As shown in the figures, during the overnight period, the higher utilization rate happens along block faces other than the Eastlake Ave E corridor which shows the high demand for residential on-street parking in the area. The utilization along Eastlake Ave E is relatively low compared to the other streets in the neighborhood with the on-street parking 34% utilized.

Table 8. Eastlake Extended Area- Summary of Existing On-Street Parking Inventory and Utilization Rates by Time Period

STUDY ZONE	MIDDAY			PM PEAK			LATE EVENING			OVERNIGHT		
	PARKING	OCCU-PANCY	UTILIZA-TION	PARKING	OCCU-PANCY	UTILIZA-TION	PARKING	OCCU-PANCY	UTILIZA-TION	PARKING	OCCU-PANCY	UTILIZA-TION
5	579	524	91%	504	415	82%	579	404	70%	676	481	71%
6	506	426	84%	442	362	82%	506	398	79%	960	862	90%
7	411	415	101%	388	254	65%	411	254	62%	474	270	57%
Total	1,496	1,365	91%	1,334	1,031	77%	1,496	1,056	71%	2,110	1,613	76%

5. RESULTS

The project proposes to provide enhanced multimodal transportation system improvements, which will include providing dedicated space for transit and bicycle activities in many parts of the corridor. This would result in a change in curb space use following the City of Seattle priorities for managing curb space/flex zone functions based on surrounding land uses along this corridor. The following summarizes changes that would occur with the RapidRide Roosevelt project.

5.1 On-street Parking Inventory and Loading Zone Change

The on-street parking and loading zone inventory along portions of the RapidRide Roosevelt corridor would be reduced by the project; the project would not impact off-street parking facilities. Table 9 summarizes the proposed changes in the parking inventory from the existing conditions for each parking study zone and time period.

Table 9. Summary of Change in Future On-Street Parking Inventory by Type

STUDY ZONE	MIDDAY/LATE EVENING/OVERNIGHT PERIOD[a,b]			PM PEAK PERIOD[c]		
	PARKING	LOADING ZONES		PARKING	LOADING ZONES	
		CVLZ	PLZ		CVLZ	PLZ
1[d]	-15 (-3%)	0 (0%)	0 (0%)	-15 (-3%)	0 (0%)	0 (0%)
2	-67 (-7%)	-3 (-14%)	0 (0%)	-45 (-5%)	-1 (-7%)	0 (0%)
3	-107 (-20%)	-2 (-14%)	-1 (-14%)	-107 (-20%)	-2 (-14%)	-1 (-14%)
4	-52 (-17%)	-2 (-10%)	-4 (-36%)	-33 (-12%)	-2 (-10%)	-1 (-13%)
5[e]	-144 (-21 to -25%)	-5 (-42 to -45%)	-2 (-100%)	-69 (-14%)	-3 (-33%)	-1 (-100%)
6[e]	-142 (-15 to -28%)	-10 (-43 to -71%)	-2 (-100%)	-78 (-18%)	-4 (-50%)	-2 (-100%)
7[e]	-38 (-8 to -9%)	-3 (-30%)	0 (0%)	-15 (-4%)	-2 (-22%)	0 (0%)
8	-70 (-37%)	0 (0%)	0 (0%)	-70 (-37%)	0 (0%)	0 (0%)
9	-21 (-7%)	-4 (-15%)	-3 (-19%)	-6 (-2%)	-3 (-13%)	-1 (-7%)
10	-43 (-15%)	-5 (-16%)	-12 (-24%)	-33 (-14%)	-4 (-14%)	-9 (-20%)
Total	-699 (-15%)	-34 (-20%)	-24 (-24%)	-471 (-11%)	-21 (-14%)	-15 (-17%)

Note: Negative numbers show the number of parking spots that would be removed.

[a] The inventory is the same for midday and late evening time periods.

[b] When range is stated, the lower value belongs to overnight period and higher value represents midday/late evening periods.

[c] The PM peak period has less inventory than in other times of the day due to peak period parking restrictions.

[d] Zone 1 parking assumes the north-end NE 67th St bus turnaround option utilizing layover along NE 67th St, which removes up to 15 stalls. NE 70th St bus turn-around option would remove up to 14 parking stalls.

[e] Parking and loading zone data for overnight period (3 AM to 4 AM) is only collected for study zones 5, 6, and 7 (Eastlake Neighborhood) for the extended study area. The on-street parking and loading zone inventory is increased with the additional block faces collected beyond the primary study area.

CVLZ = commercial vehicle loading zone; PLZ = passenger loading zone

Because the parking inventory changes by time of day due to curb space controls, the reduction in on-street parking inventory would vary by time of day. For example, the on-street parking spaces would be reduced by 471 during the PM peak, compared to 699 spaces during midday and late evening. This is because current PM peak parking controls already restrict on-street parking in parts of the corridor.

As shown in Table 9, 699 on-street parking would be removed as a result of the RapidRide Roosevelt project. None of these parking spaces are marked for exclusive use by vehicles with a disabled parking permit. The locations of the disabled parking spots in the study area are shown on the maps in Attachment A-3.

Table 9 also shows that loading zones are reduced by 58 (34 CVLZs and 24 PLZs) during midday and late evening. Most of the zones would have a few commercial vehicle and passenger loading zones removed except Zones 6 and 10, which would have 10 CVLZs removed and between 9 and 12 PLZs removed, respectively, depending on the time zone. The removal of these loading zones would be addressed and relocated as feasible by the City of Seattle.

Table 9 summarizes the proposed changes in the parking inventory compared to the existing conditions for each parking study zone and time period in Eastlake neighborhood. As shown in the table, the reduction in the number of on-street parking and loading zone inventory during overnight time period with the extended study area is the same as other off-peak time periods (midday and PM peak) for primary study area. This is because on-street parking and load zones would be only removed along Eastlake Ave E as a result of the RapidRide Roosevelt project. However, the overall percent reduction in the on-street parking and loading zones during overnight time period is lower than during midday/late evening due to the additional on-street parking inventoried as part of the extended study area.

Regarding the northern layover, 3 or 4 layovers spaces would be required with the project. If all of the layover is located along NE 67th St, up to 15 on-street parking spaces would be removed; including passenger load zones associated with developments along NE 67th St as part of the Roosevelt Link light rail station.

Two potential layover spaces are identified along 12th Ave NE between NE 67th St and NE 68th St which would remove up to 5 on-street parking stalls. Moreover, one school bus zone (1 PM to 4 PM) would be affected by implementing layover along 12th Ave NE, south of NE 68th St. Along 12th Ave NE, there are two other potential layover spaces identified between NE 67th St and NE 66th St. These spaces would remove up to 6 on-street parking stalls including one school bus zone (1 PM to 4 PM) located near NE 67th St.

Along Roosevelt Way NE, two potential layover spaces are identified between NE 67th St and NE 66th St. These would remove up to 8 on-street paid parking stalls. There are also two potential layover spaces along Roosevelt Way NE between NE 66th St and NE 65th St. These spaces would remove up to 4 paid parking stalls and one commercial/passenger load zone.

6. SUMMARY AND NEXT STEPS

The RapidRide Roosevelt project would improve transit service and offer new and upgraded pedestrian and bicycle facilities to provide alternatives to driving and parking in the corridor. The project is planning to provide frequent, all-day transit service that would have shorter travel times and better reliability that would attract new transit riders.

Within the Roosevelt, University District, South Lake Union, and Downtown neighborhoods (zones 1 through 4 and zones 8 through 10), additional parking strategies would not be proposed as either the parking removed is not substantial or there is available parking (on-street or off-street) to accommodate the loss of the parking removed by the project, as identified in Tables 3, 4, and 9. Along the entire project corridor, the City would work as feasibly as possible to relocate load zones near the removed load zone, to facilitate deliveries and other functions for those activities.

Within the Eastlake neighborhood (zones 5 through 7), the project would remove all the on-street parking and loading zones along Eastlake Ave E between Fairview Ave N and Fuhrman Ave E. The Eastlake commercial area is constrained by limited on-street parking on the adjacent block faces and the fact that, unlike the other study zones, there are relatively few off-street parking facilities that would provide additional parking options. Results of the parking duration study in Eastlake commercial area show that about 25% of the vehicles parked on Eastlake Ave E (zone 6) are parking long-term (over 4 hours). These longer-term parked vehicles most likely belong to employees or residents in the area.

The extended study area provides limited on-street parking spaces available within the Eastlake neighborhood. The results show relatively high demand for residential on-street parking during the overnight period as the overall utilization rate for the block faces added to the primary study area is more than 85%. Overnight utilization along Eastlake Ave E is relatively low (34%), likely because residents may not use the available parking along Eastlake Ave E after businesses and restaurants close in the evenings and because of early morning parking restricted zones for southbound curb lane. The additional loading zones that are available in the extended study zones (mainly in study zone 6) are serving local business and are not within a reasonable distance to serve the Eastlake commercial area.

Beyond the relocation of loading zones throughout the project corridor, the City would coordinate with the Eastlake neighborhood on parking and access strategies, which may include:

- Working with the businesses and neighborhood to communicate the parking regulations and the available commute options.
- Considering adjustments to the RPZ to better ease parking congestion in the residential area and to address the needs of all curb space users in the area.
- Facilitating a discussion, and if desired, seeking funding to work with private businesses that may be interested, or able to, allow parking lots to be shared parking for other uses.

The City will evaluate the costs, timing, issues, and opportunities with these potential mitigation strategies throughout the rest of the project design and development.

7. REFERENCES

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City of Seattle. 2019. *Seattle 2035 Comprehensive Plan*. http://www.seattle.gov/opcd/ongoing-initiatives/comprehensive-plan#projectdocuments.

Attachment A
Parking Maps

ATTACHMENT A-1
ON-STREET PARKING EXISTING UTILIZATION MAPS

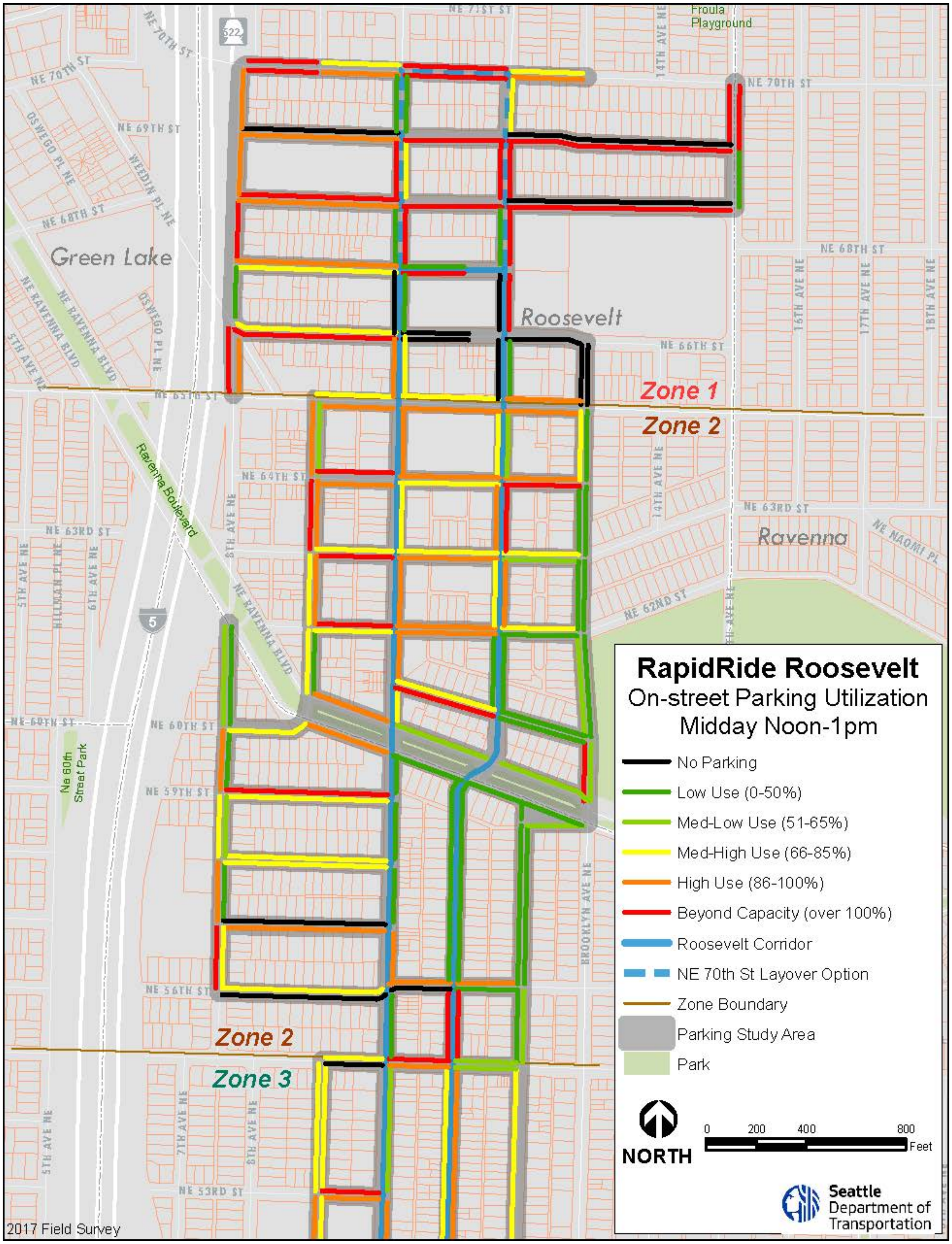


Figure A-1. Midday On-street Parking Utilization in Zones 1, 2

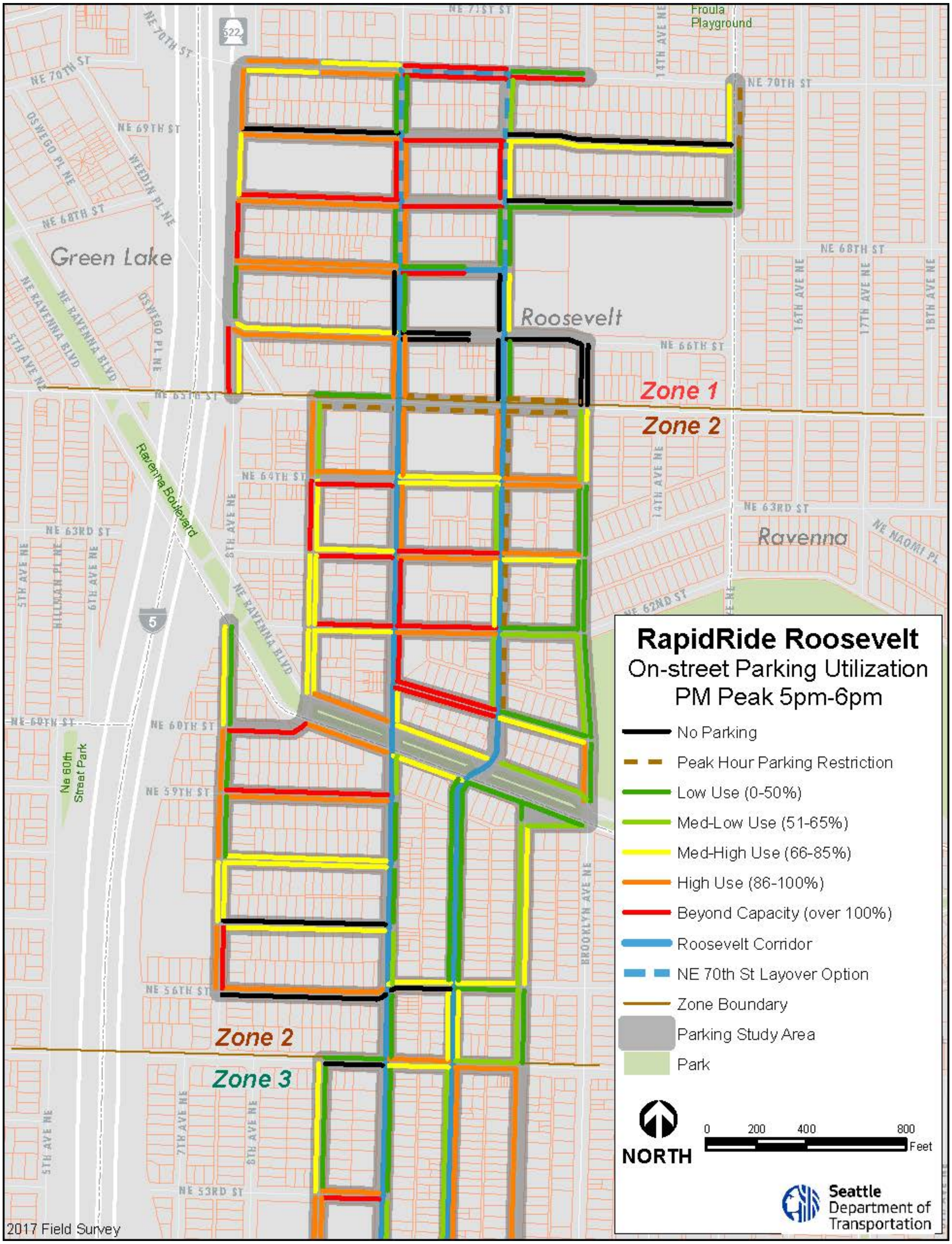


Figure A-2. PM Peak On-street Parking Utilization in Zones 1, 2

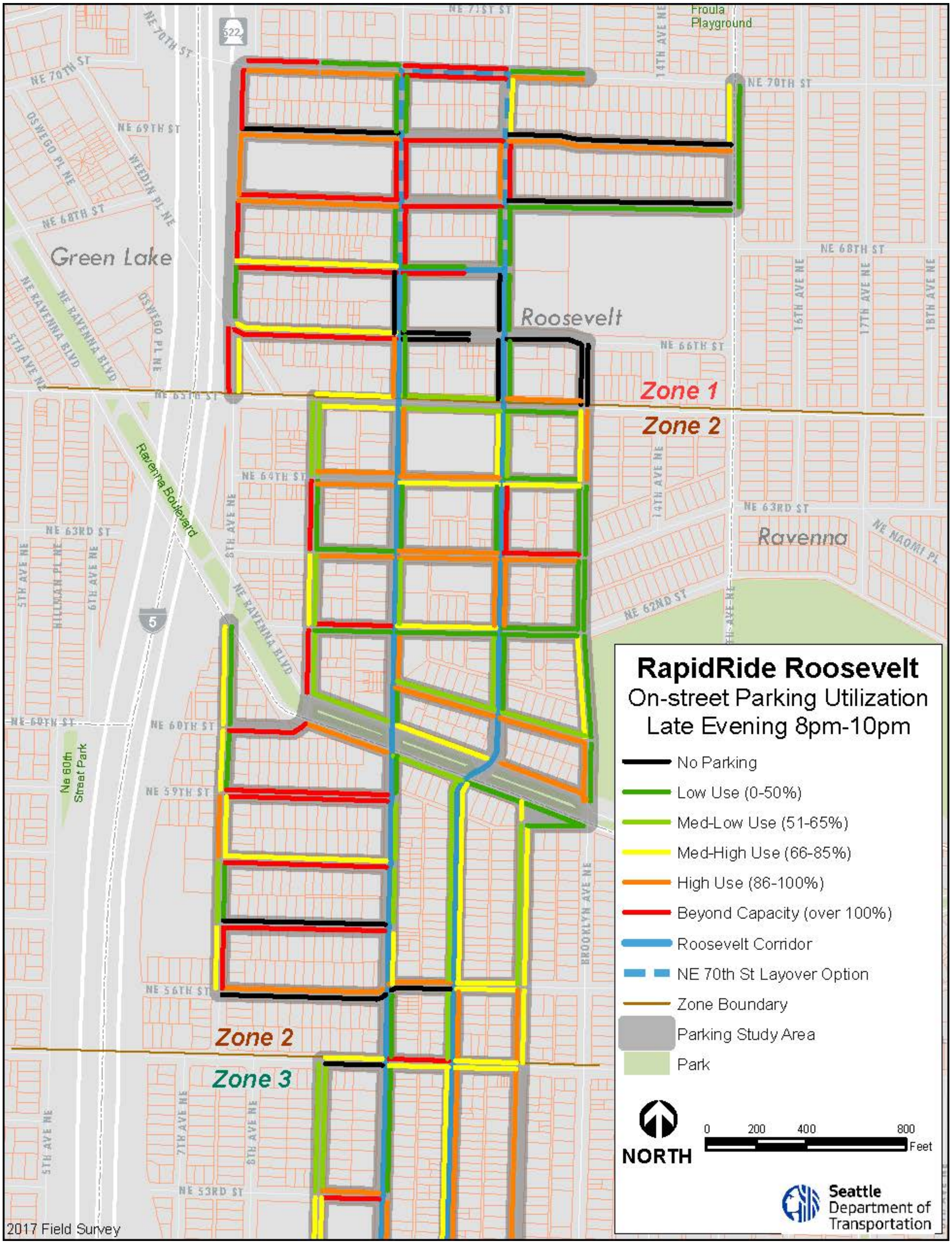


Figure A-3. Late Evening On-street Parking Utilization in Zones 1, 2

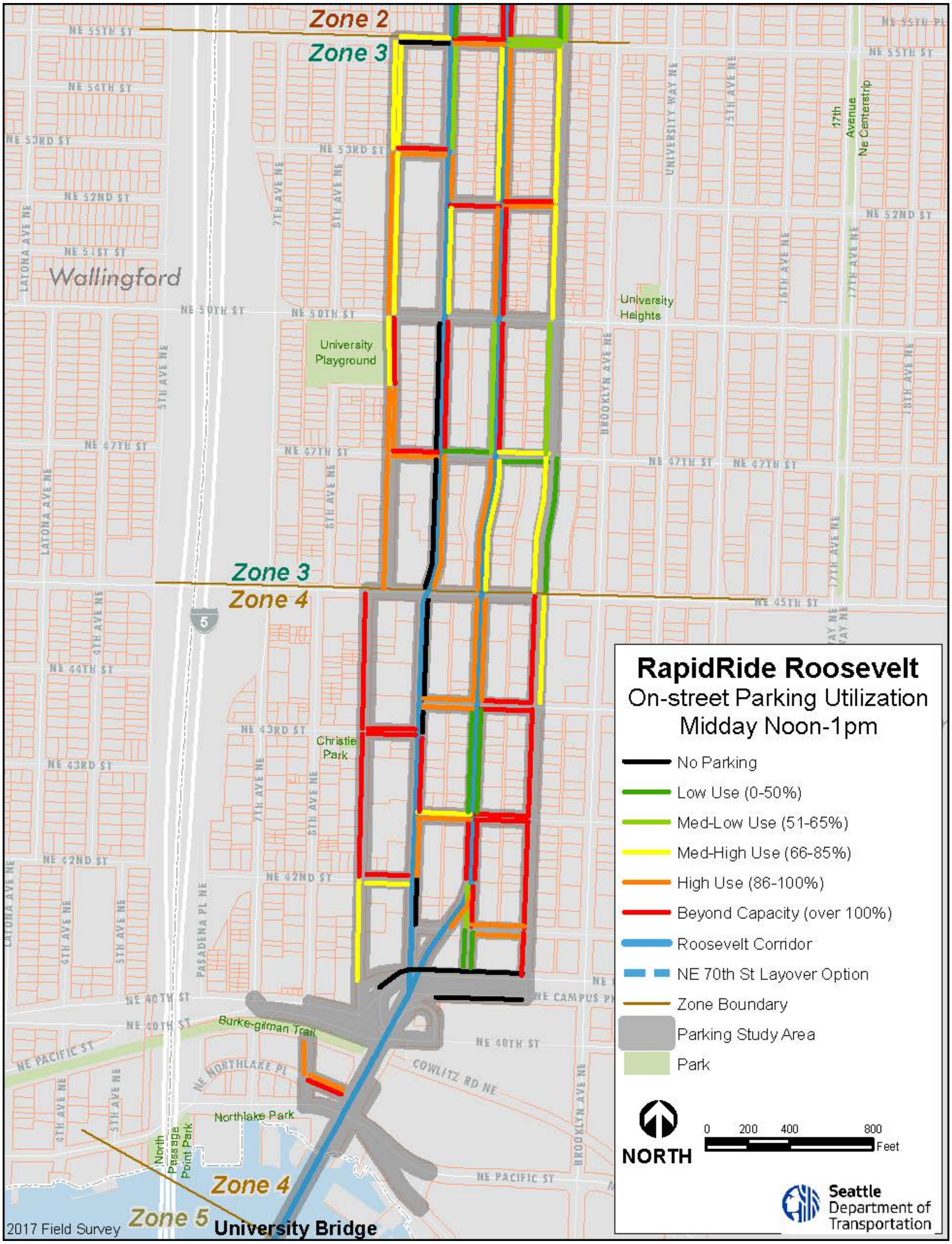


Figure A-4. Midday On-street Parking Utilization in Zones 3, 4

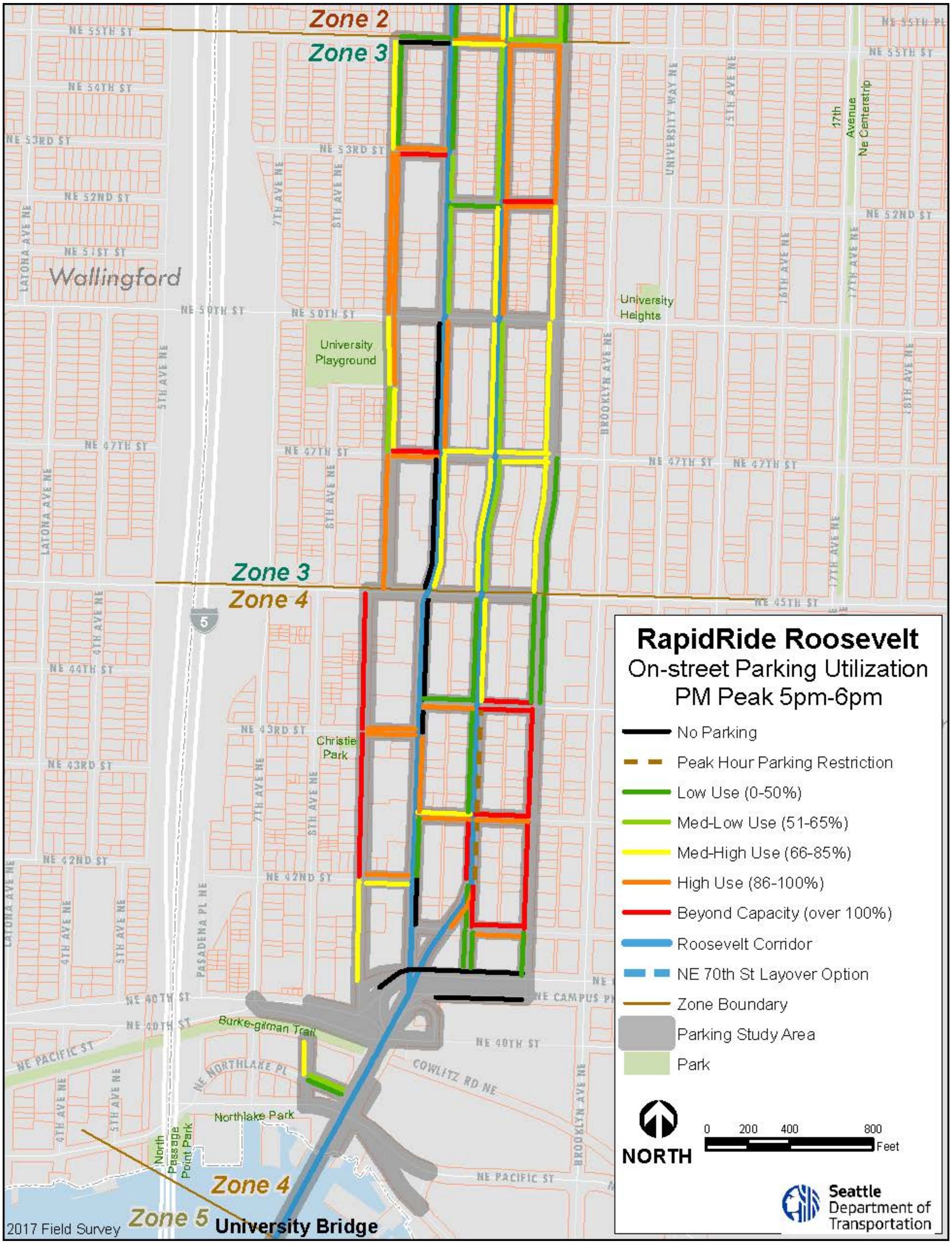


Figure A-5. PM Peak On-street Parking Utilization in Zones 3, 4

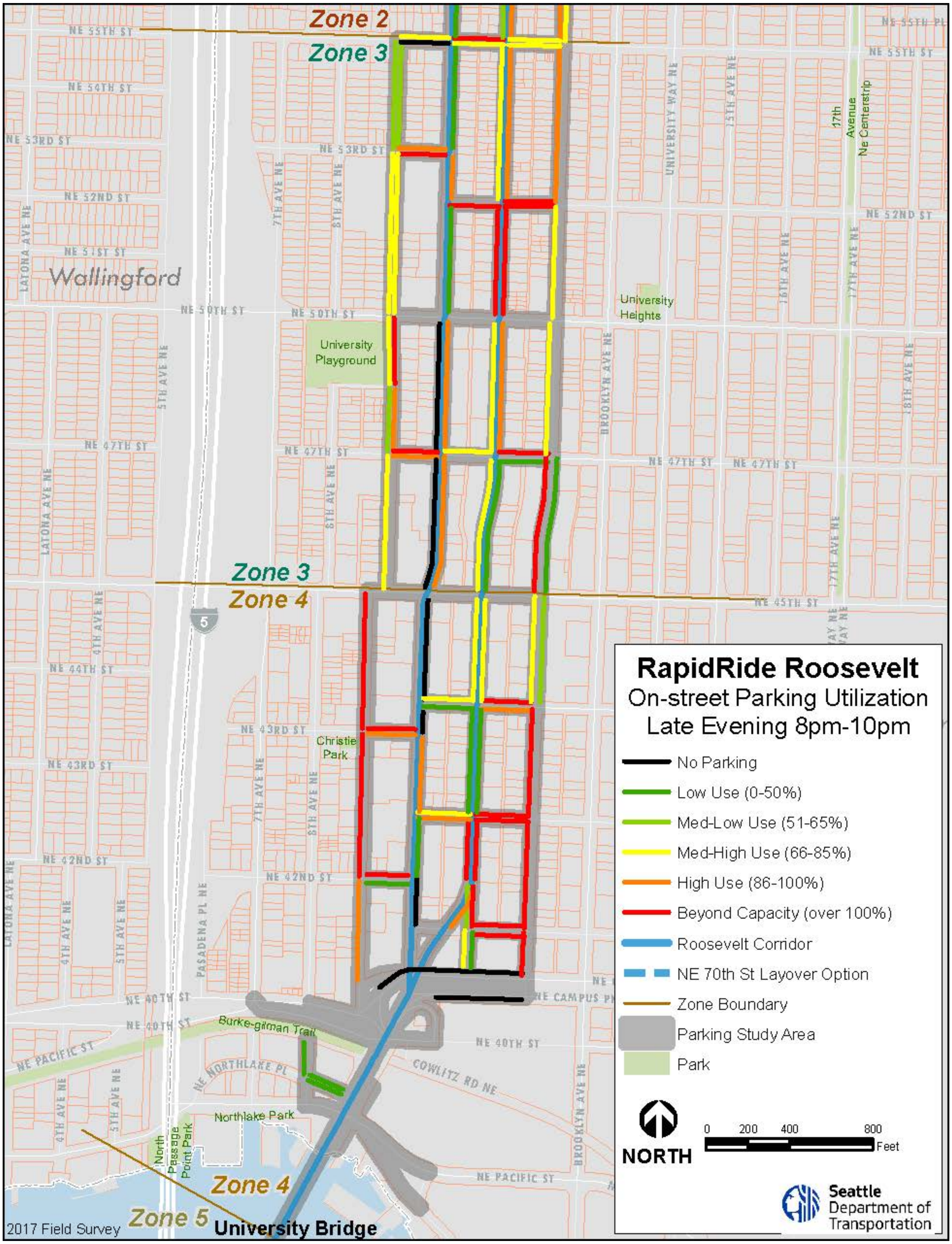


Figure A-6. Late Evening On-street Parking Utilization in Zones 3, 4

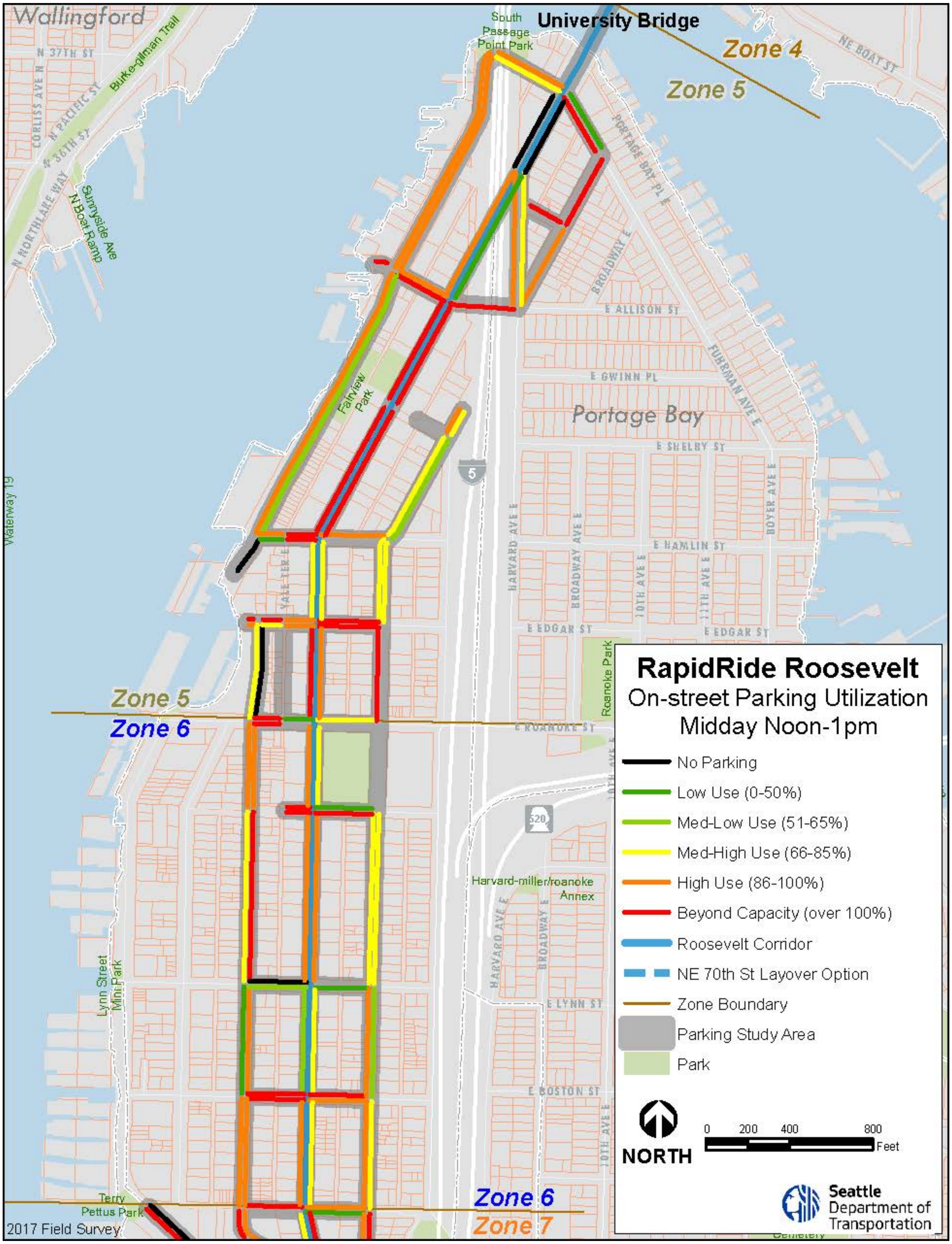


Figure A-7. Midday On-street Parking Utilization in Zones 5, 6

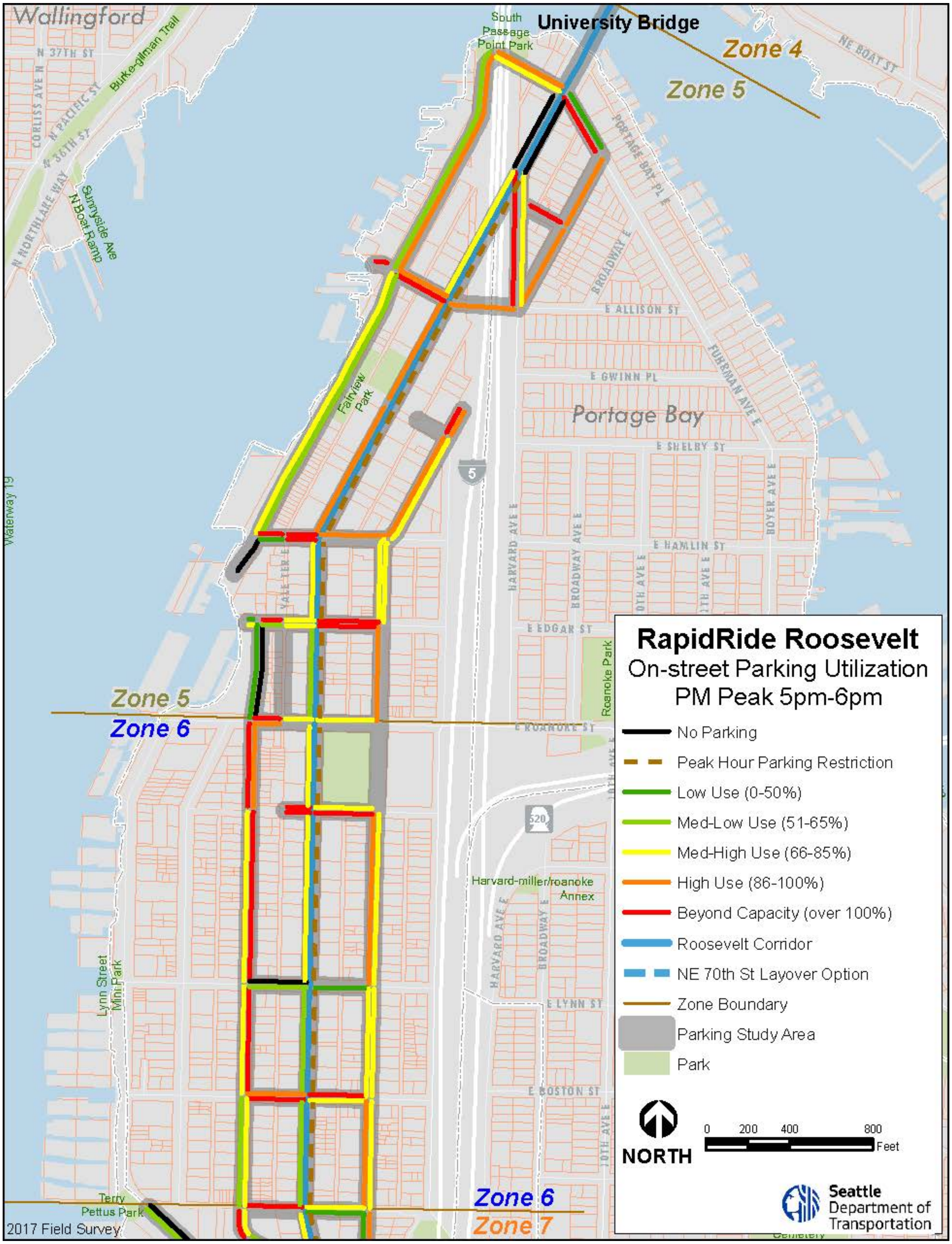


Figure A-8. PM Peak On-street Parking Utilization in Zones 5, 6

Figure A-9. Late Evening On-street Parking Utilization in Zones 5, 6

Figure A-10. Overnight On-street Parking Utilization in Zones 5

Figure A-11. Overnight On-street Parking Utilization in Zones 6

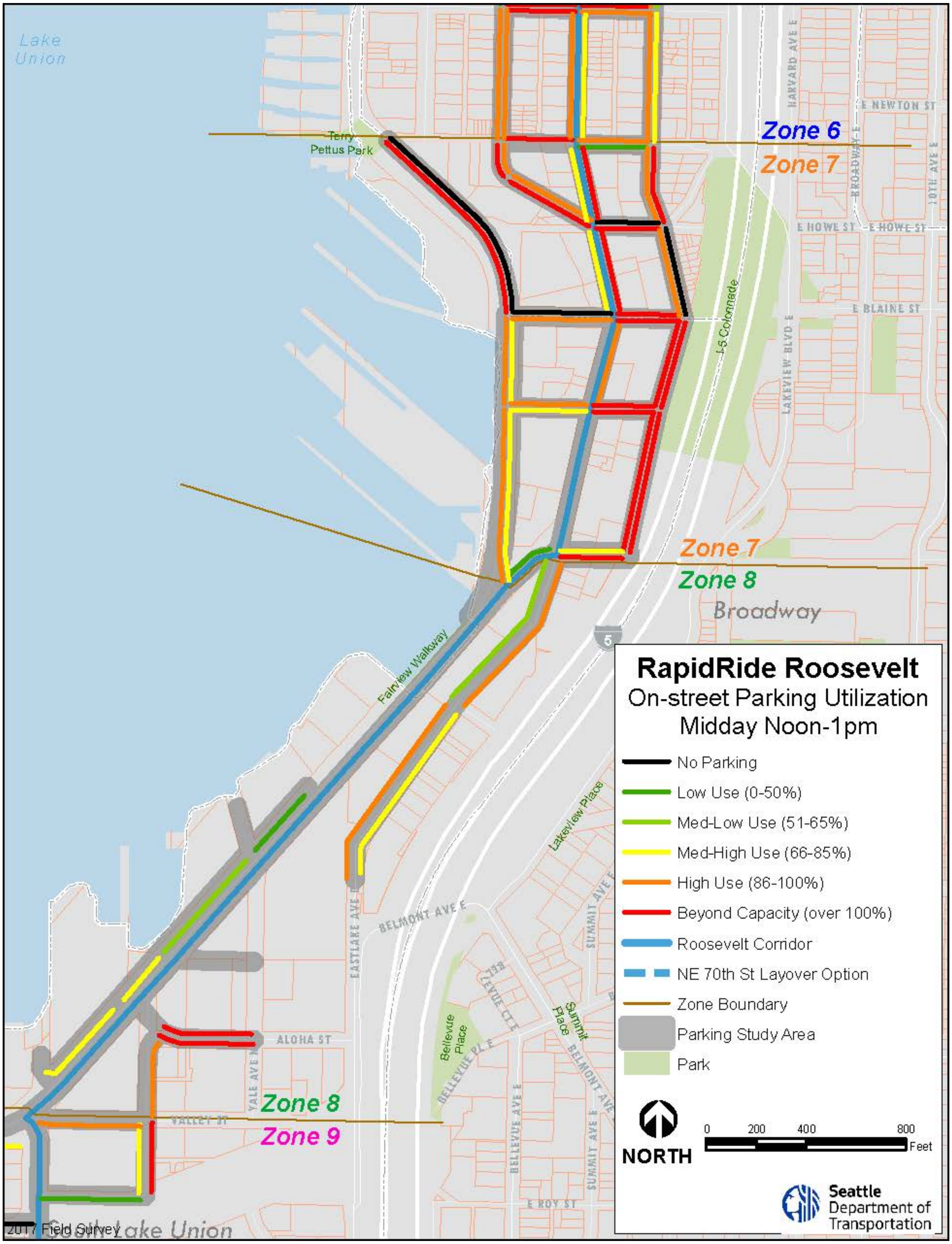


Figure A-12. Midday On-street Parking Utilization in Zones 7, 8

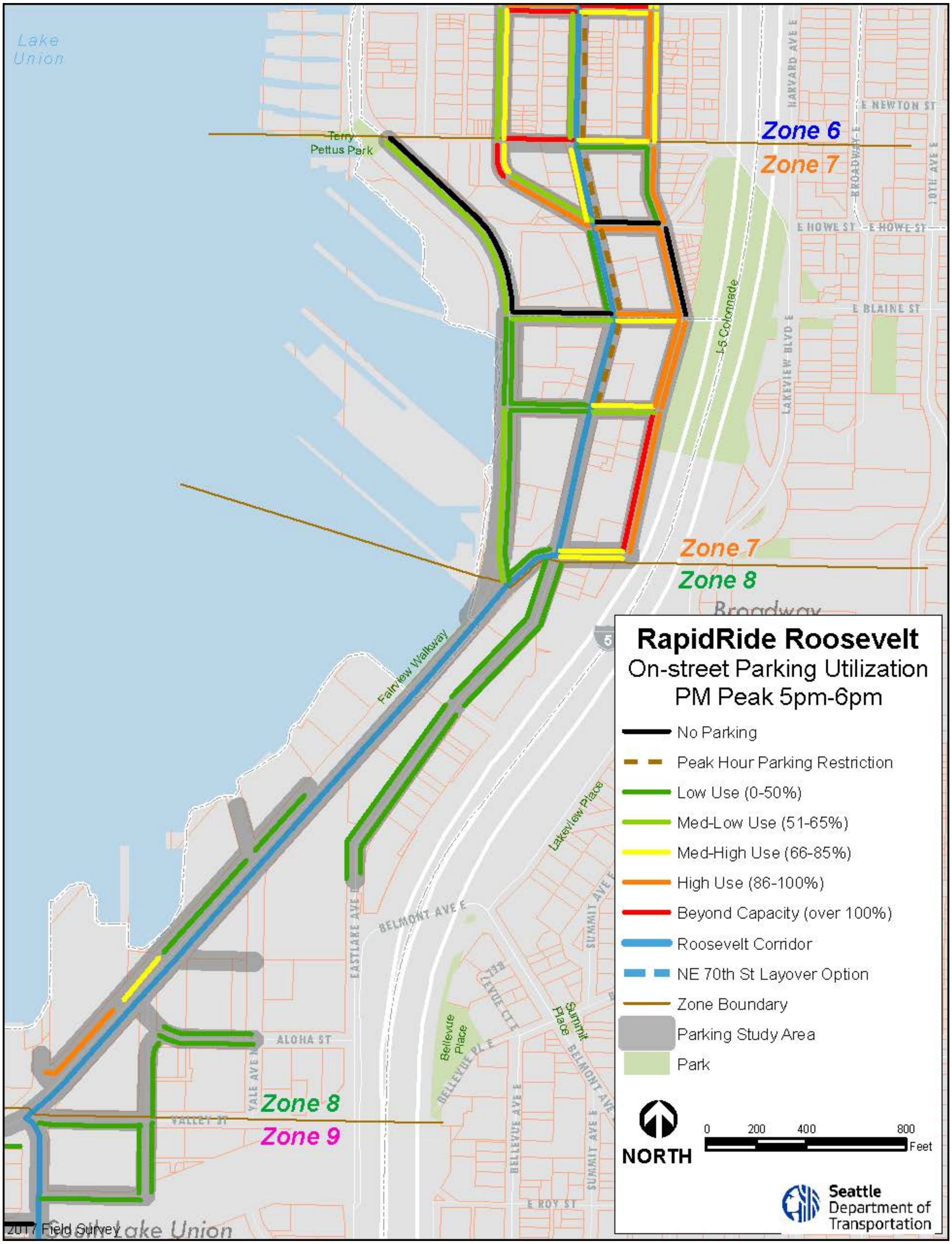


Figure A-13. PM Peak On-street Parking Utilization in Zones 7, 8

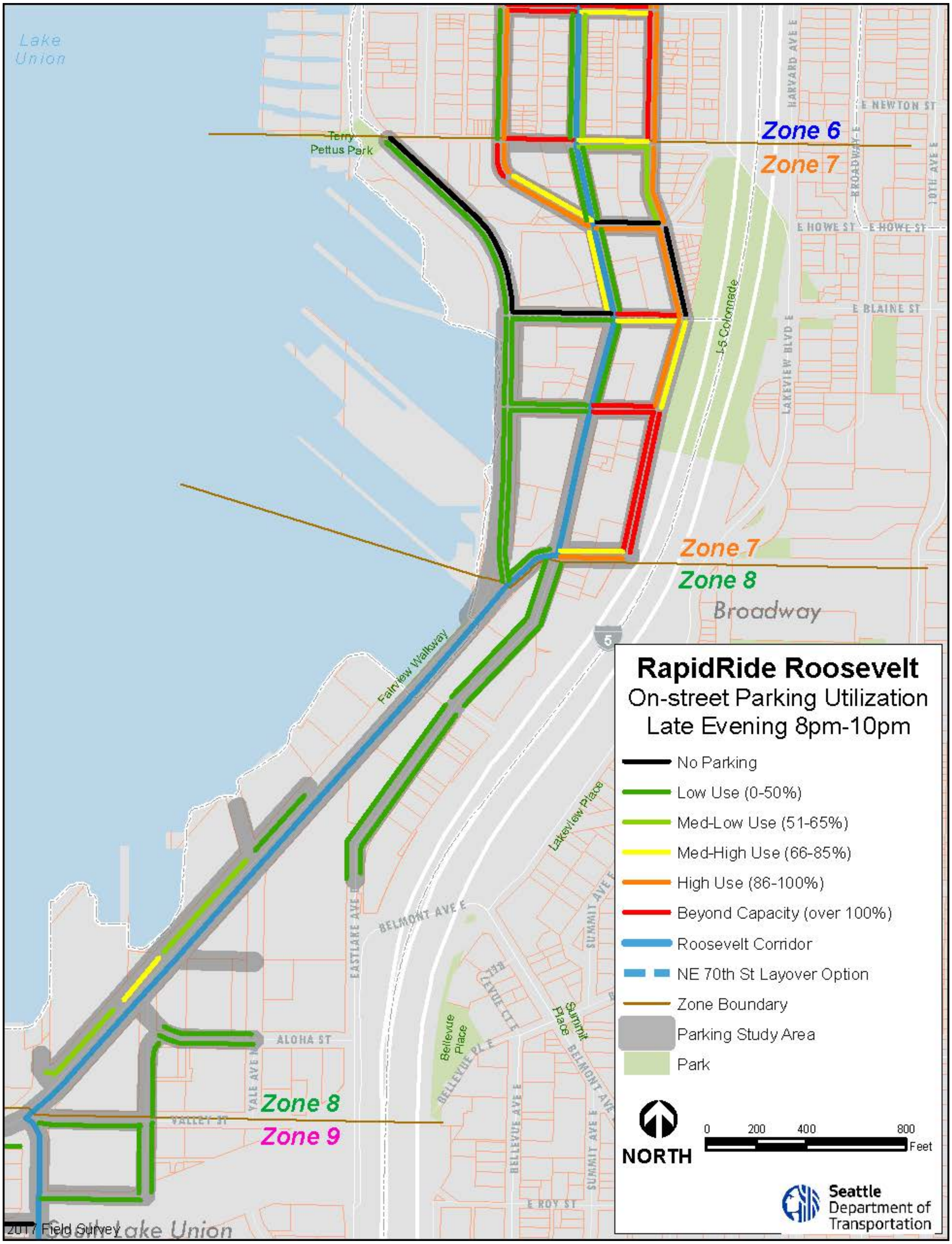


Figure A-14. Late Evening On-street Parking Utilization in Zones 7, 8

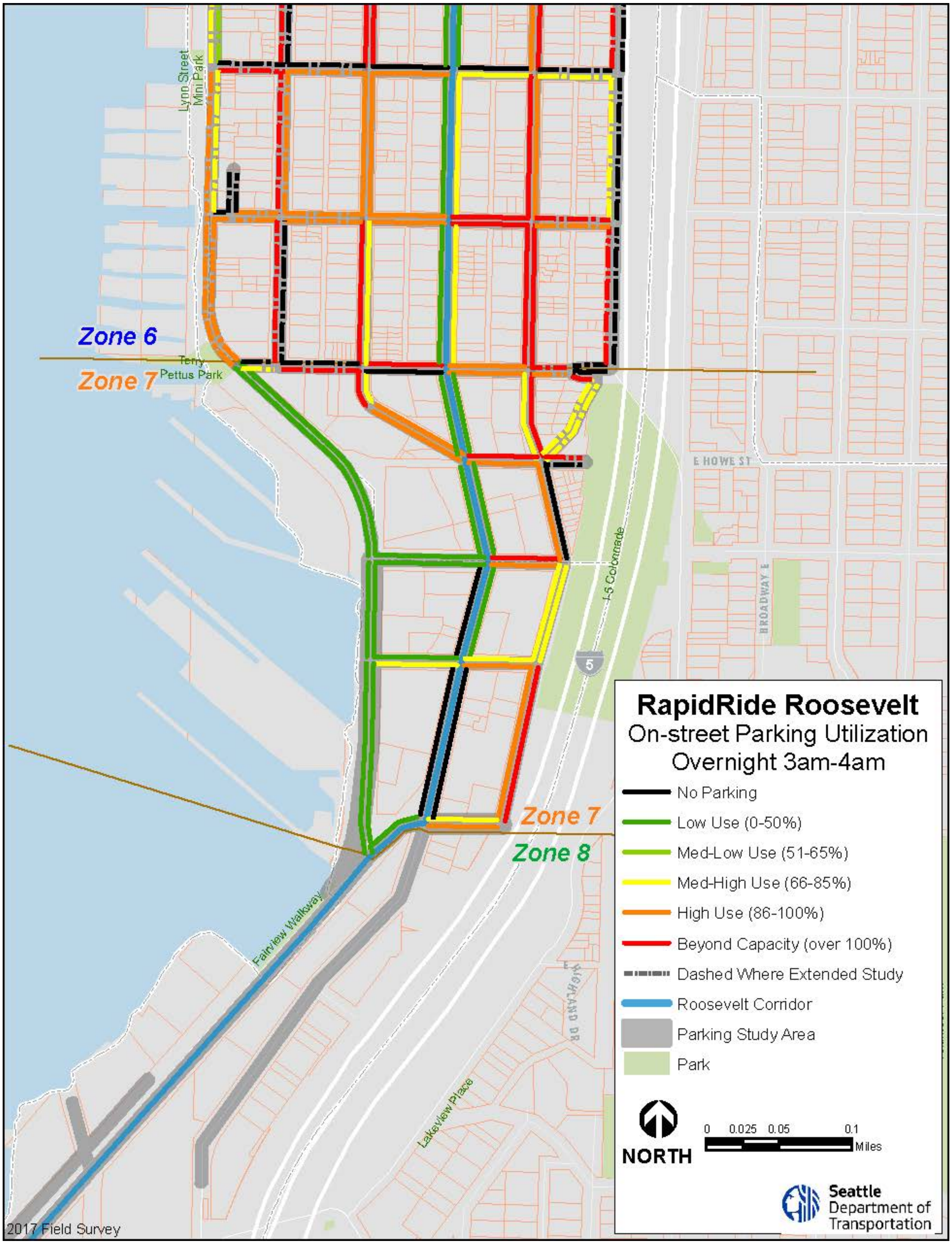


Figure A-15. Overnight On-street Parking Utilization in Zones 7

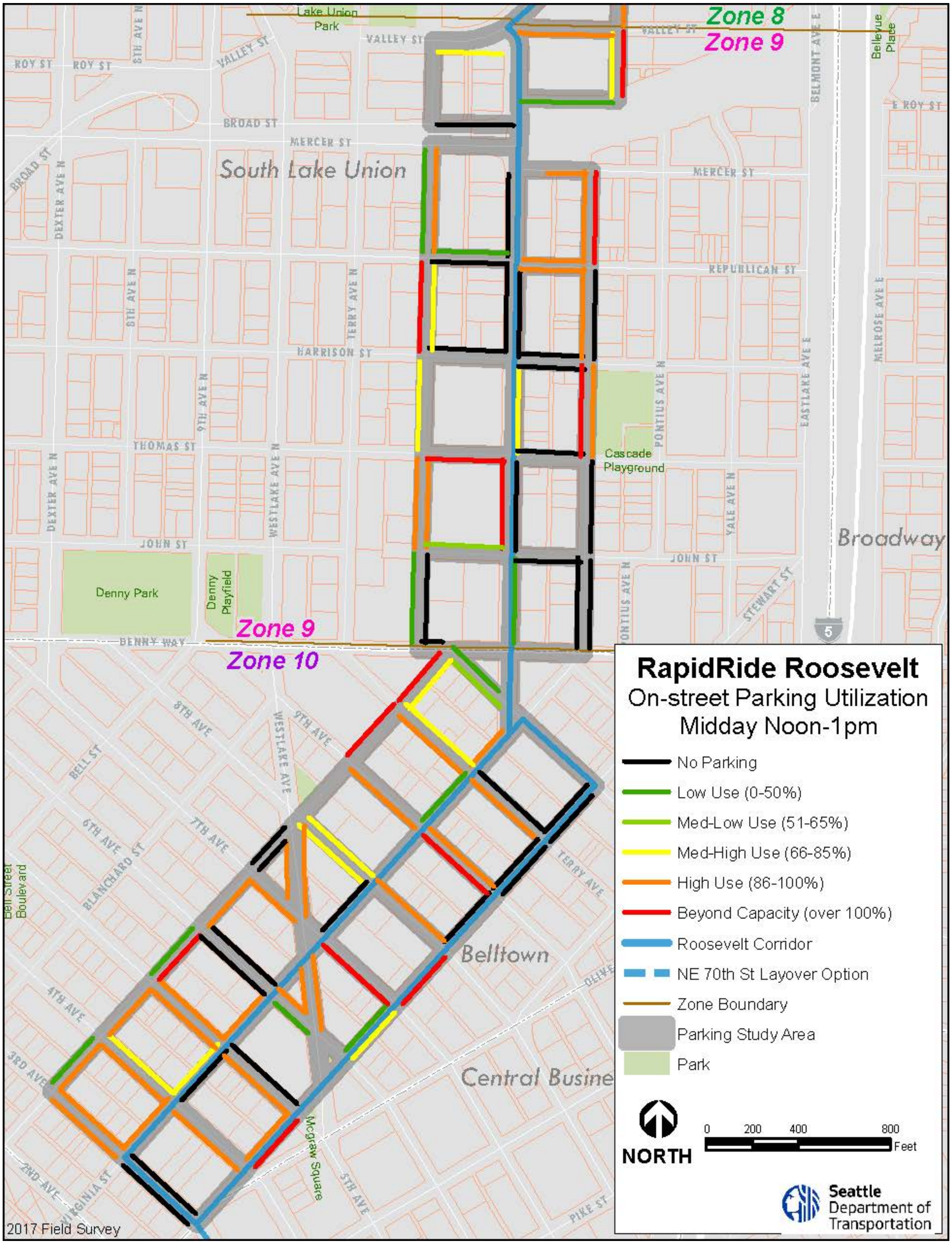


Figure A-16. Midday On-street Parking Utilization in Zones 9, 10

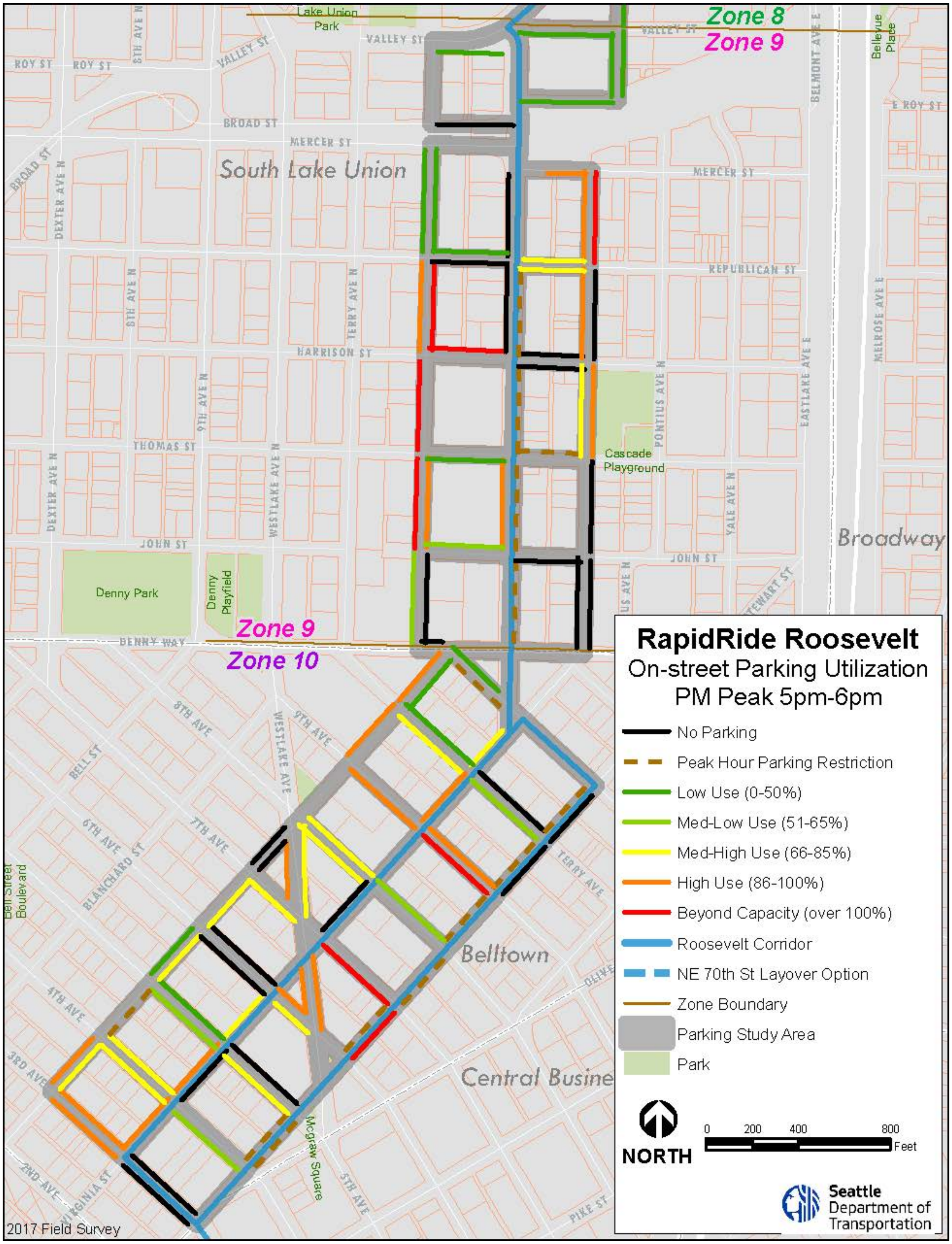


Figure A-17. PM Peak On-street Parking Utilization in Zones 9, 10

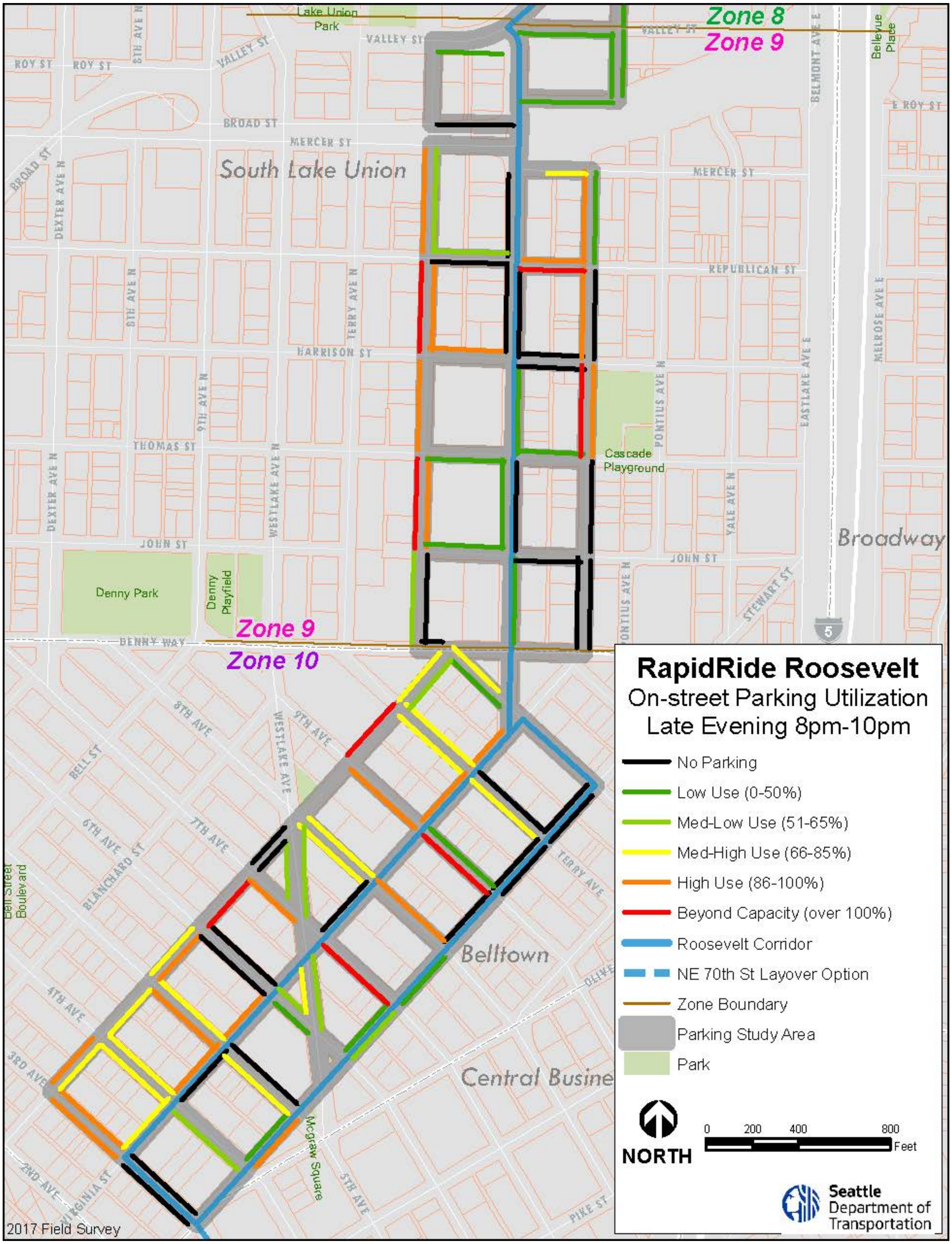


Figure A-18 Late Evening On-street Parking Utilization in Zones 9, 10

ATTACHMENT A-2
PAID/UNPAID ON-STREET PARKING MAP

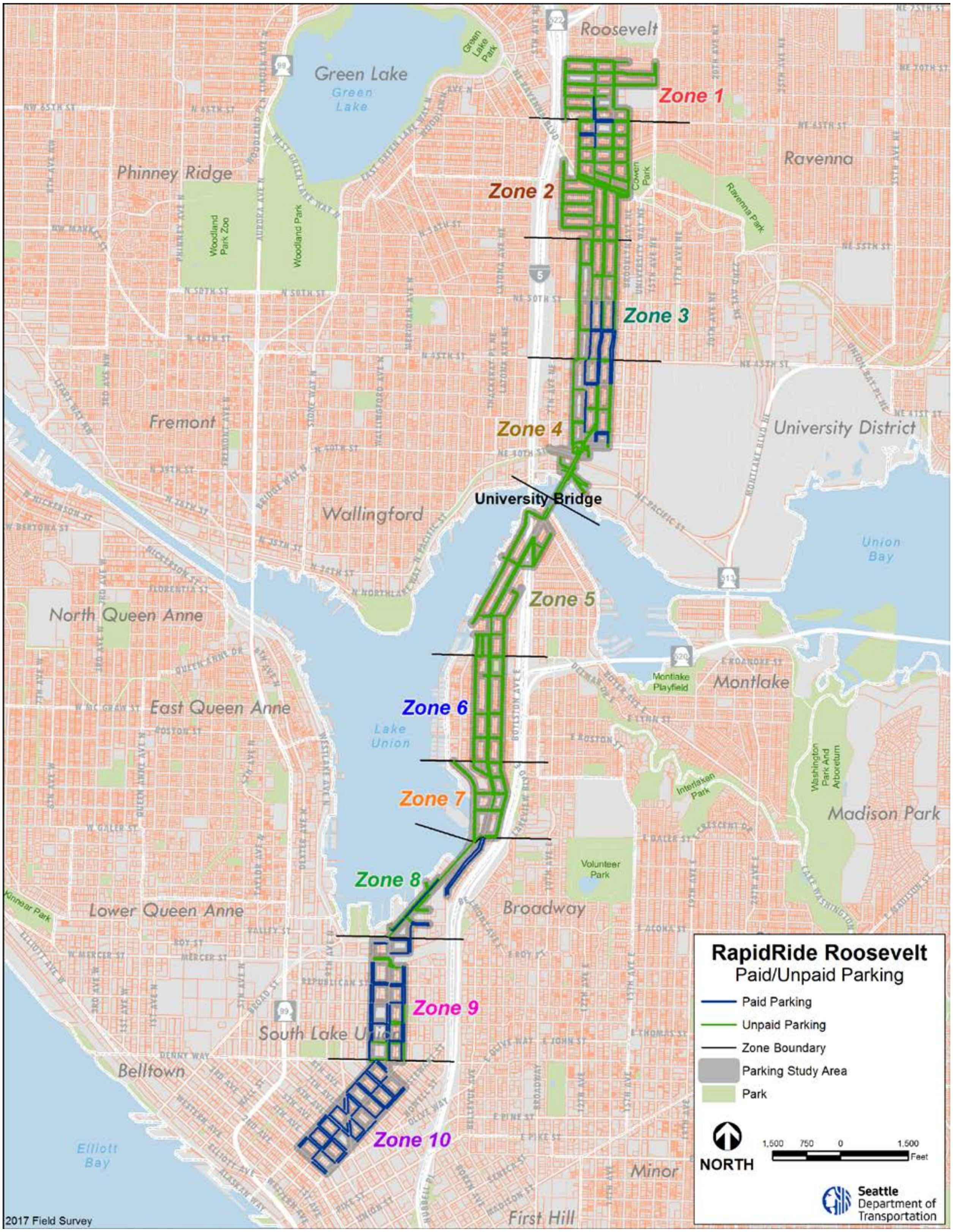


Figure A-19. Paid/Unpaid On-street Parking

ATTACHMENT A-3
DISABLED ON-STREET PARKING MAP

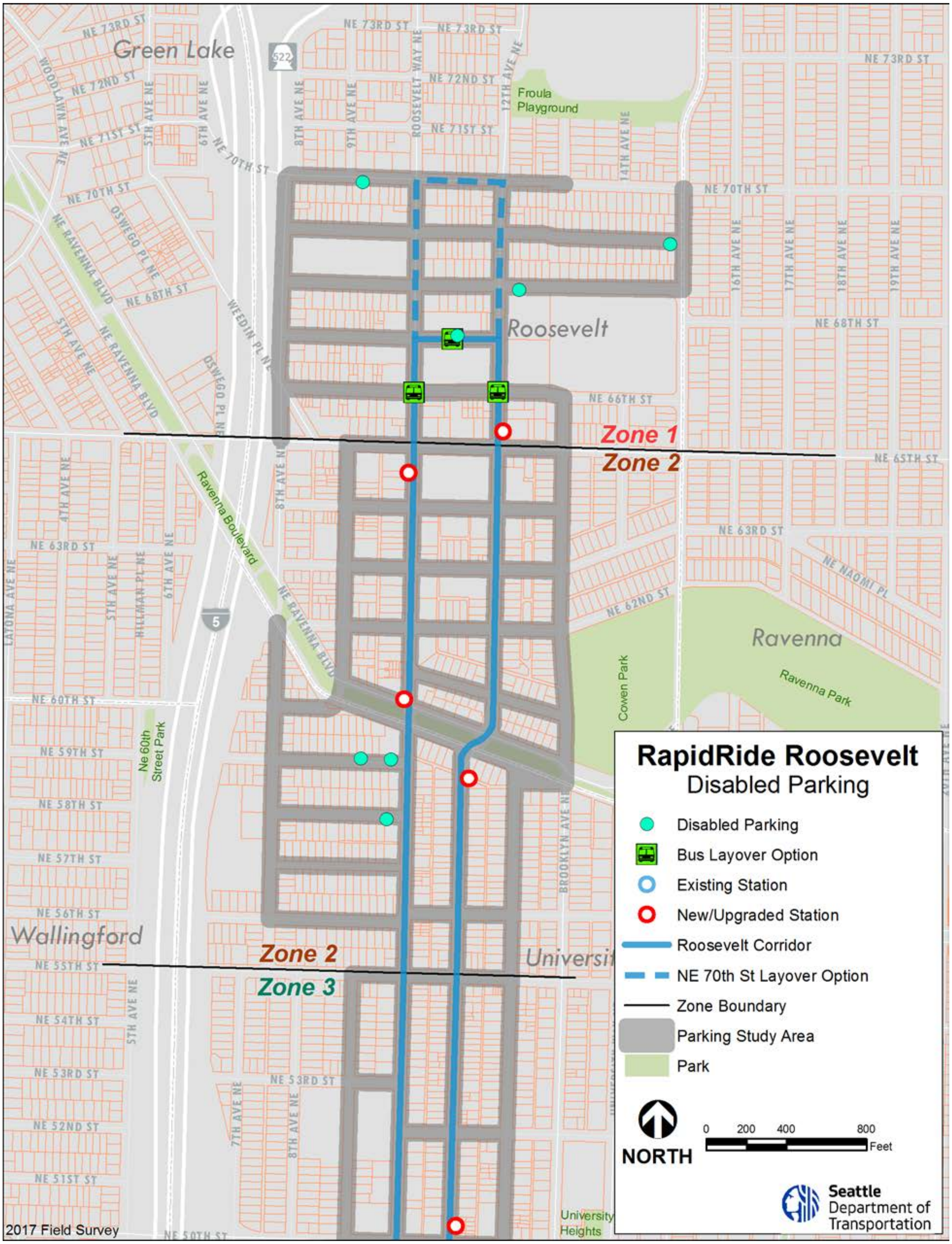


Figure A-20. Disabled On-street Parking in Zones 1, 2

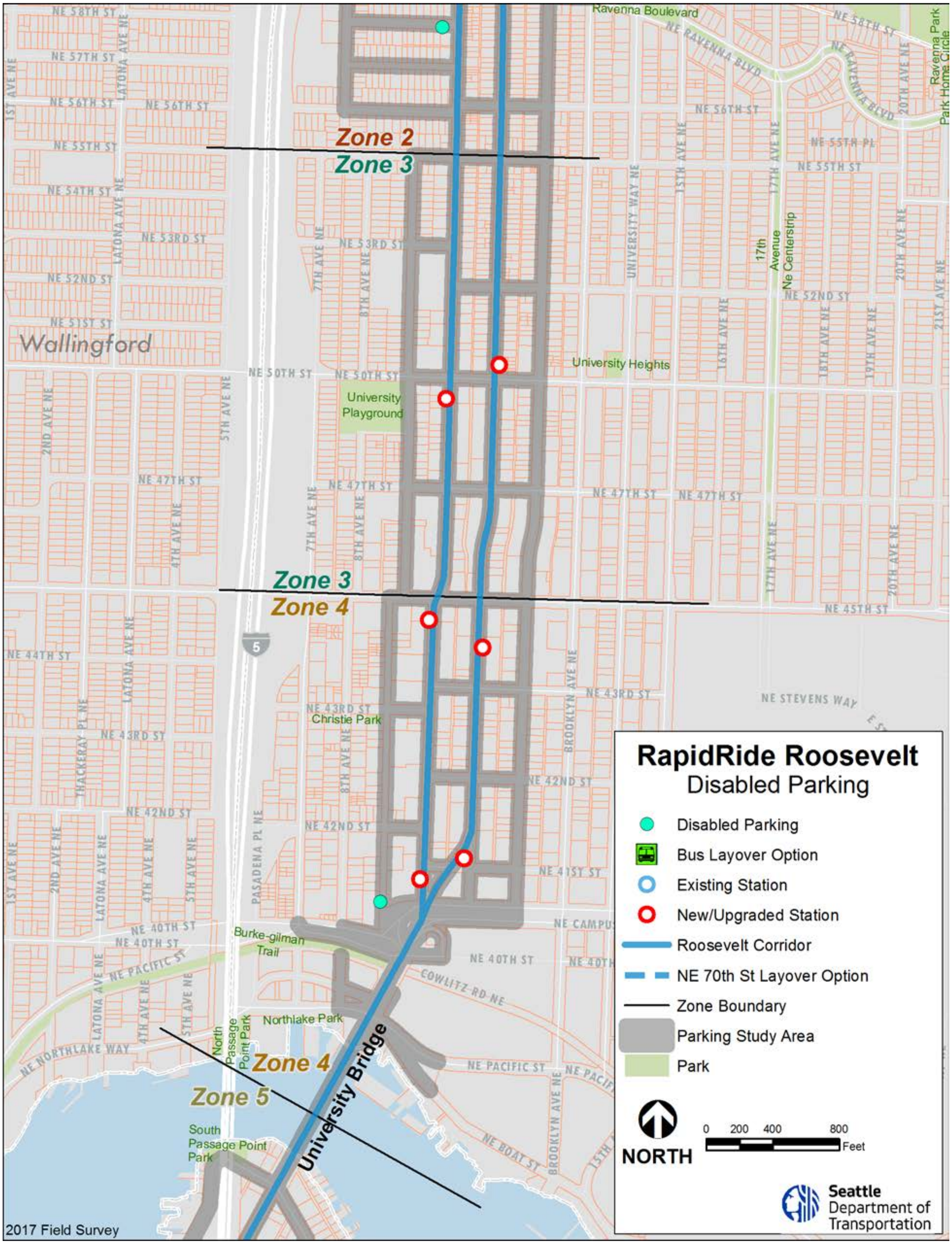


Figure A-21. Disabled On-street Parking in Zones 3, 4

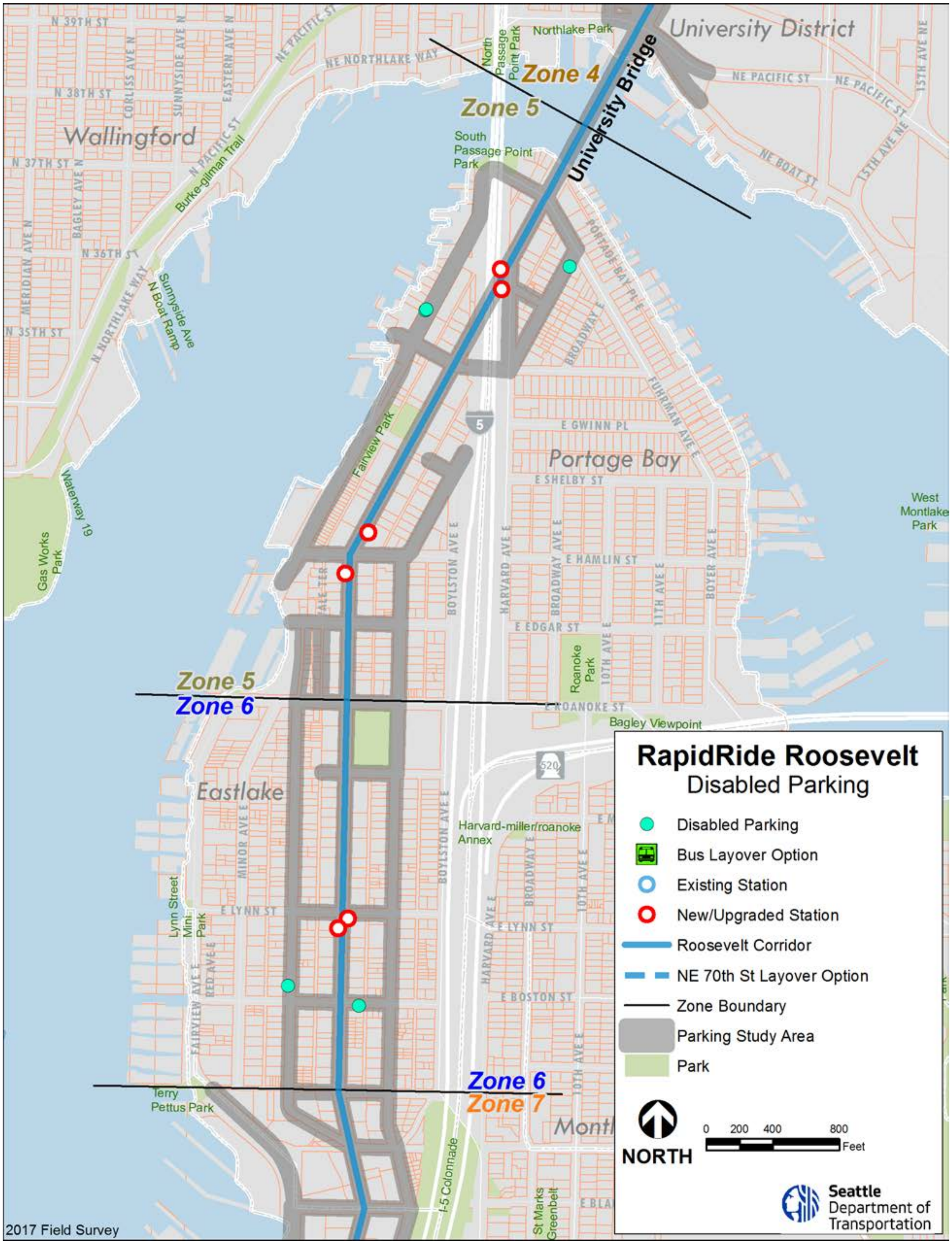


Figure A-22 Disabled On-street Parking in Zones 5, 6

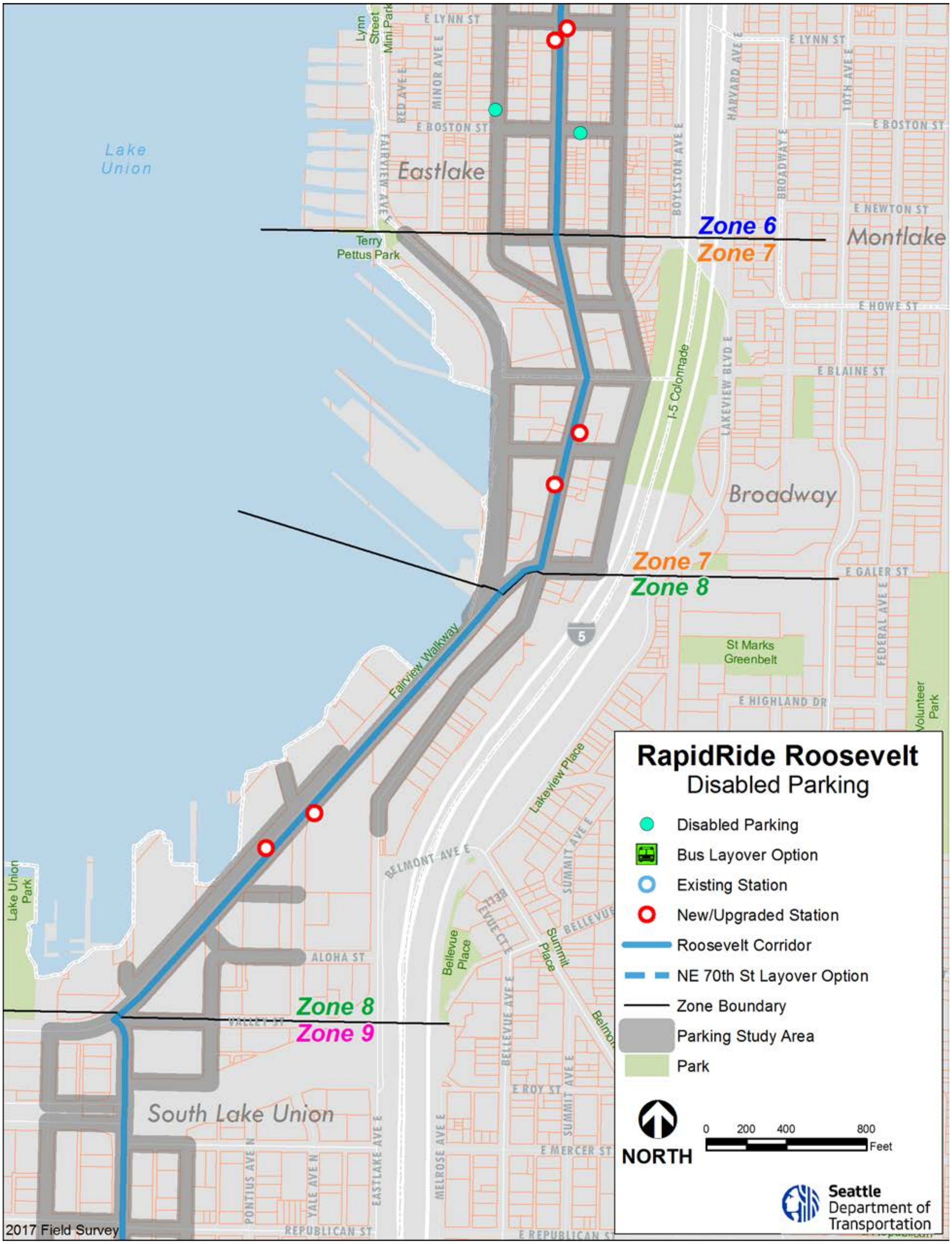


Figure A-23. Disabled On-street Parking in Zones 7, 8

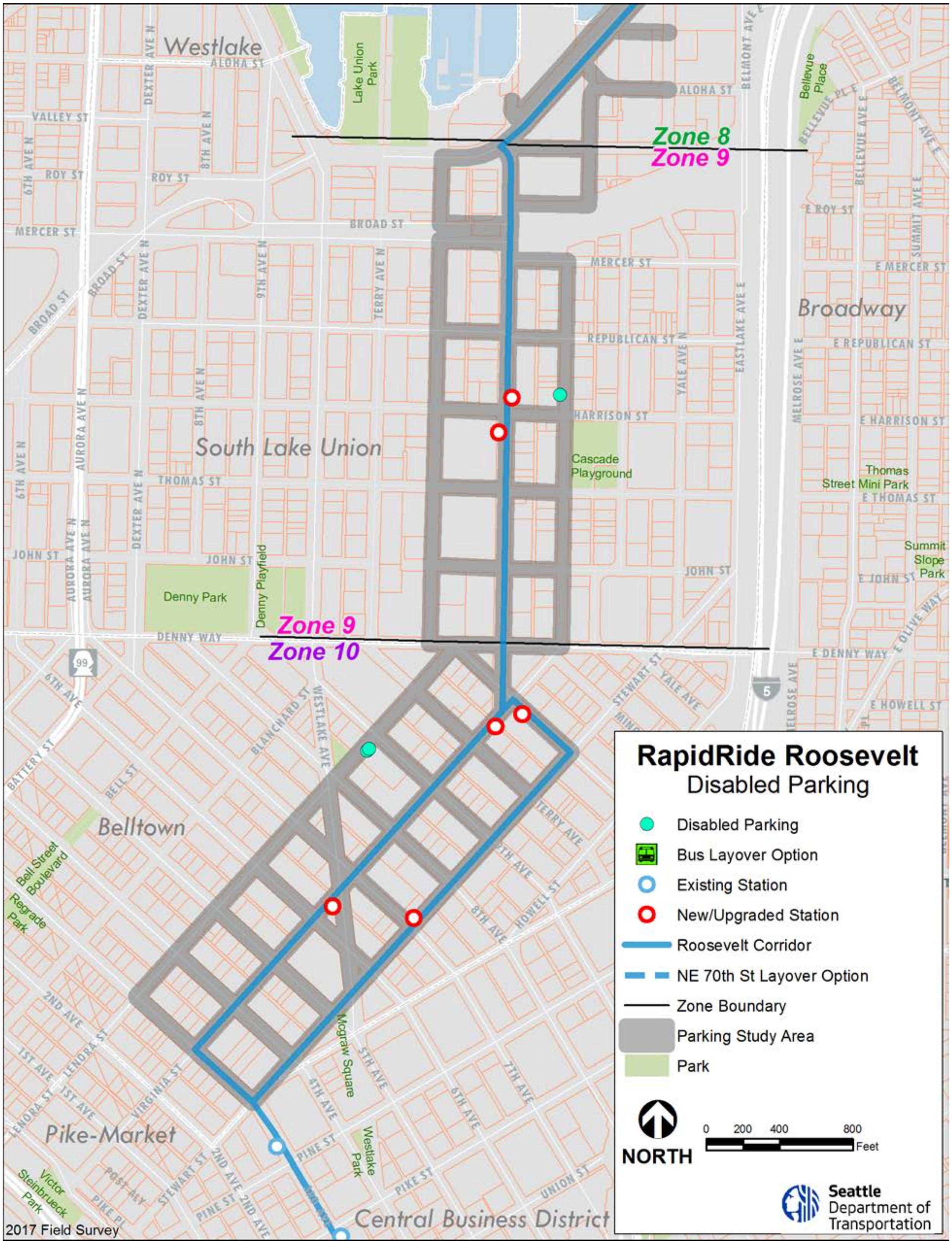


Figure A-24. Disabled On-street Parking in Zones 9, 10

ATTACHMENT A-4
RESTRICTED PARKING ZONE AND TIME-LIMITED ON-STREET PARKING MAP

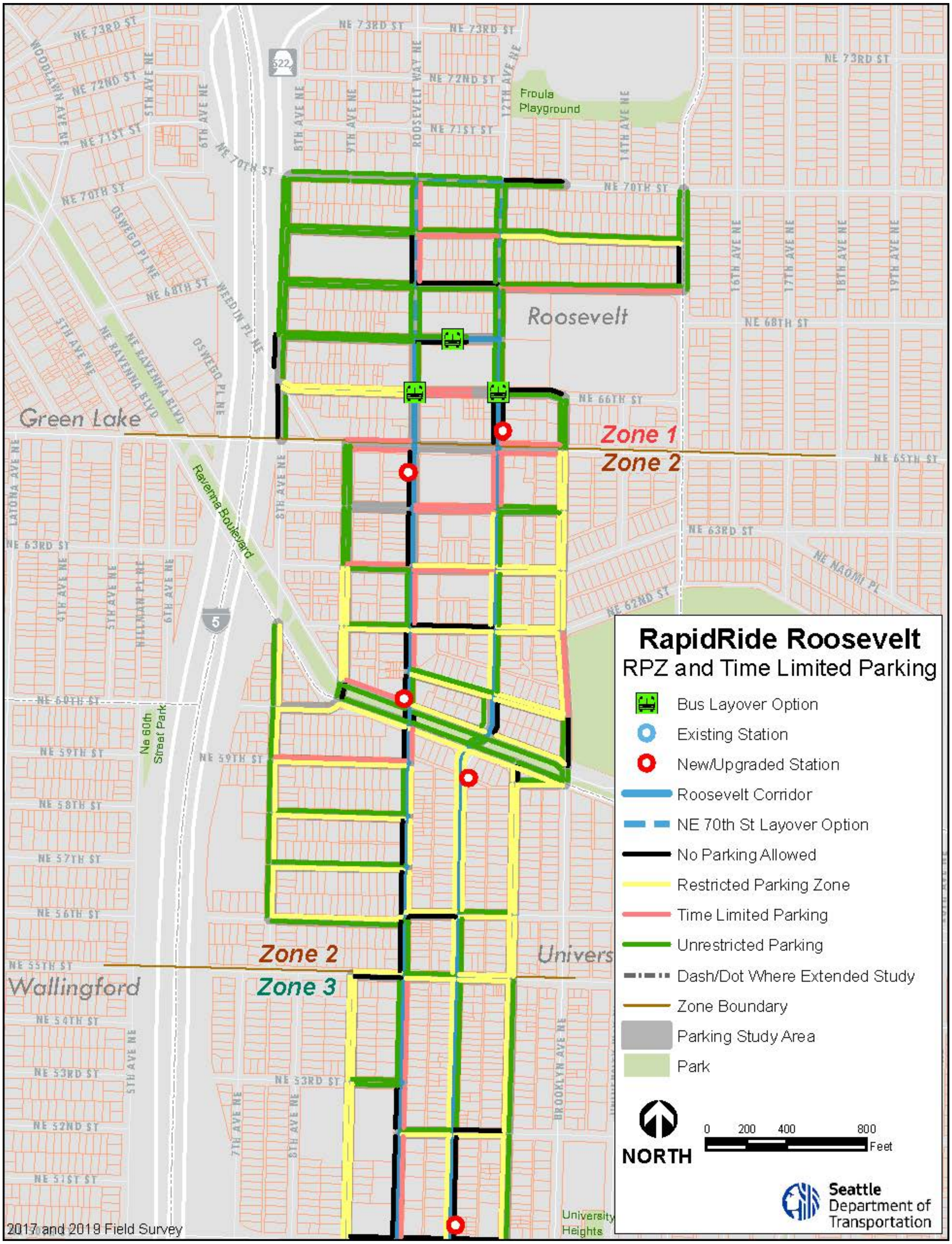


Figure A-25. Restricted Parking Zone and Time Limited On-street Parking in Zones 1, 2

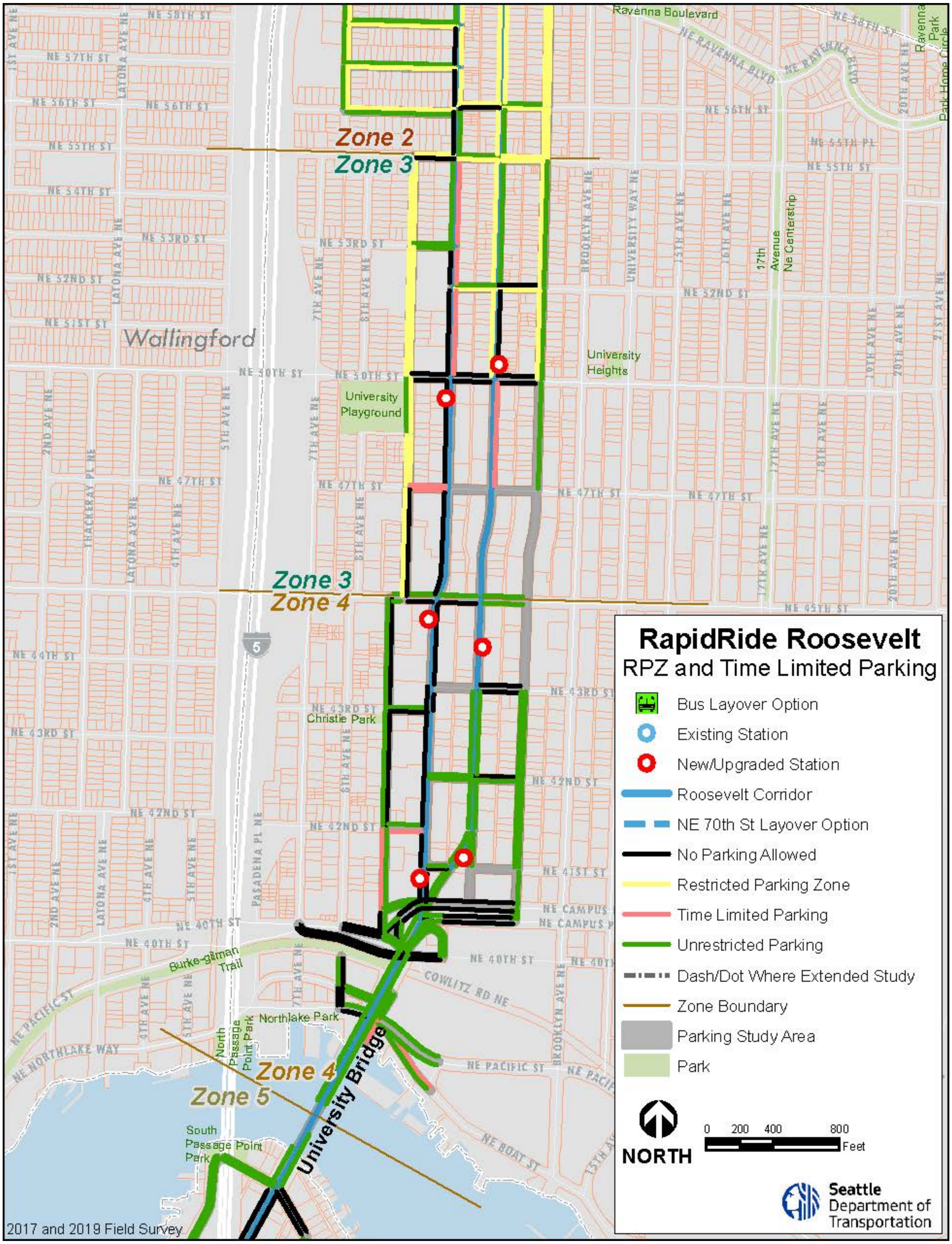


Figure A-26. Restricted Parking Zone and Time Limited On-street Parking in Zones 3, 4

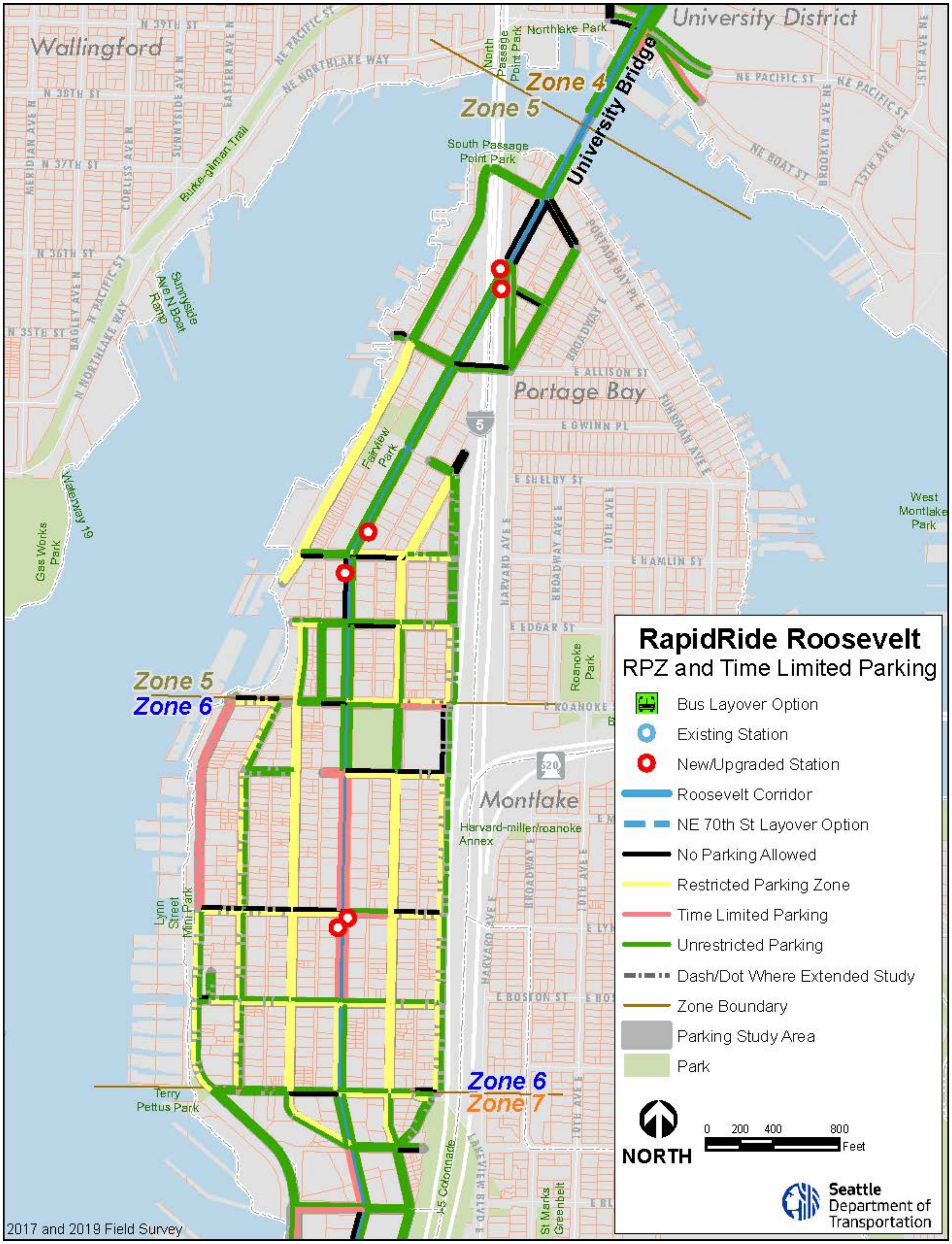


Figure A-27. Restricted Parking Zone and Time Limited On-street Parking in Zones 5, 6

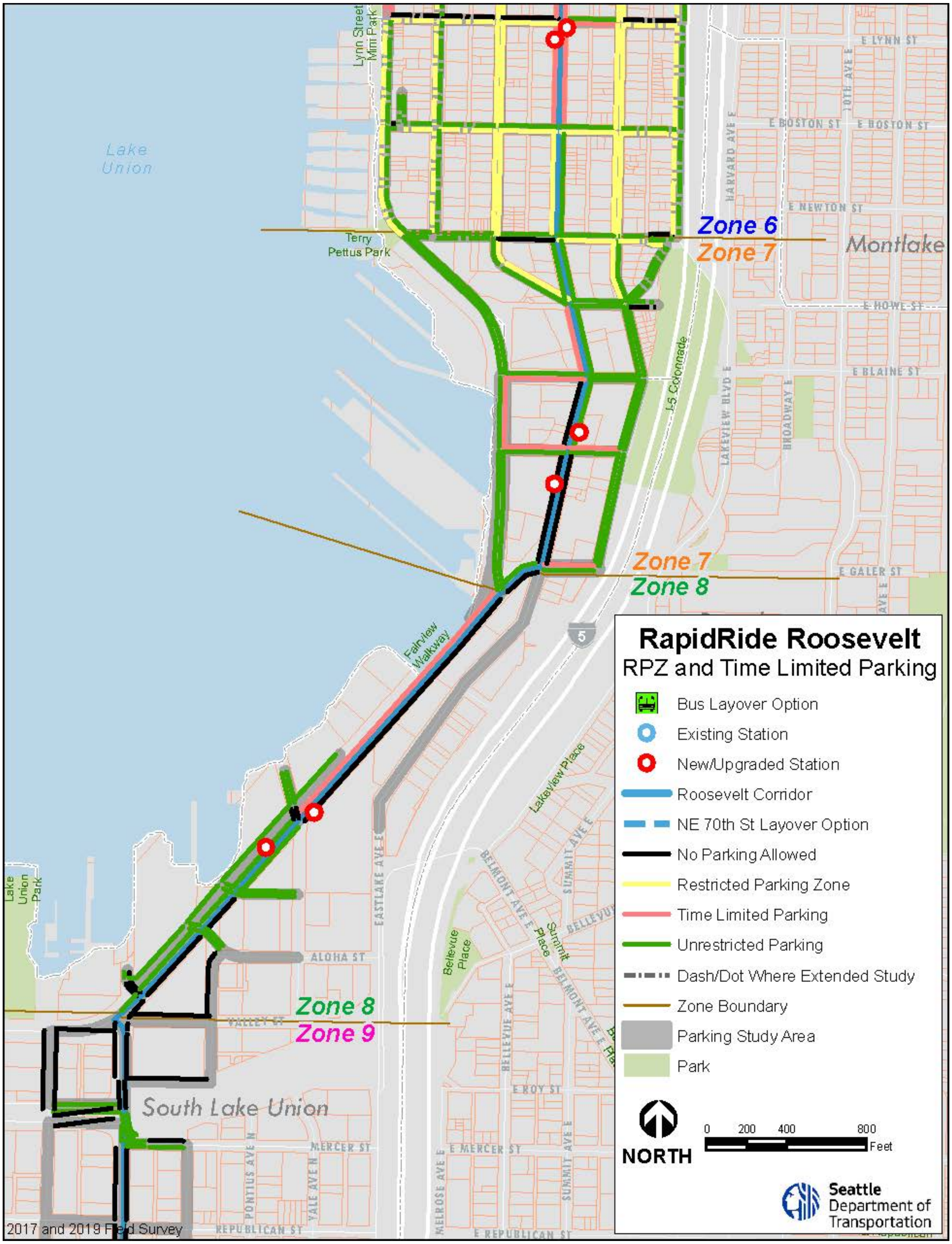


Figure A-28. Restricted Parking Zone and Time Limited On-street Parking in Zones 7, 8

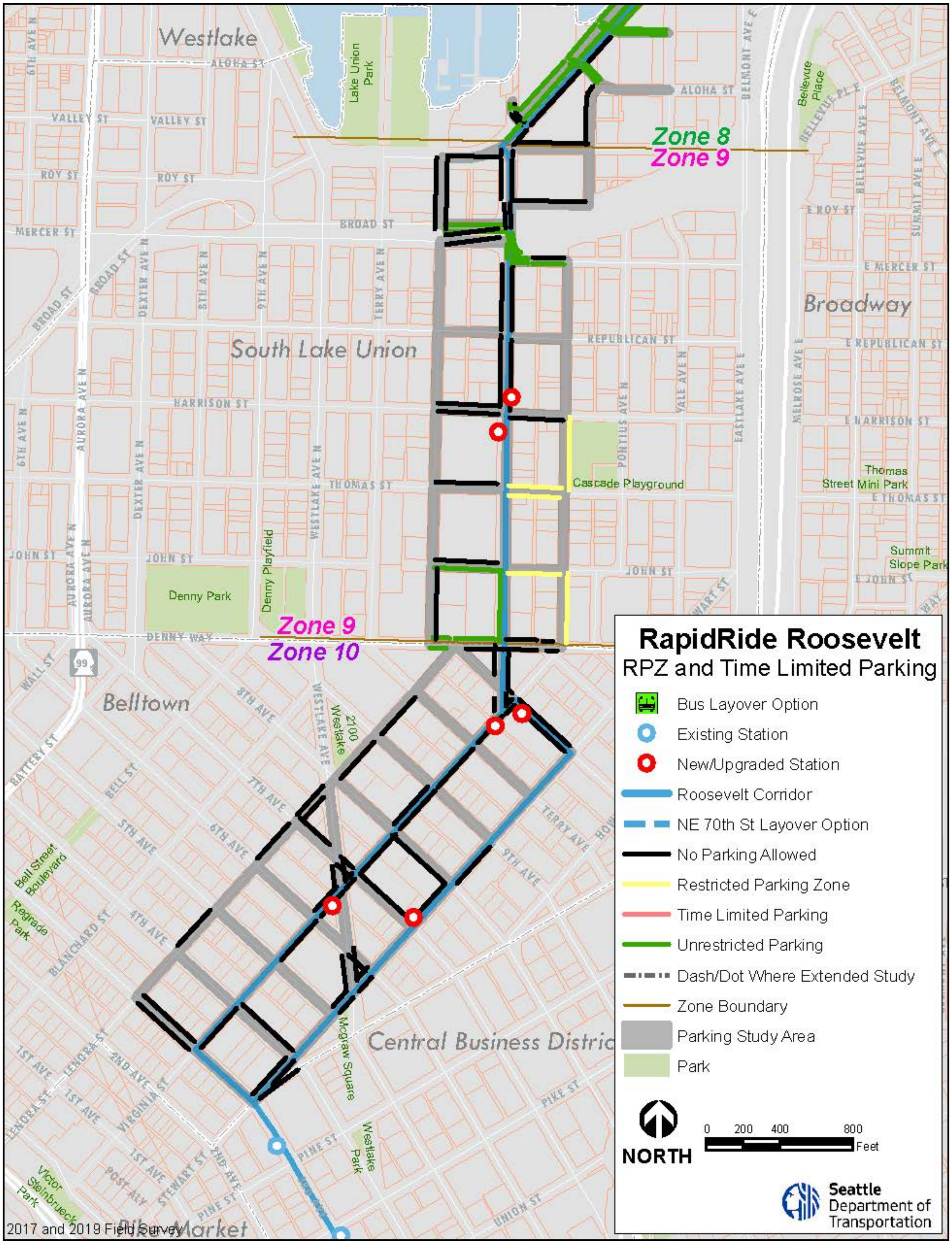


Figure A-29. Restricted Parking Zone and Time Limited On-street Parking in Zones 9, 10

Attachment B
Eastlake Commercial Area Duration Study Utilization Rates per Block Face

Tables B-1 through B-8 show the hourly utilization by block face. The effects of peak-period parking restrictions can be seen as 0% or close to 0% (i.e., illegally parked vehicles) utilization factor for peak periods for some of the block faces.

Table B-1. Hourly Utilization - Eastlake Ave E between E Roanoke St and E Louisa St West Side (Block Face 1A)

Time 1	Supply	Occupancy	Utilization
7:00 AM	16	1	3%-
8:00 AM	16	0.0	0%-
9:00 AM	16	11	66%
10:00 AM	16	14.0	88%
11:00 AM	16	15.0	94%
12:00 PM	16	15.0	94%
1:00 PM	16	15	91%
2:00 PM	16	15.0	94%
3:00 PM	16	14.0	88%
4:00 PM	16	14	84%
5:00 PM	16	13	78%
6:00 PM	16	12.0	75%

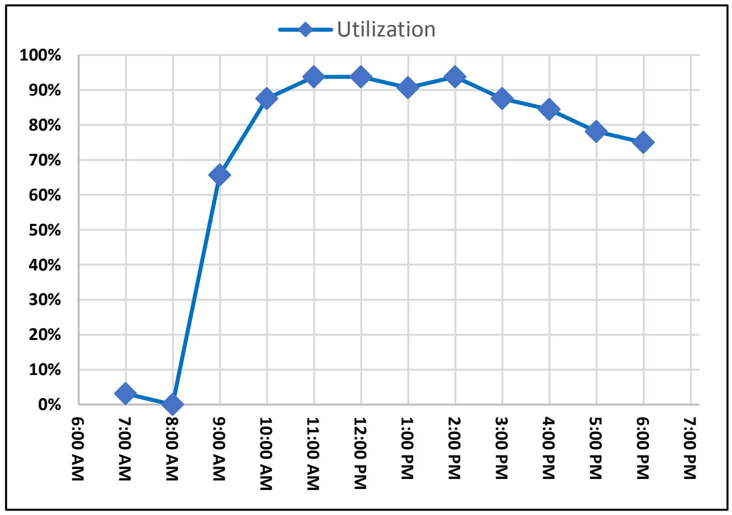


Table B-2. Hourly Utilization - Eastlake Ave E between E Louisa St and E Roanoke St East Side (Block Face 1B)

Time 8	Supply	Occupancy	Utilization
7:00 AM	13	13.0	100%
8:00 AM	13	13.0	100%
9:00 AM	13	13	96%
10:00 AM	13	12.0	92%
11:00 AM	13	13	96%
12:00 PM	13	12	88%
1:00 PM	13	12.0	92%
2:00 PM	13	11.0	85%
3:00 PM	13	8.0	62%
4:00 PM	0	1	4%
5:00 PM	0	0.0	0%
6:00 PM	13	1	4%

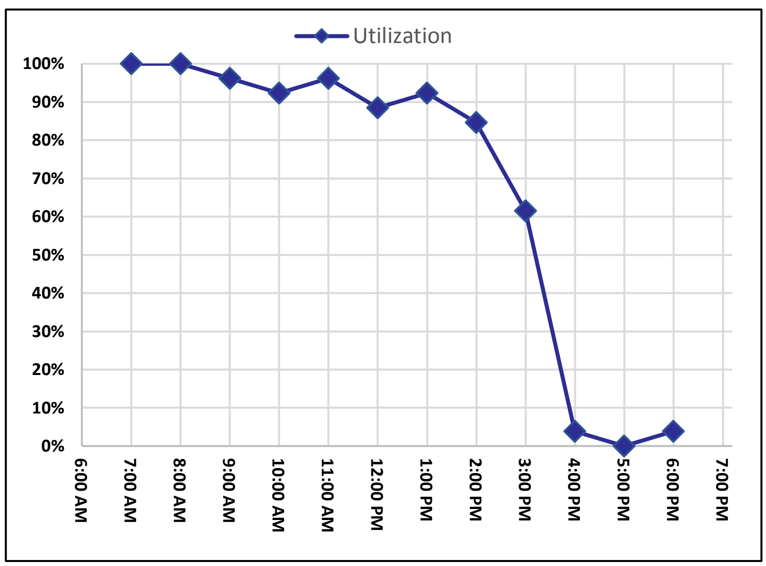


Table B-3. Hourly Utilization - Eastlake Ave E between E Louisa St and E Lynn St West Side (Block Face 2A)

Time 2	Supply	Occupancy	Utilization
7:00 AM	0	0.0	0%
8:00 AM	0	0.0	0%
9:00 AM	25	19	74%
10:00 AM	25	23	90%
11:00 AM	25	22.0	88%
12:00 PM	25	22	86%
1:00 PM	25	23.0	92%
2:00 PM	25	24	94%
3:00 PM	25	24	94%
4:00 PM	25	21.0	84%
5:00 PM	25	18.0	72%
6:00 PM	25	17.0	68%

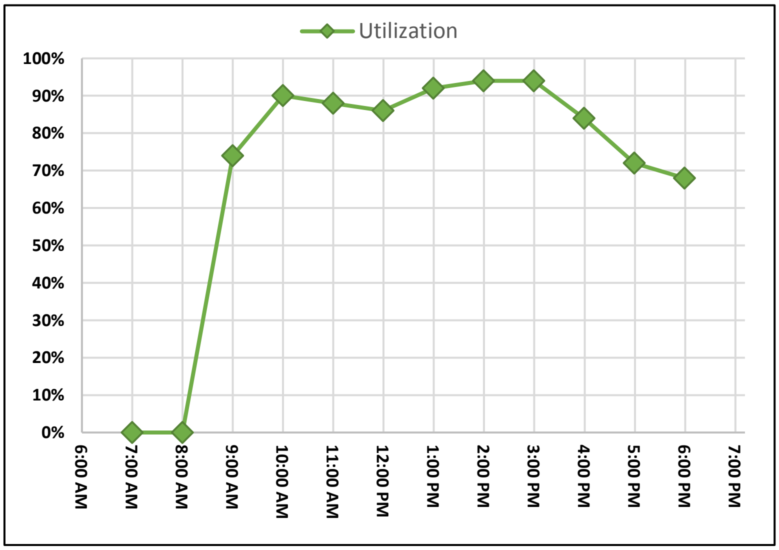


Table B-4. Hourly Utilization - Eastlake Ave E between E Lynn St and E Louisa St East Side (Block Face 2B)

Time 7	Supply	Occupancy	Utilization
7:00 AM	20	16	78%
8:00 AM	20	18.0	90%
9:00 AM	20	15.0	75%
10:00 AM	20	18	88%
11:00 AM	20	18.0	90%
12:00 PM	20	15	73%
1:00 PM	20	15.0	75%
2:00 PM	20	16	78%
3:00 PM	20	11	53%
4:00 PM	0	3*	13%
5:00 PM	0	1*	3%
6:00 PM	20	4.0	20%

*Occupancy greater than zero during peak period parking restriction shows that the cars were illegally parked.

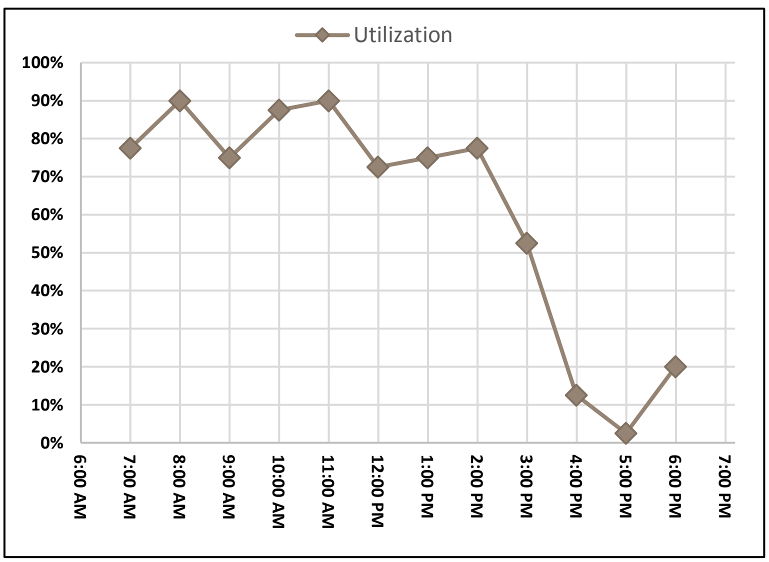


Table B-5. Hourly Utilization - Eastlake Ave E between E Lynn St and E Boston St West Side (Block Face 3A)

Time 3	Supply	Occupancy	Utilization
7:00 AM	0	0.0	0%
8:00 AM	0	0.0	0%
9:00 AM	16	4.0	25%
10:00 AM	16	7.0	44%
11:00 AM	16	10.0	63%
12:00 PM	16	12	72%
1:00 PM	16	11.0	69%
2:00 PM	16	12	72%
3:00 PM	16	10.0	63%
4:00 PM	16	13.0	81%
5:00 PM	16	11.0	69%
6:00 PM	16	12.0	75%

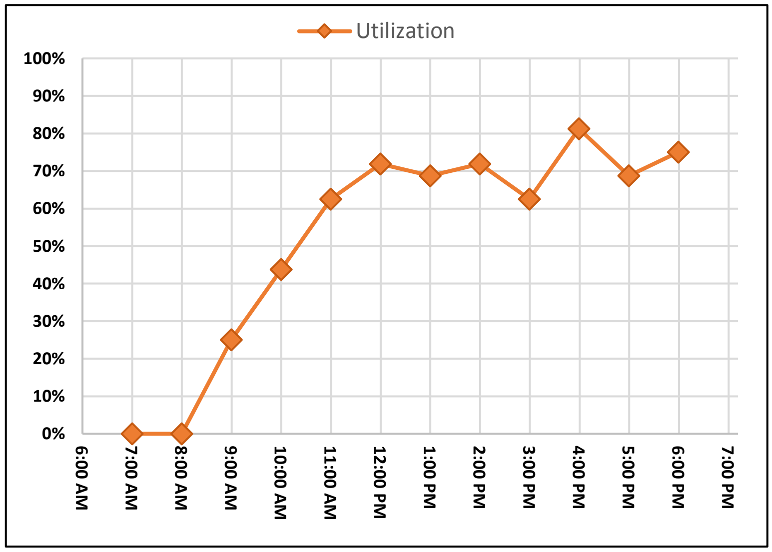


Table B-6. Hourly Utilization - Eastlake Ave E between E Boston St and E Lynn St East Side (Block Face 3B)

Time 6	Supply	Occupancy	Utilization
7:00 AM	14	9	61%
8:00 AM	14	10	68%
9:00 AM	14	9	61%
10:00 AM	14	9	61%
11:00 AM	14	8.0	57%
12:00 PM	14	9.0	64%
1:00 PM	14	11	75%
2:00 PM	14	8.0	57%
3:00 PM	0	1.0*	7%
4:00 PM	0	0.0	0%
5:00 PM	0	0.0	0%
6:00 PM	14	1.0	7%

*Occupancy greater than zero during peak period parking restriction shows that the cars were illegally parked.

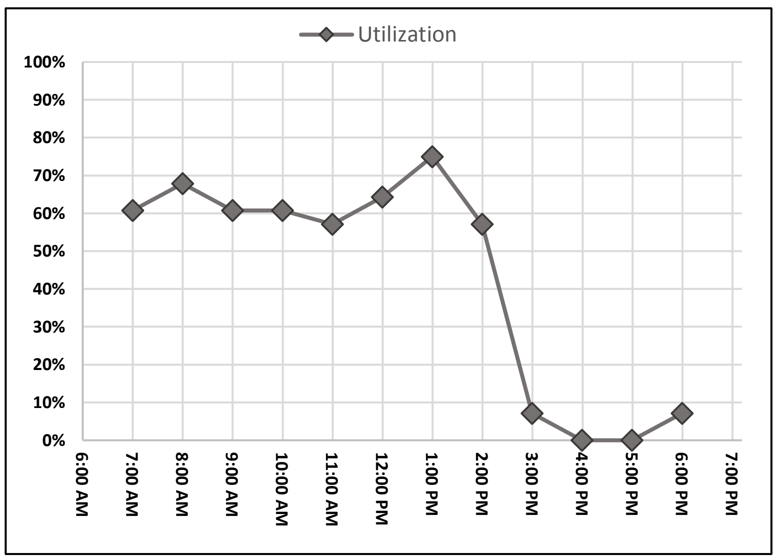


Table B-7. Hourly Utilization - Eastlake Ave E between E Boston St and E Newton St West Side (Block Face 4A)

Time 4	Supply	Occupancy	Utilization
7:00 AM	21	1	2%
8:00 AM	21	0.0	0%
9:00 AM	21	6	26%
10:00 AM	21	12.0	57%
11:00 AM	21	12.0	57%
12:00 PM	21	18.0	86%
1:00 PM	21	17.0	81%
2:00 PM	21	15	69%
3:00 PM	21	12	55%
4:00 PM	21	12.0	57%
5:00 PM	21	12	55%
6:00 PM	21	11.0	52%

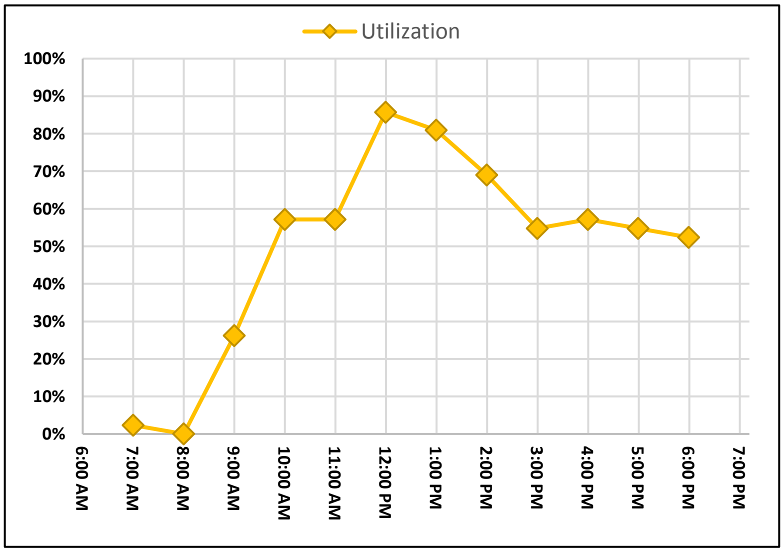
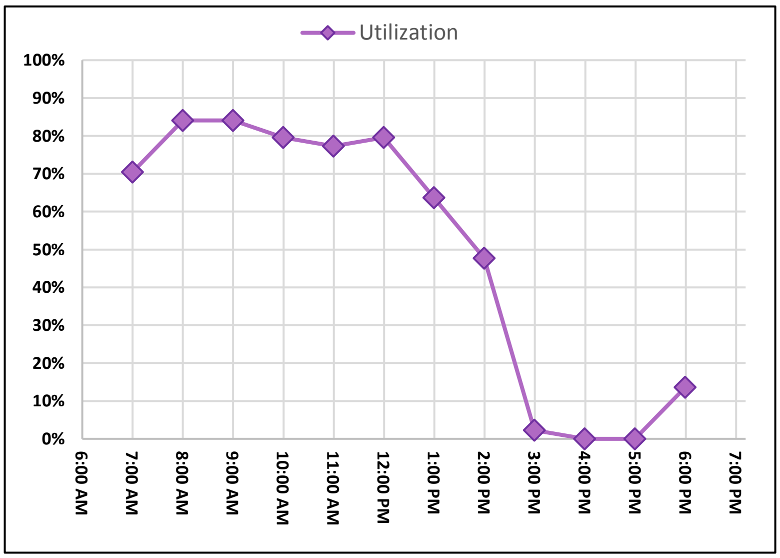


Table B-8. Eastlake Ave E between E Newton St and E Boston St East Side (Block Face 4B)

Time 5	Supply	Occupancy	Utilization
7:00 AM	22	15.5	70%
8:00 AM	22	18.5	84%
9:00 AM	22	18.5	84%
10:00 AM	22	17.5	80%
11:00 AM	22	17.0	77%
12:00 PM	22	17.5	80%
1:00 PM	22	14.0	64%
2:00 PM	22	10.5	48%
3:00 PM	0	1 *	2%
4:00 PM	0	0.0	0%
5:00 PM	0	0.0	0%
6:00 PM	22	3.0	14%

*Occupancy greater than zero during peak period parking restriction shows that the cars were illegally parked.



Appendix D
Preliminary Design Drawings of Locally Preferred Alternative

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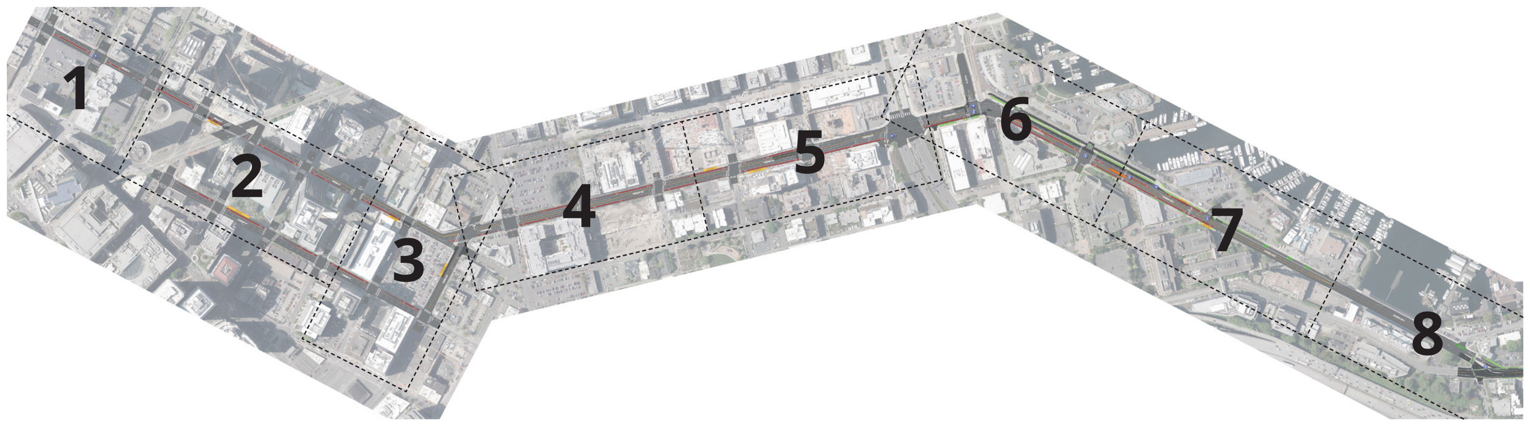
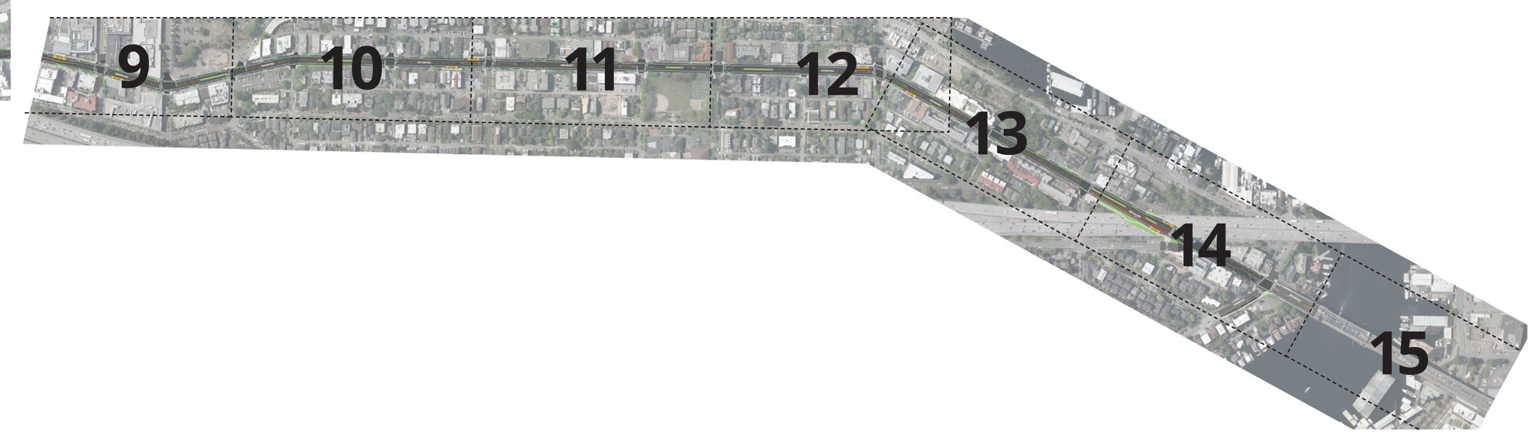
J Roosevelt Line

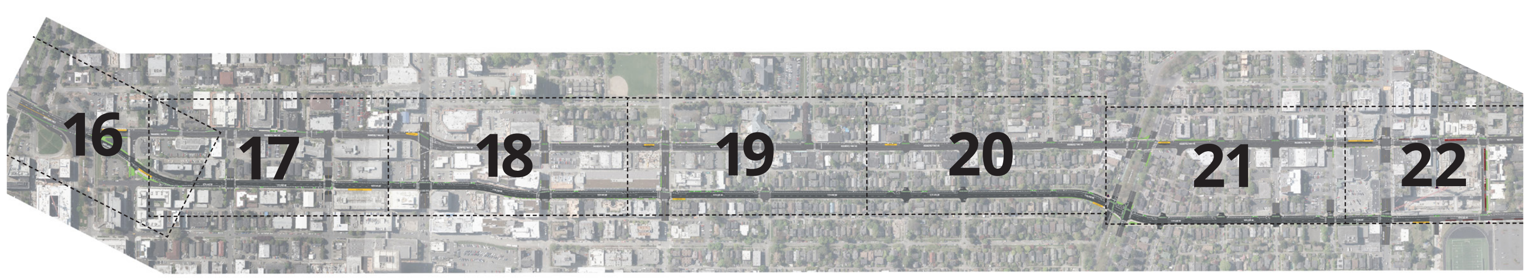
Segment 1



Segment 2



Segment 3



Neighborhoods

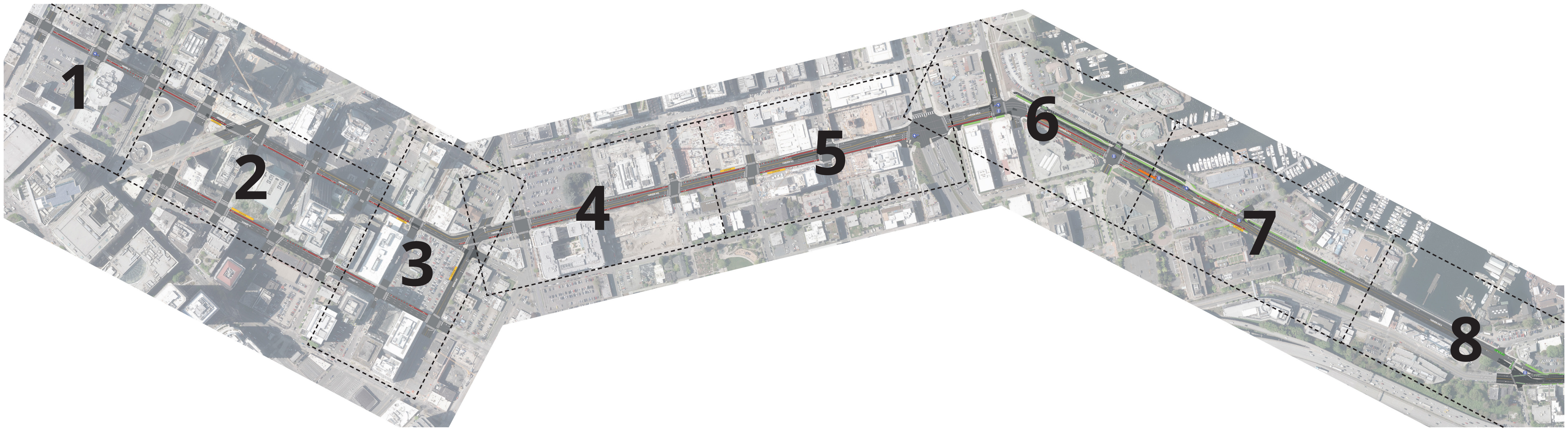
- Belltown - Sheets 1 to 3
- South Lake Union - Sheets 3 to 9
- Eastlake - Sheets 9 to 14
- University District - Sheets 14 to 21
- Roosevelt - Sheets 21 to 22

NOTE: 3rd Ave is not included because there are no project improvements south of Stewart St.

J

Roosevelt Line

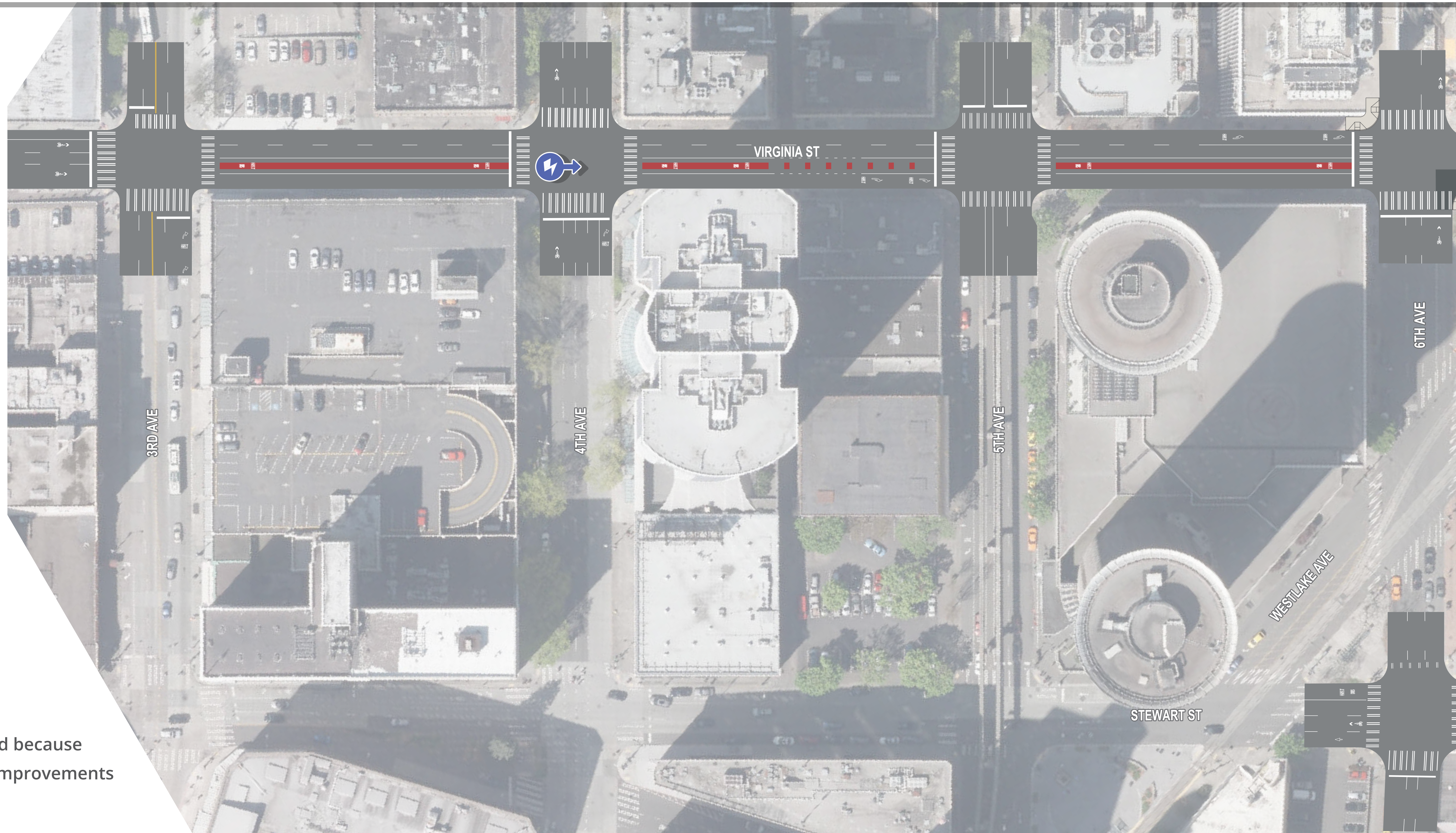
Segment 1



Legend

- Bus Lane
- Existing Pavement
- Pavement (Concrete or Mill & Overlay Asphalt)
- Two-way Bike Lane
- Bike Lane Driveway Zone
- Bike Lane Crosswalk
- Sidewalk
- Landscape
- Bus Station
- Bus Layover Option
- Signal Improvement
- Bus Queue Jump
- Streetcar Station
- Traction Power Substation (TPSS)

Notes: 1. Exact location of TPSS not yet determined. Fourth option located to the north within the Green Lake Reservoir property.
2. Existing streetcar to remain.



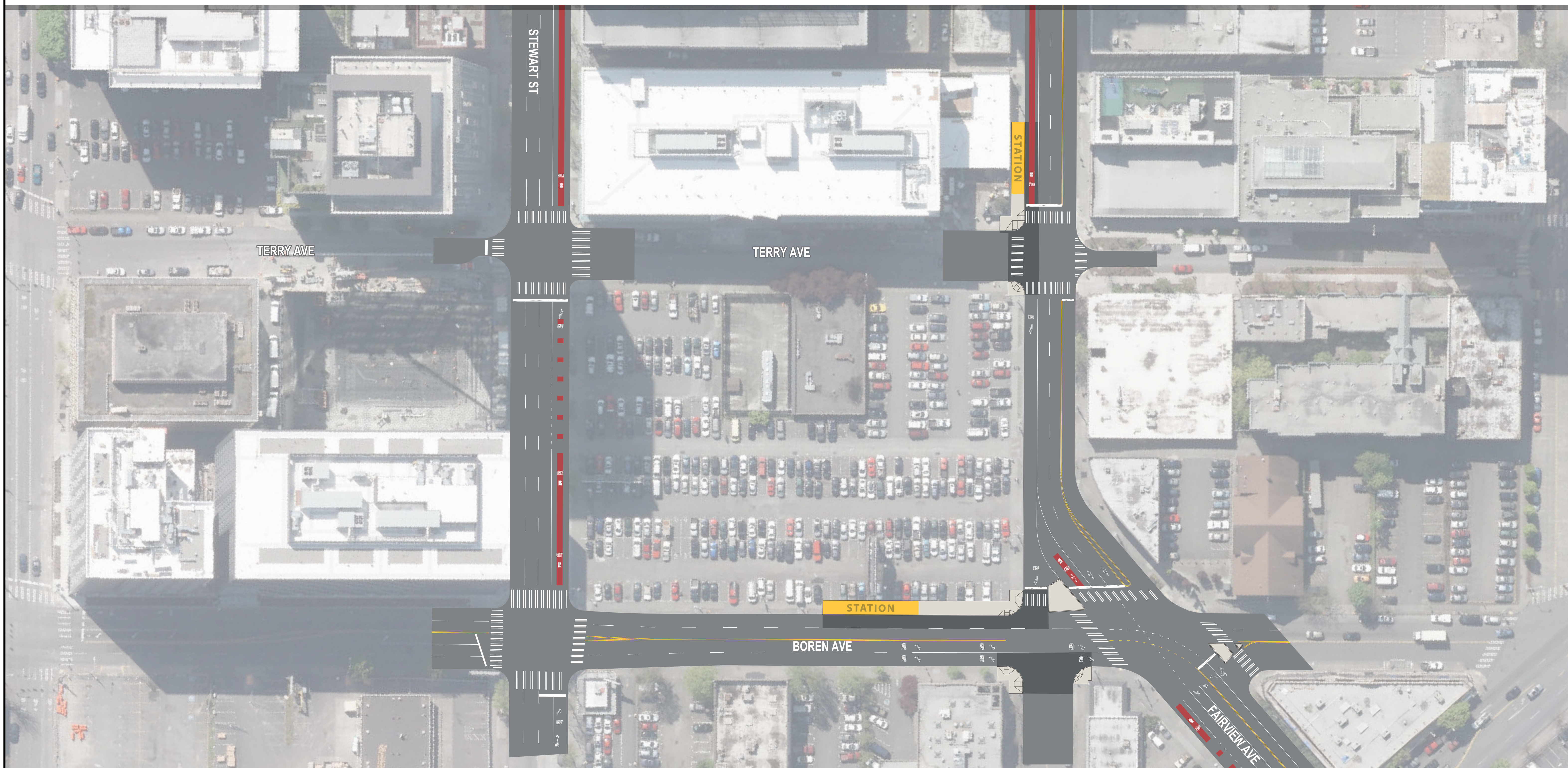
Note:

1. 3rd Ave is not included because there are no project improvements south of Stewart St.


VIRGINIA ST
STATION
6TH AVE
7TH AVE
8TH AVE
9TH AVE
VIRGINIA ST
WESTLAKE AVE
STEWART ST
STATION
STEWART ST

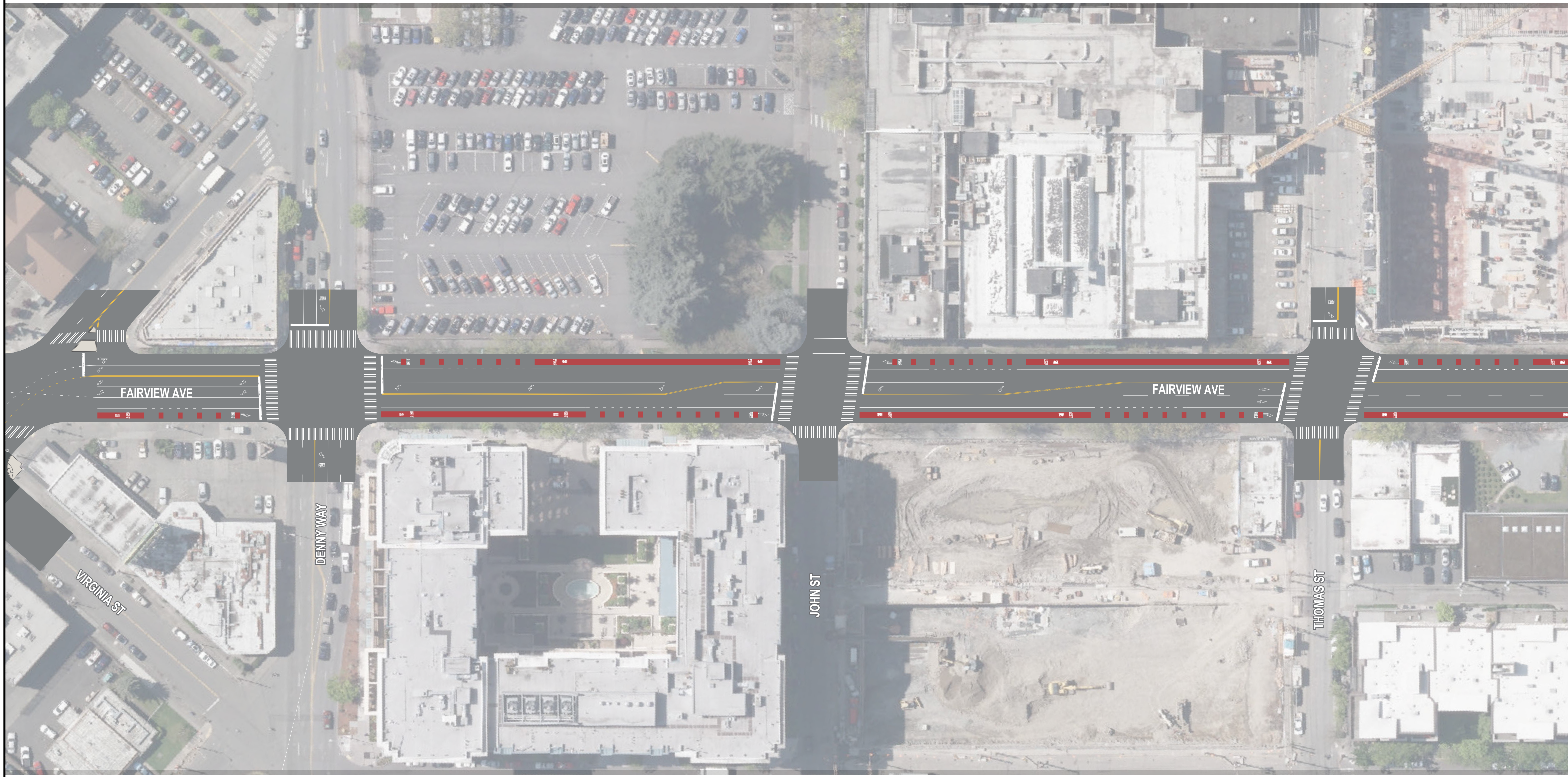
J

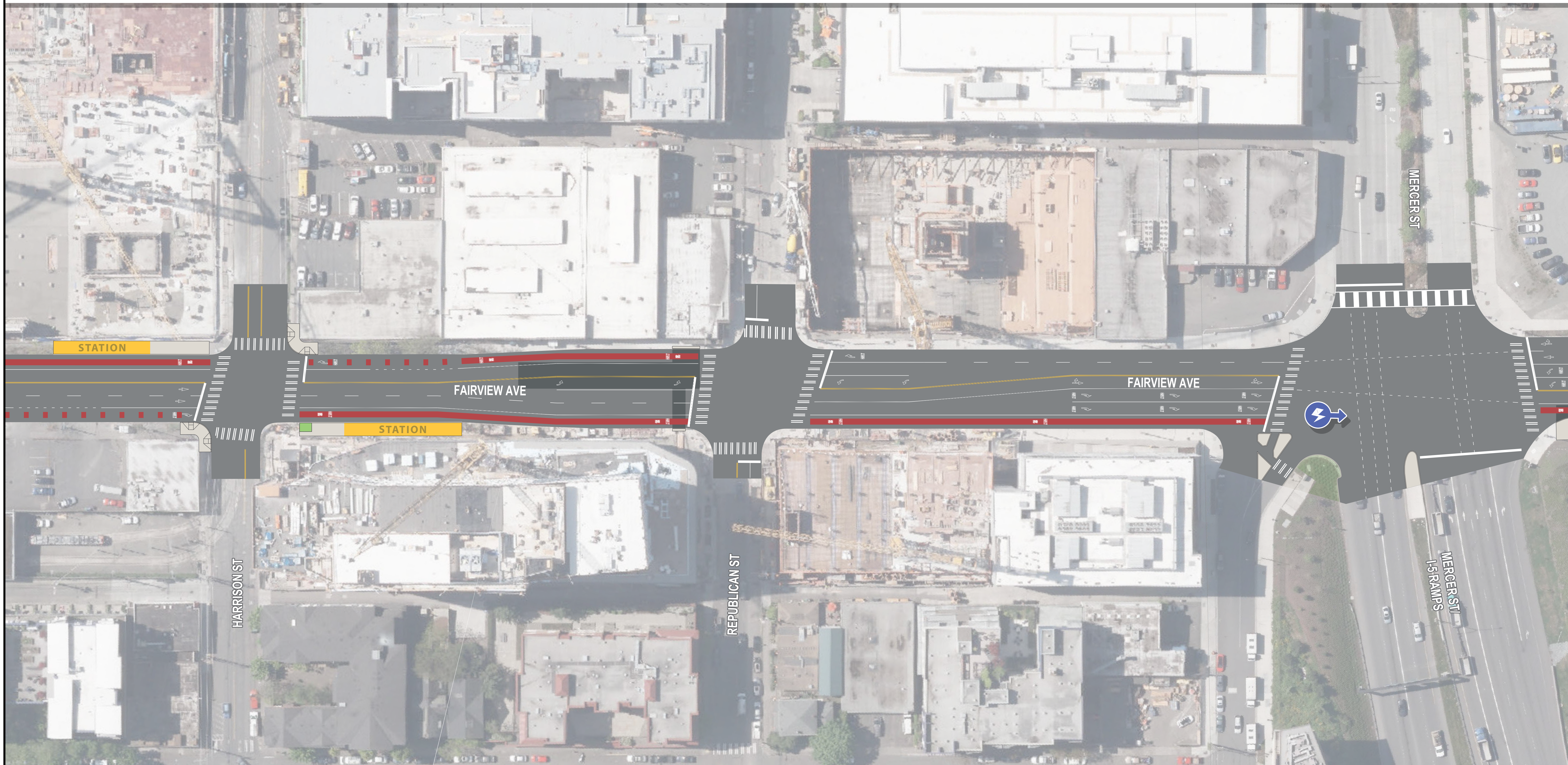
Roosevelt Line



Conceptual Design

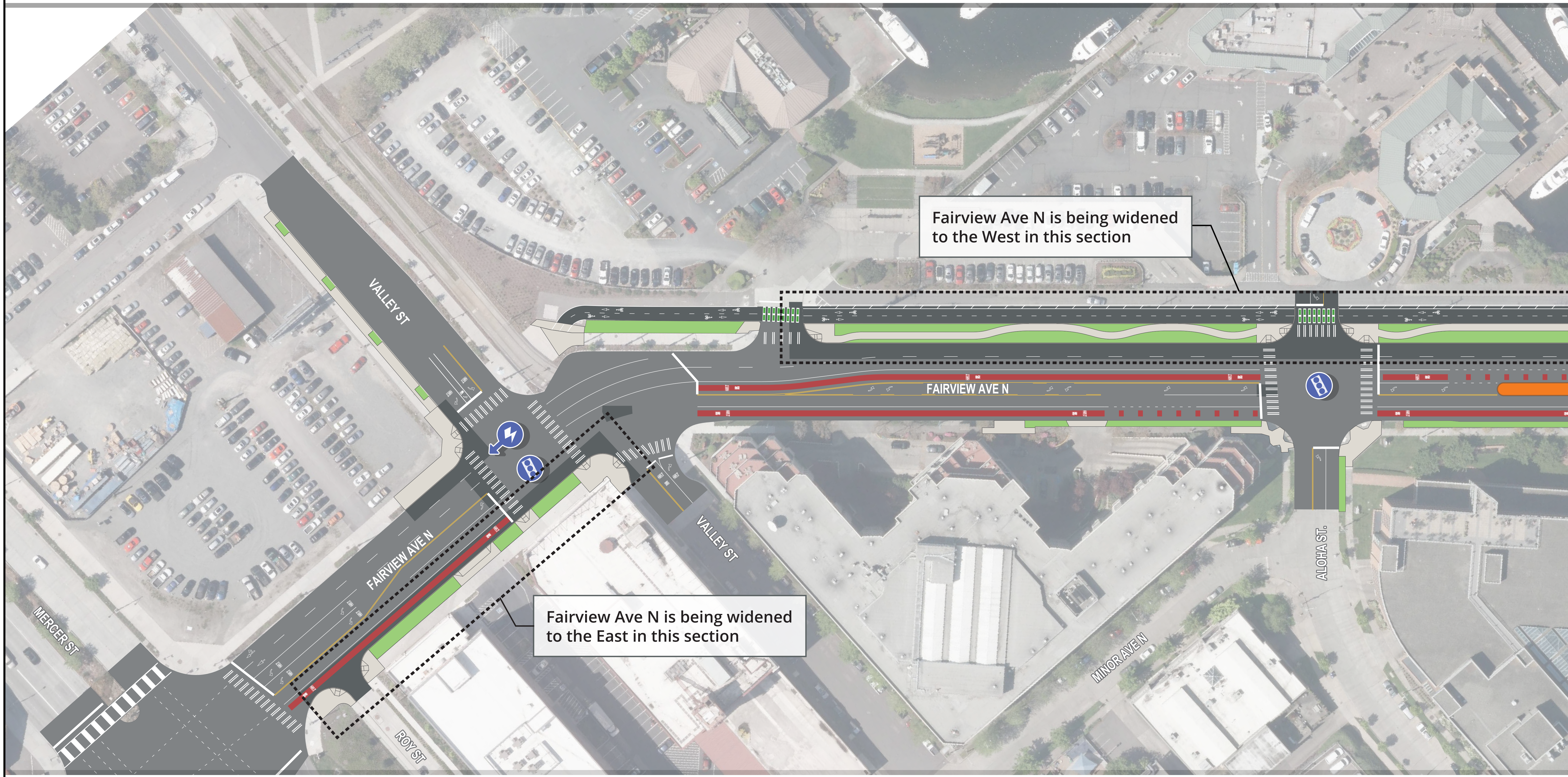
October 2019

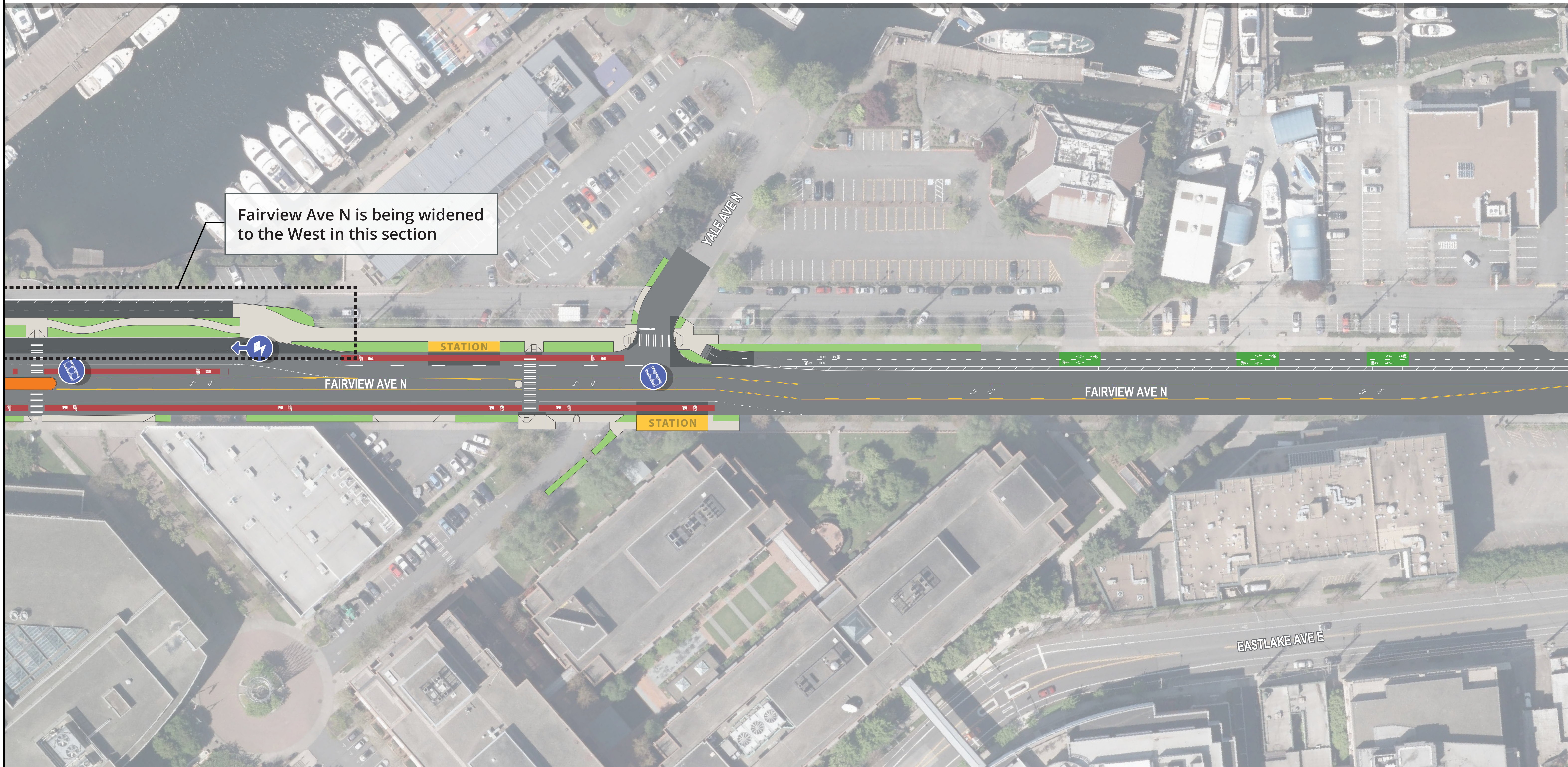

FAIRVIEW AVE
FAIRVIEW AVE
DENNY WAY
VIRGINIA ST
JOHN ST
THOMAS ST

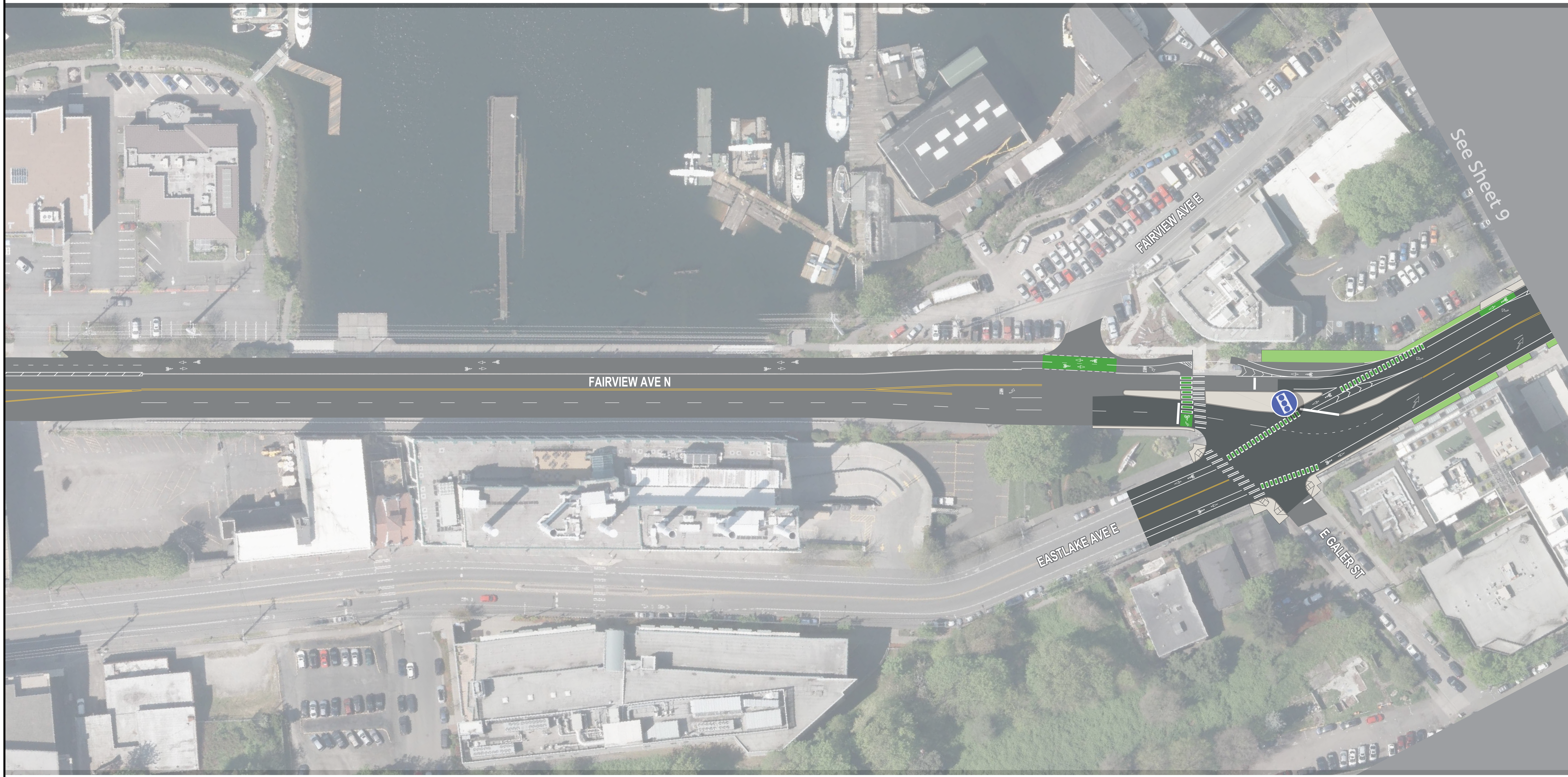


Conceptual Design

October 2019


Fairview Ave N is being widened to the West in this section
Fairview Ave N is being widened to the East in this section
VALLEY ST
FAIRVIEW AVE N
FAIRVIEW AVE N
VALLEY ST
ALOHA ST
MERCER ST
ROY ST
MINOR AVE N


Fairview Ave N is being widened to the West in this section
STATION
STATION
YALE AVE N
FAIRVIEW AVE N
FAIRVIEW AVE N
EASTLAKE AVE E



N

0 50 100 200
SCALE IN FEET

Conceptual Design
October 2019

Segment 2

Legend

- Bus Lane
- Existing Pavement
- Pavement (Concrete or Mill & Overlay Asphalt)
- Two-way Bike Lane
- Bike Lane Driveway Zone
- Bike Lane Crosswalk
- Sidewalk
- Landscape
- Bus Station
- Bus Layover Option
- Signal Improvement
- Bus Queue Jump
- Streetcar Station
- Traction Power Substation (TPSS)

Notes: 1. Exact location of TPSS not yet determined. Fourth option located to the north within the Green Lake Reservoir property.
2. Existing streetcar to remain.

See Sheet 8

Conceptual Design

October 2019

Roosevelt Line

J

Conceptual Design

October 2019

J Roosevelt Line

STATION
EASTLAKE AVE E
STATION
EASTLAKE AVE E
E ROANOKE ST
E EDGAR ST
E HAMLIN ST

J

Roosevelt Line


FAIRVIEW AVE E
I-5
STATION
EASTLAKE AVE E
STATION
EASTLAKE AVE E
HARVARD AVE E
FUHRMAN AVE E
FRANKLIN AVE E

J

Roosevelt Line

See Sheet 16

Seattle Department of Transportation

MOVE SEATTLE

King County METRO

N

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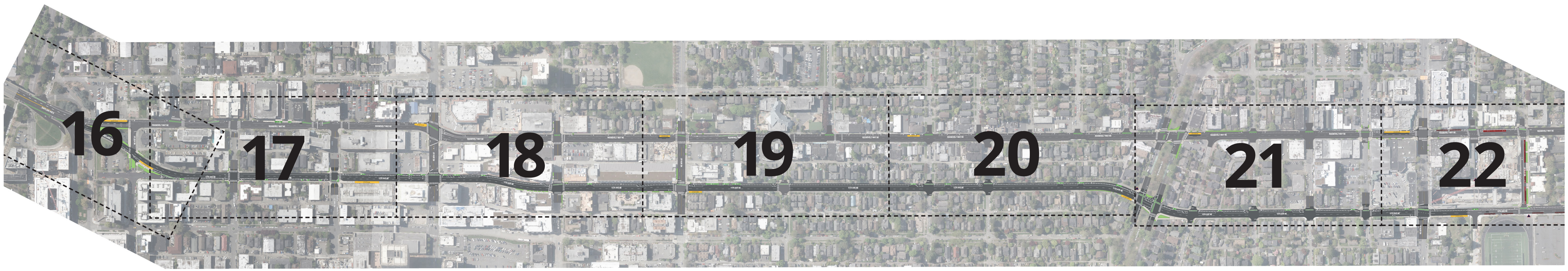
SCALE IN FEET

Conceptual Design

October 2019

Segment 3



Legend

- Bus Lane
- Existing Pavement
- Pavement (Concrete or Mill & Overlay Asphalt)
- Two-way Bike Lane
- Bike Lane Driveway Zone
- Bike Lane Crosswalk
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Notes: 1. Exact location of TPSS not yet determined. Fourth option located to the north within the Green Lake Reservoir property.
2. Existing streetcar to remain.

Conceptual Design

October 2019


NE 42ND ST
NE 43RD ST
ROOSEVELT WAY NE
ROOSEVELT WAY NE
ROOSEVELT WAY NE
11TH AVE NE
11TH AVE NE
11TH AVE NE
STATION
NE 42ND ST
NE 43RD ST

Conceptual Design

October 2019

Seattle Department of Transportation
MOVE SEATTLE
King County METRO
N
0 50 100 200
SCALE IN FEET

Conceptual Design

October 2019

J Roosevelt Line

Seattle Department of Transportation

MOVE SEATTLE

King County METRO

N

0 50 100 200
SCALE IN FEET

Conceptual Design

October 2019

J Roosevelt Line

Seattle Department of Transportation

MOVE SEATTLE

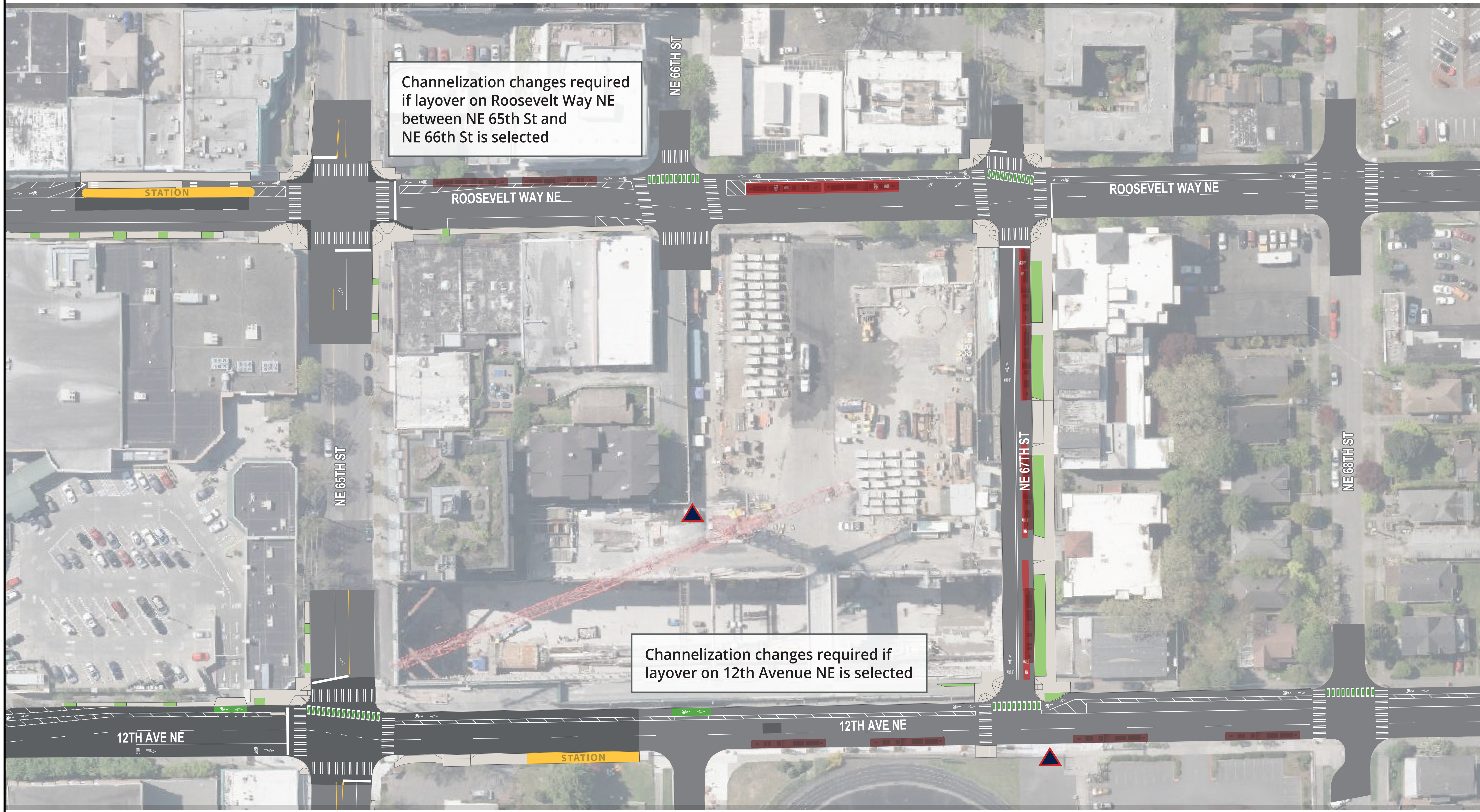
King County METRO

N

0 50 100 200
SCALE IN FEET

Conceptual Design

October 2019


Channelization changes required if layover on Roosevelt Way NE between NE 65th St and NE 66th St is selected
Channelization changes required if layover on 12th Avenue NE is selected
ROOSEVELT WAY NE
ROOSEVELT WAY NE
12TH AVE NE
12TH AVE NE
NE 65TH ST
NE 66TH ST
NE 67TH ST
NE 68TH ST
STATION
STATION
0
50
100
200
SCALE IN FEET
N

Appendix E
Eastlake Bicycle Facility Evaluation Memorandum

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DRAFT REPORT

RAPIDRIDE ROOSEVELT CORRIDOR EASTLAKE BICYCLE FACILITY EVALUATION

Prepared for

Seattle Department of Transportation

Seattle
Department of
Transportation

August 2018

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TABLE OF CONTENTS

Attachments

Tables

Figures

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ACRONYMS AND ABBREVIATIONS

AAA	all ages and abilities
BMP	Bicycle Master Plan
BRT	bus rapid transit
FTA	Federal Transit Administration
HCT	high-capacity transit
LPA	locally preferred alternative
NACTO	National Association of City Transportation Officials
NB	northbound
NEPA	National Environmental Policy Act
PBL	protected bicycle lane
RPZ	restricted parking zone
SB	southbound
SDOT	Seattle Department of Transportation
TMP	Transit Master Plan

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EXECUTIVE SUMMARY

The City of Seattle is in the environmental review phase of the RapidRide Roosevelt bus rapid transit project. In December 2017, Seattle Department of Transportation (SDOT) conducted project scoping to begin the environmental process, inform agencies and the public about the project, and solicit feedback on project alternatives. Based on feedback received during the public scoping period, which included comments on the protected bicycle lanes (PBLs), including both support for PBLs on Eastlake and concerns regarding loss of parking, SDOT decided to complete a more detailed evaluation of bicycle facility options in the Eastlake neighborhood as part of the RapidRide Roosevelt preliminary engineering effort. This document evaluates bicycle facility options in the Eastlake neighborhood as part of the SDOT RapidRide Roosevelt project related to the purpose and needs of the project.

This Executive Summary highlights information included within this report. Refer to the appropriate section in this report for further information.

Project Background and Elements

Seattle's 2012 Transit Master Plan (TMP) identified three high-capacity-transit (HCT) corridors as priorities for further evaluation and implementation, including the Roosevelt-University District-South Lake Union-Downtown Seattle transit corridor (SDOT, 2012). This HCT corridor was the predecessor to what is now the RapidRide Roosevelt project. The first work on the project was a conceptual design phase for the Roosevelt to Downtown HCT Study. The Roosevelt to Downtown HCT Study (SDOT, 2017a) included three rounds of public outreach in 2015 and 2016. The Roosevelt to Downtown HCT Study recommended two-way PBLs on Eastlake Ave E as part of the preferred bicycle facilities for the RapidRide Roosevelt project. In July 2017, a locally preferred alternative (LPA) was adopted by Seattle City Council that addressed the project's adopted purpose and need (Council Resolution 31761).

The purpose of the RapidRide Roosevelt project is to improve transit travel times, reliability, and capacity to increase high-frequency, all-day transit service and enhance transit connections between Downtown Seattle and the Belltown, South Lake Union, Eastlake, University District, and Roosevelt neighborhoods, in order to:

- Address current and future mobility needs for residents, workers, and students
- Address capacity constraints in the transportation network along this north-south corridor
- Provide equitable transportation access to major institutions, employers, and neighborhoods
- Improve pedestrian and bicycle connections and access to RapidRide stops and improve safety along the corridor

The RapidRide Roosevelt project would provide electric trolley bus service along a 6-mile corridor from northeast Seattle to Downtown Seattle. Transit improvements include upgrades to bus stops to provide real-time arrival information and offboard fare payment, transit signal priority upgrades, and new bus lanes. The project also includes bicycle and pedestrian access and safety improvements throughout the corridor. As part of these multimodal improvements, new PBLs are proposed along Eastlake Ave E.

Guiding Plans and Policies

Several plans and policies are used to guide decisions on the allocation of right-of-way in Seattle for travel modes. The relevant plans and polices are described in this report. They include:

- *Seattle Bicycle Master Plan* (SDOT, 2014)
- *Seattle 2035*, the Seattle Comprehensive Plan (City of Seattle, 2017a)
- Streets Illustrated, the Seattle Right-of-Way Improvements Manual (City of Seattle, 2017b)

The Bicycle Master Plan (BMP) recommended two bicycle facilities in the Eastlake neighborhood as part of the citywide recommended bicycle network: PBLs along Eastlake Ave E and a neighborhood greenway along the shore of Lake Union (following the Cheshiahud Lake Union Loop). The recommended PBLs along Eastlake Ave E are identified as part of the regional bicycle network, reflecting the importance of Eastlake Ave E as a cycling corridor.

The Comprehensive Plan identifies priorities for the use of the "flex zone," which is the portion of the right-of-way between travel lanes and the sidewalk. These priorities depend on the surrounding land uses, but in all cases modal plans are the top priority for use of the flex zone. This means that recommendations such as those in the BMP are given priority over other possible uses of the flex zone, including parking and loading.

"Streets Illustrated" is Seattle's right-of-way improvements manual and within the Eastlake neighborhood, Eastlake Ave E is classified as an Urban Village Main street. Urban Village Main streets, as defined in Streets Illustrated, serve as the primary arterials for urban villages. Streets designated Urban Village Main are intended to provide transit priority to support frequent transit service as well as on-street PBLs where recommended by the BMP.

Existing Conditions

The study area for this evaluation roughly corresponds to Seattle's Eastlake neighborhood between the University Bridge in the north and Fairview Ave N bridge in the south (Figure ES-1). PBLs in the area are on the University Bridge and extend north to the University District. These bicycle lanes continue south on Harvard Ave E connecting to Capitol Hill. In the southern part of the study area, the SDOT Fairview Ave N bridge replacement project will include a two-way PBL on Fairview Ave N. Currently there are no dedicated bicycle facilities between Harvard Ave E and Fairview Ave N. This represents a substantial gap in the bicycle network.

As part of this study, bicycle volumes were collected during daylight hours and are shown on Figure ES-2. Bicycle volumes were highest at the Eastlake Ave E/Fuhrman Ave E count location at the north end of the study area, with 2,229 cyclists observed over the 14-hour count period. Bicycles traveling north-south through the Eastlake neighborhood must pass through the intersection of Fairview Ave/Eastlake Ave E at the southern end of the study area, so it provides a good estimate of the total number of cyclists traveling through the Eastlake study area. A total of 1,462 cyclists were observed at this location over the count period.

Two counts were also conducted near the center of the study area, one on Eastlake Ave E and the other on Fairview Ave E. At the Eastlake Ave E/E Lynn St intersection, 855 cyclists were observed over the count period. At the Fairview Ave E/E Lynn St intersection, which is along the Cheshiahud Lake Union Loop (a signed bicycle route), 255 cyclists were counted.

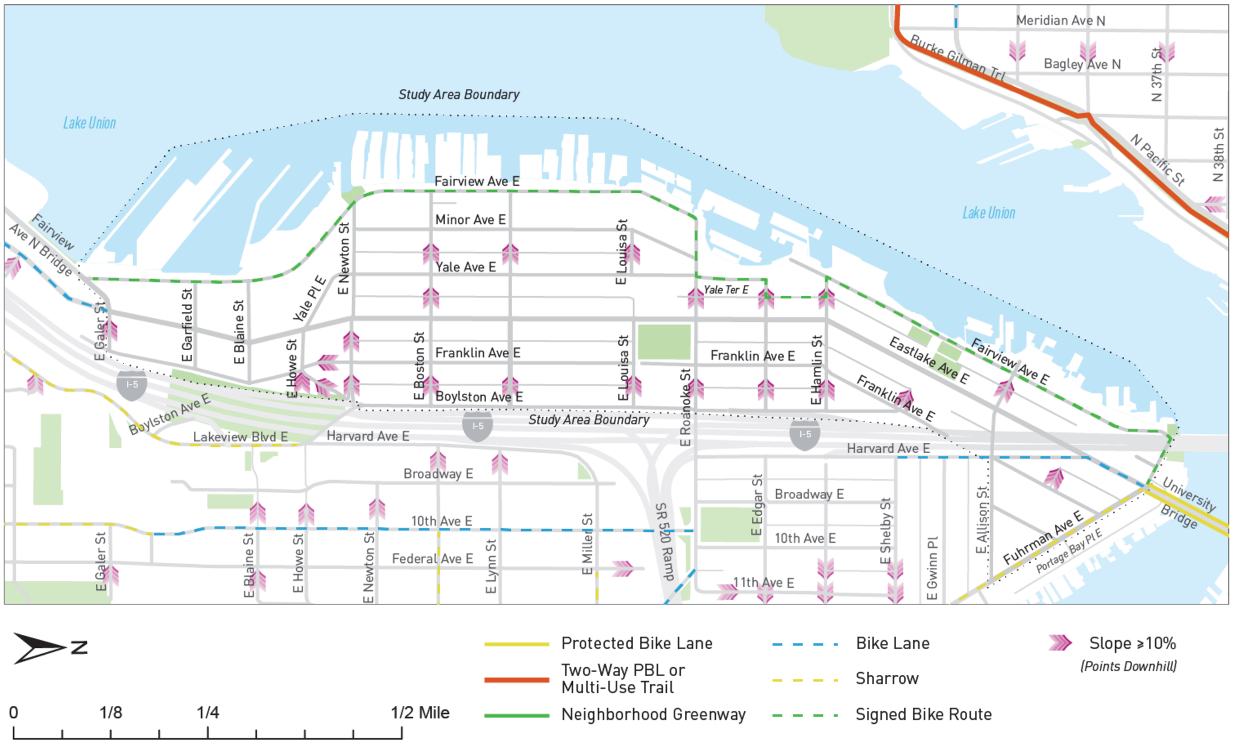

Figure ES-1. Existing Bicycle Facilities in Study Area

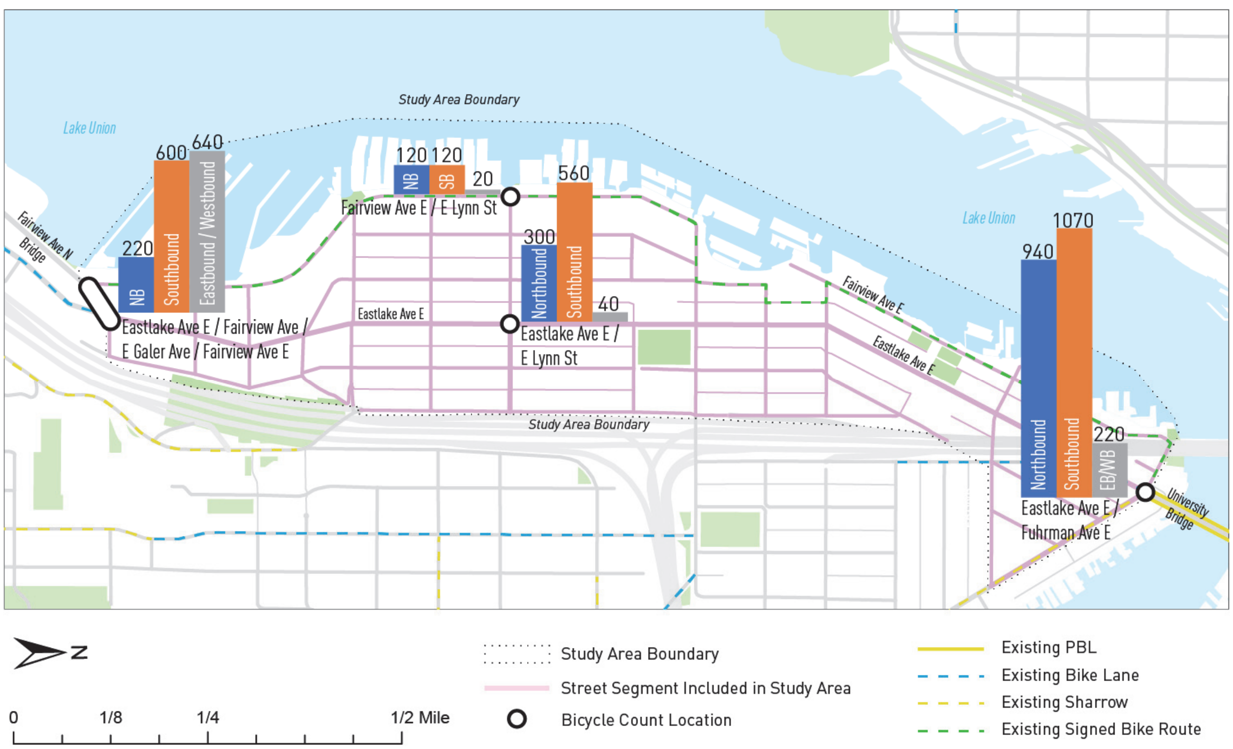

Figure ES-2. Bicycle Volumes at Eastlake Neighborhood Count Locations (14-Hour Duration)

From 2012 through 2017, 40 reported collisions involving bicycles occurred in the Eastlake neighborhood. Of those, 39 collisions occurred at locations along Eastlake Ave E, while one collision occurred off of Eastlake Ave E at the intersection of Fairview Ave E and E Garfield St. Most collisions resulted in injury (95%), including three serious injury collisions (8%). No bicycle-involved fatal collisions occurred in this area during the time period analyzed.

Bicycle Options

Eight bicycle facility options were developed for this study. A no build option with existing bicycle facilities and the future PBL on the Fairview Avenue bridge was also included in the analysis. The nine options evaluated are:

Option 1: No Build	Option 6: Multi-Use Trail on Fairview Ave E
Option 2: Protected Bicycle Lanes on Eastlake Ave E	Option 7: Greenway on Fairview Ave E (following the Cheshiahud Lake Union Loop)
Option 3: Two-Way Protected Bicycle Lanes on Eastlake Ave E	Option 8: Greenway on Minor Ave E and Fairview Ave E
Option 4: Northbound PBL on Eastlake Ave E and Southbound Greenway on Yale Ave E	Option 9: Greenway on Franklin Ave E
Option 5: Northbound PBL on Eastlake Ave E and Southbound PBL on Yale Ave E	

Evaluation Process and Results

Evaluation Process

A no build option along with eight bicycle facility options were evaluated in two stages as shown in Exhibit ES-3. Options were initially evaluated with a pass/fail rating based on criteria pertaining to feasibility of implementation. Concepts that passed this initial screening were then assessed in greater detail to determine their performance on a broader set of criteria.

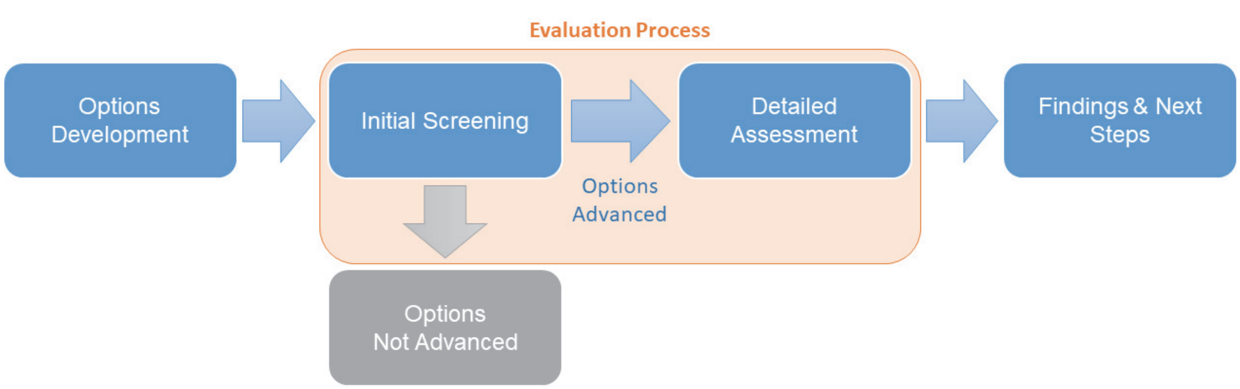

Figure ES-3. Bicycle Facility Options Evaluation Process

The initial screening stage of the evaluation process considered all nine options. The initial screen was performed to identify potential issues that would prevent implementation of the options. This step serves to screen out bicycle facility options with substantial concerns by considering whether each option would:

- Meet the project's purpose and need by providing improved safety and access to transit for bicycles.
- Provide a level bicycle route.
- Meet SDOT's bicycle facility design standards.
- Be constructible within available existing right-of-way.

Options that passed all four screening criteria were advanced beyond the initial screening to the more detailed assessment. While the initial screen was used to determine whether each option is feasible for implementation, the detailed assessment was used to provide a comparison of the benefits and impacts that would be associated with each of the remaining options based on their performance on a range of different measures. This detailed assessment evaluated the remaining options using 14 criteria addressing the following elements:

- Degree to which each option improves bicycle safety and bicycle connections to transit
- Degree to which each option is consistent with City of Seattle policy guidance
- Bicycle route conditions
- Degree to which each option provides neighborhood access
- Impacts to other transportation modes and elements

Evaluation Results

In the initial screening, five of the nine bicycle facility options were screened out due to their poor performance on one or more of the four initial screening criteria. Options that failed to pass any one of the four screening criteria were not advanced to the second stage of the evaluation. Options 2, 3, 4, and 5 passed the initial screening. Additionally, Option 1 (no build) was carried into the detailed assessment for comparison purposes only, although it does not meet the RapidRide Roosevelt purpose and need nor address existing safety concerns for the bicyclists traveling in the study area, and therefore did not pass the initial screening.

With the detailed assessment, Option 2, which would provide continuous PBLs on Eastlake Ave E within the study area, performed the best of the four bicycle facility concepts. Option 2 received a high rating on 11 of the 14 evaluation criteria and a medium rating on two criteria. Option 2 scored well in this assessment because it would provide a high level of safety improvement for bicycles, a bicycle facility adjacent to all transit stops in the study area, a level and direct bicycle route, a direct bicycle access to most businesses in the study area and have a positive impact on traffic and transit operations in the Eastlake neighborhood. Option 2 received a low rating on one criterion, impact to on-street parking, matching the ratings received by Options 3 and 5. No option advanced to the detailed assessment received a high rating for impact to on-street parking as all of the options in the detailed assessment would remove parking in the Eastlake neighborhood.

Option 3, which would also provide continuous PBLs through the study area, performed similarly to Option 2 overall. However, Option 3 received a lower rating than Option 2 on route safety because the two-way PBL layout would result in bicycles traveling in the opposite direction of adjacent motor vehicles. Option 3 also received a lower rating on impact to planted medians, as the two-way PBL would likely require the removal of all existing planted medians on Eastlake Ave E in the study area. Option 3 would result in the same parking impact as Option 2 and did not receive a higher rating than Option 2 on any of the criteria considered.

Options 4 and 5 did not perform as well as Options 2 and 3 in the detailed assessment, with each receiving five high ratings, eight medium ratings, and one low rating. Option 4 performed the best on impact to on-street parking, receiving a medium rating, but performed worst on route safety. Option 5 would result in the greatest total impact to on-street parking, requiring the removal of an estimated 375 parking spaces. Both Options 4 and 5 received lower scores than Options 2 and 3 on several other criteria, including consistency with the BMP, bicycle route legibility, access to businesses, and impact to transit and traffic performance.

1. INTRODUCTION

The City of Seattle has submitted the RapidRide Roosevelt project for federal funding from the Federal Transit Administration (FTA) through a Small Starts grant. This funding requires compliance with the National Environmental Policy Act (NEPA), including a public outreach process. In December 2017, Seattle Department of Transportation (SDOT) conducted project scoping to begin the environmental process, inform agencies and the public about the project, and solicit feedback on project alternatives. Based on feedback received during the public scoping period, which included comments on the protected bicycle lanes (PBLs), including both support for PBLs on Eastlake and concerns regarding loss of parking, SDOT decided to complete a more detailed evaluation of bicycle facility options in the Eastlake neighborhood as part of the RapidRide Roosevelt preliminary engineering effort.

This document evaluates bicycle facility options in the Eastlake neighborhood as part of the SDOT RapidRide Roosevelt project. The project proposes new protected bicycle lanes (PBLs) along the project corridor, including on Eastlake Ave E (PBLs are defined in Section 3.1).

The bicycle options considered in this evaluation include options for routing and bicycle facility type. A number of options were developed based on previous planning efforts, stakeholder and community feedback, and project team discussions. These are described in Section 5. The evaluation is structured in two parts with an initial screening and a subsequent more detailed assessment. Screening criteria include purpose and need, safety, and feasibility. Following the initial screen, the remaining options were further evaluated based on a set of quantitative and qualitative information using a broader range of criteria. The results of this evaluation will be shared with the public and used to inform the selection of a final bicycle facility design in the Eastlake neighborhood to be included as part of the RapidRide Roosevelt project.

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2. RAPIDRIDE ROOSEVELT PROJECT DESCRIPTION

2.1 Project Elements

The RapidRide Roosevelt project would provide electric trolley bus service along a 6-mile corridor from northeast to Downtown Seattle. The overall purpose of the RapidRide Roosevelt project is to improve transit travel times, reliability, and capacity to increase high-frequency, all-day transit service and enhance transit connections between Downtown Seattle and the Belltown, South Lake Union, Eastlake, University District, and Roosevelt neighborhoods, in order to:

- Address current and future mobility needs for residents, workers, and students
- Address capacity constraints in the transportation network along this north-south corridor
- Provide equitable transportation access to major institutions, employers, and neighborhoods
- Improve pedestrian and bicycle connections and access to RapidRide stops and improve safety along the corridor.

The Roosevelt corridor has been identified as a high-priority corridor for meeting the following transportation and community needs:

- Provide transit service to support housing and employment growth
- Provide neighborhood connections to future Link light rail stations
- Improve transit travel time and reliability throughout the corridor
- Reduce overcrowding of existing bus capacity
- Improve pedestrian and bicycle safety and connections to transit

2.2 Project Background

2.2.1 Roosevelt to Downtown High Capacity Transit Study

Seattle's 2012 Transit Master Plan (TMP) identified three high-capacity-transit (HCT) corridors as priorities for further evaluation and implementation, including the Roosevelt-University District-South Lake Union-Downtown Seattle transit corridor (SDOT, 2012). This HCT corridor was the predecessor to what is now the RapidRide Roosevelt project. The first work on the project was a conceptual design phase for the Roosevelt to Downtown HCT Study, which included mode analysis and began in November 2014 (SDOT, 2017a). While the TMP included a preliminary recommendation of rapid streetcar for this corridor, bus rapid transit (BRT) was selected as the preferred mode in the Roosevelt to Downtown HCT Study. BRT was chosen for several reasons, with cost being a major consideration along with other criteria such as capacity, safety, rider experience, and right-of-way limitations.

The Roosevelt to Downtown HCT Study included three rounds of public outreach in 2015 and 2016. Two open houses were held along the corridor on consecutive evenings for each round of outreach. Over 20,000 post cards were mailed to corridor residents in advance of the open houses. Existing conditions and the mode analysis were discussed at May 2015 open houses, types and characteristics of BRT were presented at December 2015 open houses, and in June 2016, a recommended corridor concept was presented along with project phasing options. In July 2017, a locally preferred alternative (LPA) was adopted by Seattle City Council that addressed the project's adopted purpose and need (Council Resolution 31761).

2.2.2 RapidRide Roosevelt Locally Preferred Alternative

The adopted Roosevelt to Downtown HCT corridor LPA is described in the Roosevelt RapidRide Project LPA Report (SDOT, 2017b). The LPA includes electric trolleybus BRT service between Roosevelt and Downtown Seattle with King County Metro's RapidRide service branding. Transit improvements include upgrades to bus stops to provide real-time arrival information and offboard fare payment, transit signal priority upgrades, and new bus lanes.

The LPA also includes bicycle and pedestrian access and safety improvements throughout the corridor. As part of these multimodal improvements, PBLs were assumed on Eastlake Ave E. North of Eastlake Ave E, the Eastlake PBLs would connect to the newly constructed southbound (SB) PBLs on Roosevelt Way and the proposed northbound (NB) PBLs on 11th and 12th Avenues NE. To the south, the Eastlake PBLs would connect to the PBLs planned as part of the project to replace the Fairview Ave N bridge. Both Eastlake Ave E PBLs and neighborhood greenway options were reviewed prior to recommending PBLs on Eastlake Ave E.

3. GUIDING PLANS AND POLICIES

Several plans and policies are used to guide decisions on the allocation of right-of-way in Seattle for all travel modes. These include:

- Seattle Bicycle Master Plan (SDOT, 2014)
- *Seattle 2035*, the Seattle Comprehensive Plan (City of Seattle, 2017a)
- Streets Illustrated, the Seattle Right-of-Way Improvements Manual (City of Seattle, 2017b)
- Complete Streets (Seattle City Council Ordinance 122386)
- Vision Zero (SDOT, 2018a)
- Safe Routes to School (SDOT, 2015)
- Best practices and industry standards

3.1 Seattle Bicycle Master Plan

The Seattle Bicycle Master Plan (BMP) was adopted in 2014 and identifies a citywide priority network of recommended bicycle facilities. The recommended citywide bicycle network is composed of bicycle facilities that are considered "all ages and abilities" (AAA), which are intended to allow a wide range of people to safely and comfortably travel by bicycle regardless of their cycling skill level. AAA bicycle facilities as defined by the BMP include the following:

- Protected bicycle lanes
  - PBLs are separated from traffic lanes and parked cars by physical barriers and buffers to prevent encroachment by motor vehicles.
  - PBLs typically include special intersection treatments to increase cyclist visibility and reduce conflicts with turning vehicles.
  - PBLs may be one-way or two-way facilities.
  - Seattle design standards for one-way PBLs specify a minimum width of 5 feet and a typical width up to 6.5 feet, with a minimum buffer width of 3 feet.
  - Seattle design standards for two-way PBLs specify a minimum width of 10 feet (5 feet per direction) and a preferred width of 12 feet, with a minimum buffer width of 3 feet.
- Off-street trails (including multi-use trails)
  - Multi-use trails are intended to be shared by people walking and biking.
  - Seattle design standards for multi-use trails specify a minimum width of 10 feet; wider trails are preferred to accommodate shared use.
- Neighborhood greenways
  - Neighborhood greenway treatments include speed humps and 20 mile-per-hour speed limits to reduce auto traffic speeds.
  - Stop signs are added to non-arterial streets crossing neighborhood greenways to reduce the risk of collisions at intersections.
  - Neighborhood greenway treatments include improved crossings of busy streets, which typically include flashing beacons or crossing signals to cross arterials.

- Seattle design standards for neighborhood greenways recommend avoiding routes with grades over 8.3%.
- Motor vehicle volumes must be low on neighborhood greenways; the National Association of City Transportation Officials (NACTO) *Urban Bikeway Design Guide* recommends motor vehicle volumes below 1,500 vehicles per day (NACTO, 2014). Traffic diversion measures should be included as part of greenway projects to keep motor vehicle volumes low.

The BMP's recommendations were developed by SDOT in coordination with the public using a robust public engagement process. Monthly briefings with the Seattle Bicycle Advisory Board were held during the BMP's development. SDOT staff also held additional community meetings across the city to gather public feedback and attended district council and community council meetings as well as provided briefings to several city commissions and advisory boards.

In addition to public feedback, the BMP recommendations considered data relating to past bicycle plans, the city's land use pattern, topography, traffic speeds and volumes, and a number of other factors. Geographic information system data and field analysis of Seattle's transportation network were extensively used to determine locations where bicycle facilities can be integrated into the existing street network. Consideration was also given to the City's other modal plans to provide a multimodal approach to locating bicycle facility recommendations.

The BMP recommendations include two bicycle facilities in the Eastlake neighborhood as part of the citywide recommended bicycle network:

1) PBLs along Eastlake Ave E
2) A neighborhood greenway along the shore of Lake Union (following the Cheshiahud Lake Union Loop)

The regional bicycle network is shown in **Error! Reference source not found.** and the recommended bicycle facilities in the Eastlake neighborhood are shown in **Error! Reference source not found.**. The recommended PBLs along Eastlake Ave E are identified as part of the regional bicycle network, reflecting the importance of Eastlake Ave E as a cycling corridor.

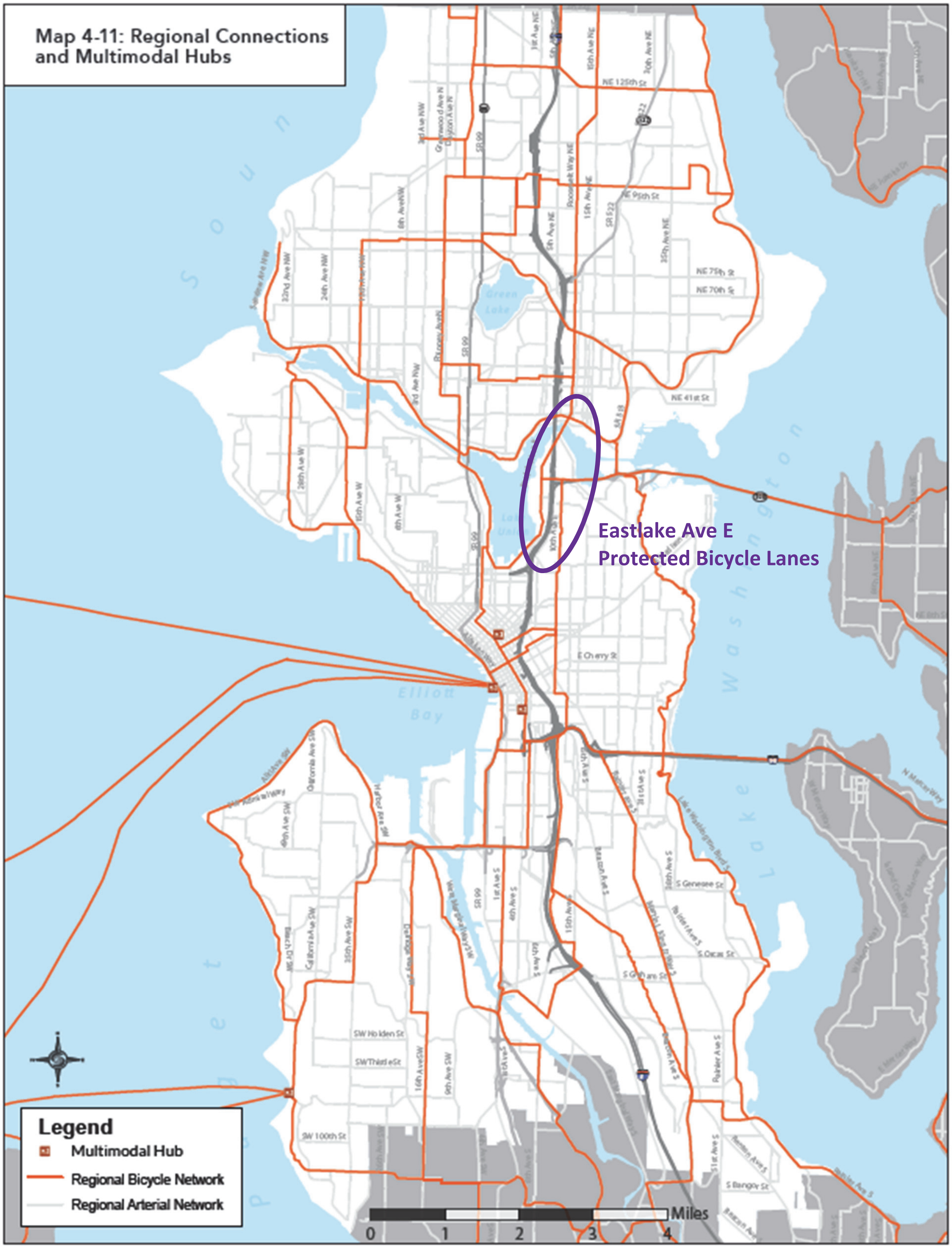

Figure 3-1. Seattle Bicycle Master Plan Regional Bicycle Network
Source: SDOT, 2014

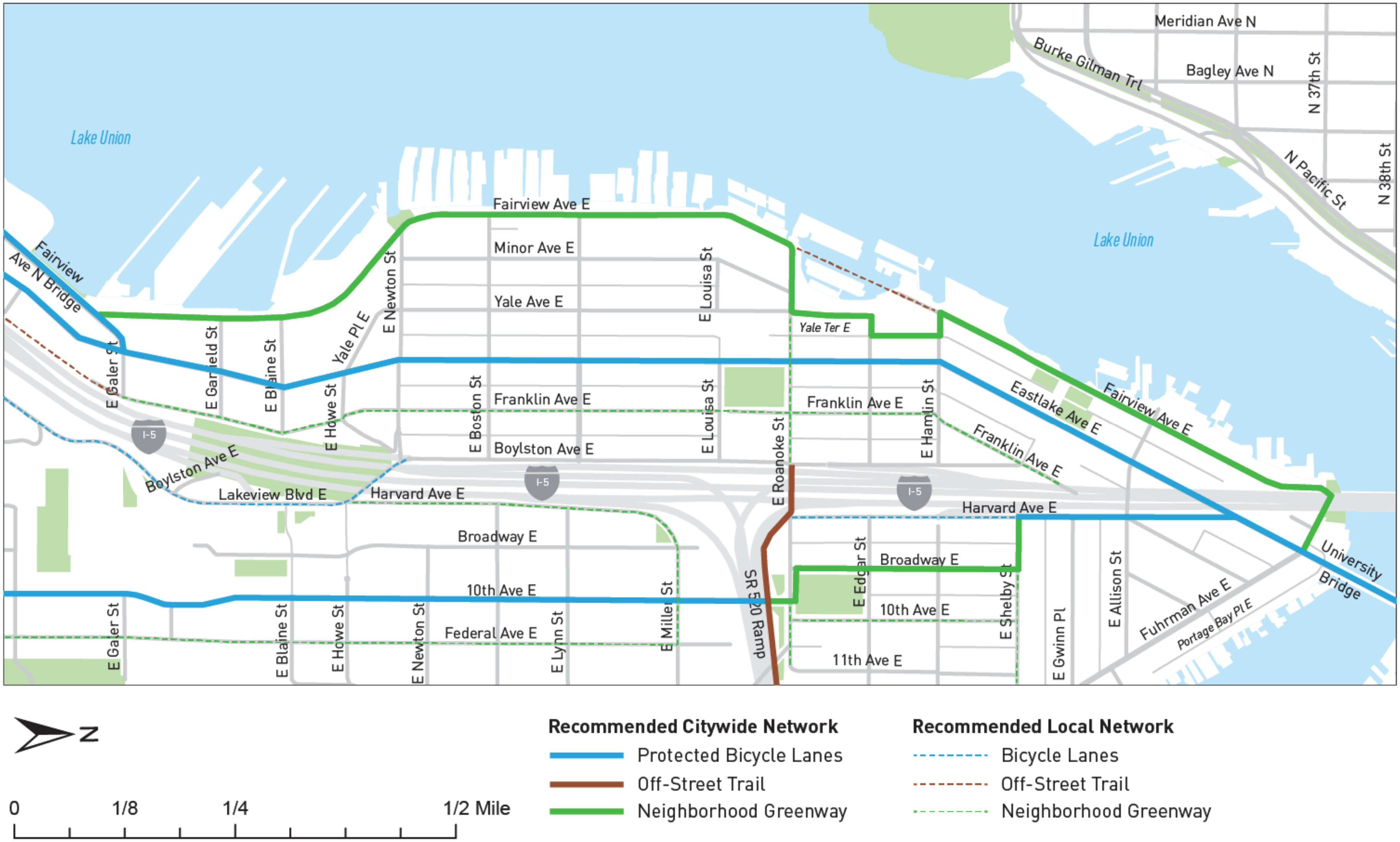

Figure 3-2. BMP-Recommended Bicycle Facilities in Eastlake Neighborhood
Source: Adapted from SDOT, 2014)

3.2 Seattle Comprehensive Plan

Seattle's most recent Comprehensive Plan, *Seattle 2035*, was adopted in 2017 (City Council Resolution 31762) and identifies guiding policies for land use and transportation in Seattle (City of Seattle, 2017a). The Comprehensive Plan's transportation section is focused on improving transportation and reducing single-occupancy vehicle use by supporting alternative transportation modes. Several of the Comprehensive Plan's goals and related transportation policies that address modal and right-of-way priorities are listed in

Table 3-1. Seattle Comprehensive Plan Goals and Policies That Address Bicycle Facilities

and 3-2.

Table 3-1. Seattle Comprehensive Plan Goals and Policies That Address Bicycle Facilities

TRANSPORTATION GOALS	TRANSPORTATION GOAL TEXT	TRANSPORTATION POLICIES	TRANSPORTATION POLICY TEXT
TG 1	Ensure that transportation decisions, strategies, and investments support the City's overall growth strategy and are coordinated with this Plan's land use goals.	T 1.2	Improve transportation connections to urban centers and villages from all Seattle neighborhoods, particularly by providing a variety of affordable travel options (pedestrian, transit, and bicycle facilities) and by being attentive to the needs of vulnerable and marginalized communities.
		T 1.5	Invest in transportation projects and programs that further progress toward meeting Seattle's mode-share goals, in Transportation Figures 1 and 2 [*not reproduced in this document*], and reduce dependence on personal automobiles, particularly in urban centers.
TG 2	Allocate space on Seattle's streets to safely and efficiently connect and move people and goods to their destinations while creating inviting spaces within the rights-of-way.	T 2.2	Ensure that the street network accommodates multiple travel modes, including transit, freight movement, pedestrians, people with disabilities, bicycles, general purpose traffic, and shared transportation options.
		T 2.3	Consider safety concerns, modal master plans, and adjacent land uses when prioritizing functions in the pedestrian, travelway, and flex zones of the right-of-way.

Table 3-1. Seattle Comprehensive Plan Goals and Policies That Address Bicycle Facilities

TRANSPORTATION GOALS	TRANSPORTATION GOAL TEXT	TRANSPORTATION POLICIES	TRANSPORTATION POLICY TEXT
		T 2.5	Prioritize mobility needs in the travelway based on safety concerns and then on the recommended networks and facilities identified in the respective modal plans.
		T 2.6	Allocate space in the flex zone to accommodate access, activation, and greening functions, except when use of the flex zone for mobility is critical to address safety or to meet connectivity needs identified in modal master plans. When mobility is needed only part of the day, design the space to accommodate other functions at other times.
		T 2.8	Employ the following tactics to resolve potential conflicts for space in the right-of-way: • Implement transportation and parking-demand management strategies to encourage more efficient use of the existing right-of-way • Allocate needed functions across a corridor composed of several streets or alleys, if all functions cannot fit in a single street • Share space between travel modes and uses where safe and where possible over the course of the day • Prioritize assignment of space to shared and shorter-duration uses • Encourage off-street accommodation for nonmobility uses, including parking and transit layover

Table 3-1. Seattle Comprehensive Plan Goals and Policies That Address Bicycle Facilities

TRANSPORTATION GOALS	TRANSPORTATION GOAL TEXT	TRANSPORTATION POLICIES	TRANSPORTATION POLICY TEXT
TG 3	Meet people's mobility needs by providing equitable access to, and encouraging use of, multiple transportation modes.	T 3.1	Develop and maintain high-quality, affordable, and connected bicycle, pedestrian, and transit facilities.
		T 3.2	Improve transportation options to and within the urban centers and villages, where most of Seattle's job and population growth will occur.
		T 3.10	Provide high-quality pedestrian, bicycle, and bus transit access to high-capacity transit stations, in order to support transit ridership and reduce single-occupant vehicle trips.
TG 4	Promote healthy communities by providing a transportation system that protects and improves Seattle's environmental quality.	T 4.3	Reduce drive-alone vehicle trips, vehicle dependence, and vehicle miles traveled in order to help meet the City's greenhouse gas reduction targets and reduce and mitigate air, water, and noise pollution.
		T 4.4	Manage the transportation system to support modes that reduce the use of fossil fuels and promote the use of alternative fuels.
TG 6	Provide and maintain a safe transportation system that protects all travelers, particularly the most vulnerable users.	T 6.1	Reduce collisions for all modes of transportation and work toward a transportation system that produces zero fatalities and serious injuries by 2030 to attain the City's Vision Zero objectives.
		T 6.4	Minimize right-of-way conflicts to safely accommodate all travelers.

Source: City of Seattle, 2017a

The Comprehensive Plan identifies priorities for the use of the "flex zone," which is the portion of the right-of-way between travel lanes and the sidewalk. These priorities depend on the predominant land use of the surrounding area (Table 3-2), but in all cases modal plans are the top priority for use of the flex zone. This means that recommendations such as those found in the BMP and the recommendations in Seattle's other modal plans for pedestrians, transit, and freight are given priority over other possible uses of the flex zone, including parking and loading.

Table 3-2. Seattle Comprehensive Plan Priorities for Right-of-Way "Flex Zone" by Predominant Use of Area

COMMERCIAL/MIXED-USE AREAS	INDUSTRIAL AREAS	RESIDENTIAL AREAS
Modal plan priorities	Modal plan priorities	Modal plan priorities
Access for commerce	Access for commerce	Access for people
Access for people	Access for people	Access for commerce
Activation	Storage	Greening
Greening	Activation	Storage
Storage	Greening	Activation

Source: City of Seattle, 2017a, pg. 77

3.3 Complete Streets, Vision Zero, and Safe Routes to School

In addition to the street use and transportation priorities outlined in the Seattle Comprehensive Plan, the City of Seattle has Complete Streets and Vision Zero policies and a Safe Routes to School program that guide management of and investment in the transportation system.

3.3.1 Complete Streets

Seattle's Complete Streets policy was adopted in 2007 by Seattle City Council Ordinance 122386. This policy directs SDOT to design streets for pedestrians, bicyclists, transit riders, and persons of all abilities, while promoting safe operation for all users, including freight. It establishes two priorities for the design of Seattle's streets:

- Highest priority: safety
- Second priority: mobility for people and goods

The Complete Streets policy directs SDOT to consider improving the safety and efficiency of the transportation system whenever improvements are made to transportation facilities. A Complete Streets checklist is used to ensure that safety and mobility for all transportation modes have been considered in all project planning and design stages. The checklist includes traffic volumes; street classification and type; an inventory of sidewalk condition, crosswalks, transit facilities, and parking restrictions; and recommendations from existing bicycle, pedestrian, freight, and transit plans.

3.3.2 Vision Zero

Vision Zero is a multi-national road traffic safety project that aims to achieve a highway system with no fatalities or serious injuries involving road traffic. It started in Sweden and was approved by their parliament in October 1997. As of April 2016, 17 U.S. cities have committed to Vision Zero, with many more exploring it, according to the newly formed Vision Zero Network.

Seattle formally launched its Vision Zero plan in February 2015 with a goal of eliminating transportation- and traffic-related deaths and serious injuries by 2030. The plan is being jointly implemented by SDOT and the Seattle Police Department. The Vision Zero objectives were incorporated into the most recent Seattle Comprehensive Plan in 2017.

Vision Zero projects that have been completed or are currently underway include corridor improvements to several arterials, such as Rainier Ave S, NE 65th St, and 35th Ave SW, as well as numerous Safe Routes to Schools projects, new neighborhood greenways, and new PBLs. Vision Zero corridor projects include speed reductions, new or improved pedestrian crossings, and, where practical, reductions in the total number of vehicle lanes.

3.3.3 Safe Routes to School

Safe Routes to School is a national movement to ensure safe walking or biking for students to and from school. SDOT is implementing a 5-year action plan for Safe Routes to School in Seattle as part of Vision Zero.

3.4 Streets Illustrated

Streets Illustrated is Seattle's Right-of-Way Improvements Manual and was adopted in 2017. Streets Illustrated provides design guidance for various street type designations and right-of-way within Seattle and is based on a guiding principle of Complete Streets, balancing the needs of all travel modes and users, including pedestrians, bicyclists, transit riders, freight, and motor vehicle drivers. The design guidance provided in Streets Illustrated is consistent with applicable City of Seattle plans and regulations, including the Seattle Comprehensive Plan; the City of Seattle *Standard Specifications for Road, Bridge, and Municipal Construction* (City of Seattle, 2017c); and the Seattle Municipal Code.

Within the Eastlake neighborhood, Eastlake Ave E is classified as an Urban Village Main street. Urban Village Main streets, as defined in Streets Illustrated, serve as the primary arterials for urban villages. Streets designated Urban Village Main are intended to provide transit priority to support frequent transit service as well as on-street PBLs where recommended by the BMP.

Alleys and adjacent side streets are intended to provide loading and parking access for retail and residential uses along Urban Village Main streets due to the to the need to accommodate transit and bicycles along the curb. The Streets Illustrated Urban Village Main street type is illustrated in Figure 3-3.

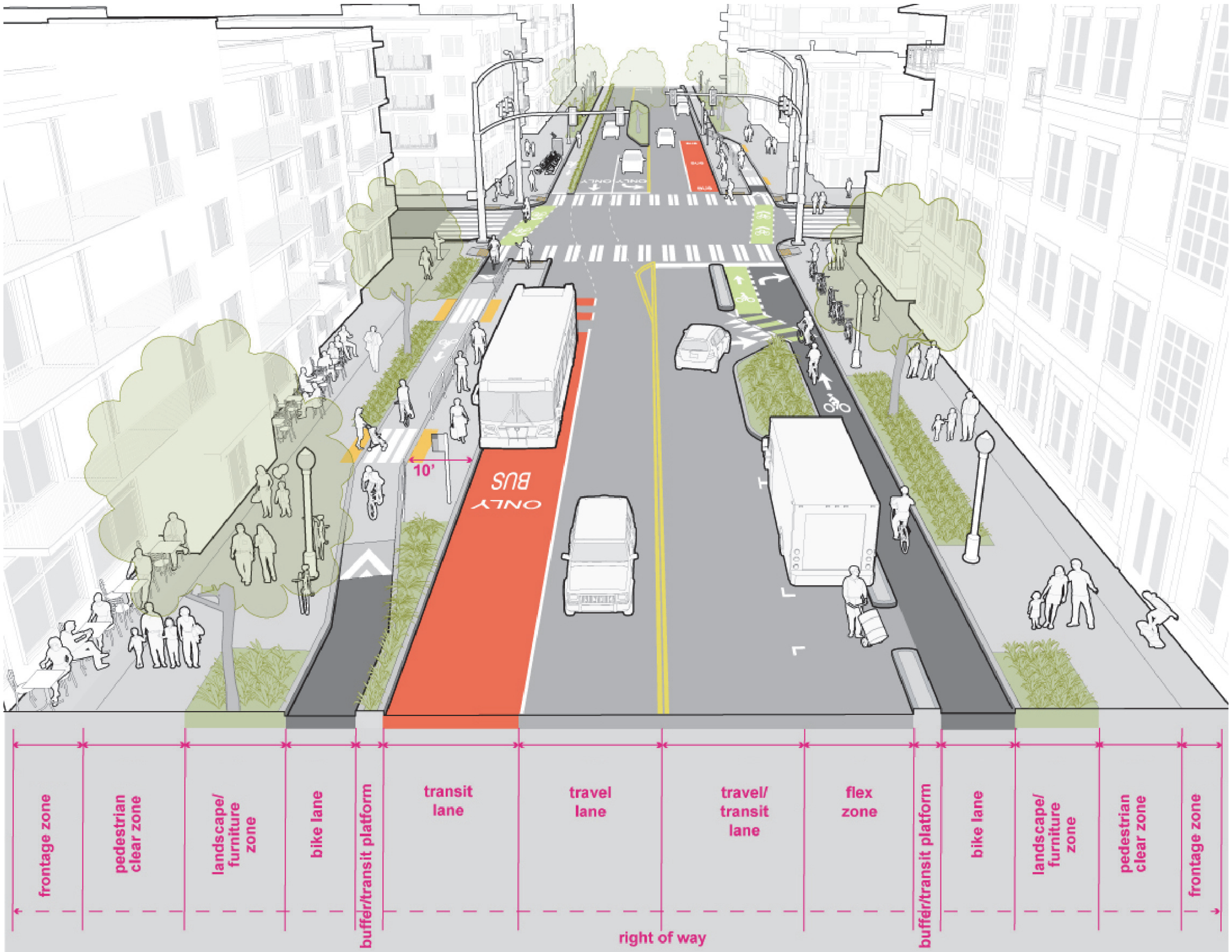

Figure 3-3. Urban Village Main Recommended Design in Streets Illustrated (Not Specific to RapidRide Roosevelt Project)
Image Source: Streets Illustrated, City of Seattle, 2017b

Most other streets within the Eastlake neighborhood are designated as Urban Village Neighborhood Access streets. Urban Village Neighborhood Access streets are intended to serve a supporting role for nearby Urban Village Main streets. Urban Village Neighborhood Access streets are generally narrower and residential, and may accommodate parking, loading, and other curbside uses where needed. This is shown in Figure 3-4.

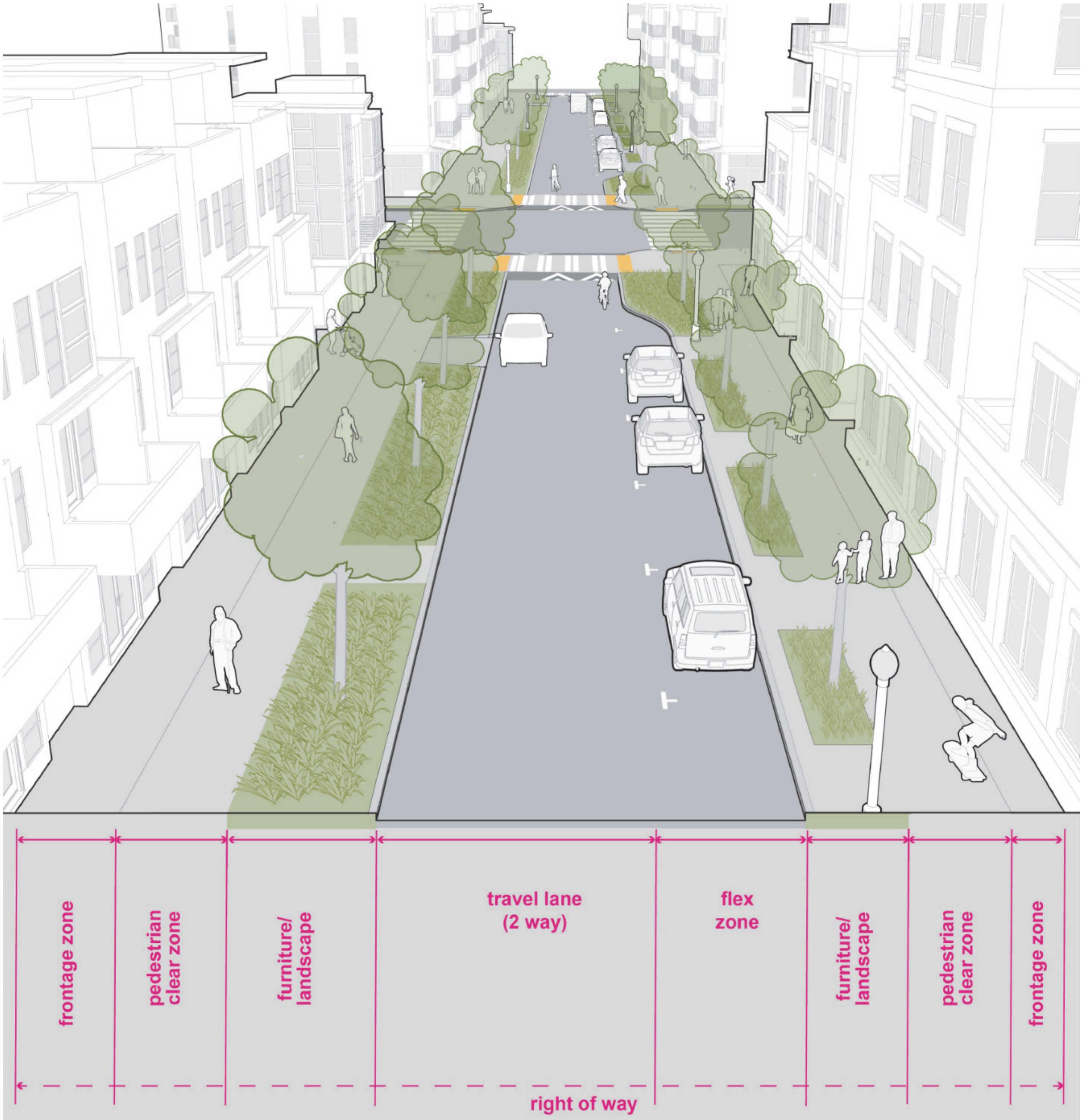

Figure 3-4. Urban Village Neighborhood Access Recommended Design in Streets Illustrated (Not Specific to RapidRide Roosevelt Project)
Image Source: Streets Illustrated, City of Seattle, 2017b

3.5 Best Practices and Industry Standards

3.5.1 AASHTO

The American Association of State Highway Transportation Officials (AASHTO) publishes standards for design of bicycle facilities in the *Guide for the Development of Bicycle Facilities* (AASHTO, 2012). The most recent edition, published in 2012, includes recommendations for bicycle facility design and identifies appropriate types of bicycle facilities for a wide range of different contexts, including urban, suburban, and rural roads and highways.

3.5.2 National Association of City Transportation Officials

NACTO publishes the *Urban Bikeway Design Guide*. The most recent edition of the guide was published in 2014. The guide is focused primarily on urban streets and provides specific guidelines for the design of a number of different bicycle facilities. Its guidance for designing bicycle facilities for all ages and abilities is generally consistent with Seattle's standards for AAA bicycle facilities.

4. STUDY AREA AND EXISTING CONDITIONS

4.1 Study Area

The study area for this evaluation roughly corresponds to Seattle's Eastlake neighborhood and extends from the University Bridge in the north to the Fairview Ave N bridge in the south (Figure 4.1). The University Bridge includes PBLs extending north to the University District and provides a logical connection point for a bike facility within the Eastlake neighborhood. The Fairview Ave N bridge replacement project will include a two-way PBL, and this new bike facility will provide the southern connection point for a bicycle facility within Eastlake.

Interstate 5 (I-5) and Lake Union provide the general eastern and western boundaries of the study area, respectively. A small portion of the northern study area extends east of I-5 along E Allison St and Fuhrman Ave E. These streets are included in the study area because they could provide bicycle connections to Harvard Ave E or Fuhrman Ave E east of the freeway.

As the intended connection points for a bicycle facility in the Eastlake neighborhood lie at the north and south end of the study area, most of the analysis was focused on north-south roads through the area, including the following streets:

- Fairview Ave E
- Minor Ave E
- Yale Ave E
- Eastlake Ave E
- Franklin Ave E

The road segments included in the study area are shown on Figure 4-1.

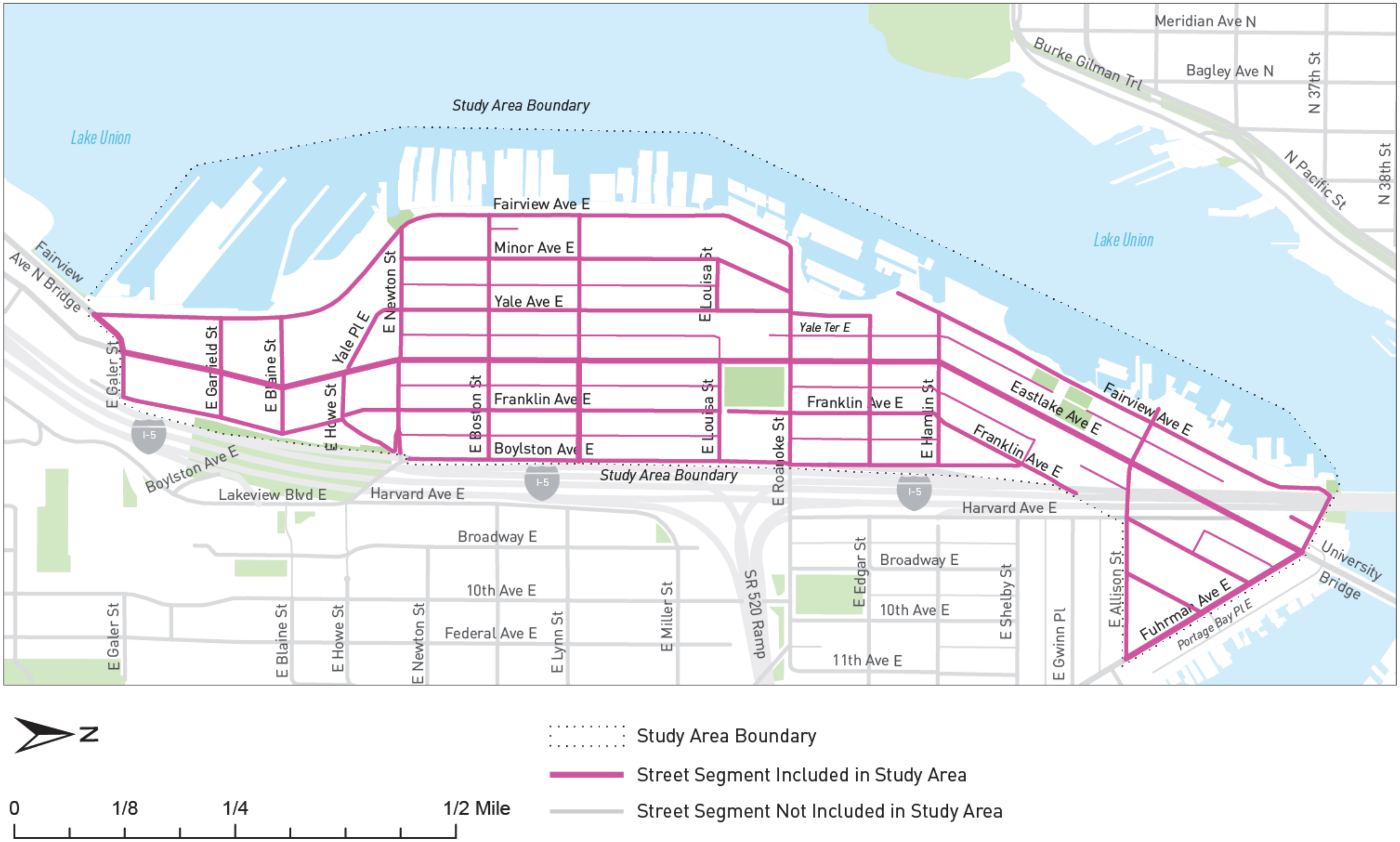

Figure 4-1. Study Area

4.2 Existing Conditions in the Eastlake Neighborhood

4.2.1 Existing Roadway Conditions

Eastlake Ave E is the primary arterial in the study area. It runs primarily north-south, connecting to the University Bridge in the north and continuing south through South Lake Union and into Downtown Seattle. Average daily traffic volumes along Eastlake Ave E are approximately 14,000 from Harvard Ave E to E Lynn St and 15,800 from E Lynn St to Fairview Ave according to SDOT's 2017 Traffic Report (SDOT, 2017c). Eastlake Ave E primarily has a five-lane configuration through the study area as shown in Figure 4-2, with two travel lanes in each direction plus a two-way center turn lane. The curb lane on either side serves as a parking lane during most hours of the day, but peak-direction peak-period parking restrictions are in place. Parking is prohibited on the west side in the morning (7-9 AM) and on the east side in the evening (3-6 PM). The peak parking restrictions are illustrated on

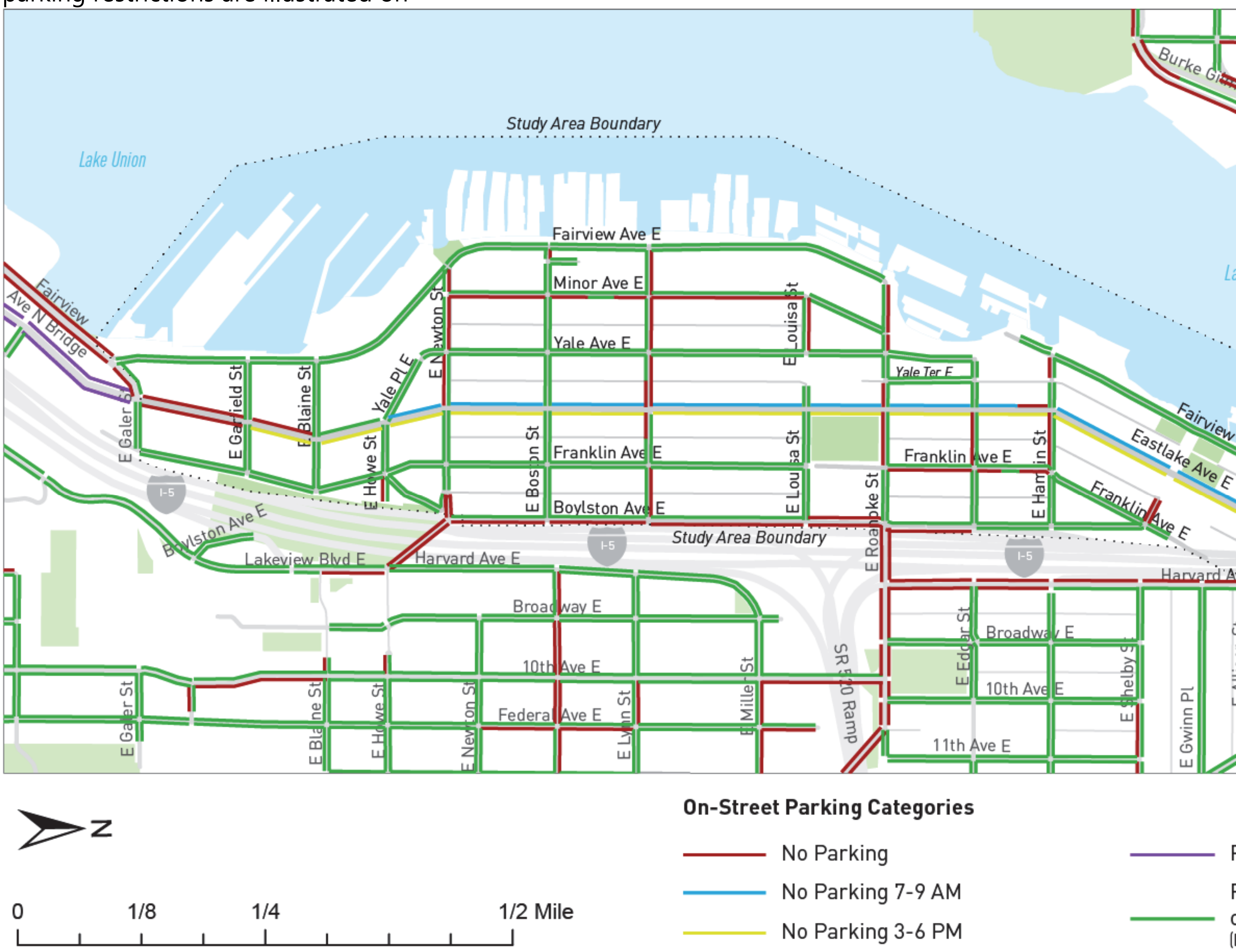

Figure 4-3.

Figure 4-2. Eastlake Ave E in the Eastlake Neighborhood
View facing north toward E Lynn St from Eastlake Ave E. Curb lanes function as additional peak hour/peak direction travel lanes. Image source: Google Maps Street View, July 2017; image captured May 2018.

Eastlake Ave E serves as the main commercial corridor in the Eastlake neighborhood and includes a number of retail and mixed-use buildings. Most other streets in the study area are non-arterial streets, which are narrower, carry lower volumes of traffic, and are primarily residential. Non-arterial streets within the study area are typically 25 feet wide from curb to curb and allow parking on both sides of the street, leaving narrow shared two-way travel lanes between parked cars. Existing conditions on a number of non-arterial streets in the study area are shown in

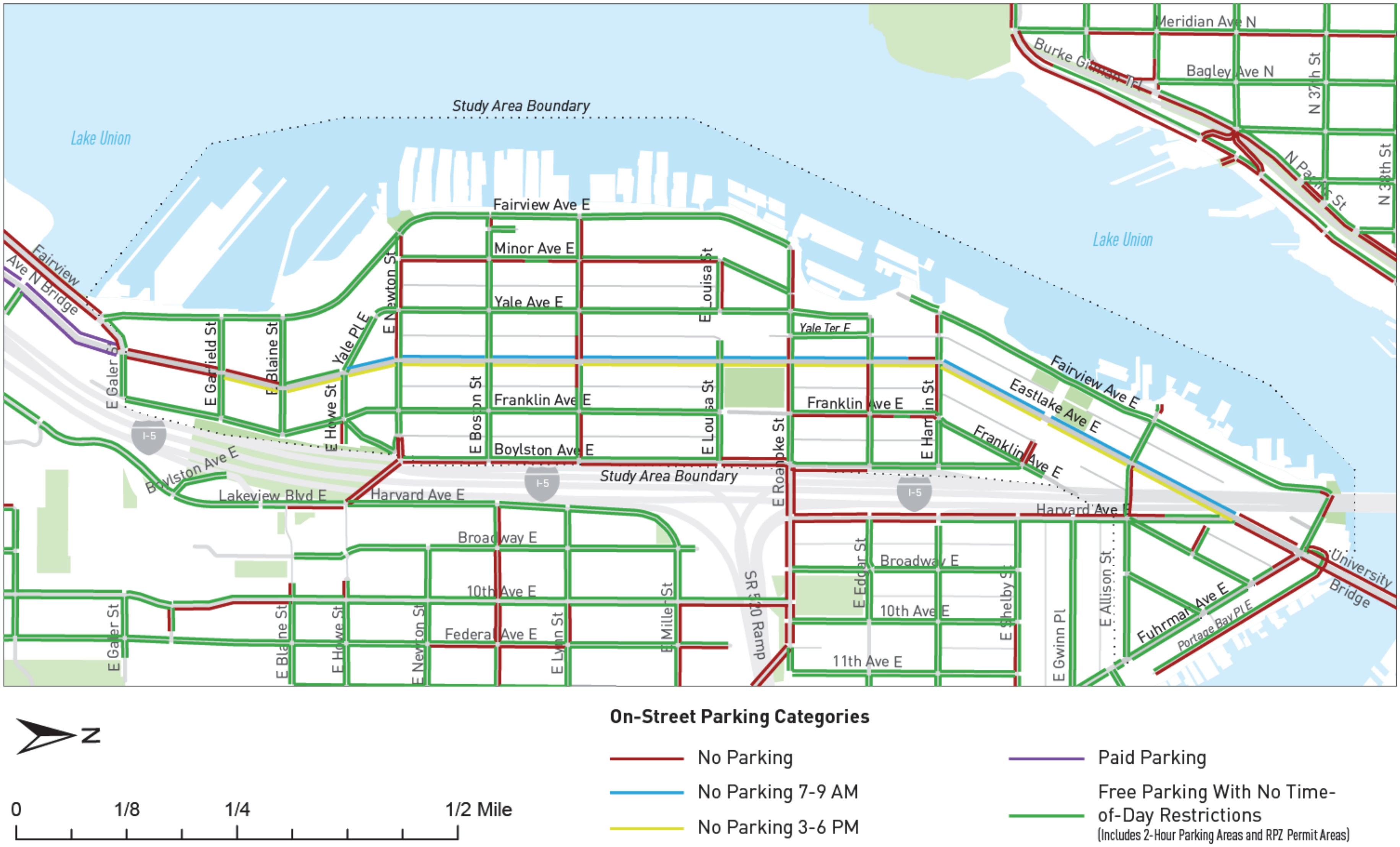

Figure 4-3. Existing On-Street Parking in Study Area

Figure 4-4 through

Figure 4-10. The location and direction of these representative pictures within the study area are shown in Figure 4-11. These streets encourage low-speed travel but can be difficult for bicyclists to navigate through as little space is available to allow passage of multiple bicyclists and motor vehicles. Most of the residential streets within the study area provide parking within a restricted parking zone (RPZ), which requires permits to park longer than 2 hours. Most streets in Eastlake include sidewalks, although Fairview Ave E lacks sidewalks and curbs throughout the study area (

Figure 4-9).

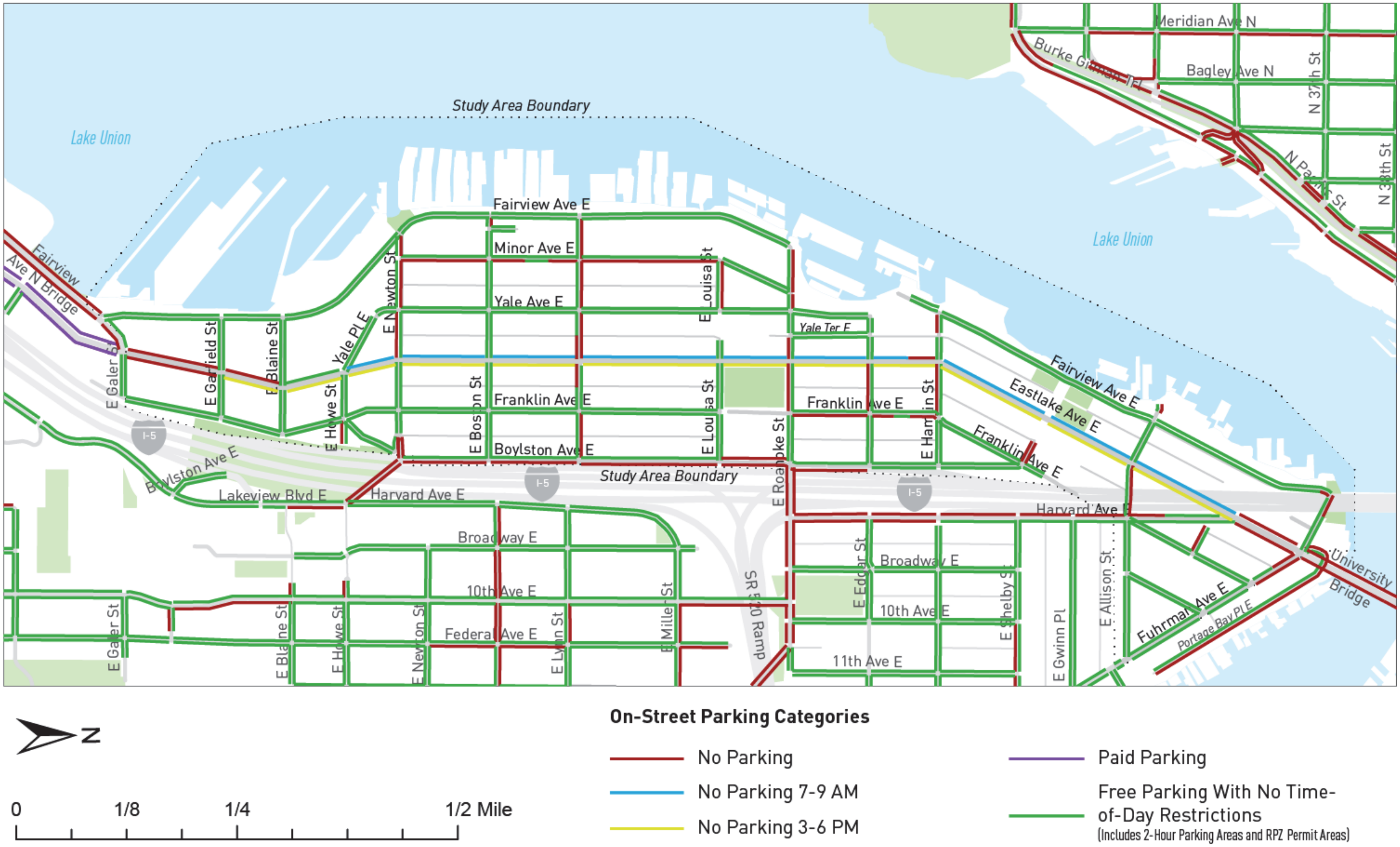

Figure 4-3. Existing On-Street Parking in Study Area

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Figure 4-4. Franklin Ave E in the Eastlake Neighborhood
View facing north toward E Lynn St from Franklin Ave E. Parking is allowed on both sides of Franklin Ave E (subject to RPZ restrictions), leaving a single two-way travel lane between parked cars. Image source: Google Maps Street View, August 2015; image captured May 2018.

Figure 4-5. Yale Ave E in the Eastlake Neighborhood
View facing north toward E Lynn St from Yale Ave E. Parking is allowed on both sides of Yale Ave E (subject to RPZ restrictions), leaving a single two-way travel lane between parked cars. Image source: Google Maps Street View, August 2015; image captured May 2018.

Figure 4-6. Yale Place E in the Eastlake Neighborhood
View facing west-northwest toward Yale Ave E from Yale Place E. Parking is allowed on both sides of Yale Place E (subject to RPZ restrictions), leaving a single two-way travel lane between parked cars. Image source: Google Maps Street View, July 2017; image captured May 2018.

Figure 4-7. Minor Ave E in the Eastlake Neighborhood
View facing north toward E Lynn St from Minor Ave E. Parking is not allowed on the east side of Minor Ave E, while parking on the west side is subject to RPZ restrictions. Image source: Google Maps Street View, July 2017; image captured May 2018.

Figure 4-8. E Roanoke St in the Eastlake Neighborhood
View facing west toward Yale Ave E from E Roanoke St. This segment of E Roanoke St includes two separate travel lanes with perpendicular parking built into the north side of the right-of-way. This parking configuration presents a safety challenge for bicycles as visibility is poor for cars backing out of parking spaces, and a grade exceeding 10% requires long stopping distances for cyclists headed downhill. Image source: Google Maps Street View, August 2015; image captured May 2018.

Figure 4-9. Fairview Ave E (also Cheshiahud Lake Union Loop) in the Eastlake Neighborhood
View facing north toward E Lynn St from Fairview Ave E. The Cheshiahud Lake Union Loop follows this segment of Fairview Ave E, but Fairview Ave E lacks sidewalks, curbs, bicycle lanes, and defined parking areas and travel lanes. Image source: Google Maps Street View, July 2017; image captured May 2018.

Figure 4-10. Yale Terrace E Alley (also Cheshiahud Lake Union Loop)
View facing north toward E Hamlin St from Yale Terrace E alley. This alley is part of the Cheshiahud Lake Union Loop. Two-way traffic is allowed, but the alley is too narrow to allow bicycles and cars to pass one another. Image source: Google Maps Street View, May 2014; image captured May 2018.

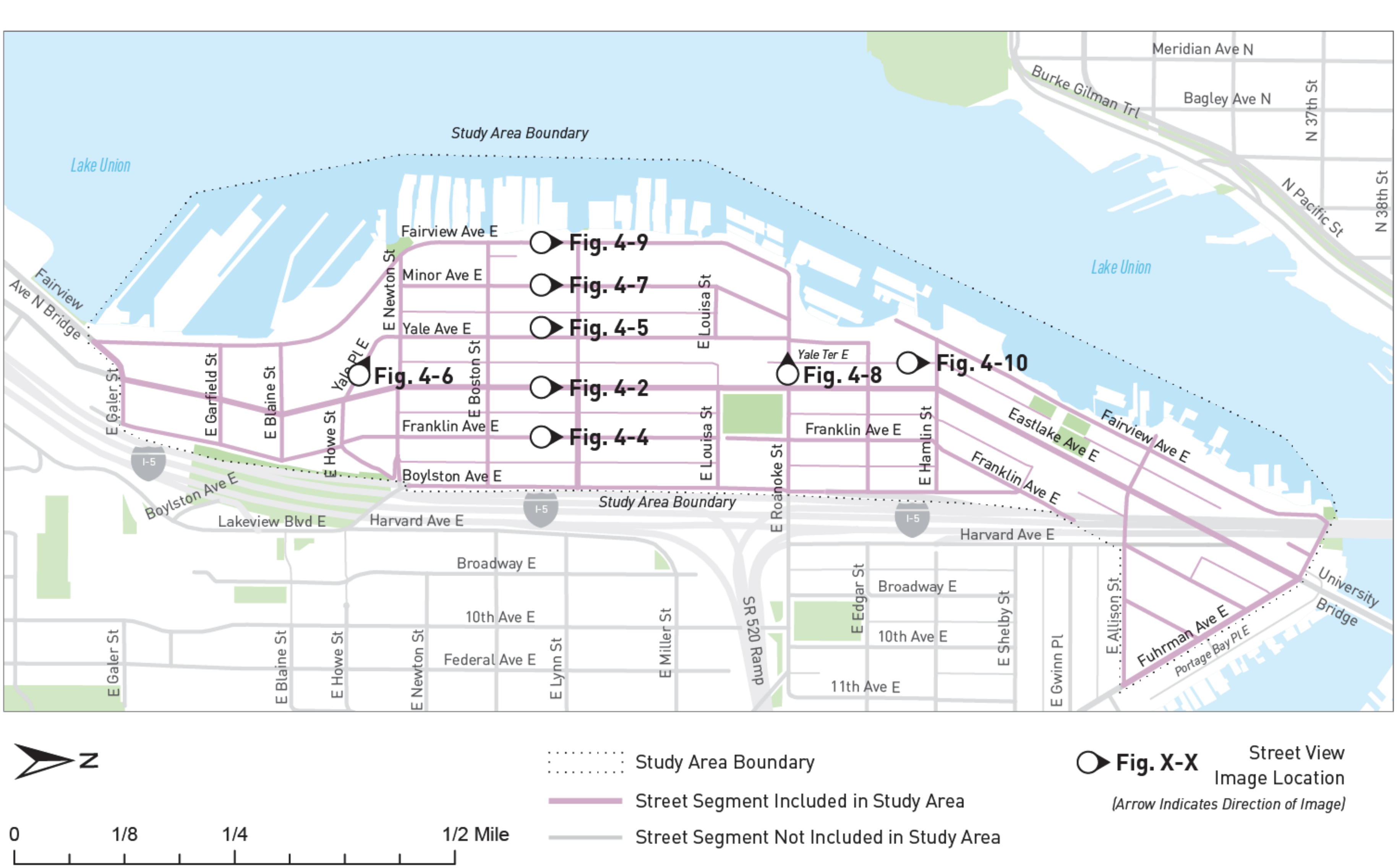

Figure 4-11. Locations of Street View Images Within Study Area (Figure 4-2 and Figures 4-4 through 4-10)

4.2.2 Existing Bicycle Facilities in the Eastlake Neighborhood

Existing bicycle facilities in the study area are shown on Figure 4-12. The PBLs on University Bridge connect to non-protected bicycle lanes, which extend for a block south along Eastlake Ave E. These bicycle lanes continue south up Harvard Ave E, providing a connection to Capitol Hill on the east side of I-5.

At the southern end of the study area, bike lanes begin on Eastlake Ave E at the intersection of E Galer St/Fairview Ave N and extend south toward Downtown Seattle. The current Fairview Ave N bridge carries a SB PBL; this will be expanded to off-street two-way PBLs as part of the Fairview Ave N bridge replacement project.

There are many steep slopes throughout the study area and the street grid is discontinuous due to the proximity to Lake Union and I-5. Figure 4-12 shows street segments with slopes greater than 10% in the study area. Hills in the study area generally slope towards Lake Union.

Currently there are no dedicated bicycle facilities between Harvard Ave E and Fairview Ave N. This represents a substantial gap in the bicycle network. Based on collected bicycle counts, Eastlake Ave E currently serves as the primary bicycle route within the neighborhood despite not having bicycle lanes (see bicycle counts in Section 4.2.3). Peak-period parking restrictions extend nearly the full length of Eastlake Ave E within the study area, with parking prohibited on the west side in the morning (7-9 AM) and on the east side in the evening (3-6 PM). These peak-period lanes function as de facto shared bicycle and bus lanes, although open to all traffic. Outside of peak periods or in reverse-peak directions, cyclists on Eastlake Ave E share the travel lane with cars and buses. See

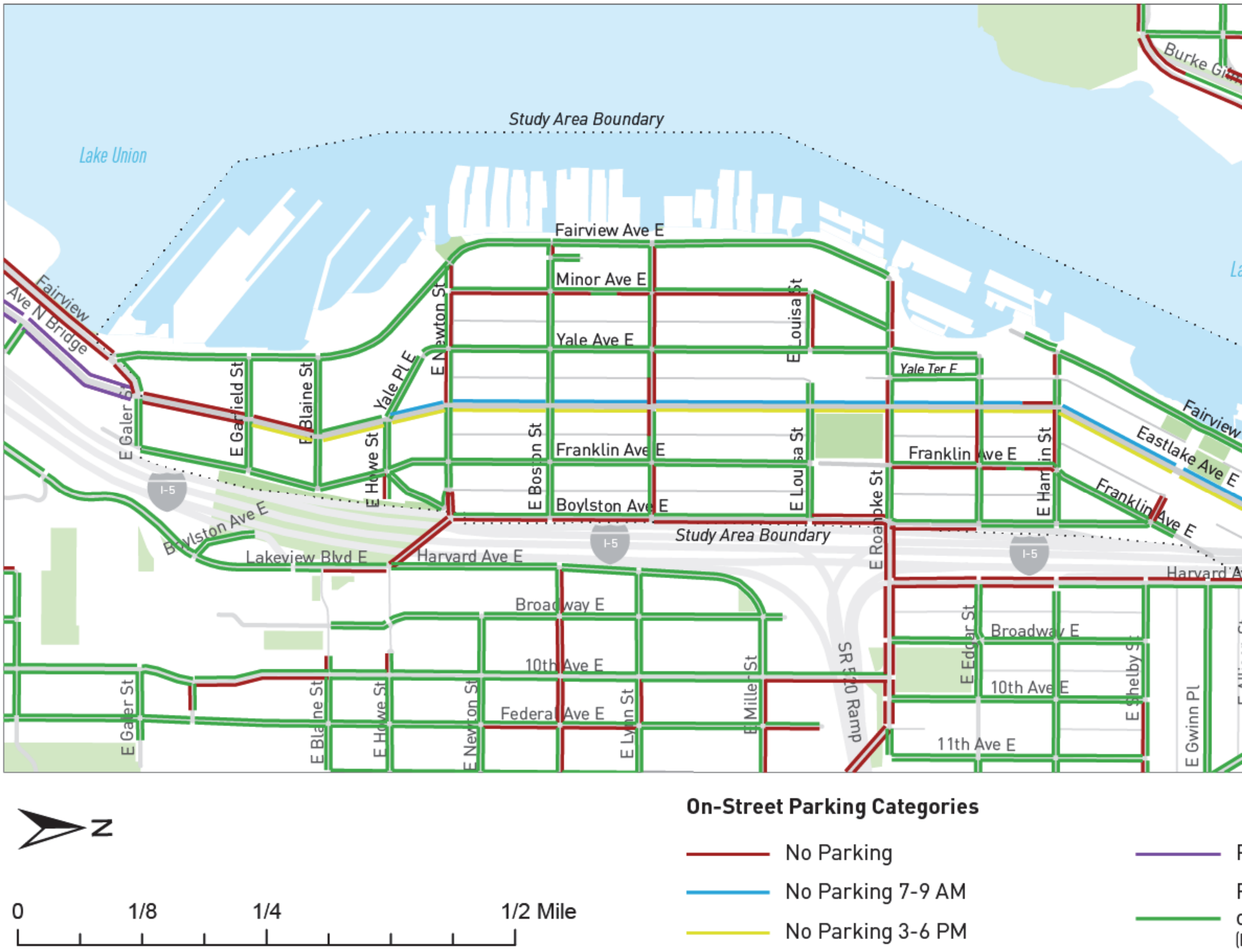

Figure 4-3 for existing on-street parking in the study area.

While not a bicycle facility, the Cheshiahud Lake Union Loop follows the shoreline within Eastlake and serves as a signed walking and bicycling route. The Cheshiahud Lake Union Loop primarily uses Fairview Ave E. The signed route has no painted bicycle lanes or other bicycle provisions beyond signage. Walking and cycling conditions along the Cheshiahud Lake Union

Loop are generally poor. As shown in

Figure 4-9 and

Figure 4-10, the route lacks curbs and sidewalks in many locations and passes through a very narrow alley for one block. This route also includes very steep slopes, with a 15% grade on E Hamlin St and a 12% grade on E Roanoke St.

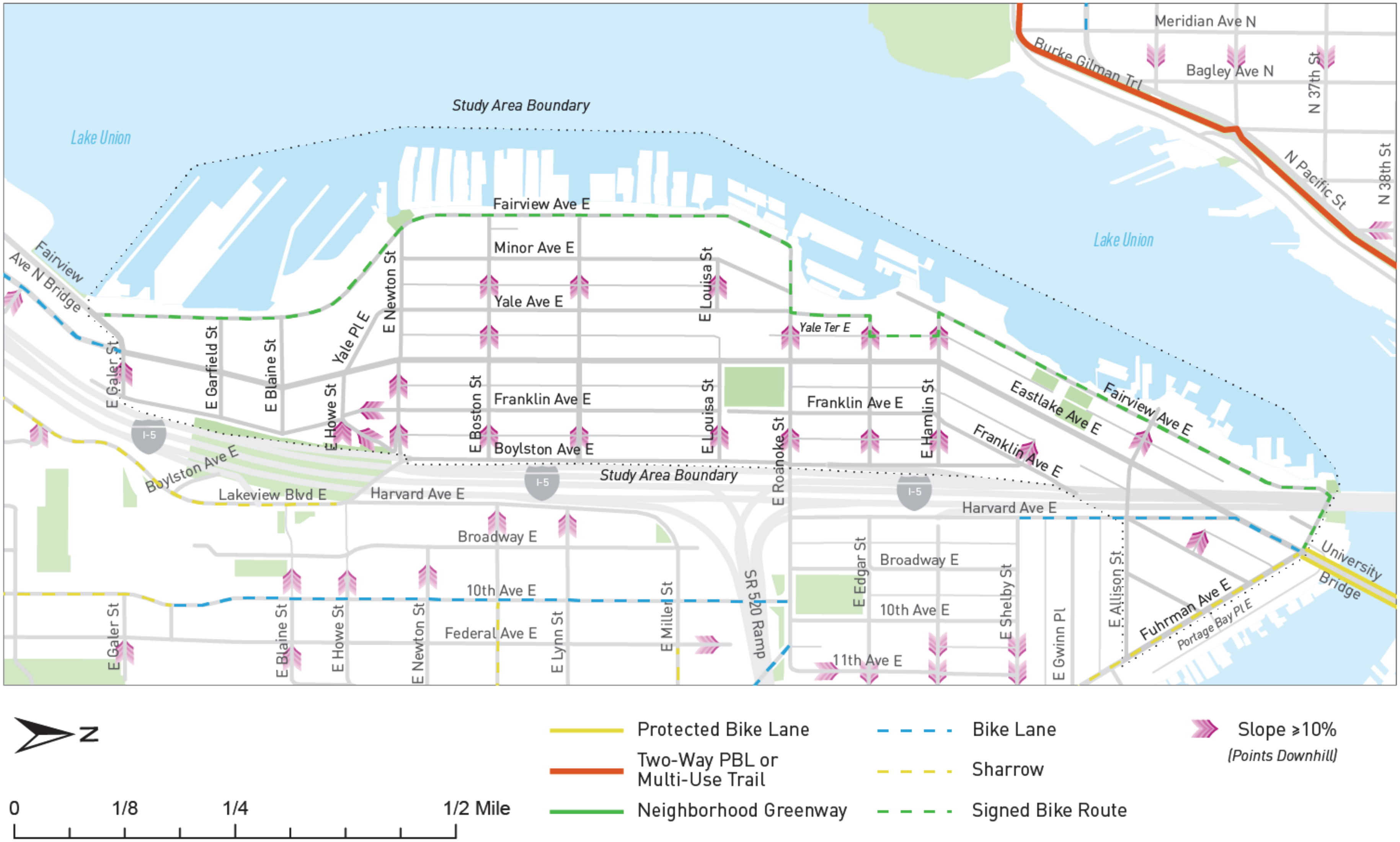

Figure 4-12. Existing Bicycle Facilities in Study Area

4.2.3 Bicycle Volumes

Eastlake Ave E currently serves as a major bicycle route in Seattle with a high number of bicyclists despite a lack of bicycle facilities in the Eastlake neighborhood. A set of citywide bicycle counts conducted at over 100 locations in Seattle in 2016 showed that the University Bridge had a volume of approximately 1,720 riders per day (SDOT, 2017c). This was the second-highest average daily bicycle volume in the city following the Fremont Bridge (see Figure 4-13). Additional bicycle counts collected in 2018 (Attachment A) showed that over 2,200 riders crossed the University Bridge in a single day and many of these cyclists continued through the Eastlake neighborhood (see Attachment A, Table A1).

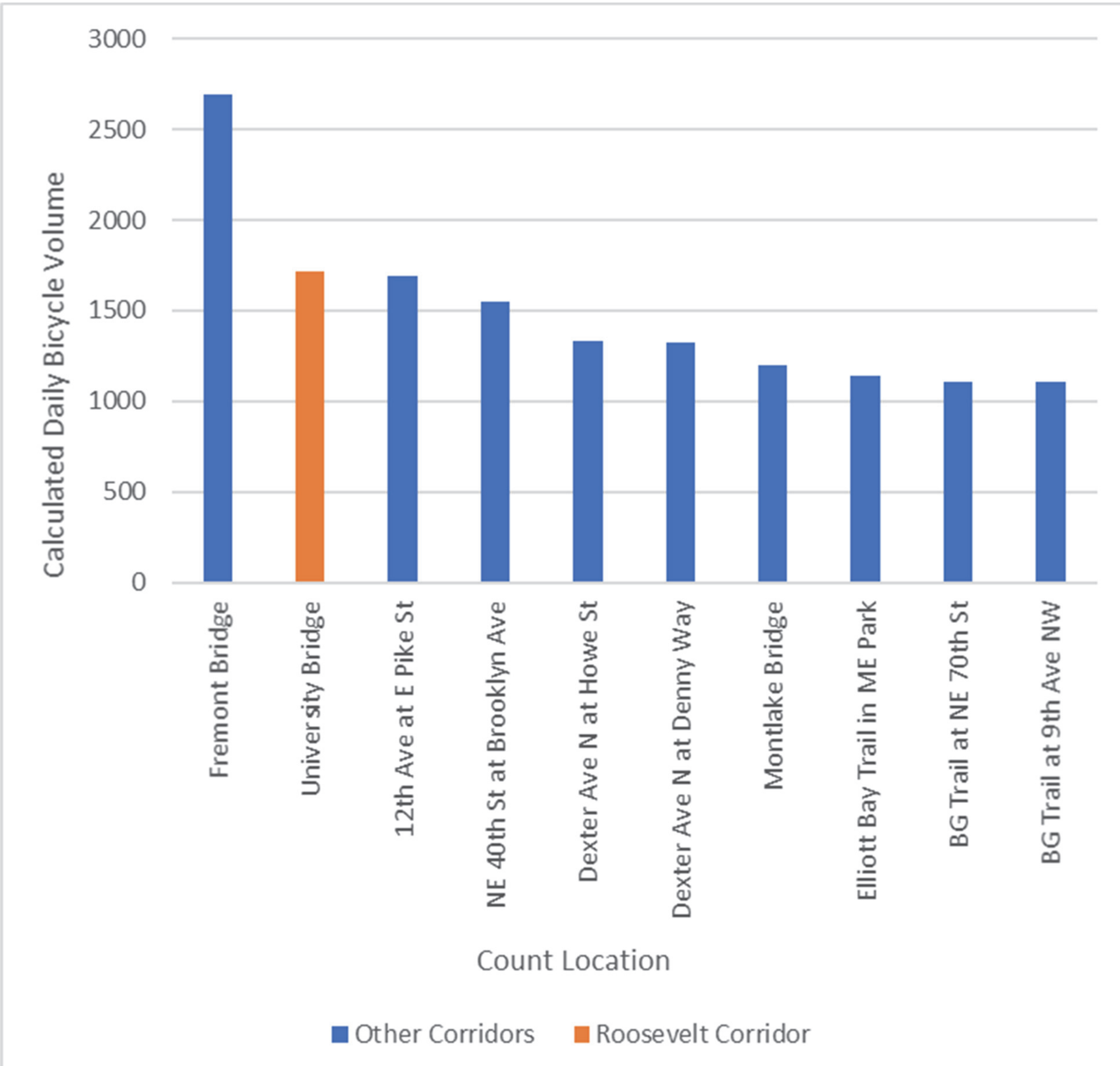

Figure 4-13. The 10 Highest-Volume Bicycle Locations in Seattle, 2016

Source: Adapted from SDOT, 2017c

BG = Burke Gilman
ME = Myrtle Edwards

To better understand bicycle movements and the distribution of bicycle volumes in the study area, single-day bicycle counts were conducted at four intersections in the Eastlake neighborhood on May 23, 2018 during daylight hours. These counts are included in Attachment A with additional information on count methodology. The four intersections were:

- Eastlake Ave E and Fuhrman Ave E
- Eastlake Ave E and E Lynn St
- Fairview Ave E and E Lynn St (also Cheshiahud Lake Union Loop)
- Fairview Ave and Eastlake Ave E (this intersection also includes Fairview Ave E and E Galer St legs)

Bicycle volumes are shown for the four count locations on Figure 4-14. Bicycle volumes were highest at the Eastlake Ave E/Fuhrman Ave E count location at the north end of the study area, with 2,229 cyclists observed over the count period. Some of these cyclists do not continue through the rest of the study area, instead continuing up Harvard Ave E toward the Capitol Hill area.

The intersection of Fairview Ave/Eastlake Ave E at the southern end of the study area is at a narrow point between Lake Union and I-5. All bicycles traveling north-south through the Eastlake neighborhood must pass through this complex intersection, and thus the observed bicycle volume at this location provides a good estimate of the total number of cyclists traveling through the study area on all routes. A total of 1,462 cyclists were observed at this location over the 14-hour count duration, approximately two-thirds the number observed at the Eastlake Ave E/Fuhrman Ave E intersection.

Two count locations were included along E Lynn St near the center of the study area, one at Eastlake Ave E and the other at Fairview Ave E. At the Eastlake Ave E/E Lynn St intersection, 855 cyclists were observed over the count period. At the Fairview Ave E/E Lynn St intersection, which is along the Cheshiahud Lake Union Loop (a signed bicycle route), 255 cyclists were counted. This is less than a third of the number of cyclists counted at the Eastlake Ave E/E Lynn St intersection.

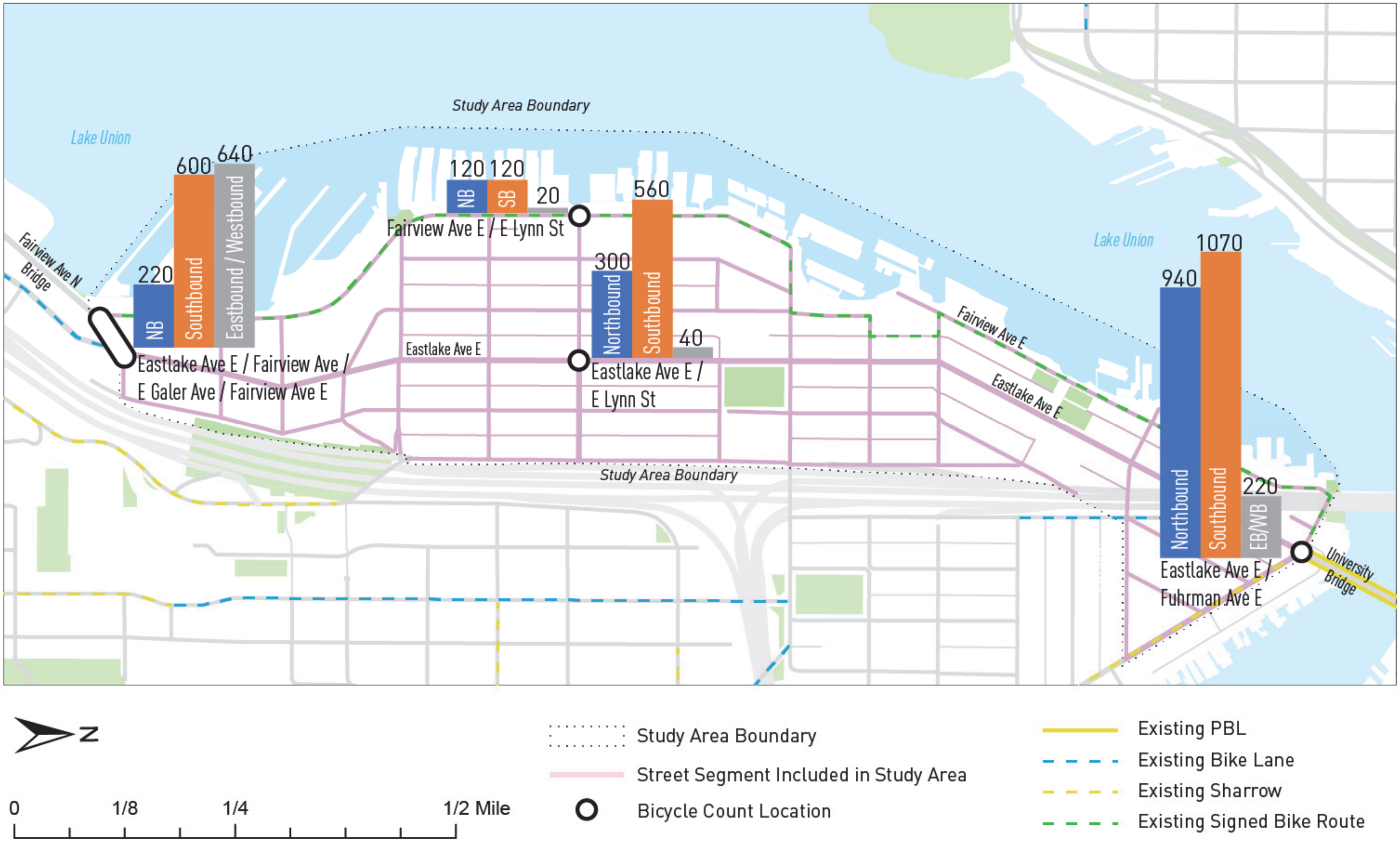

Figure 4-14. Daylight Bicycle Volumes at Eastlake Neighborhood Count Locations (14-Hour Duration)

The Eastlake Ave E/E Lynn St intersection provides the best picture of bicycle volumes on Eastlake Ave E in the study area. At this location, 855 bicyclists were observed traveling on Eastlake Ave E over the 14-hour count duration. Peak-hour volumes were approximately 130 cyclists per hour in both the AM and PM peaks. Most observed cyclists were traveling SB in the morning and NB in the evening, consistent with typical commuting patterns. Hourly counts at Eastlake Ave E/E Lynn St are shown on Figure 4-15.

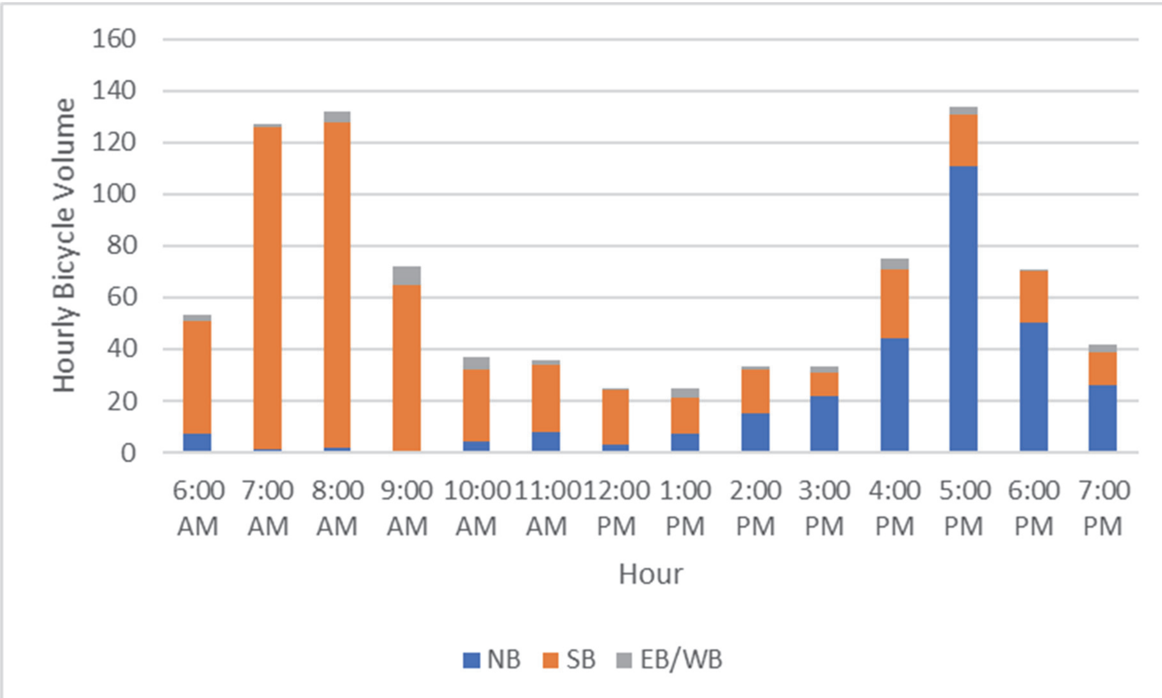

Figure 4-15. Hourly Bicycle Volumes at Eastlake Ave E and E Lynn St Intersection, May 23, 2018

4.2.4 Bicycle Safety

From 2012 through 2017, 40 collisions involving bicycles occurred in the Eastlake neighborhood. Of those, 39 collisions occurred at locations along Eastlake Ave E, while one collision occurred off of Eastlake Ave E at the intersection of Fairview Ave E and E Garfield St (Table 4-1). Most collisions resulted in injury (95%), including three serious injury collisions (8%). No bicycle-involved fatal collisions occurred in this area during the time period analyzed. Most collisions in this area were front end angle collisions between cars and bicyclists, with a smaller number of instances where cars struck bicycles in rear end or sideswipe collisions, primarily at midblock locations.

The north end of Eastlake Ave E, including the intersection with Fuhrman Ave E and the midblock segment between Fuhrman Ave E and Harvard Ave E, had the highest rate of collisions involving bicycles with a total of 13 collisions between 2012 and 2017. This high collision rate is reflective of high bicycle volumes near the University Bridge. No other location along Eastlake Ave E saw more than four collisions during the time period reviewed, but the number of bicycle collisions along this road is relatively high compared to other streets in the city. Including all collisions listed in Table 4-1. Collisions Involving Bicycles in the Eastlake Study Area (2012-2017)

, the average rate of collisions involving bicycles in the Eastlake neighborhood is 6.7 per year. The portion of Eastlake Ave E that lacks any bicycle facilities (south of Harvard Ave E and north of Fairview Ave N) has an average rate of collisions involving bicycles of 4.3 per year.

The high rate of collisions between bicycles and cars in the Eastlake neighborhood, primarily along Eastlake Ave E, indicates a need for improved bicycle facilities in this area. The RapidRide Roosevelt project's purpose and need statement identifies a need for improved bicycle safety along the project corridor (including Eastlake Ave E) to address this issue.

Table 4-1. Collisions Involving Bicycles in the Eastlake Study Area (2012-2017)

LOCATION	LOCATION TYPE	PROPERTY DAMAGE	INJURY	SERIOUS INJURY	TOTAL
COLLISIONS ON EASTLAKE AVE E					
Eastlake Ave E and Fuhrman Ave E	Signal Intersection	1	5	2	**8**
Eastlake Ave E Between Harvard Ave E and Fuhrman Ave E	Midblock		5		**5**
Eastlake Ave E Between E Hamlin St and E Shelby St	Midblock		2		**2**
Eastlake Ave E and E Hamlin St	Signal Intersection	1	2		**3**
Eastlake Ave E Between E Edgar St and E Hamlin St	Midblock		1		**1**
Eastlake Ave E and E Edgar St	Non-Signal Intersection		3		**3**
Eastlake Ave E Between E Roanoke St and E Edgar St	Midblock		3	1	**4**
Eastlake Ave E and E Roanoke St	Signal Intersection		1		**1**
Eastlake Ave E Between E Lynn St and E Louisa St	Midblock		3		**3**
Eastlake Ave E Between E Howe St and E Newton St	Midblock		2		**2**
Eastlake Ave E Between E Blaine St and E Howe St	Midblock		2		**2**
Eastlake Ave E and E Blaine St	Non-Signal Intersection		3		**3**
Eastlake Ave E and E Garfield St	Signal Intersection		1		**1**
Eastlake Ave E Between Fairview Ave N and E Garfield St	Midblock		1		**1**
Total Collisions on Eastlake Ave E	**All**	**2**	**34**	**3**	**39**
COLLISIONS ON OTHER STREETS IN STUDY AREA					
Fairview Ave E and E Garfield St	Non-Signal Intersection		1		**1**
Total Collisions on Other Streets	**All**	**0**	**1**	**0**	**1**
GRAND TOTAL (ALL LOCATIONS)	***ALL***	***2***	***35***	***3***	***40***

Source: SDOT, 2018b
Note: Data cover January 2012 through December 2017.

5. BICYCLE FACILITY OPTIONS DEVELOPMENT

The Roosevelt to Downtown HCT Study (SDOT, 2017a) recommended two-way PBLs on Eastlake Ave E as part of the preferred bicycle facilities for the RapidRide Roosevelt project. These PBLs were incorporated into the LPA approved by City Council in 2017. This current evaluation effort considers the recommendations included in the LPA along with a broader range of bicycle facility options for the Eastlake neighborhood, including off-corridor options.

Additional options were developed by the project team considering all north-south streets through the study area to identify possible off-corridor connections. In developing additional options the following attributes were considered:

- Bicycle facility options must provide a continuous connection between the University Bridge and Fairview Ave N bridge bicycle facilities.
- Bicycle facility options should also attempt to connect to the existing bicycle lanes on Eastlake Ave E south of Fairview Ave.
- Bicycle facility options should be composed of the AAA bicycle facility types outlined in the BMP, which include:
  - PBLs
  - Off-street/multi-use trails
  - Neighborhood greenways
- Bicycle facility options should attempt to balance the needs of other modes, including maintaining on-street parking where possible.

Eight bicycle facility options were developed for this study. A no-build option with existing bicycle facilities and the future PBL on the Fairview Ave N bridge was also included in the analysis. The nine options are summarized in

Table 5-1. Eastlake Bicycle Facility Options

and illustrated in Figures 5-1 to 5-18.

The bicycle facility options included in this evaluation cover all north-south streets in the study area except for Boylston Ave E, an arterial road located just west of I-5. No options were developed using Boylston Ave E because Boylston Ave E:

- Is narrow for a busy arterial at 29 feet from curb to curb. Adequate space is not available to provide bicycle facilities on this street.
- Includes freeway on- and off-ramps, which are not compatible with the design of AAA bicycle facilities.
- Is at the highest elevation of all roads in the study area; bicyclists would have to climb long steep hills to reach it from either the University Bridge or the Fairview Ave N bridge.

Table 5-1. Eastlake Bicycle Facility Options

BICYCLE FACILITY OPTION	DESCRIPTION
Option 1: No Build	• This option includes the bicycle facilities in the study area identified in the existing conditions section and the PBL on the Fairview Ave N bridge. • No parking removal would be required. • Cyclists in the study area would likely continue to use their existing routes.
Option 2: Protected Bicycle Lanes on Eastlake Ave E	• This option adds PBLs on each side of Eastlake Ave E within the study area. • This option matches the LPA and one of the Seattle BMP's recommendations for bicycle facilities in the study area to complete the citywide bicycle network. • On-street parking would be removed from both sides of Eastlake Ave E between Harvard Ave E and E Blaine St.
Option 3: Two-Way Protected Bicycle Lanes on Eastlake Ave E	• This option adds a two-way PBL facility on the west side of Eastlake Ave E within the study area. • On-street parking would be removed from both sides of Eastlake Ave E between Harvard Ave E and E Blaine St.
Option 4: Northbound PBL on Eastlake Ave E and Southbound Greenway on Yale Ave E	• This option adds a NB PBL on Eastlake Ave E and a SB greenway on Yale Ave E between E Roanoke St and E Howe St. • This option adds PBLs on both sides of Eastlake Ave E north of E Roanoke St and south of E Howe St. • On-street parking would be removed from both sides of Eastlake Ave E from Harvard Ave E to E Roanoke St and from E Howe St to E Blaine St. • On-street parking would be removed from the east side of Eastlake Ave E from E Roanoke St to E Howe St.
Option 5: Northbound PBL on Eastlake Ave E and Southbound PBL on Yale Ave E	• This option adds a NB PBL on Eastlake Ave E and a SB PBL on Yale Ave E between E Roanoke St and E Howe St. • This option adds PBLs on both sides of Eastlake Ave E north of E Roanoke St and south of E Howe St. • On-street parking would be removed from both sides of Eastlake Ave E from Harvard Ave E to E Roanoke St and from E Howe St to E Blaine St. • On-street parking would be removed from the west side of Yale Ave E/Yale Place E and the east side of Eastlake Ave E from E Roanoke St to E Howe St.

Table 5-1. Eastlake Bicycle Facility Options

BICYCLE FACILITY OPTION	DESCRIPTION
Option 6: Multi-Use Trail on Fairview Ave E	• This option adds a multi-use trail on the west side of Fairview Ave E throughout the study area. • This option includes a multi-use trail in new right-of-way along the Lake Union shoreline between E Hamlin St and E Roanoke St (this would require new right-of-way). • This option does not add bicycle facility improvements on Eastlake Ave E. • On-street parking would be changed reconfigured or removed on both sides of Fairview Ave E from Fuhrman Ave E to Fairview Ave.
Option 7: Greenway on Fairview Ave E (following the Cheshiahud Lake Union Loop)	• This option adds typical greenway treatments to the existing Cheshiahud Lake Union Loop, which primarily uses Fairview Ave N. • This option matches one of the Seattle BMP's recommendations for bicycle facilities in the study area to complete the citywide bicycle network. • This option does not add bicycle facility improvements on Eastlake Ave E.
Option 8: Greenway on Minor Ave E and Fairview Ave E	• This option adds typical greenway treatments to Fairview Ave E and Minor Ave E within the study area. • This option would follow the existing Cheshiahud Lake Union Loop signed bike route (primarily on Fairview Ave E) north of E Roanoke St and south of E Newton St, using Minor Ave E in between. • This option does not add any bicycle facility improvements on Eastlake Ave E.
Option 9: Greenway on Franklin Ave E	• This option adds PBLs on each side of Eastlake Ave E between Fuhrman Ave E (the University Bridge) and E Hamlin St, and from E Garfield St to Fairview Ave N. • This option adds typical greenway treatments to Franklin Ave E between E Hamlin St and E Garfield St. • This option does not add bicycle facility improvements on Eastlake Ave E between E Hamlin St and E Garfield St.

Figure 5-1. Option 1: No Build Option

Option 1 would provide no bike facilities in Eastlake beyond the Cheshiahud Lake Union Loop signed route. Commuter cyclists would continue to use their existing routes. The Fairview Ave N bridge replacement would still provide a two-way PBL south of the study area.

Figure 5-2. Option 2: Protected Bicycle Lanes on Eastlake Ave E

Option 2 would add PBLs on each side of Eastlake Ave E within the study area, connecting to the existing University Bridge bike lanes in the north and the Fairview Ave N bridge two-way PBL to the south. This option matches one of the BMP's recommendations within the study area for completing the citywide bicycle network.

Figure 5-3. Option 3: Two-Way Protected Bicycle Lanes on Eastlake Ave E

Option 3 would add a two-way PBL on the west side of Eastlake Ave E within the study area, connecting to the existing University Bridge bike lanes in the north and the Fairview Ave N bridge two-way PBL to the south.

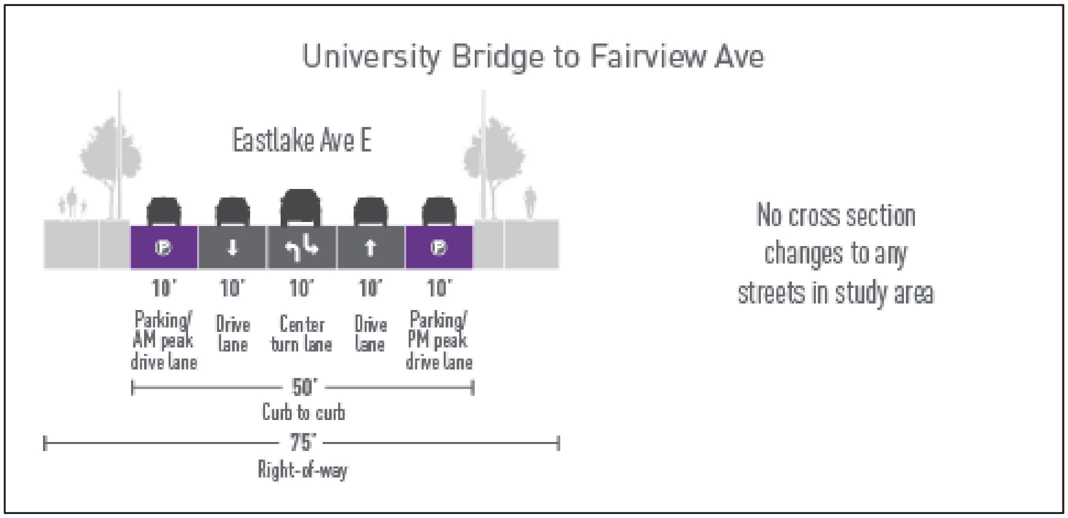

Figure 5-4. Option 1: No Build Option Representative Cross Section

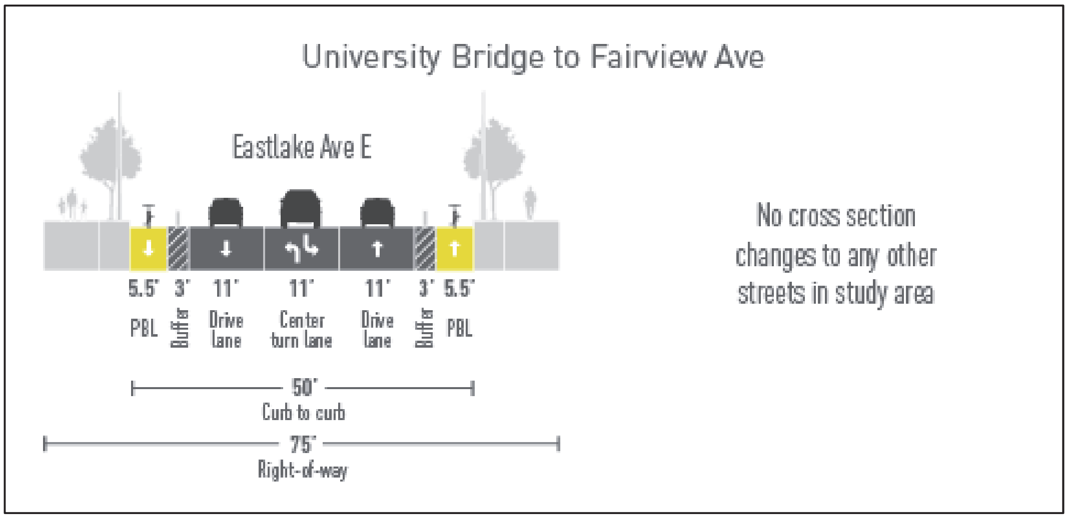

Figure 5-5. Option 2: Protected Bicycle Lanes on Eastlake Ave E Representative Cross Section

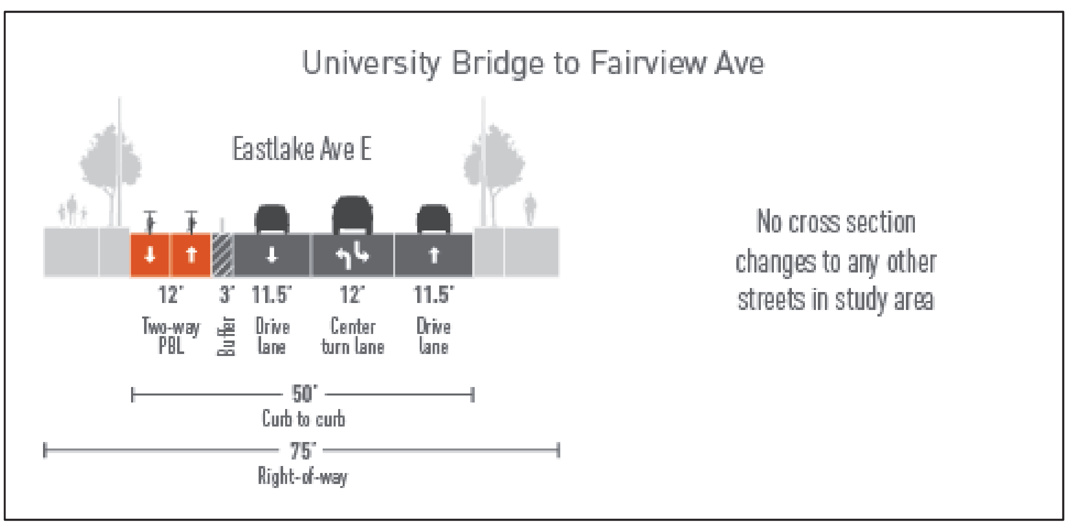

Figure 5-6. Option 3: Two-Way Protected Bicycle Lane on Eastlake Ave E Representative Cross Section

Figure 5-7. Option 4: Northbound Protected Bicycle Lane on Eastlake Ave E and Southbound Greenway on Yale Ave E

Option 4 would add a NB PBL on Eastlake Ave E and a corresponding SB greenway on Yale Ave E between E Roanoke St and E Howe St. PBLs would be provided on both sides of Eastlake Ave E north of E Roanoke St and south of E Howe St.

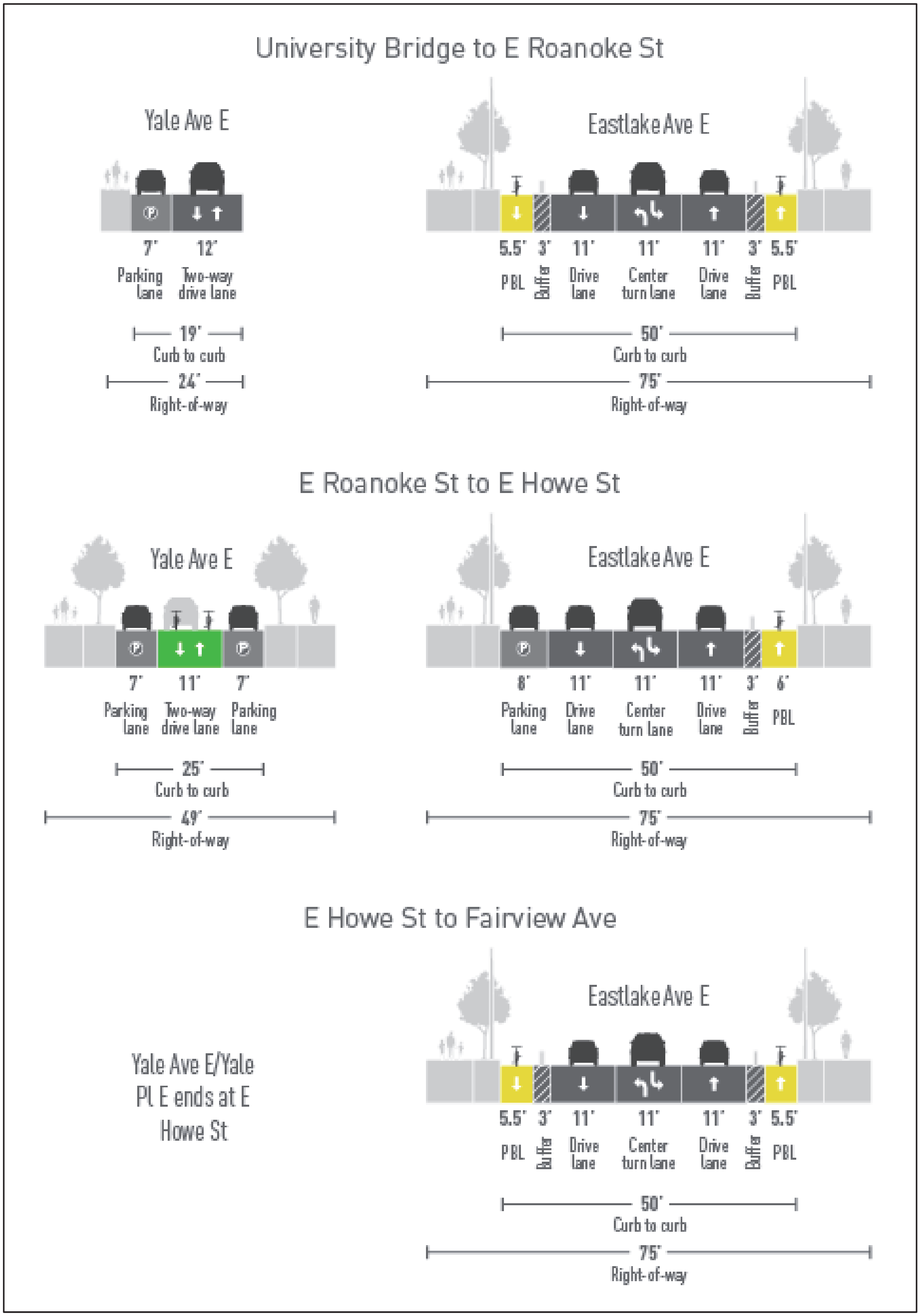

Figure 5-8. Option 4: Northbound Protected Bicycle Lane on Eastlake Ave E and Southbound Greenway on Yale Ave E Representative Cross Sections

Figure 5-9. Option 5: Northbound Protected Bicycle Lane on Eastlake Ave E and Southbound Protected Bicycle Lane on Yale Ave E

Option 5 would add a NB PBL on Eastlake Ave E and a corresponding SB PBL on Yale Ave E between E Roanoke St and E Howe St, with connections via PBLs on E Roanoke St and Yale Place E. PBLs would be provided on both sides of Eastlake Ave E north of E Roanoke St and south of E Howe St.

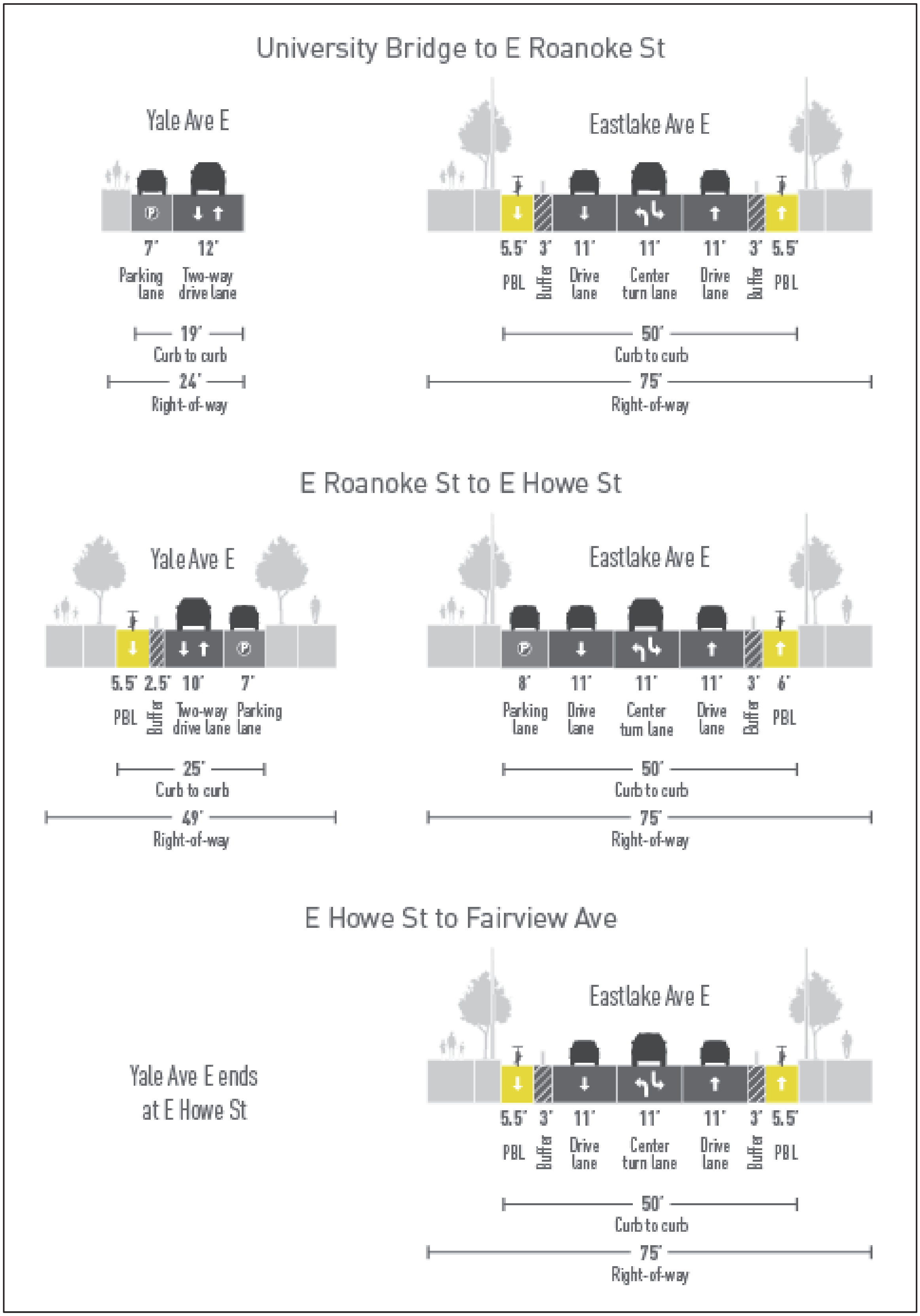

Figure 5-10. Option 5: Northbound Protected Bicycle Lane on Eastlake Ave E and Southbound Protected Bicycle Lane on Yale Ave E Representative Cross Sections

Figure 5-11. Option 6: Multi-Use Trail on Fairview Ave E

Option 6 would add a multi-use trail on the west side of Fairview Ave E throughout the study area. This option includes a multi-use trail in new right-of-way along the Lake Union shoreline between E Hamlin St and E Roanoke St to provide a flat and continuous bike route. This would require right-of-way acquisition along about 740 feet of the shoreline. This option would not add bicycle facility improvements on Eastlake Ave E between the University Bridge and the Fairview Ave N bridge.

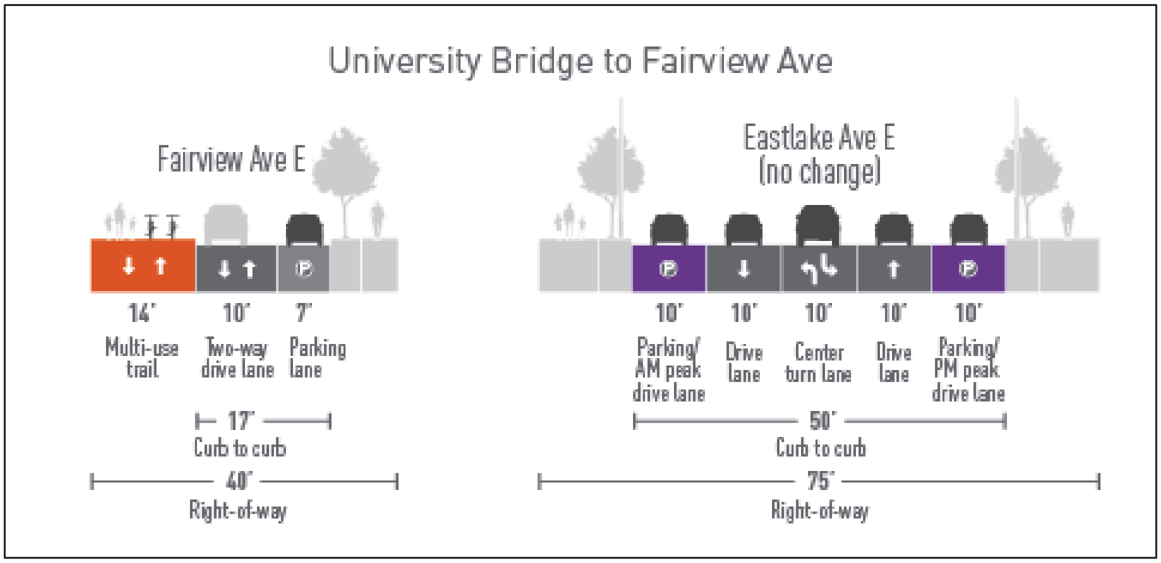

Figure 5-12. Option 6: Multi-Use Trail on Fairview Ave E Representative Cross Sections

Figure 5-13. Option 7: Greenway on Fairview Ave E (following the Cheshiahud Lake Union Loop)
Option 7 would add typical greenway treatments to the existing Cheshiahud Lake Union Loop, a signed bike route that primarily uses Fairview Ave N. This option would not add any bicycle facility improvements on Eastlake Ave E between the University Bridge and the Fairview Ave N bridge This option matches one of the BMP's recommendations within the study area for completing the citywide bicycle network.

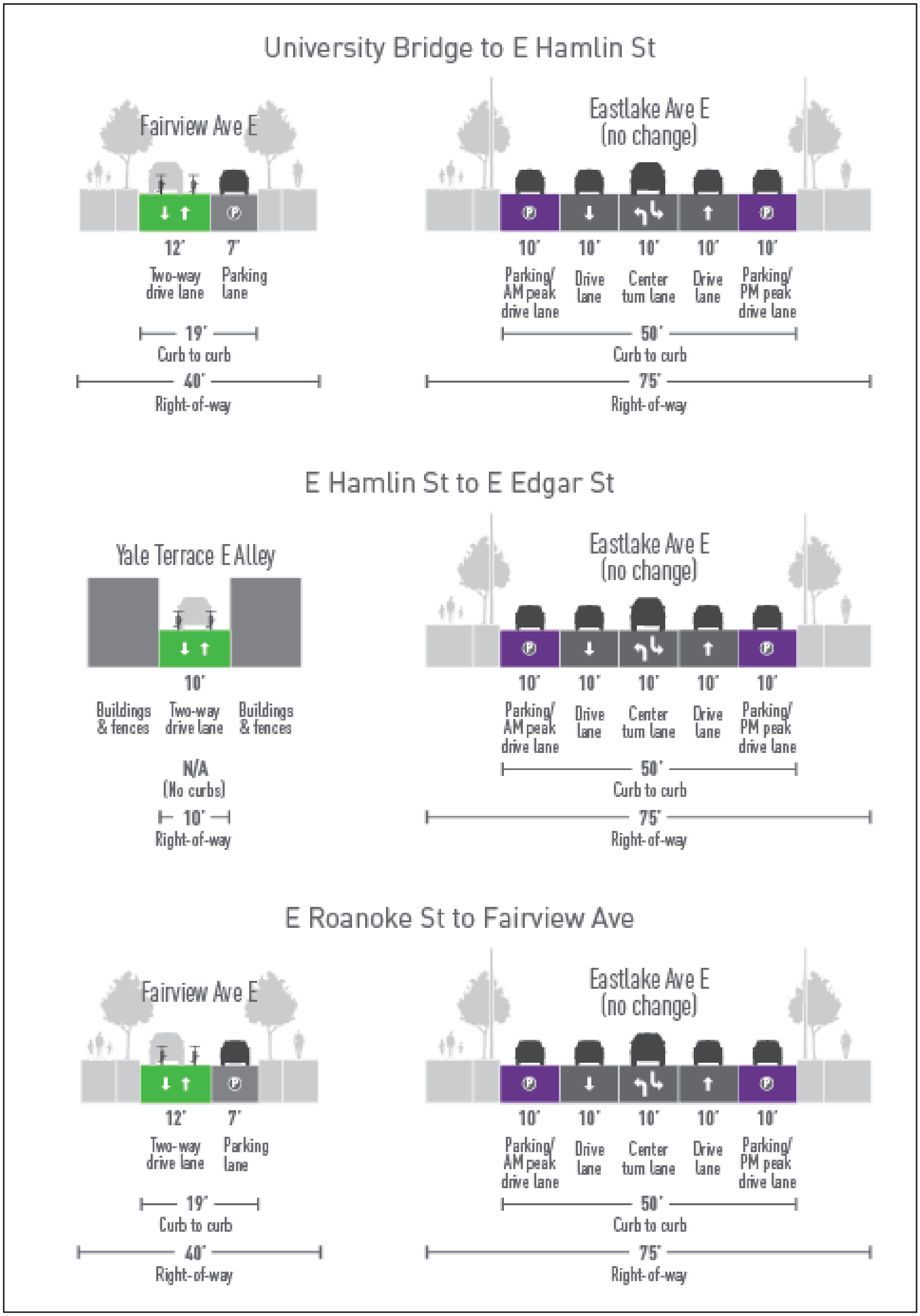

Figure 5-14. Option 7: Greenway on Fairview Ave E Representative Cross Sections

Figure 5-15. Option 8: Greenway on Minor Ave E and Fairview Ave E

Option 8 would add typical greenway treatments to Fairview Ave E and Minor Ave E within the study area. This option would follow the existing Cheshiahud Lake Union Loop signed bike route (primarily on Fairview Ave E) north of E Roanoke St and south of E Newton St, using Minor Ave E in between. This option would not add bicycle facility improvements on Eastlake Ave E between the University Bridge and the Fairview Ave N bridge.

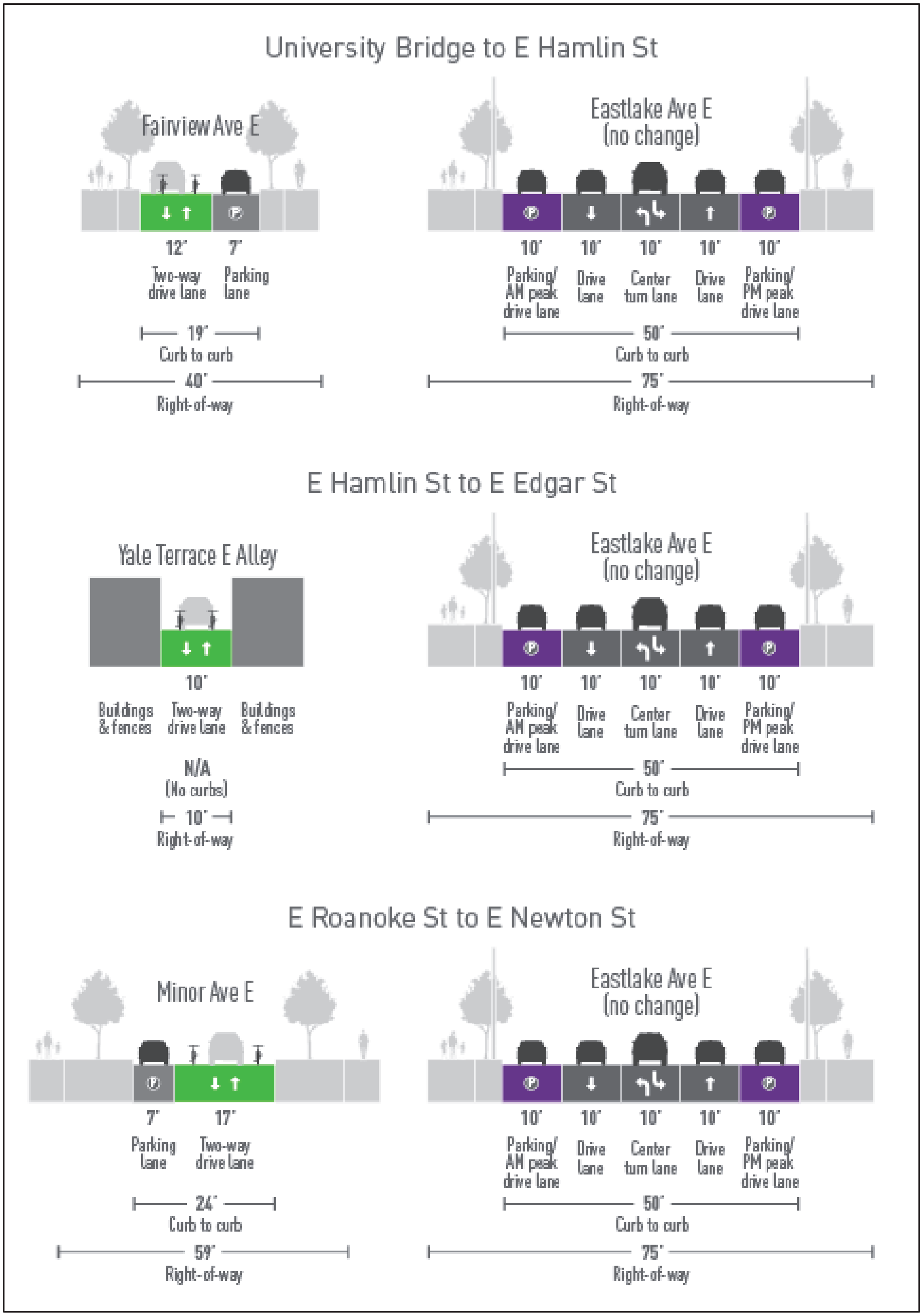

Figure 5-16. Option 8: Greenway on Minor Ave E and Fairview Ave E Representative Cross Sections

Figure 5-17. Option 9: Greenway on Franklin Ave E

Option 9 would add PBLs on each side of Eastlake Ave E between Fuhrman Ave E (the University Bridge) and E Hamlin St, and from E Garfield St to Fairview Ave N. Between E Hamlin St and E Garfield St, typical greenway treatments would be added to Franklin Ave E to make a continuous bike route.

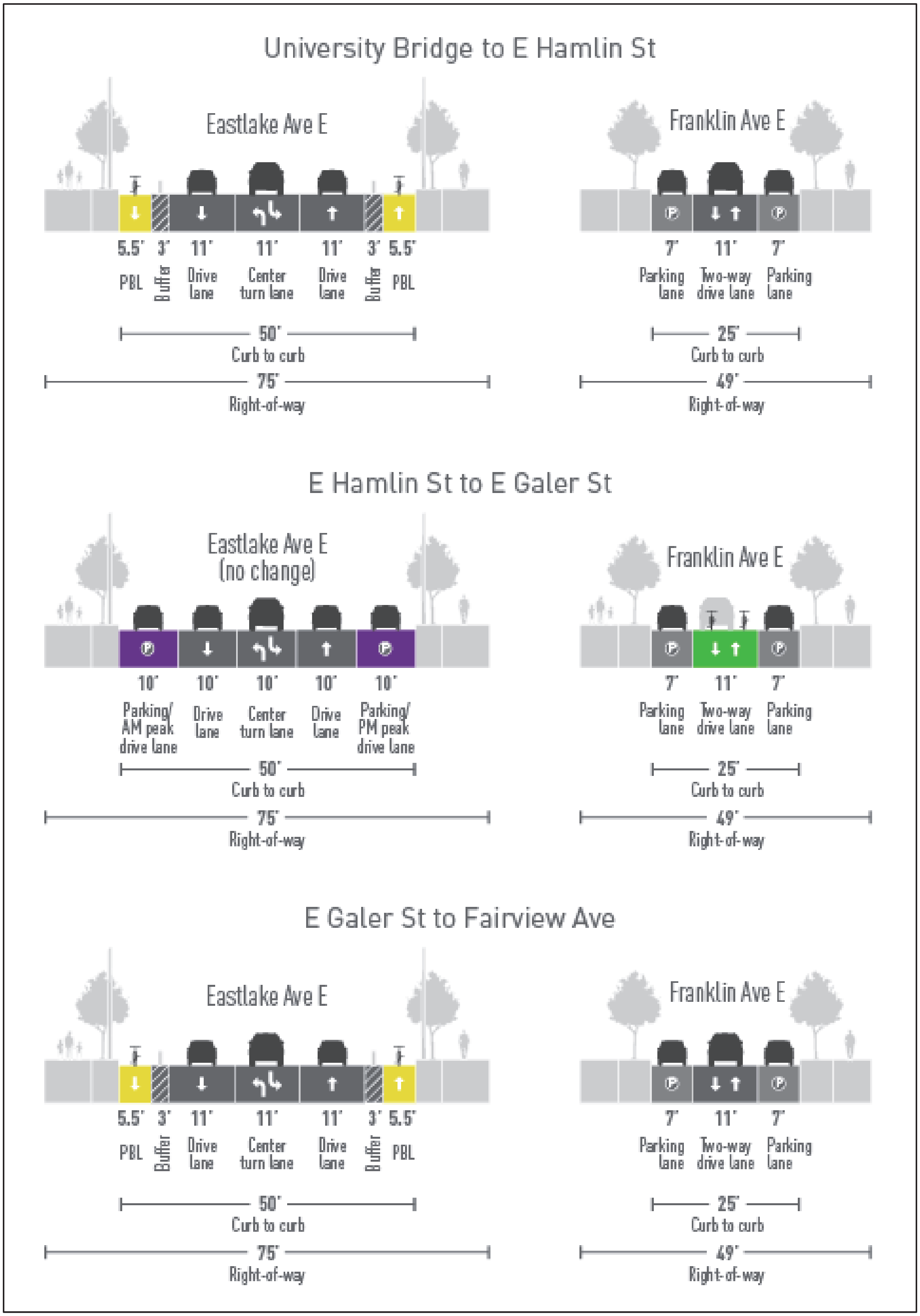

Figure 5-18. Option 9: Greenway on Franklin Ave E Representative Cross Sections

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6. EVALUATION METHODOLOGY AND RESULTS

The nine bicycle facility options described in Section 5 were evaluated in two stages following the process shown in

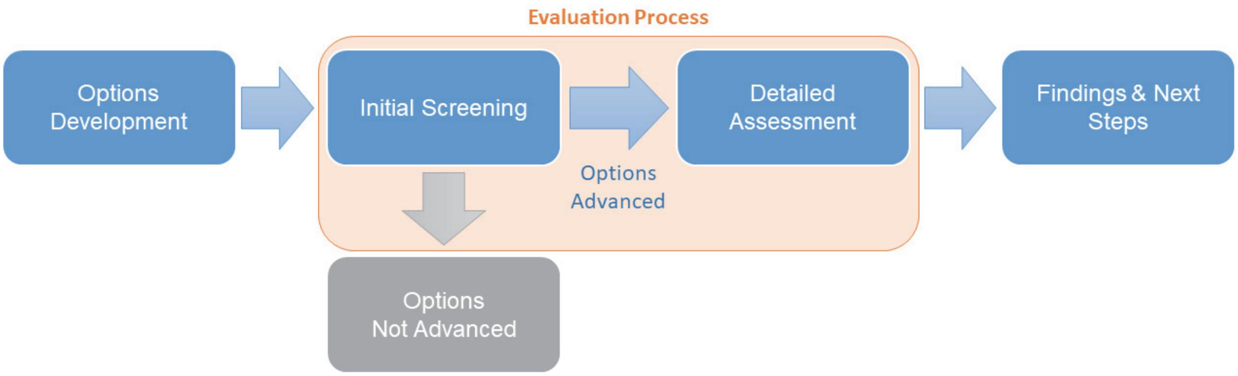

Figure 6-1. Options were initially evaluated with a pass/fail rating based on criteria pertaining to feasibility of implementation. Concepts that passed this initial screening were then assessed in greater detail to determine their performance on a broader set of criteria. The evaluation criteria and methods are described in Section 6.1.

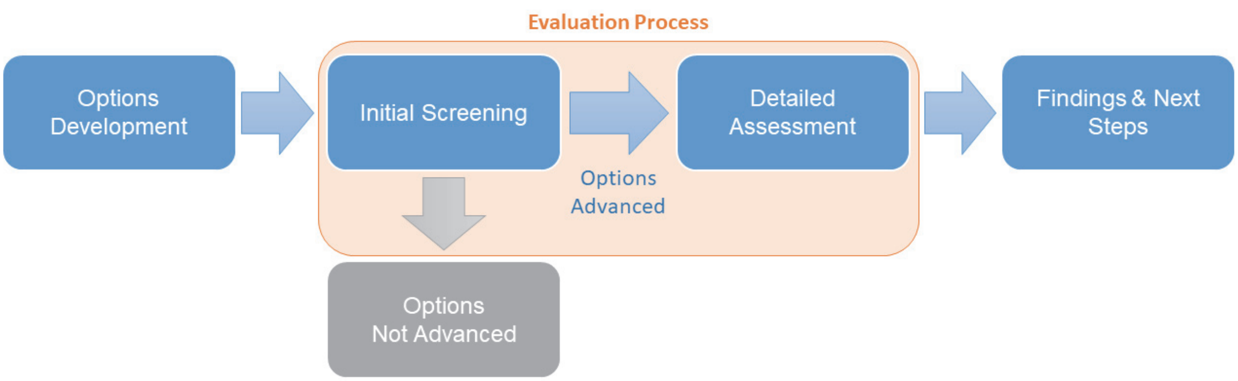

Figure 6-1. Bicycle Facility Options Evaluation Process

6.1 Methodology

6.1.1 Initial Screening Methodology

The initial screening stage of the evaluation process considered all nine bicycle facility options described in Section 5. The initial screen was performed to identify potential issues that would prevent implementation of the options. This step serves to screen out bicycle facility options with substantial concerns by considering whether each option would:

- Meet the project's purpose and need by providing improved safety and access to transit for bicycles. These are identified as key goals in the RapidRide Roosevelt project purpose and need, and thus any bicycle facility design included in the project must represent an improvement over the existing conditions for both of these goals.

- Provide a level bicycle route. Steep slopes, particularly uphill slopes, are not appropriate for AAA cycling routes as they present a potential barrier to all but the strongest cyclists and could discourage most potential users from using the facility.
- Meet SDOT's bicycle facility design standards. Design standards ensure that bicycle facilities are functional and safe for all users. Options that do not meet design standards and therefore introduce potential safety conflicts for people biking or for people walking are not suitable for implementation.
- Be constructible within available existing right-of-way. Options that require property acquisition present a substantial risk of community concerns, delays to the project schedule, and project cost overruns.

Options that passed all four screening criteria were advanced beyond the initial screening to a more detailed assessment.

Table 6-1. Initial Screening Criteria

summarizes the initial screening criteria.

Table 6-1. Initial Screening Criteria

CRITERION	REASON FOR INCLUSION	HOW ASSESSED	RATING
Meets the project purpose and need	• The project purpose and need includes improving safety and access to transit for people biking in the project corridor. Only bicycle facilities that represent an improvement over the existing conditions for both of these goals receive a 'pass' rating.	Options were qualitatively evaluated based on how they improve connections to transit and improve safety for non-motorized users. This considered both providing AAA bicycle facilities within the study area and providing bicycle facilities that directly connect with transit stops.	**Pass:** Option meets purpose and need by improving both safety and access to transit for bicycles within study area. **Fail:** Option does not improve safety and/or access to transit for bicycles within study area.
Provides a level bicycle route	• Steep slopes, particularly uphill slopes, are not appropriate for AAA cycling routes as they present a potential barrier to all but the strongest cyclists. • Steep uphill climbs can be physically taxing and are likely to discourage cyclists from using the new bicycle facility, leading to little change in bicycle volumes along Eastlake Ave E and	Options were evaluated based on whether routing would require climbing grades of 10% or greater.	**Pass:** Option does not require uphill travel on grades of 10% or more. **Fail:** Option requires uphill travel on grades of 10% or more.

Table 6-1. Initial Screening Criteria

CRITERION	REASON FOR INCLUSION	HOW ASSESSED	RATING
	limited safety improvement over existing conditions. • Streets Illustrated recommends slopes below 8.3% for greenways; a 10% threshold is more flexible and corresponds to the maximum slope generally allowed in other cities.		
Meets SDOT's bicycle facility design standards	• Streets Illustrated includes design standards for the AAA bicycle facility types considered. Each bicycle facility option must be checked against these standards to ensure that the facility would be safe and functional for intended users.	Options were qualitatively evaluated on whether the bicycle facility design would meet relevant standards for bicycle facility design including: • Inadequate street lighting for bicycle travel in low- or no-light conditions (applies to all facilities) • Slopes greater than 5% on two-way bicycle facilities leading to risk of head-on bicycle collisions (specific to two-way PBLs) • Roadway width too narrow to allow cars and bicycles to pass when two-way mixed traffic is present (specific to greenways)	**Pass:** Option meets design standards as outlined. **Fail:** Option does not meet one or more design standards as outlined.

Table 6-1. Initial Screening Criteria

CRITERION	REASON FOR INCLUSION	HOW ASSESSED	RATING
Able to be constructed within available existing right-of-way	• Acquiring property would delay project delivery and increase costs; options that require property acquisition to expand right-of-way or establish new right-of-way are not considered feasible.	Options were evaluated quantitatively based on whether they would require property acquisition to provide new or expanded right-of-way. Minimum facility widths are from Streets Illustrated: • One-way PBL pair: 5′ lane and 3′ buffer each direction; 16′ total • Two-Way PBL: 10′ lane and 3′ buffer; 13′ minimum • Greenway: no minimum width identified • Multi-use path: 10′ minimum; 12′ recommended	**Pass:** Option does not require property acquisition to construct. **Fail:** Option requires property acquisition to construct.

6.1.2 Detailed Assessment Methodology

Bicycle facility options that advanced through the initial screening were then assessed in greater detail. While the initial screen was used to determine whether each option is feasible for implementation, the detailed assessment was used to provide a comparison of the benefits and impacts that would be associated with each of the remaining options based on their performance on a range of different measures. This detailed assessment evaluated the remaining options using criteria addressing the following elements:

- Degree to which each option improves bicycle safety and bicycle connections to transit
- Degree to which each option is consistent with City of Seattle policy guidance
- Bicycle route conditions
- Degree to which each option provides neighborhood access
- Impacts to other transportation modes and elements

Within each of the elements, a variety of measures was assessed to create a broad evaluation of the remaining bicycle facility options. The evaluation criteria and evaluation methods for each criterion are listed in

Table 6-2. Detailed Assessment Criteria and Methodology

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Table 6-2. Detailed Assessment Criteria and Methodology

CRITERION	REASON FOR INCLUSION	HOW ASSESSED	RATING
BICYCLE SAFETY AND TRANSIT CONNECTIONS			
Route Safety	Improving safety for people biking in the project corridor, including the Eastlake neighborhood, is an explicit goal of the RapidRide Roosevelt project. While options have already been screened for safety concerns, the remaining options may still vary in the degree of safety benefit provided.	Quantitative and qualitative – based on bike route characteristics and considers: • Frequency of driveway conflict points • Whether physical separation between bicycles and motor vehicles is provided • Whether the facility results in bicycles traveling against the direction of motor vehicle traffic	**High:** Minimizes the occurrence of all identified safety considerations **Medium:** Minimizes two of three identified safety considerations **Low:** Minimizes the occurrence of one or none of the identified safety considerations
Bicycle Connection to Transit	Improving access to transit for people biking in the project corridor, including the Eastlake neighborhood, is an explicit goal of the RapidRide Roosevelt project.	Quantitative – Number of transit stops directly along signed or designated bicycle route. Within the study area there are eight proposed stops.	**High:** 7-8 **Medium:** 3-6 **Low:** 0-2
CITY OF SEATTLE POLICY GUIDANCE			
Consistency with Bicycle Master Plan	The BMP produced specific recommendations for bicycle facilities to be completed as part of the citywide bicycle network, including facility type and route.	Qualitative – Compare to BMP citywide bicycle network recommendations in the study area (shown in Section 3.1): • PBLs along Eastlake Ave E • Neighborhood greenway along the shore of Lake Union (following the Cheshiahud Lake Union Loop)	**High:** Matches a BMP citywide network recommendation over the full length of the study area with no deviations **Medium:** Mostly matches a BMP citywide network recommendation over the full length of the study area with one-block deviations **Low:** Does not match a BMP citywide network recommendation or

Table 6-2. Detailed Assessment Criteria and Methodology

CRITERION	REASON FOR INCLUSION	HOW ASSESSED	RATING
			includes significant deviations of more than one block
ROUTE CONDITIONS			
Route Distance	Bicyclists typically choose the shortest routes assuming other factors are equal. Cyclists currently using Eastlake Ave E are unlikely to divert to bicycle facilities that require traveling longer distances.	Quantitative – Route distance from the University Bridge to the Fairview Ave N bridge as measured using Google Maps (total for both NB and SB directions).	**High:** < 3 miles **Medium:** 3-3.5 miles **Low:** > 3.5 miles
Elevation Gain	Bicyclists typically choose flatter routes that require less elevation gain assuming other factors are equal. Cyclists currently using Eastlake Ave E are unlikely to divert to bicycle facilities that require greater elevation gain.	Quantitative – Vertical elevation gain from the University Bridge to the Fairview Ave N bridge as measured using Google Maps (total for both NB and SB directions).	**High:** <50 feet **Medium:** 50-100 feet **Low:** >100 feet
Maximum Uphill Slope	Bicyclists typically choose flatter routes with more gradual slopes assuming other factors are equal. Cyclists currently using Eastlake Ave E are unlikely to divert to bicycle facilities that require climbing hills with steep slopes.	Quantitative – Maximum uphill grade along the route per SDOT's "Street Slope 2017" geographic information system data.	**High:** 0-2% **Medium:** 3-6% **Low:** 7-8%
Route Legibility and Directness	Cyclists currently using Eastlake Ave E are unlikely to divert to bicycle facilities that are indirect and thus more difficult to follow.	Quantitative –Turns required to travel along route from the University Bridge to the Fairview Ave N bridge (total for both NB and SB directions).	**High:** 0-2 **Medium:** 3-6 **Low:** ≥7

Table 6-2. Detailed Assessment Criteria and Methodology

CRITERION	REASON FOR INCLUSION	HOW ASSESSED	RATING
Number of Arterial Crossings Required	Cyclists currently using Eastlake Ave E are unlikely to divert to bicycle facilities that require a large number of arterial crossings as these add delay and increase travel time.	Quantitative – Arterial crossings required to navigate the route (total for both NB and SB directions).	**High:** 0-1 **Medium:** 2-3 **Low:** ≥4
NEIGHBORHOOD ACCESS			
Access to Businesses	Bicycle facilities that allow direct access to businesses along Eastlake Ave E will support nonmotorized access to businesses, supporting Seattle's goals of reducing driving rates and greenhouse gas emissions.	Qualitative – Direct access to businesses provided by signed or designated bicycle route.	**High:** Provides direct access to businesses on Eastlake Ave E in both directions **Medium:** Provides direct access to businesses on Eastlake Ave E in one direction **Low:** Does not provide direct access to businesses on Eastlake Ave E
Access to Schools	Bicycle facilities that connect to schools in the Eastlake neighborhood support the Safe Routes to Schools program. Safe Routes to School is a national movement to ensure safe walking or biking for students to and from school; this program is implemented by SDOT as part of Vision Zero in Seattle.	Qualitative – Direct access to schools provided by signed or designated bicycle route.	**High:** Provides direct access to TOPS K-8 School grounds in both directions **Medium:** Provides direct access to TOPS K-8 School grounds in one direction **Low:** Does not provide direct access to TOPS K-8 School grounds

Table 6-2. Detailed Assessment Criteria and Methodology

CRITERION	REASON FOR INCLUSION	HOW ASSESSED	RATING
IMPACTS TO OTHER TRANSPORTATION MODES AND ELEMENTS			
Transit Performance	RapidRide Roosevelt buses operating on Eastlake Ave E are subject to delay due to interaction with other travel modes. Minimizing these interactions will benefit travel time and reliability for RapidRide Roosevelt service.	Qualitative – Assessment of potential for transit delay along Eastlake Ave E. Considers: • Interaction between buses and bicycles • Interaction between buses and parallel parking cars Note: This analysis assumes that some cyclists will not divert off of Eastlake Ave E if a bicycle route is built off of Eastlake.	**High:** Minimizes potential interaction of buses with bicycles and parallel parking cars for the full length of the study area **Medium:** Minimizes potential interaction of buses with bicycles and parallel parking cars for part of the length of the study area **Low:** Does not minimize potential interaction of buses with bicycles or parallel parking cars
Auto Traffic Performance	General-purpose traffic on Eastlake Ave E is subject to delay due to interaction with other travel modes. Minimizing these interactions will benefit travel time and reliability for through traffic on Eastlake Ave E.	Qualitative – Assessment of potential for general-purpose traffic delay along Eastlake Ave E. Considers: • Interaction between buses and bicycles • Interaction between buses and parallel parking cars Note: This analysis assumes that some cyclists will not divert off of Eastlake Ave E if a bicycle route is built off of Eastlake.	**High:** Minimizes potential interaction of general-purpose traffic with bicycles and parallel parking cars for the full length of the study area **Medium:** Minimizes potential interaction of general-purpose traffic with bicycles and parallel parking cars for part of the length of the study area **Low:** Does not minimize the potential interaction of general-purpose traffic with either bicycles or parallel parking cars

Table 6-2. Detailed Assessment Criteria and Methodology

CRITERION	REASON FOR INCLUSION	HOW ASSESSED	RATING
On-Street Parking	Construction of bicycle facilities in the Eastlake neighborhood will require repurposing existing road space. In practice, this will mean removing on-street parking spaces to provide space for bicycle facilities. Parking impact is an area of significant community concern in the Eastlake neighborhood (see the Curb Space Management Study, Appendix F of the *RapidRide Roosevelt Project Transportation Technical Report)*.	Quantitative – The number of on-street parking spaces removed within study area.	**High:** <200 spaces removed **Medium:** 200-300 spaces removed **Low:** >300 spaces removed
Planted Medians	The Eastlake Community Council submitted scoping comments for the RapidRide Roosevelt project's environmental assessment that included a desire to protect or, if possible, expand planted medians located along Eastlake Ave E within the study area. Some bicycle facility options may require removing or significantly altering these medians to provide adequate space for bicycle facilities and other travel lanes.	Qualitative – Based on required bicycle facility width, width of other travel lanes required, and the locations of existing planted medians along Eastlake Ave E. Minimum bicycle facility widths are from Streets Illustrated: • One-way PBL pair: 5′ lane and 3′ buffer each direction; 16′ total • Two-way PBL: 10′ lane and 3′ buffer; 13′ minimum • Greenway: no minimum width identified • Multi-use path: 10′ minimum; 12′ recommended	**High:** The existing planted medians are not expected to be impacted by the bicycle facility design **Medium:** Partial removal (or replacement) of existing planted medians likely required due to bicycle facility design **Low:** Complete removal (or replacement) of existing planted medians likely required due to bicycle facility design

6.2 Evaluation Results

6.2.1 Initial Screening Results

Five of the nine bicycle facility options were screened out due to their poor performance on one or more of the four initial screening criteria. Table 6-3. Initial Screening Results

shows the results of the initial screen.

Table 6-3. Initial Screening Results

CRITERION	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6	OPTION 7	OPTION 8	OPTION 9
Meets the project purpose and need	**Fail** – Does not improve bicycle safety or access to transit	**Pass** – Improves bicycle safety and access to transit	**Pass** – Improves bicycle safety and access to transit	**Pass** – Improves bicycle safety and access to transit	**Pass** – Improves bicycle safety and access to transit	**Fail** – Does not improve bicycle access to transit	**Fail** – Does not improve bicycle access to transit	**Fail** – Does not improve bicycle access to transit	**Pass** – Improves bicycle safety and access to transit
Provides a level bicycle route	**Not applicable** – No route	**Pass** – Max uphill grade 5%	**Pass** – Max uphill grade 5%	**Pass** – Max uphill grade 6%	**Pass** – Max uphill grade 6%	**Pass** – Max uphill grade 5%	**Fail** – Max uphill grade 15%	**Fail** – Max uphill grade 15%	**Fail** – Max uphill grade 17%
Meets SDOT's bicycle facility design standards	**Not applicable** – No facility/design to evaluate	**Pass** – Meets design standards	**Pass** – Meets design standards	**Pass** – Meets design standards	**Pass** – Meets design standards	**Pass** – Meets design standards	**Fail** – Yale Terrace E alley travelway is too narrow to accommodate two-way auto and bike traffic	**Fail** – Yale Terrace E alley travelway is too narrow to accommodate two-way auto and bike traffic	**Pass** – Meets design standards
Able to be constructed within available existing right-of-way	**Pass** – Does not require property acquisition	**Pass** – Does not require property acquisition	**Pass** – Does not require property acquisition	**Pass** – Does not require property acquisition	**Pass** – Does not require property acquisition	**Fail** – Property acquisition required to implement design between E Hamlin St and E Roanoke St	**Pass** – Does not require property acquisition	**Pass** – Does not require property acquisition	**Pass** – Does not require property acquisition
RESULT	***Advanced for Comparison Only***	***Advanced to Detailed Assessment***	***Advanced to Detailed Assessment***	***Advanced to Detailed Assessment***	***Advanced to Detailed Assessment***	***Not Advanced***	***Not Advanced***	***Not Advanced***	***Not Advanced***

Options that failed to pass any one of the four screening criteria were not advanced to the second stage of the evaluation.

- **Option 1 – No Build (did not pass initial screening; used for comparison purposes only).** Option 1 does not meet the RapidRide Roosevelt purpose and need, as it does not provide any AAA bicycle facilities in the study area and therefore would also not provide any bicycle connection to transit stops. Option 1 would also not address the existing bicycle safety issues in the study area, including a lack of continuous bicycle facilities through the study area and a high number of bicycle collisions on Eastlake Ave E. Option 1 would therefore present a continuing safety concern for cyclists. Because Option 1 would not provide a bicycle facility or designated bicycle route, it was not assessed for the presence of steep uphill slopes or for compliance with design standards. The no build option would not require property acquisition. Option 1 did not pass the initial screening because it does not meet the project purpose and need and does not address bicycle safety concerns in the study area, but it was considered as part of the subsequent detailed assessment to provide a point of comparison with the advanced options.
- **Option 2 – PBLs on Eastlake Ave E: Advanced.** Option 2 meets the project purpose and need by improving bicycle safety in the study area with the addition of new AAA bicycle facilities. It also improves bicycle access to transit as the PBLs would provide cyclists direct access to bus stops along Eastlake Ave E. This option would not encounter steep slopes; the maximum slope along the route in Option 2 is 5%. The PBL facility in Option 2 meets design standards and would not require property acquisition as it fits within available right-of-way on Eastlake Ave E. Option 2 was advanced to the detailed assessment because it passed all of the initial screening criteria.
- **Option 3 – Two-Way PBL on Eastlake Ave E: Advanced.** Option 3 improves safety and access to transit by providing AAA bicycle facilities adjacent to transit stops, meeting the project purpose and need. Option 3 would not include bicycle facilities with steep uphill slopes as the maximum slope is 5%. This option meets design standards and fits within the existing right-of-way on Eastlake Ave E, so this option would not require property acquisition. Option 3 was therefore advanced to the detailed assessment.
- **Option 4 – Northbound PBL on Eastlake Ave E and Southbound Greenway on Yale Ave E: Advanced.** Option 4 meets all four screening criteria. It meets the project purpose and need, it meets bicycle facility design standards, and it does not require property acquisition as it would fit within existing right-of-way along Eastlake Ave E, E Roanoke St, Yale Ave E, and Yale Place E. This option does include one street segment with a grade over 10% (along E Roanoke St), but this street segment would only be used by SB cyclists in Option 4 and they would therefore be traveling downhill. The steepest uphill slope along Option 4 is 6% on Yale Ave E. Option 4 passed all screening criteria and was advanced to the detailed assessment.
- **Option 5 – Northbound PBL on Eastlake Ave E and Southbound PBL on Yale Ave E: Advanced.** Option 5 uses the same route as Option 4, but Option 5 substitutes a PBL on Yale Ave E in place of the greenway used in Option 4. Option 5 performed the same on all screening criteria as Option 4, and was therefore advanced to the detailed assessment.

- **Option 6 – Multi-Use Trail on Fairview Ave E: Not Advanced.** Option 6 would provide a complete AAA bicycle facility through the study area, which would address the need for safety improvements identified in the RapidRide Roosevelt purpose and need statement. However, the multi-use trail in Option 6 would not provide access to any transit stops in the study area, and therefore would not meet the project's purpose and need because it would not improve access to transit for bicycles.
  - Option 6 does not include steep uphill slopes and it complies with the identified design standards. This option would require property acquisition to connect the trail between E Hamlin St and E Roanoke St. Fairview Ave E does not connect across this section due to the shoreline of Lake Union, and no continuous public right-of-way is available through this area. Property would need to be acquired along the Lake Union shoreline between E Hamlin St and E Roanoke St to establish new right-of-way to implement this bicycle facility. Option 6 was not advanced to the detailed assessment because it does not meet the project purpose and need and because it would require property acquisition to implement.
- **Option 7 – Greenway on Fairview Ave E (following the Cheshiahud Lake Union Loop): Not Advanced.** Option 7 would provide a complete AAA bicycle facility through the study area, which would address the need for safety improvements identified in the RapidRide Roosevelt purpose and need statement. However, the multi-use trail in Option 7 would not provide access to any transit stops in the study area, and therefore would not meet the project's purpose and need because it would not improve access to transit for bicycles.
  - Option 7 includes steep uphill slopes for cyclists traveling in both the NB and SB directions. These grades are 12% on E Roanoke St for NB cyclists and 17% on E Hamlin St for SB cyclists. This option also requires travel through a narrow and tightly constrained two-way alley on Yale Terrace E between E Hamlin St and E Edgar St. The alley does not have sufficient space for cars and bicycles to move past one another and so does not meet design standards. Option 7 would not require property acquisition. Option 7 was not advanced to the detailed assessment because it does not meet the project purpose and need, it includes steep uphill slopes, and it does not meet design standards.
- **Option 8 – Greenway on Minor Ave E and Fairview Ave E: Not Advanced.** Option 8 has drawbacks similar to Option 7, including not meeting the project purpose and need by not improving bicycle access to transit stops, routing cyclists up steep uphill slopes, and not meeting design standards due to routing through a narrow alley that is shared with two-way car traffic. Option 8 was therefore not advanced to the detailed assessment.
- **Option 9 – Greenway on Franklin Ave E: Not Advanced.** Option 9 meets the RapidRide Roosevelt project purpose and need because it would provide a continuous AAA bicycle facility through the study area, improving bicycle safety, and it would include PBLs that provide direct access to bus stops on Eastlake Ave E, improving access to transit for bicyclists. However, Option 9 would route bicycle facilities along steep uphill slopes; Franklin Ave E has a 17% grade between E Newton St and E Howe St. This option does not present any apparent safety concerns and would not require property acquisition. Option 9 was not advanced to the detailed assessment due to the inclusion of steep uphill slopes.

In summary, Options 2, 3, 4, and 5 passed the initial screening. Additionally, Option 1 (no build) was carried into the detailed assessment for comparison purposes only, although it does not meet the RapidRide Roosevelt purpose and need nor address existing safety concerns for the bicyclists traveling in the study area, and therefore did not pass the initial screening.

6.2.2 Detailed Assessment Results

Four options, Options 2, 3, 4, and 5, were advanced from the initial screening and evaluated in the detailed assessment. Option 1, the no-build condition, was also carried into the detailed assessment for comparison although it did not pass the initial screening. The evaluation results are summarized in Table 6-4. Each option was given a high, medium, or low rating for each criterion as described in Table 6-2.

- Option 1 – No Build
  - ***Bicycle Safety and Transit Connections:*** Option 1 would not improve bicycle safety or access to transit within the study area because it would not provide any bicycle facilities. All other options considered in the detailed assessment would perform better with respect to these measures.
  - ***City of Seattle Policy Guidance:*** Option 1 does not implement any recommendations from the BMP. All other options considered in the detailed assessment would implement BMP recommendations.
  - ***Route Conditions:*** Since Option 1 would not create a bicycle facility, it is assumed that cyclists would continue to travel on their current routes through the study area. Traveling via Eastlake Ave E is relatively flat, level, and continuous, but also requires cyclists to interact with cars and buses with no separation. Using other routes to travel through the study area (such as the Cheshiahud Lake Union Loop) would require climbing steep slopes, greater total elevation gain, and less direct routes with several turns.
  - ***Neighborhood Access:*** Option 1 would not provide direct bicycle access to businesses on Eastlake Ave E or to the TOPS K-8 School grounds.
  - ***Impacts to Other Transportation Modes and Elements:*** Under Option 1, many cyclists would continue to ride in mixed traffic on Eastlake Ave E, which is the primary arterial through the study area. This would result in the most significant impacts to transit and auto traffic operations, as buses and cars would interact with bicycles in shared travel lanes along Eastlake Ave E throughout the study area. Bicycles can have a particularly acute impact on transit travel time and reliability, since bicycles and buses typically travel at similar average speeds but different maximum speeds. In practice, this means that buses and bicycles must continually pass each other as buses make stops, resulting in buses traveling slowly behind bicycles until they have space to pass safely. Option 1 would not make any changes to on-street parking in the study area or require removal of any of the existing planted medians.
- Option 2 – PBLs on Eastlake Ave E:
  - ***Bicycle Safety and Transit Connections:*** Option 2 received the highest rating for potential improvement to bicycle safety. Option 2 would provide separated bicycle facilities through the full length of the study area, avoiding mixed-traffic operation for bicycles. Option 2 would result in a low frequency of driveway conflicts by staying on Eastlake Ave E. This option would also keep bicycles traveling in the same direction as other traffic by providing a one-way PBL on each side of the street, reducing the

potential for conflicts at intersections. Option 2 would also provide direct access to all eight planned RapidRide stops in the study area—the most of all the options considered in the detailed assessment.

- ***City of Seattle Policy Guidance:*** Option 2 would fully implement one of the BMP's two recommendations for bicycle facilities as part of the citywide bicycle network by providing PBLs on Eastlake Ave E from the University Bridge to the Fairview Ave N bridge. This option does not include any deviations off of Eastlake Ave E. Option 2 received a high rating on this measure.
- ***Route Conditions:*** Option 2 would provide the best bicycle route conditions of the options considered based on the evaluated criteria, tied with Option 3. Option 2 would create a short, direct, and legible bicycle route in the study area that would be easy for cyclists to follow, receiving high ratings on these criteria. Option 2 received medium ratings for elevation gain and maximum slope, but Options 3, 4, and 5 also received medium ratings on these criteria, reflecting the hilly topography in the study area.
- ***Neighborhood Access:*** Option 2 would provide direct bicycle access to businesses along the full length of Eastlake Ave E through the study area, receiving a high rating along with Option 3 and scoring higher than Options 4 and 5. Options 2, 3, 4, and 5 would all provide direct bicycle access to the TOPS K-8 School grounds, representing an improvement over Option 1 and existing conditions.
- ***Impacts to Other Transportation Modes and Elements:*** Option 2 would minimize the interaction of bicycles with buses and auto traffic on Eastlake Ave E by providing PBLs through the full length of the study area with no deviation from Eastlake Ave E. This would result in the greatest benefit to transit and auto travel time and reliability.
  - Option 2 would require the removal of approximately 325 on-street parking spaces from Eastlake Ave E, receiving a low rating on this criterion and matching the parking removal required by Option 3. This option and Option 3 both result in less total on-street parking removal than Option 5, but they require the greatest amount of parking removal from Eastlake Ave E of the options evaluated in the detailed assessment.
  - Option 2 would not require the removal of any of the existing planted medians on Eastlake Ave E and received a high rating on this criterion.

- Option 3 – Two-Way PBL on Eastlake Ave E:
  - ***Bicycle Safety and Transit Connections:*** Option 3 received a medium rating for potential improvement to bicycle safety. While Option 3 would provide separated bicycle facilities through the full length of the study area and result in a low frequency of driveway conflicts, it would result in bicycles traveling in the opposite direction to adjacent motor vehicle traffic due to the two-way PBL layout, increasing the potential for conflicts at intersections. Option 3 would provide direct access to all eight planned RapidRide stops in the study, receiving a high rating and tying with Option 2 for the best performance of all options considered on this criterion.
  - ***City of Seattle Policy Guidance:*** Option 3 would fully implement one of the BMP's two recommendations for bicycle facilities as part of the citywide bicycle network by

providing PBLs on Eastlake Ave E from the University Bridge to the Fairview Ave N bridge. This option includes no deviations from Eastlake Ave E, receiving a high rating.

- ***Route Conditions:*** Option 3 would provide the best bicycle route conditions of the options considered based on the evaluated criteria, tied with Option 2. Option 3 would create a short, direct, and legible bicycle route in the study area that would be easy for cyclists to follow, receiving high ratings on these criteria. Option 3 received medium ratings for elevation gain and maximum slope, but Options 2, 4, and 5 also received medium ratings on these criteria, reflecting the hilly topography in the study area.
- ***Neighborhood Access:*** Option 3 would provide direct bicycle access to businesses along the full length of Eastlake Ave E through the study area, performing the highest of the options considered on this criterion. Options 2, 3, 4, and 5 would all provide direct bicycle access to the TOPS K-8 School grounds, representing an improvement over Option 1 and existing conditions.
- ***Impacts to Other Transportation Modes and Elements:*** Option 3 would minimize the interaction of bicycles with buses and auto traffic on Eastlake Ave E by providing PBLs through the full length of the study area with no deviation from Eastlake Ave E. This would result in the greatest benefit to transit and auto travel time and reliability.
  - Option 3 would require the removal of approximately 325 on-street parking spaces from Eastlake Ave E, receiving a low rating on this criterion and matching the parking removal required by Option 2. Though the two-way PBL design of Option 3 requires less total right-of-way width than the separated PBL design in Option 2, the difference is only approximately three feet and is not enough to retain any of the existing on-street parking on Eastlake Ave E. Option 2 and Option 3 would both result in less total on-street parking removal than Option 5, but they require the greatest amount of parking removal from Eastlake Ave E of the options evaluated in the detailed assessment.
  - Option 3 would require the removal of all of the existing planted medians on Eastlake Ave E because adding a two-way PBL to one side of the street requires shifting all other lanes over from their current positions within the street. Option 3 received a low rating on this criterion.

- Option 4 – Northbound PBL on Eastlake Ave E and Southbound Greenway on Yale Ave E:
  - ***Bicycle Safety and Transit Connections:*** Option 4 did not perform as well as Options 2, 3, or 5 for its benefit to bicycle safety and connections to transit, although it would represent an improvement over the existing conditions. Option 4 would provide the lowest safety improvement compared to Options 2, 3, and 5 because it has a higher frequency of driveway conflict points than routing on Eastlake Ave E and it requires SB cyclists to share a single travel lane with two-way auto traffic on E Roanoke St, Yale Ave E, and Yale Place E. Option 4 received a low rating on this criterion.
    - Option 4 would provide direct access to seven of the eight planned RapidRide stops in the study area, skipping the SB stop at E Lynn St where the bicycle route would be along Yale Ave E. This would require some cyclists to travel a longer distance or off of a AAA bicycle facility to access the SB E Lynn St stop, but Option 4 still received a

high rating on this criterion. Option 4 would represent an improvement in bicycle access to transit over existing conditions.

- ***City of Seattle Policy Guidance:*** Option 4 would implement one of the BMP's two recommendations for bicycle facilities as part of the citywide bicycle network by providing PBLs on Eastlake Ave E from the University Bridge to the Fairview Ave N bridge. However, Option 4 includes a five-block route deviation from the BMP as the bicycle facility would be routed along Yale Ave E for SB cyclists. Option 4 received a medium rating on this criterion.
- ***Route Conditions:*** Option 4 would provide an improvement in bicycle route conditions over existing conditions. This route would offer a short route between the University Bridge and the Fairview Ave N bridge in both directions, receiving a high rating. Like Options 2, 3, and 5, Option 4 received medium ratings for elevation gain and maximum slope, reflecting the hilly topography in the study area. This route would be more circuitous than Options 2 and 3, requiring SB cyclists to make several turns to divert off of Eastlake Ave E onto a parallel greenway route. This may result in some rider confusion and would require clear wayfinding signage. Option 4 received a medium rating for this criterion.
- ***Neighborhood Access:*** Option 4 would provide direct bicycle access to many businesses along Eastlake Ave E in the study area, but the bicycle facility diverts off of Eastlake Ave E for several blocks through the center of the Eastlake business district under Option 4. This criterion received a medium rating. Options 2, 3, 4, and 5 would all provide direct bicycle access to the TOPS K-8 School grounds, representing an improvement over Option 1 and existing conditions.
- ***Impacts to Other Transportation Modes and Elements:*** Option 4 would reduce the interaction of bicycles with buses and auto traffic on Eastlake Ave E by providing PBLs through most of the study area. However, it is likely that some cyclists will continue to ride SB on Eastlake Ave E in mixed traffic where the bicycle facility is along Yale Ave E. Cyclists may choose to continue on Eastlake Ave E to access businesses and RapidRide stops or prefer to travel on a shorter, flatter route. This would result in somewhat higher transit and auto travel time and lower reliability in the SB direction as vehicles and bicyclists would mix together in travel lanes, resulting in a medium rating on these criteria.
  - Option 4 would require the removal of approximately 250 on-street parking spaces from Eastlake Ave E, the lowest amount of on-street parking removal of the options considered in the detailed assessment. Option 4 received a medium rating on this criterion.
  - Option 4 would not require the removal of any of the existing planted medians on Eastlake Ave E and received a high rating on this criterion.

- Option 5 – Northbound PBL on Eastlake Ave E and Southbound PBL on Yale Ave E:
  - ***Bicycle Safety and Transit Connections:*** Option 5 performed better than Options 3 and 4 but not as well as Option 2 for its benefit to bicycle safety. Option 5 would have more driveway conflict points than Options 2 and 3, but it does not require cyclists to operate in mixed traffic, maintaining continuous PBLs along the full length of the route. Option 5

also would not require bicycles to travel against the flow of adjacent motor vehicle traffic. Option 5 received a medium rating on the safety criterion.

  - Option 5 would provide direct access to seven of the eight planned RapidRide stops in the study area, skipping the SB stop at E Lynn St where the bicycle route would divert to Yale Ave E. This would require some cyclists to travel a longer distance or off of an AAA bicycle facility to access the SB E Lynn St stop, but Option 5 still received a high rating on this criterion. Option 5 would represent an improvement in bicycle access to transit over existing conditions.

- ***City of Seattle Policy Guidance:*** Option 5 would implement one of the BMP's two recommendations for bicycle facilities as part of the citywide bicycle network by providing PBLs on Eastlake Ave E from the University Bridge to the Fairview Ave N bridge. However, Option 5 includes a five-block route deviation from the BMP as the bicycle facility would be along Yale Ave E for SB cyclists. Option 5 received a medium rating on this criterion.

- ***Route Conditions:*** Option 5 would provide an improvement in bicycle route conditions over existing conditions. This route would offer a short route between the University Bridge and the Fairview Ave N bridge in both directions, receiving a high rating. Like Options 2, 3, and 4, Option 5 received medium ratings for elevation gain and maximum slope, reflecting the hilly topography in the study area. This route would be more circuitous than Options 2 and 3, requiring SB cyclists to make several turns to divert off of Eastlake Ave E onto a parallel route. This may result in some rider confusion, although the continuous PBL would provide a clearly delineated path for cyclists. Option 5 received a medium rating for this criterion.

- ***Neighborhood Access:*** Option 5 would provide direct bicycle access to many businesses along Eastlake Ave E in the study area, but the bicycle facility diverts off of Eastlake Ave E for several blocks through the center of the Eastlake business district. This criterion received a medium rating. Options 2, 3, 4, and 5 would all provide direct bicycle access to the TOPS K-8 School grounds, representing an improvement over Option 1 and existing conditions.

- ***Impacts to Other Transportation Modes and Elements:*** Option 5 would reduce the interaction of bicycles with buses and auto traffic on Eastlake Ave E by providing PBLs through most of the study area. However, it is likely that some cyclists will continue to ride SB on Eastlake Ave E in mixed traffic when the bicycle facility is along Yale Ave E. Cyclists may choose to continue on Eastlake Ave E to access businesses and RapidRide stops or prefer to travel on a shorter, flatter route. This would result in somewhat higher transit and auto travel time and lower reliability in the SB direction as vehicles and bicyclists would mix together in travel lanes, resulting in a medium rating on these criteria.

  - Option 5 would require the removal of approximately 375 on-street parking spaces in total, including 250 spaces from Eastlake Ave E. This option had the highest total amount of on-street parking removed of the options considered in the detailed assessment, although it would require removing fewer parking spaces from Eastlake Ave E than Options 2 and 3. Option 5 received a low rating for on-street parking impact.

Option 5 would not require the removal of any of the existing planted medians on Eastlake Ave E and received a high rating on this criterion.

6.2.3 Detailed Evaluation Results Summary

Option 2, which would provide continuous PBLs on Eastlake Ave E within the study area, performed the best of the four bicycle facility concepts advanced to the detailed assessment. Option 2 received a high rating on 11 of the 14 evaluation criteria and a medium rating on two criteria. Option 2 scored well on most criteria in this detailed assessment because it would provide a high level of safety improvement for bicycles, a bicycle facility adjacent to all transit stops in the study area, a level and direct bicycle route, a direct bicycle access to most businesses in the study area and have a positive impact on traffic and transit operations in the Eastlake neighborhood. Option 2 received a low rating on one criterion, impact to on-street parking, matching the ratings received by Options 3 and 5. No option advanced to the detailed assessment received a high rating for impact to on-street parking as all of the options in the detailed assessment would remove parking in the Eastlake neighborhood.

Option 3, which would also provide continuous PBLs through the study area, performed similarly to Option 2 overall. However, Option 3 received a lower rating than Option 2 on route safety because the two-way PBL layout would result in bicycles traveling in the opposite direction of adjacent motor vehicles. Option 3 also received a lower rating on impact to planted medians, as the two-way PBL would likely require the removal of all existing planted medians on Eastlake Ave E in the study area. Option 3 would result in the same parking impact as Option 2 and did not receive a higher rating than Option 2 on any of the criteria considered.

Options 4 and 5 did not perform as well as Options 2 and 3 in the detailed assessment, with each receiving five high ratings, eight medium ratings, and one low rating. Option 4 performed the best on impact to on-street parking, receiving a medium rating, but performed worst on route safety. Option 5 would result in the greatest total impact to on-street parking, requiring the removal of an estimated 375 parking spaces. Both Options 4 and 5 received lower scores than Options 2 and 3 on several other criteria, including consistency with the BMP, bicycle route legibility, access to businesses, and impact to transit and traffic performance.

Table 6-4. Detailed Assessment Results

CRITERION	OPTION 1: NO BUILD	OPTION 2: PBLs ON EASTLAKE	OPTION 3: TWO-WAY PBL ON EASTLAKE	OPTION 4: NB PBL ON EASTLAKE, SB GREENWAY ON YALE	OPTION 5: NB PBL ON EASTLAKE, SB PBL ON YALE
BICYCLE SAFETY AND CONNECTION TO TRANSIT					
Route Safety	No change from existing conditions	**High** – Few conflict points, bicycle and motor vehicles separated, bicycles travel in the same direction as adjacent motor vehicle traffic	**Medium** – Few conflict points, bicycles and motor vehicles separated, bicycles travel in the opposite direction of adjacent motor vehicle traffic	**Low** – Many conflict points, no separation between bicycles and motor vehicles, bicycles travel in the opposite direction of adjacent motor vehicle traffic on greenway segment	**Medium** – Many conflict points, bicycles and motor vehicles separated, bicycles travel in the same direction as adjacent motor vehicle traffic
Bicycle Connection to Transit	Does not provide a signed or designated bicycle route to any transit stops in study area	**High** – Direct bicycle connection to 8 stops	**High** – Direct bicycle connection to 8 stops	**High** – Direct bicycle connection to 7 stops	**High** – Direct bicycle connection to 7 stops

Table 6-4. Detailed Assessment Results

CRITERION	OPTION 1: NO BUILD	OPTION 2: PBLs ON EASTLAKE	OPTION 3: TWO-WAY PBL ON EASTLAKE	OPTION 4: NB PBL ON EASTLAKE, SB GREENWAY ON YALE	OPTION 5: NB PBL ON EASTLAKE, SB PBL ON YALE
CITY OF SEATTLE POLICY GUIDANCE					
Consistency with Bicycle Master Plan	Does not implement any BMP recommendations	● **High** – Matches BMP recommendation on Eastlake Ave E with no deviations	● **High** – Matches BMP recommendation on Eastlake Ave E with no deviations	◐ **Medium** – Matches BMP recommendation on Eastlake Ave E with partial one-block deviation	◐ **Medium** – Matches BMP recommendation on Eastlake Ave E with partial one-block deviation
ROUTE CONDITIONS					
Route Distance	• Via Eastlake Ave E: 1.42 miles each way (2.84 miles total) • Via Cheshiahud Lake Union Loop: 1.67 miles each way (3.34 miles total)	● **High** – 1.42 miles NB, 1.42 miles SB, 2.84 miles total	● **High** – 1.42 miles NB, 1.42 miles SB, 2.84 miles total	● **High** – 1.42 miles NB, 1.51 miles SB, 2.93 miles total	● **High** – 1.42 miles NB, 1.51 miles SB, 2.93 miles total

Table 6-4. Detailed Assessment Results

CRITERION	OPTION 1: NO BUILD	OPTION 2: PBLs ON EASTLAKE	OPTION 3: TWO-WAY PBL ON EASTLAKE	OPTION 4: NB PBL ON EASTLAKE, SB GREENWAY ON YALE	OPTION 5: NB PBL ON EASTLAKE, SB PBL ON YALE
Elevation Gain	• Via Eastlake Ave E: +49 feet NB, +35 feet SB, +85 feet total • Via Cheshiahud Lake Union Loop: +82 feet NB, +56 feet SB, +138 feet total	**Medium** – +49 feet NB, +36 feet SB, +85 feet total	**Medium** – +49 feet NB, +36 feet SB, +85 feet total	**Medium** – +49 feet NB, +33 feet SB, +82 feet total	**Medium** – +49 feet NB, +33 feet SB, +82 feet total
Maximum Uphill Slope	• Via Eastlake Ave E: 5% max uphill slope (encountered NB) • Via Cheshiahud Lake Union Loop: 15% max uphill slope (encountered SB)	**Medium** – 5% max uphill slope (encountered NB)	**Medium** – 5% max uphill slope (encountered NB)	**Medium** – 6% max uphill slope (encountered SB)	**Medium** – 6% max uphill slope (encountered SB)

Table 6-4. Detailed Assessment Results

CRITERION	OPTION 1: NO BUILD	OPTION 2: PBLs ON EASTLAKE	OPTION 3: TWO-WAY PBL ON EASTLAKE	OPTION 4: NB PBL ON EASTLAKE, SB GREENWAY ON YALE	OPTION 5: NB PBL ON EASTLAKE, SB PBL ON YALE
Route Legibility and Directness	• Via Eastlake Ave E: 1 turn NB, 1 turn SB, 2 turns total • Via Cheshiahud Lake Union Loop: 8 turns NB, 8 turns SB, 16 turns total	**High** – 1 turn NB, 1 turn SB, 2 turns total	**High** – 1 turn NB, 1 turn SB, 2 turns total	**Medium** – 1 turn NB, 4 turns SB, 5 turns total	**Medium** – 1 turn NB, 4 turns SB, 5 turns total
Number of Arterial Crossings Required	• Via Eastlake Ave E: 1 crossing NB, 0 crossings SB, 1 crossing total • Via Cheshiahud Lake Union Loop: 2 crossings NB, 0 crossings SB, 2 crossings total	**High** – 1 crossing NB, 0 crossings SB, 1 crossing total	**High** – 1 crossing NB, 0 crossings SB, 1 crossing total	**High** – 1 crossing NB, 0 crossings SB, 1 crossing total	**High** – 1 crossing NB, 0 crossings SB, 1 crossing total

Table 6-4. Detailed Assessment Results

CRITERION	OPTION 1: NO BUILD	OPTION 2: PBLs ON EASTLAKE	OPTION 3: TWO-WAY PBL ON EASTLAKE	OPTION 4: NB PBL ON EASTLAKE, SB GREENWAY ON YALE	OPTION 5: NB PBL ON EASTLAKE, SB PBL ON YALE
NEIGHBORHOOD ACCESS					
Access to Businesses	Does not provide a signed or designated bicycle route to Eastlake businesses	**High** – Direct bicycle access to Eastlake businesses in both directions	**High** – Direct bicycle access to Eastlake businesses in both directions	**Medium** – Direct bicycle access to Eastlake businesses in one direction (NB)	**Medium** – Direct bicycle access to Eastlake businesses in one direction (NB)
Access to Schools (Supports Safe Routes to Schools)	Does not provide a signed or designated bicycle route to TOPS K-8 School grounds	**High** – Direct bicycle access to TOPS K-8 School grounds in both directions	**High** – Direct bicycle access to TOPS K-8 School grounds in both directions	**High** – Direct bicycle access to TOPS K-8 School grounds in both directions	**High** – Direct bicycle access to TOPS K-8 School grounds in both directions
IMPACT TO OTHER TRANSPORTATION MODES AND ELEMENTS					
Transit Performance	Does not reduce interaction of buses with bicycles or parallel parking cars	**High** – Minimizes interaction of buses with bicycles and parallel parking cars over full length of study area	**High** – Minimizes interaction of buses with bicycles and parallel parking cars over full length of study area	**Medium** – Minimizes interaction of buses with bicycles and parallel parking cars over partial length of study area	**Medium** – Minimizes interaction of buses with bicycles and parallel parking cars over partial length of study area

Table 6-4. Detailed Assessment Results

CRITERION	OPTION 1: NO BUILD	OPTION 2: PBLs ON EASTLAKE	OPTION 3: TWO-WAY PBL ON EASTLAKE	OPTION 4: NB PBL ON EASTLAKE, SB GREENWAY ON YALE	OPTION 5: NB PBL ON EASTLAKE, SB PBL ON YALE
Auto Traffic Performance	Does not reduce interaction of general-purpose vehicles with bicycles or parallel parking cars	● **High** – Minimizes interaction of general-purpose vehicles with bicycles and parallel parking cars over full length of study area	● **High** – Minimizes interaction of general-purpose vehicles with bicycles and parallel parking cars over full length of study area	◐ **Medium** – Minimizes interaction of general-purpose vehicles with bicycles and parallel parking cars over partial length of study area	◐ **Medium** – Minimizes interaction of general-purpose vehicles with bicycles and parallel parking cars over partial length of study area
On-Street Parking	Does not require removal of any parking spaces in study area	○ **Low** – 325 parking spaces removed on Eastlake Ave E	○ **Low** – 325 parking spaces removed on Eastlake Ave E	◐ **Medium** – 250 parking spaces removed on Eastlake Ave E	○ **Low** – 375 total parking spaces removed (250 spaces on Eastlake Ave E, 110 spaces on Yale Ave E, 15 spaces on E Roanoke St)
Planted Medians	Does not require any removal of planted medians	● **High** – Does not require any removal of planted medians	○ **Low** –Requires removal of all planted medians in study area	● **High** – Does not require any removal of planted medians	● **High** – Does not require any removal of planted medians
TOTAL SCORES					
● **High**	N/A	**11**	**9**	**5**	**5**

Table 6-4. Detailed Assessment Results

CRITERION		OPTION 1: NO BUILD	OPTION 2: PBLs ON EASTLAKE	OPTION 3: TWO-WAY PBL ON EASTLAKE	OPTION 4: NB PBL ON EASTLAKE, SB GREENWAY ON YALE	OPTION 5: NB PBL ON EASTLAKE, SB PBL ON YALE
◐	**Medium**		**2**	**3**	**8**	**8**
○	**Low**		**1**	**2**	**1**	**1**

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Appendix F
2021/2024 Travel Demand Forecast Comparison

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DRAFT MEMORANDUM
RAPIDRIDE ROOSEVELT PROJECT – EVALUATION OF CHANGE OF OPENING YEAR FROM 2021 TO 2024

PREPARED FOR:	City of Seattle
COPY TO:	Craig Grandstrom
PREPARED BY:	Patrick McGrath
DATE:	November 9, 2018

EXECUTIVE SUMMARY

The purpose of this memo is to document the analysis results comparing year 2021 transportation data to the current RapidRide Roosevelt 2024 opening year. This effort was conducted because at the onset of the analysis the project was assuming a year of opening of 2021. This assessment's purpose is to understand if there are noticeable differences in the forecasts and background transportation assumptions that would affect the results in the Transportation Technical Report. Two assessments were conducted: a review of the traffic forecasts and a review of transportation project/network assumptions.

The sensitivity test found an approximately 3% difference in traffic volumes in the study area between 2021 and 2024, which is within the 10% threshold for acceptable model variation per Federal Highway Administration guidance. Additionally, a design year of 2040 is included in the Transportation Technical Report and provides a more conservative analysis with higher land use and traffic growth than in 2024.

A review of the network assumption revealed no projects within or adjacent to the project area that would have an influence on the transportation system or forecasts. Expanding more broadly, one project was found adjacent to the City of Seattle that was not in the 2021 network but would be in a 2024 network if one were to be developed. This project is in the City of Shoreline and therefore is not expected to influence analysis results in the RapidRide Roosevelt project area.

In summary, the 2021 model results are not expected to be noticeably different from 2024 results and would not affect the results, conclusions or mitigation presented in the Transportation Technical Report. Therefore, this analysis is considered acceptable for analyzing and documenting the transportation impacts of the RapidRide Roosevelt project in the project's opening year of 2024.

INTRODUCTION

When the supporting analysis for the Roosevelt RapidRide Transportation Technical Report started to be developed in 2017 the project was scheduled to open for service in 2021. Since then the project schedule has changed and the anticipated opening year is now 2024. This change has the potential to affect the analysis results since several traffic operations-related evaluation measures used the results of travel demand forecasting as an input (e.g. traffic volumes, travel times, and intersection level of service), and the original model run used trip tables and network configuration assumptions consistent with a 2021 opening year. To evaluate whether the schedule change would substantially impact the results, two reviews were conducted.

First, a sensitivity test was performed to determine the degree of change in traffic volumes as forecasted by the model for 2021 and 2024 and whether this change is significant. Second, the list of assumed future transportation projects and system assumed into the 2021 model was reviewed to determine whether there would be any changes to these assumptions between 2021 and 2024 that could influence the analysis and results.

VOLUME SENSITIVITY TEST

Sensitivity Test

The Puget Sound Regional Council's (PSRC) travel demand model was used for the project. This is a regional EMME-based model that was developed by PSRC for three time horizons: 2014, 2025, and 2040. In order to model the Roosevelt RapidRide's original 2021 opening year, trip tables for 2021 were generated by interpolating between the existing and 2025 tables. To evaluate the magnitude of change in travel demand between 2021 and 2024 this process was repeated to create 2024 trip tables.

After re-running the model's trip assignments, 2024 forecasts were compared to 2021 forecasts at:

1) A ½ mile buffer around the project area
2) two screenlines on Interstate 5 at NE 45th St, in the north half of the project, and I-5 at Mercer St in the south half.

I-5 was selected for this analysis because as a major highway facility it is less susceptible to model data "noise": the irregular and unrealistic distribution of forecasted traffic volumes at the local street scale that can occur in regional travel demand forecast results. Since I-5 is within the project area, these changes can be used as a proxy for overall traffic volume changes in the vicinity of the project area.

As shown in both Figure 1 and Table 1, the additional three years between 2021 to 2024 results in an 3% or less increase in traffic volumes within the project area.

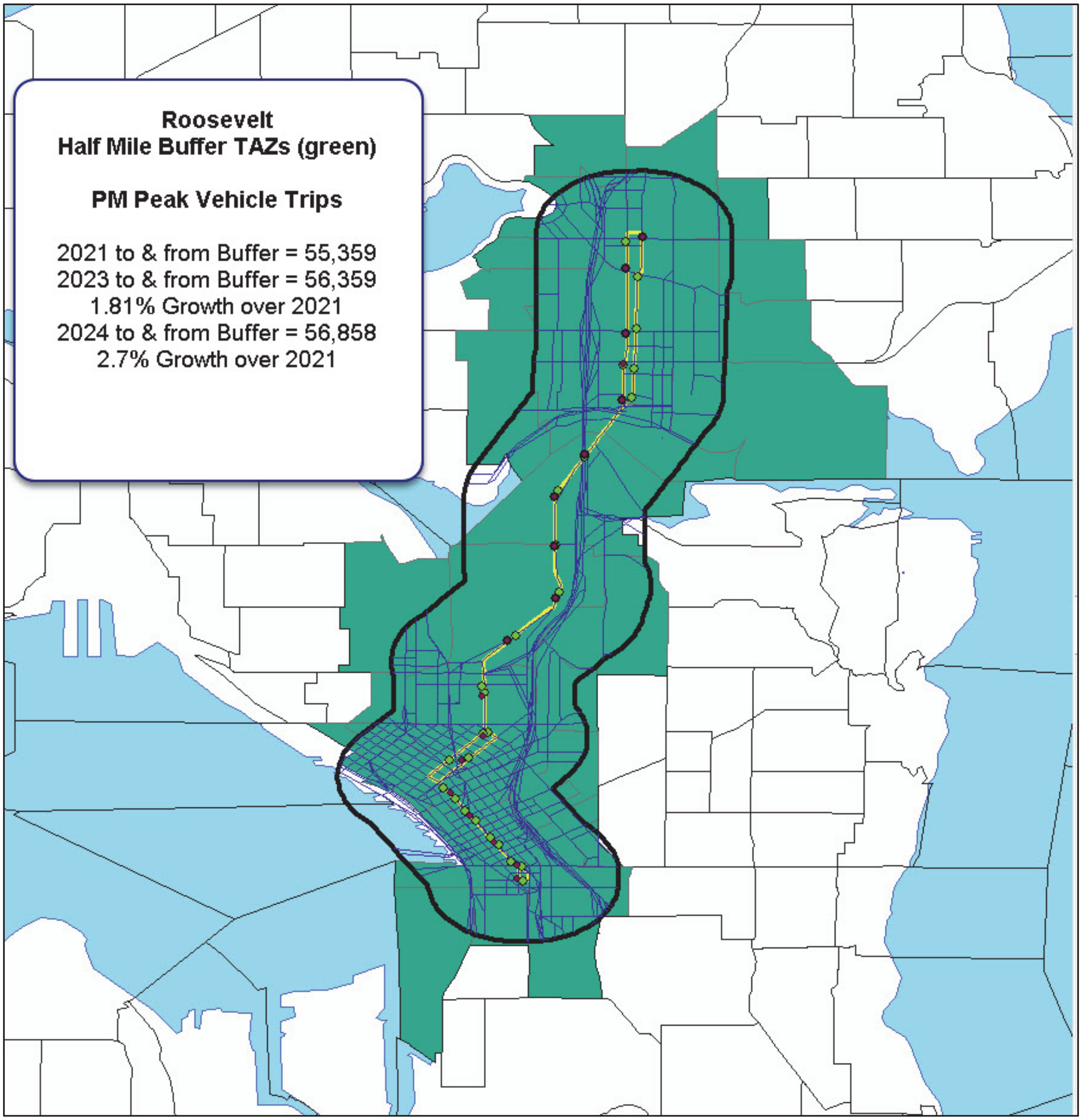

Figure 1.PM Peak Hour Vehicle Trips (1/2 Mile Buffer)

Table 1. PM Peak Hour Volumes at I-5 Screenlines

LOCATION	EXISTING (2014)	2021 NO BUILD	2024 NO BUILD	2024-2021 DIFFERENCE (#)	2024-2021 DIFFERENCE (PERCENT CHANGE)
I-5 north NE 45th St	18,548	21,947	22,606	659	3%
I-5 north of Mercer St	20,776	26,115	26,759	644	2.5%

Because travel demand forecast models are imperfect, the acceptability of their results is judged based on how far they diverge from observation. Federal Highway Administration guidance[1] states that when calibrating a model, a variation of 10% or less between a model forecast and observed traffic counts is “preferable.” This threshold provides a useful benchmark when evaluating the predicated change between 2021 and 2024 volumes. The 3% change shown in Table 1 is well within a 10% threshold and is therefore comparable to the acceptable levels of variation that one would expect when developing any travel demand forecast model. Therefore, the year of opening adjustment to 2024 is not considered a substantial change to the transportation data that would alter the results of the RapidRide Roosevelt transportation technical analysis.

It should also be noted that the Transportation Technical Report includes two future years; a year of opening of 2024 and a design year of 2040. By year 2040, the land use and transportation system is expected to incur additional growth beyond 2024 and is the more conservative analysis when compared to year 2024 data, therefore the Transportation Technical Report, by documenting year 2040 conditions already assumes the most conservative analysis.

NETWORK ASSUMPTIONS

To create the 2021 model transportation network, future transportation projects that are assumed to be completed between 2021 and 2025 were removed from the 2025 network provided by PSRC[2]. Based on this effort to create a year 2021 transportation network, many transportation projects within the City of Seattle are assumed to be built by year 2021. This includes WSDOT’s Alaska Way Viaduct (SR 99) Replacement Program and SR 520 Bridge Replacement and Sound Transit’s HOV Program and Northgate Link light rail extensions to Roosevelt station. With the project modified to open by 2024, a review was conducted to confirm whether there are projects with anticipated completion dates between 2022 to 2024 that could affect the transportation results. These projects with a completion date between 2022 to 2024 were omitted from the 2021 network.

The PSRC project list was reviewed for any roadway capital projects in or adjacent to the project corridor that could influence the transportation analysis and results in the Transportation Technical Report. From the PSRC project list there are no projects with an anticipated opening date between 2022 to 2024 within or adjacent to the project corridor. Expanding this review more broadly revealed one project in the City of Shoreline with a anticipated completion date between 2021 and 2024 (see Table 2).

[1] https://www.fhwa.dot.gov/planning/tmip/publications/other_reports/validation_and_reasonableness_2010/fhwahep10042.pdf

[2] Future highway projects are based on the PSRC T2040 Regional Capacity Projects List, adopted 2015

Table 2. T2040 Regional Capacity Projects (completion year 2021-2024) in or adjacent to the City of Seattle

SPONSOR	T2040 PROJECT ID	PROJECT TITLE	ESTIMATED COMPLETION DATE	DESCRIPTION
Shoreline	4434	145th Street Improvements	2023	• Improvements to vehicular capacity, safety and traffic flow, transit speed and reliability and accessibility to I-5 and the future light rail station. • Upgrade existing substandard, non-ADA-compliant sidewalks and construct new sidewalk for a continuous system along the corridor • Install continuous illumination and landscaping, bus stop improvements. • Upgrade existing stormwater management system to improve water quality and provide flow control.

The 145th Street Improvements project is a multimodal corridor safety and access project that would provide enhanced pedestrian, bicycle, and transit facilities, as well as intersection and roadway widening along this corridor. This project is approximately 5 miles from the RapidRide Roosevelt project and is focused on local access and circulation. It is not expected to affect the results of transportation analysis in the RapidRide Roosevelt study area. Other projects could be built within the 2022 to 2024 timeframe but are not reflected in adopted capital plans and are not reasonably foreseeable at this time.

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Appendix G
Existing Pedestrian and Bicycle Volumes

Table G-1. Existing Pedestrian and Bicycle Volumes (2017, PM Peak)

INTERSECTION	PEDESTRIANS	BICYCLES
Roosevelt Way NE & NE 66 St	172	9
Roosevelt Way NE & NE 67th St	122	7
Roosevelt Way NE & NE 68th St	95	7
12th Ave NE & NE 68th St	51	22
Roosevelt Way NE & NE 65th St	410	7
12th Ave NE & NE 65th St	247	27
Roosevelt Way NE & NE 64th St	246	8
Roosevelt Way NE & NE Ravenna Blvd Westbound	142	73
12th Ave NE & NE Ravenna Blvd Westbound	83	89
Roosevelt Way NE & NE 55th St	no data	no data
Roosevelt Way NE & NE 50th St	289	25
NE 50th St & 11th Ave NE	299	73
Roosevelt Way NE & NE 47th ST	320	31
11th Ave NE & NE 47th ST	323	54
Roosevelt Way NE & NE 45th St	717	20
11th Ave NE & NE 45th St	548	75
11th Ave NE & NE 43rd St	230	76
11th Ave NE & NE 42nd St	359	72
Roosevelt Way NE & NE 42nd St (north leg)	407	13
Roosevelt Way NE & 42nd St (south leg)	187	34
11th Ave NE & NE Campus S Pkwy & Roosevelt Way NE	57	98
Eastlake Ave E & Fuhrman Ave E	147	271
Eastlake Ave E & Harvard Ave E	40	137
Eastlake Ave E & E Allison St	124	103
Eastlake Ave E & E Hamlin St	180	123
Eastlake Ave E & E Roanoke St	106	68
Eastlake Ave E & E Louisa St	207	94

INTERSECTION	PEDESTRIANS	BICYCLES
Eastlake Ave E & E Lynn St	226	93
Eastlake Ave E & E Boston St	135	92
Eastlake Ave E & E Howe St/E Yale St	78	114
Eastlake Ave E & E Blaine St	101	106
Eastlake Ave E & E Garfield St	190	72
Fairview Ave N & Eastlake Ave E/ E Galer St	191	88
Fairview Ave N & Yale Ave	103	114
Fairview Ave N & Ward St	122	32
Fairview Ave N & Aloha St	337	26
Fairview Ave N & Valley St	317	44
Fairview Ave N & Mercer St	426	22
Fairview Ave N & Republican St	842	32
Fairview Ave N & Harrison St	734	24
Fairview Ave N & Thomas St	702	24
Fairview Ave N & John St	571	32
Fairview Ave & Denny Way	1,302	28
Fairview Ave & Boren Ave	520	2
Boren Ave & Stewart St	752	31
Terry Ave & Virginia St	749	15
Terry Ave & Stewart St	1,042	46
Ninth Ave & Virginia St	866	42
Ninth Ave & Stewart St	1,280	92
Eighth Ave & Virginia St	1,447	42
Eighth Ave & Stewart St	1,257	71
Seventh Ave & Virginia St	1,754	36
Seventh Ave & Stewart St	1,722	64
Westlake Ave & Virginia St	970	41
Sixth Ave & Virginia St	1,466	76

INTERSECTION	PEDESTRIANS	BICYCLES
Sixth Ave & Stewart St	1,917	120
Westlake Ave & Stewart St	864	43
Fifth Ave & Virginia St	947	30
Fifth Ave & Stewart St	1,570	52
Fourth Ave & Virginia St	1,442	67
Fourth Ave & Stewart St	1,442	92
Third Ave & Virginia St	1,013	29
Third Ave & Stewart St	2,247	34
Second Ave & Virginia St	1,033	27
Second Ave & Stewart St	1,401	46
6th Ave & Westlake Ave	1,436	51
7th Ave & Westlake Ave	670	13

Source: 2017 Field Counts