Ballard Interbay Regional Transportation System (BIRT) Study

Appendix A: Public Information Plan

November 2020

Seattle Department of Transportation

BACKGROUND

Purpose

The Washington State Legislature asked SDOT to develop a report on how to improve travel for people and goods in Ballard-Interbay.

Figure 1 Ballard-Interbay Regional Transportation Study Project Information Flyer

Background

In 2019 the Washington State Legislature appropriated funding for the Ballard-Interbay Regional Transportation System (BIRT) project, which directs SDOT to develop a report on how to improve mobility for freight and people in the area.

The report must provide recommendations on how to maintain the current and future capacities of the Ballard and Magnolia bridges and include agency partners in the planning process. A report to the state legislature is due by November 1, 2020. (See ESHB 1160 - Section 311(18)(b), page 5.)

The City of Seattle's Department of Transportation completed a Magnolia bridge study in June 2019 and is currently working on a Ballard bridge study. The analysis and findings from these studies will inform the work of BIRT, as will many other previous and current studies and plans. This is not a bridge design or engineering project. It is a multimodal, whole systems, transportation study of the Ballard-Interbay area taking multiple future agency projects, and industrial/residential growth into consideration.

2019 Washington State Legislative Language

ESHB 1160 – Section 311(18)(b)

"Funding in this subsection is provided solely for the City of Seattle to develop a plan and report for the Ballard-Interbay Regional Transportation System project to **improve mobility for people and freight**. The plan must be developed in coordination and partnership with entities including but not limited to the City of Seattle, King County, the Port of Seattle, Sound Transit, the Washington State Military Department for the Seattle armory, and the Washington State Department of Transportation.

The plan must **examine replacement of the Ballard Bridge and the Magnolia Bridge**, which was damaged in the 2001 Nisqually earthquake. The city must provide a report on the plan that includes **recommendations to the Seattle City Council, King County Council, and the transportation committees of the legislature by November 1, 2020.** The report must include recommendations on how to **maintain the current and future capacities** of the Magnolia and Ballard bridges, an overview and analysis of all plans between 2010 and 2020 that examine how to replace the Magnolia bridge, and recommendations on a **timeline for constructing new Magnolia and Ballard bridges**."

KEY MESSAGES

Project Overview

The Ballard-Interbay Regional Transportation System (BIRT) study, is a technical transportation study that will evaluate and recommend future improvements for a safe and reliable transportation system in the Ballard and Interbay neighborhoods. The study will address all types of travel and consider the replacement of the Ballard and Magnolia bridges in the context of the broader transportation system, including regional access and connections for people and goods.

A final report will be prepared and delivered to the Washington State Legislature with recommendations including a timeline for replacing the Ballard and Magnolia bridges. The report will also address ways to fill gaps in the mobility system, and recommendations will have associated plans and next steps. Funding is not allocated to, nor adequate for, the design or engineering of the bridges.

Key scope elements include the following:

- Review existing plans and previous studies;
- Forecast and assess multimodal needs and integration;
- Analyze impacts and benefits of bridges and system improvements;
- Develop bridge replacement timeline and funding strategy; and
- Report to Washington State Legislature.

Who?

The scope for the BIRT study is defined by the Washington State Legislature. It will be guided by an Interagency Team as dictated by the legislation. SDOT is leading this project in collaboration with the City of Seattle, Port of Seattle (Port), Sound Transit, King County Metro, Washington State Department of Transportation (WSDOT), and the Washington State Military.

When?

This study is a 10-month process that began in early 2020 and ends with a report by November 1, 2020.

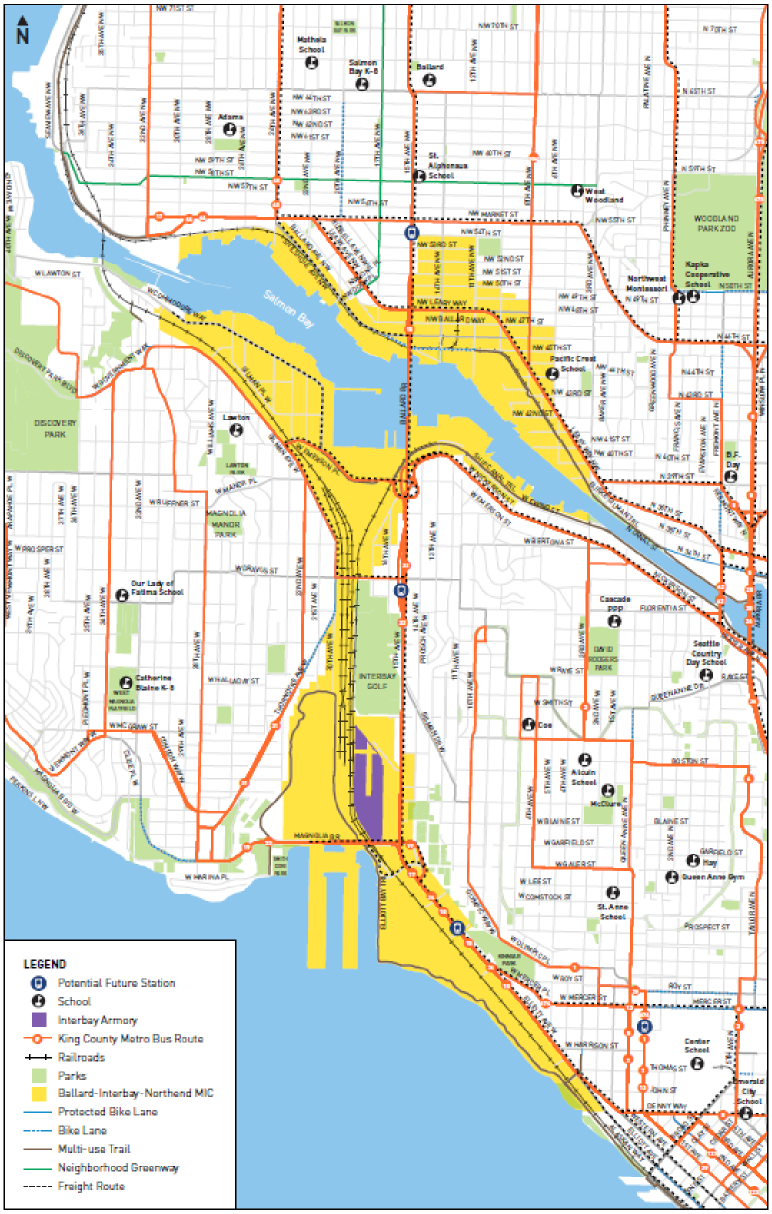
Where?

Ballard-Interbay is a dynamic area with employment and residential growth, maritime and industrial uses, local and regional freight routes, and an evolving transportation system that includes three future Sound Transit light rail stations. The primary area of study is illustrated on the map in Figure 2 and Appendix A, and the Manufacturing and Industrial Center is highlighted in yellow. Personal and commercial transportation needs are not only localized—the study will take into account the ways local changes and projects affect travel more broadly, including travel on regional systems such as SR 99 and I-5.

Why?

The 2019 Washington State legislature allocated funds for the BIRT project. The elements in the scope of work for the study and the timeline for its completion are based on the legislative language above.

Figure 2 Study Area Map



FACILITATION & ENGAGEMENT STRATEGY

Community engagement will be limited, targeted, and occur at key intervals during the study process to keep the community apprised of the work and progress of the study. Stakeholder engagement tactics for the study include three rounds of public meetings, five or six Interagency Team meetings, briefings with elected officials, and regular website and social media updates.

Public Meetings

Three rounds of public meetings will be held at the beginning, middle, and end of the project:

- **Community Kickoff Meetings** (two meetings, January/February 2020): Project Kickoff and Overview
- **Mid-Project Public Meeting** (one meeting, June 2020): Review Draft Project Lists and Traffic Management Strategies
- **Final Public Meetings** (two meetings, October 2020): Review Draft Report

Interagency Team Meetings

Stakeholders from SDOT, Port of Seattle, WSDOT, Sound Transit, King County Metro, the Washington State Military, and the Washington State Freight Mobility Strategic Investment Board (FMSIB) will form the Interagency Team (IAT). The IAT will meet approximately every other month (five or six meetings) over the course of the project; three of the meetings will be open for public attendance. The role of the IAT is to advise the project team at critical junctures, review study documents and findings, and elevate critical information to leadership or the appropriate colleagues in their organizations. Meetings will be scheduled around key project milestones:

- **Meeting #1 (January 2020):** Project Introduction, Roles and Responsibilities of the IAT, Scope of Work and Schedule, Project Goal Setting
- **Meeting #2 (March 2020):** Plan Review and Background, Existing Conditions Summary, Baseline Assumptions for Analysis
- ***Meeting #3 (May 2020):** Multimodal Evaluation Framework, Traffic Forecast Results and Alternatives, Draft Project and Strategy List
- ***Meeting #4 (July 2020):** Technical Findings and Preliminary Recommendations, Draft Bridge Replacement Timelines, Draft Traffic Management Plans
- ***Meeting #5 (September 2020):** Draft Recommendations, Final Timeline and Traffic Management Plans, Draft Funding Strategy
- **Meeting #6 (October 2020, if needed):** Final Review of Draft Report

**Indicates key IAT meetings open to the public*

Elected Official Meetings

BIRT will include briefings with elected officials including the Seattle Mayor, Seattle City Council, Washington State Legislature, Port Commission, and King County Council. The Mayor's Office will be briefed on study progress at key intervals in the project.

Project Website & Social Media Updates

SDOT will maintain and regularly update the Ballard-Interbay Regional Transportation System study website as the project progresses to provide full transparency and updates about the project to all stakeholders. Major deliverables and meeting notes, as well as community outreach opportunities, will be posted on the website. Listserv notifications will accompany website updates at key points in the project. Website content will include:

- The project schedule and workplan outline to provide website visitors a clear sense of the project scope and timeline
- Public meeting presentations and meeting notes within a month of meetings
- Interagency Team agendas, meeting materials, and meeting summaries within a month of meetings
- Key technical memoranda and a draft and final version of the BIRT study report

CORE PROJECT TEAM

Project Managers

Diane Wiatr, Principal Planner, Diane.Wiatr@seattle.gov

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PUBLIC OUTREACH SUMMARY

Objectives

- The public and stakeholders have a clear sense of the project scope and timeline.
- The engagement tools provide full transparency and updates about the project to all stakeholders.
- Targeted community engagement activities at key intervals during the study process keep the community apprised of the work and progress of the study.
- Interagency and community stakeholders are engaged to provide local knowledge and input at key project milestones.
- Targeted outreach to maritime, industrial, and freight employees will achieve equitable engagement outcomes.

Quantifiable Measurements

- Number of attendees at public meetings and IAT meetings relative to notifications and invitations
- Number and duration of visits to the project website
- Number of comments submitted via mail, email, in person, or other methods
- Number of small group and community-specific meetings, including targeted outreach to community stakeholders highlighted by the Racial Equity Toolkit
- Number of elected official meetings and briefings
- Number of IAT members at meetings and level of engagement by IAT members
- Number of presentations to SDOT modal boards

Anticipated Concerns

(More information on anticipated concerns)

- Magnolia and Ballard Bridge replacement, maintenance, and possible closure
- Traffic and access impacts during bridge maintenance and/or construction
- Freight mobility, access, =and connections to regional highway facilities

- Mobility needs of the seafood processing and fishing-related industry and small businesses
- Safety for all people traveling along the corridor, including walk, bike, auto, freight, and transit access
- Transit speed and reliability, especially for Rapid Ride corridors
- Frustration with planning process and desire for tangible outcomes
- Limited public involvement in decision-making and few touchpoints in a short timeframe
- Communication and coordination between interagency and interdepartmental teams such as between BIRT and Sound Transit 3 (ST3)
- Current and anticipated impacts of Expedia Campus employee travel on the transportation network

Media & Stakeholders

- Travelers to, through, and within Ballard, Interbay, and surrounding neighborhoods
- Industrial businesses, including maritime and manufacturing
- Freight stakeholders (trucks, ships, rail), including the Port of Seattle
- Neighborhood groups and residents
- City advisory boards/special interest groups
- *Agency Partners per Legislation:*
- Washington State Department of Transportation (WSDOT)
- King County
- Port of Seattle
- Sound Transit
- Washington Military Department
- Seattle Department of Transportation
- *Other Identified Partners:*
- Freight Mobility Strategy Investment Board (FMSIB)
- Department of Commerce
- Seattle School District
- *Media:*
- Project website
- Online media

Public Project Contact

Diane Wiatr

Email: Diane.Wiatr@seattle.gov

Demographics

Zip codes: 98199, 98119, 98107

Census tracts[1]**:** 32, 33, 34, 47, 48, 56, 57, 58.01, 58.02, 59, 69, 71

[1] Census 2010, Seattle WA. Census Tracts and Zip Code Boundaries.
https://www.seattle.gov/Documents/Departments/OPCD/Demographics/GeographicFilesandMaps/2010CensusTractsandZipCodeBoundaries.pdf

Translation needs: None

Budget

Total funds: $505,058

Funding sources: Washington State Legislature

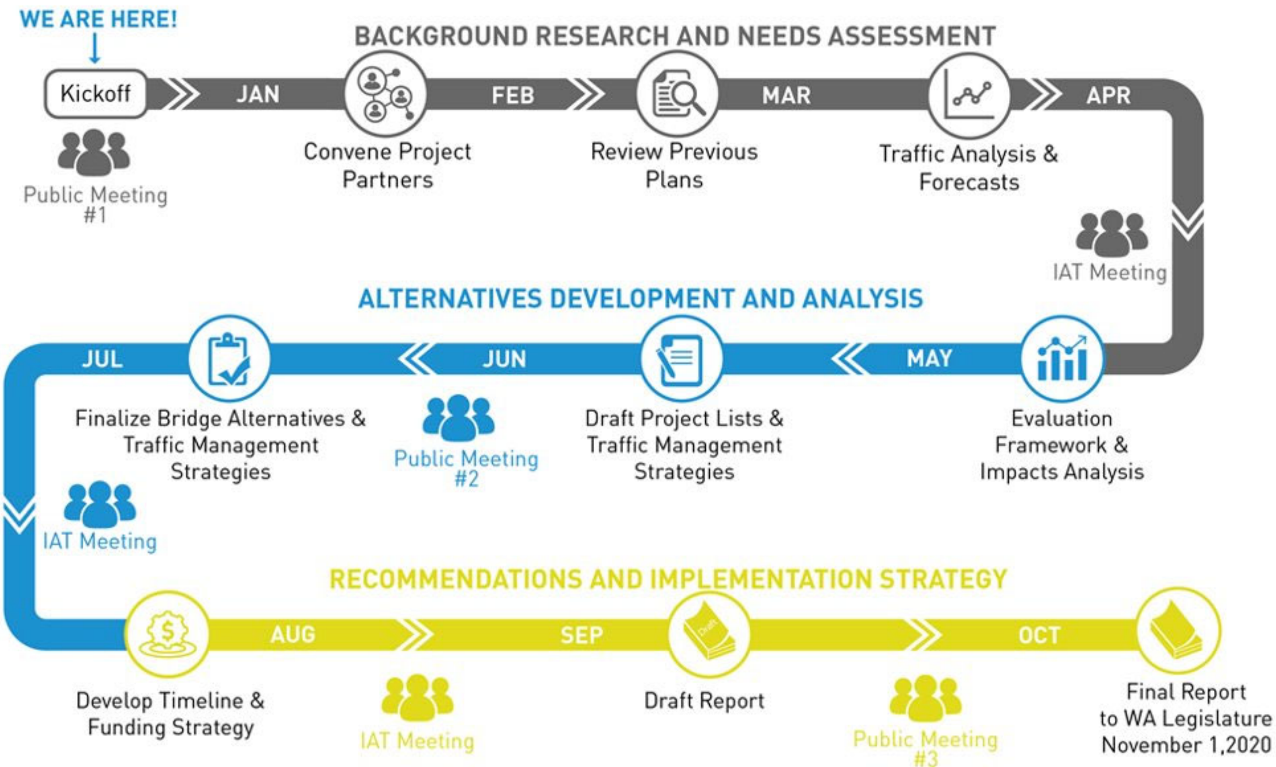
Funding dedicated to outreach/engagement: $22,000

Planned Major Outreach Activities

(More information on the activities log; more information on IOPE elements)

When	What	Why	Complete
Jan 23, 2020	**Interagency Team Meeting #1**	Project Introduction, Roles and Responsibilities of the IAT, Scope of Work and Schedule, Project Goal Setting	☒
Jan 28, 2020	**Ballard Community Meeting #1**	Project Kickoff and Overview: Project Purpose, Goals, and Timeline	☒
Feb 3, 2020	**Magnolia Community Meeting #1**	Project Kickoff and Overview: Project Purpose, Goals, and Timeline	☒
March 2020	**Interagency Team Meeting #2**	Plan Review and Background, Existing Conditions Summary, Baseline Assumptions for Analysis	☒
May 2020	**Interagency Team Meeting #3** **Meeting open to public	Multimodal Evaluation Framework, Traffic Forecast Results and Alternatives, Draft Project and Strategy List	☒
June 2020	**Public Meeting #2** (one meeting)	Review Draft Project Lists and Traffic Management Strategies	☒
July 2020	**Interagency Team Meeting #4** **Meeting open to public	Technical Findings and Preliminary Recommendations, Draft Bridge Replacement Timelines, Draft Traffic Management Plans	☒
September 2020	**Interagency Team Meeting #5** **Meeting open to public	Draft Recommendations, Final Timeline and Traffic Management Plans, Draft Funding Strategy	☒
October 2020	**Interagency Team Meeting #6**	Final Review of Draft Report	☒
November 2020	**Public Meeting #3**	Present Draft Report	☒

SCHEDULE & MAJOR MILESTONES



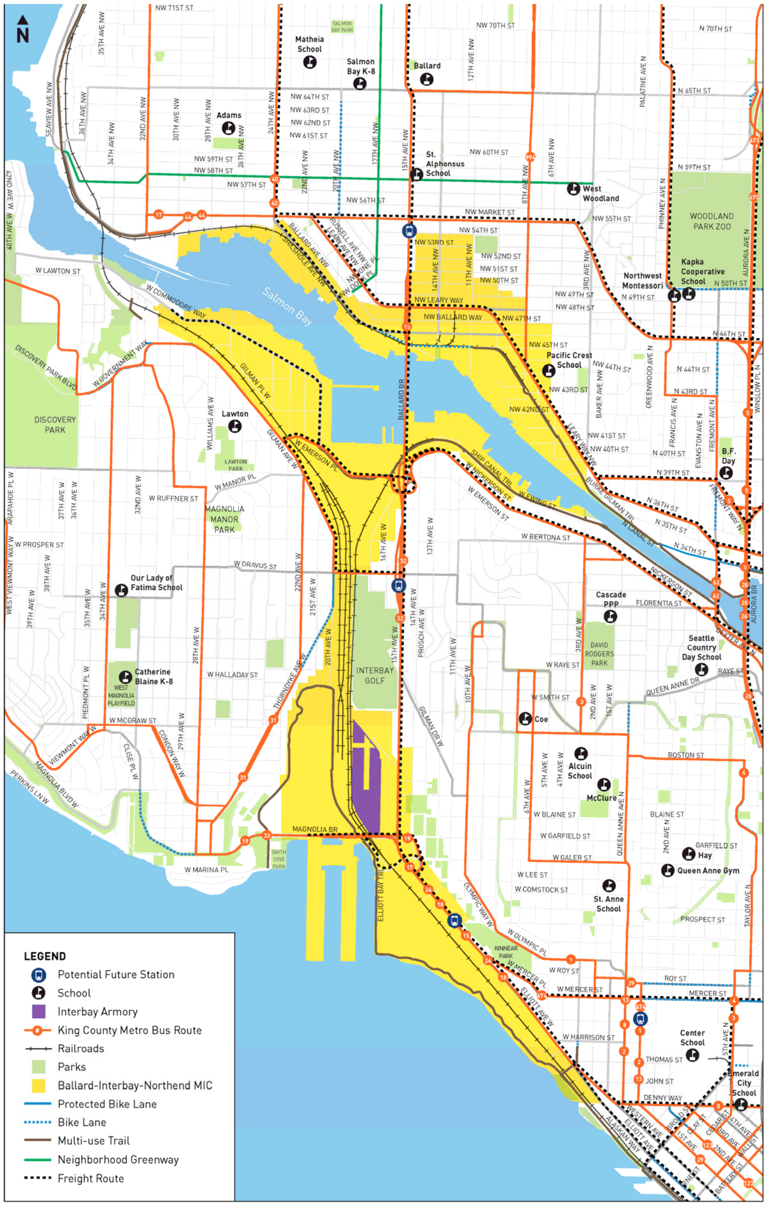
Webpage

http://www.seattle.gov/transportation/birt/

Live? Yes

PROJECT AREA MAP & LOCATIONS

Project Area Map



Locations

BIRT is focused on three neighborhoods:

- Ballard
- Interbay, including the Ballard-Interbay-Northend Manufacturing and Industrial Center (BINMIC) and east of 15th Ave NW
- Magnolia

ANTICIPATED CONCERNS

Initial anticipated concerns are listed below. This list will be updated following further stakeholder input and data gathering.

Bridges

- Potential mobility impacts of Magnolia and Ballard Bridge replacement, maintenance, and/or possible closure
- Bridge replacement options must accommodate all modes, including active transportation and transit
- Tension between the anticipated lifespan of the Magnolia Bridge and planning timeline to replace the bridge
- 2035 planning horizon assumes ST3 West Seattle and Ballard Link Extensions is online, likely influencing Ballard bridge replacement timeframe
- Dravus Street and Emerson bridges are older structures that provide access to Magnolia and may be impacted by Magnolia bridge replacement options; Emerson is a critical pathway for movement of trucks, good, and people to offices

Freight Access and Mobility

- Freight mobility, access, and connections to regional highway facilities should be enhanced for greater efficiency
- Travelshed for freight travelling to and through Ballard-Interbay includes broader, regional transportation system
- Maintenance of industrial, manufacturing, and maritime employment and access to jobs (Mayor's Maritime Industrial Strategy)
- Mobility system changes impacting BINMIC, Smith Cove, and Terminal 91 redevelopment
- Accommodating the mobility needs of the seafood processing and fishing-related industries, including Fisherman's Terminal (home port to the North Pacific Fishing Fleet)
- Small businesses rely on "micro" freight practices: pathways, streets, turns, locations, loading, parking, and delivery practices that are not always captured in "macro" plans
- Future use of the Armory site
- The Port of Seattle's proposal for Terminal 91 Uplands redevelopment (e.g., misconceptions that a hotel is planned versus light manufacturing)

Planning and Engagement Processes

- Methodology and technical data assumptions for the study may not fully reflect local knowledge as an input to balance forecast modeling and technical analysis
- Community members have expressed "planning fatigue," concern about BIRT's redundancy with past efforts, and frustration that planning is delaying "real changes" and improvements
- Pace of the study (10 months) and fast timeline to complete technical analysis
- Limited opportunities for public input due to schedule and three in-person public meetings
- Study outputs will not be ready-to-implement, fully funded projects
- Inclusive community organization and small business involvement, especially small maritime businesses
- Sense of urgency and important window of opportunity to complete the study to recommend the most viable alternative before it becomes too expensive to achieve the right solution
- Extent to which this project will support Seattle's climate change goals

Multimodal Access

- Safety for all people travelling along the corridor, including walk, bike, auto, freight, and transit access
- Transit speed and reliability, especially for the Rapid Ride D Line
- Urgency of ST3 implementation to accommodate growing transit demand
- Freight and transit corridor safety and reliability in an urban area
- Small business industrial, freight, and (un)loading needs may compete with walkways and bikeways

- Office and industrial public parking are critical for small businesses in Ballard and Interbay
- Reliability and speed of person trips (transit and driving); freight reliability for goods and services
- Safe pedestrian access to and high-quality experience at Rapid Ride transit stations and future Sound Transit stations
- Interest in possible new Sounder station in Interbay

ST3—West Seattle and Ballard Link Extensions

- Specific alignments for ST3 and preferred station locations
- ST3 Salmon Bay crossing coordination
- Coordinated access to future and current Sound Transit stations by transit, biking, and walking
- Coordination without duplication or conflicts between BIRT and ST3 planning processes

STAKEHOLDER CHECKLIST

The list will be updated following further stakeholder input and data gathering.

Incorporated? (Y or N)	Audiences to Consider	Examples (this is not a complete list)
	Adjacent property owners and tenants, including businesses and residents	Salmon Bay Marina, Fisherman's Terminal, Expedia, Terminal 91, Armory, Independent Packers, Lineage City Ice, Trident Seafoods, Marel Seattle Inc., CTA, Kerf Design Inc., Peddler Brewing Company, Stoup Brewing, Holy Mountain Brewing, We Drive You, Cutter Buck Inc, Pacific Studio, Foss Maritime, Swedish Medical, GM Nameplate, Alaska Ship Supply, Marine Exchange, Freezer Longline Coalition, Green Marine, American Waterways Operators Tsubota site tiny homes community (leased by the Port of Seattle) with 42 structures on site expiring 11/16/20.
	Typical users of project area	Pedestrians, cyclists, transit riders, freight operators, drivers
	Council Districts	City of Seattle, City Council Districts: District 7 (Magnolia), District 6 (Northeast Seattle) King County: District 4
	Community groups and neighborhood organizations	Magnolia Community Council, Ballard District Council
	Cultural and religious organizations	Seattle Church of Christ, Queen Anne United Methodist Church, Quest Church, Bar Church, St Luke's Episcopal Church, United Church, St Margaret's Church
	Chambers of commerce and local business organizations	Ballard Alliance, Industrial Small Businesses – Fisherman's Terminal Adjacent, Magnolia Chamber, NSIA, Seattle Marine Business Coalition, Ballard Business Improvement Association
	City of Seattle Departments	SDOT, Public Utilities, City Light, Department of Parks and Recreation, Fire Department, Police Department, Department of Neighborhoods, Office of Planning and Community Development, Seattle Public Utilities

Incorporated? (Y or N)	Audiences to Consider	Examples (this is not a complete list)
	Other agencies	WSDOT, King County Metro Transit, Sound Transit, Port of Seattle, Washington State Military
	Other transportation/utility companies	Puget Sound Energy, charter bus companies, Amazon/Expedia/other company shuttles, cruise industry and support businesses
	Universities and institutions	Seattle Pacific University, Seattle Maritime Academy
	Public facilities	Ballard Community Center, Magnolia Community Center, Kinnear Park, Smith Cove Park, Magnolia Park, Bayview Playground, Ella Bailey Park, Discovery Park, Interbay Athletic Complex
	Schools and childcare facilities	Magnolia Elementary School, The Center School, Ballard High School, Salmon Bay K-8 School
	Hospitals	Swedish Medical Center Ballard Campus
	Social service organizations and facilities (including those serving people with disabilities)	Equal Rights Washington, World Aid, Rooted in Rights
	Bicycle and pedestrian advocacy groups	Seattle Neighborhood Greenways, Cascade Bicycle Club, WA State Bicycle Alliance, Feet First
	City of Seattle Advisory Boards	Bicycle, Pedestrian, Freight, Transit
	Railroads	BNSF, Ballard Terminal Railway Co.
	Major developers/property owners	Port of Seattle, Expedia, BNSF, Dept. of Natural Resources, STRONG VENTURE LLC, HBK-EWING LLC, STIMSON C D Company
	Major employers	Expedia, Port of Seattle, Whole Foods, OFC, Swedish Medical Center, Trident Seafoods, U.S. Department of Defense, PCC, Foss Marine, BNSF, USPS
	Event Centers	Interbay Golf Center
	Freight	Ballard Interbay North Manufacturing Industrial Center (BINMIC), North Seattle Industrial Association (NSIA), Ballard Oil, T-86 Grain Terminal, T-91, Fishermens Terminal
	Media Outlets	Seattle Times, Queen Anne/Magnolia News, Ballard News Tribune, The Urbanist, Seattle Bike Blog, Seattle Transit Blog
	Indigenous Peoples	United Indians of All Tribes
	Legislative Districts	36^{th} Legislative District
	Populations that may need targeted outreach to due to cultural barriers, language differences, etc.	Small business, seasonal employees (fishing industry), and immigrants and people of color

GUIDING QUESTIONS

****Please see Racial Equity Toolkit.****

1. What are the racial equity goals of the project?

Give special consideration to the voices and transportation needs of people of color and lower-income employees who work in Interbay and Ballard, and people who depend on the transportation system for a living (e.g., truck and goods delivery drivers).

Understand the social and economic impacts and benefits of the Ballard and Magnolia bridges to people of color and lower-income workers.

Understand the trip origins of those who work in Interbay and Ballard, and how they to get to their places of employment. High housing costs in Seattle require many lower-income workers to live outside the city, resulting in long commutes that affect quality of life.

2. What racial or social inequities currently exist in the project area?

Ballard and Magnolia are both majority white communities, and Magnolia is more affluent than the average Seattle neighborhood. Both neighborhoods have very engaged community members. Many of these community members are able to devote the time and effort to navigate systems and make their transportation needs heard. The people who live and work in Interbay are not necessarily organized in a similar way. For example, small maritime/industrial businesses in Ballard bring employees from many areas of the region; these workers may have different interests and needs than the Magnolia residential community.

According to the Magnolia Bridge Replacement Environmental Assessment Report (May 2015), the percentage of workers of color and those whose language of preference is not English in the major marine businesses (six Terminal 91 businesses) is higher than in the region's population. Transit use by workers at these employers is generally high compared to regional trends.

Economic inequities are also prevalent in the study area. There are many low income, blue collar, and seasonal workers within the study area. Many of the jobs in Interbay require highly skilled workers that are low-paid (e.g., fish cutters, commercial fishing, seafood processing). While there are generally high wages in the maritime industry, lower wage jobs are among the critical industries in Interbay.

3. How do the project goals address or consider the existing racial or social inequities? How will the project increase or decrease racial or social equity?

BIRT will develop a framework for evaluating up to four alternatives for replacing the two bridges that includes assessment of regional, local economic, and social impacts of the bridge replacement alternatives. This alternative evaluation framework will include race and social justice indicators. Alternatives evaluation will center the assessment of who benefits from improvements and who does not along with other equity considerations. Anticipated impacts of the bridge replacement alternatives could include access to jobs and support of Seattle's industrial activity.

How will you address the project's impacts (including unintended consequences) on racial or social equity?

BIRT will focus on achieving equitable engagement outcomes by targeting outreach toward those voices not typically represented in planning processes. The project team will work to understand diverse perspectives and lived experiences related to how people use the Ballard-Interbay transportation system. Populations for targeted outreach include maritime, industrial, and freight employees as well as other area workers and traditionally underrepresented residents. The project team will prioritize outreach to and engagement of workers in the manufacturing, industrial, and maritime sectors to inquire about their transportation needs.

The BIRT Final Report will amplify these voices for the Washington State Legislature, including strategies for mitigating unintended consequences to those who may bear disproportionate burden in the Ballard-Interbay transportation system based on income or race. For example, BIRT will prioritize projects that improve access and safety for workers traveling by transit, as many may not have other travel options. Those with the fewest choices should not bear more travel time, safety, or cost burden than those with many mobility choices.

The BIRT team will think broadly about recommendations that go beyond physical infrastructure improvements. These may include options such as employee circulator buses, first/last mile shuttles connecting from high capacity transit stations to job sites, and creation of incentive mode-split programs for small businesses. BIRT will develop creative solutions tailored to the unique travel needs to enhance the functionality of the Ballard-Interbay transportation system for all.

LANGUAGE NEEDS

Projects are required to provide materials and information in non-English languages if five (or more) percent of the population in that project area speaks a given language. For any project, materials in other languages are available upon request.

Source	Languages Over 5%
US Census Language Map	None
ACS 2017 5 Year Estimates	

TRANSLATIONS THRESHOLD

87.2% of study area population speaks only English at home, while 12.8% of the population does not speak English at home. Predominant languages include: Spanish, Chinese, Asian and Pacific Island languages, and Indo-European languages.

ACTIVITIES LOG

The table below details the outreach activities completed to date. Future planned activities can be found on the PIP cover sheet.

When	What	Who	Details
September 24, 2019	**Freight Advisory Board**	SDOT, SFAB	Project Introduction, Presentation, Q&A with board members
October 22, 2019	**North Seattle Industrial Association**	SDOT, NSIA	Project Introduction, Presentation, Q&A with stakeholders
October 24, 2019	**Ballard Bridge Planning Study drop-in**	SDOT, residents, employees, business owners, and other interested parties	Drop-in on existing SDOT event to engage with community members.
Jan 23, 2020	**Interagency Meeting #1**	SDOT, Port of Seattle, WSDOT, Sound Transit, King County Metro	Project Introduction, Roles and Responsibilities of the IAT, Scope of Work and Schedule, Project Goal Setting
Jan 28, 2020	**Ballard Community Meeting #1**	Ballard and Magnolia residents, employees, business owners, and other interested parties	Project Kickoff and Overview: Project Purpose, Goals, and Timeline
Feb 3, 2020	**Magnolia Community Meeting #1**	Ballard and Magnolia residents, employees, business owners, and other interested parties	Project Kickoff and Overview: Project Purpose, Goals, and Timeline
Feb 18, 2020	**Magnolia Community Council**	Magnolia Community Council and interested residents	Project Overview, Goals, Timeline, Question & Answer

When	What	Who	Details
Feb 26, 2020	**Fremont-Ballard Neighborhood Greenways**	Fremont-Ballard Neighborhood Greenways, bicyclists, and pedestrians	Project Overview, Goals, Timeline, Question & Answer Workshop of Identifying Challenges and Solutions
March 18, 2020	**Interagency Meeting #2**	SDOT, Port of Seattle, WSDOT, Sound Transit, King County Metro	Review Baseline Assumptions, Draft Project Evaluation Criteria, Plan Review Themes, and Public Involvement Plan
April 7, 2020	**Ballard Fremont and Queen Anne Neighborhood Greenways**	Ballard Freemont Neighborhood Greenways, Queen Anne Greenways, bicyclists and pedestrians	Review Draft Methods and Assumptions Framework, Stakeholder Engagement Input for Accessibility
May 6, 2020	**Bike Advisory Board**	SDOT, SBAB	Presentation and Q&A with stakeholders about project. Checking to see if past bike comments ring true with the board.
May 21, 2020	**Interagency Meeting #3**	*Open to the public* SDOT, Port of Seattle, WSDOT, Sound Transit, King County Metro	Multimodal Evaluation Framework, Traffic Forecast Results and Alternatives, Draft Project and Strategy List
July 21, 2020	**Magnolia Community Council**	Magnolia Community Council and interested residents	
July 29, 2020	**Virtual Mid-Project Public Meeting #1**	Ballard and Magnolia residents, employees, business owners, and other interested parties	Review Draft Project Lists and Traffic Management Strategies
August 6, 2020	**Virtual Mid-Project Public Meeting #2**	Ballard and Magnolia residents, employees, business owners, and other interested parties	Review Draft Project Lists and Traffic Management Strategies
August 18, 2020	**Freight Advisory Board**	SDOT, SFAB	Presentation and Q&A with stakeholders about project updates.
August 20, 2020	**City of Seattle Planning Commission: Land Use and Transportation Committee**		Presentation and Q&A with stakeholders about project updates.
August 20, 2020	**Interagency Meeting #4**	*Open to the public* SDOT, Port of Seattle, WSDOT, Sound Transit, King County Metro	Technical Findings and Preliminary Recommendations, Draft Bridge Replacement Timelines, Draft Traffic Management Plans
October 1, 2020	**Interagency Meeting #5**	*Open to the public* SDOT, Port of Seattle, WSDOT, Sound Transit, King County Metro	Review of Draft Report

When	What	Who	Details
November 2, 2020	**Final Public Meeting**	Ballard and Magnolia residents, employees, business owners, and other interested parties	Present Draft Report

IOPE ELEMENTS

In addition to the outreach activities listed on the cover sheet, the project team will ensure that the project's public participation opportunities are inclusive of the affected stakeholders. Accordingly, outreach activities will include:

- Events
- Mailings
- Web
- Advertising/ Media

This is a document with all of our Social Media efforts: https://seattlegov.sharepoint.com/:w:/r/sites/dot-external/BIRT/Shared%20Documents/5_Outreach%20and%20Engagement/1_Outreach%20and%20Engagement%20Plan/Outreach%20Efforts.docx?d=w34bc934c1c8e449f8636fe4816478229&csf=1&web=1&e=PRSleC

Ballard Interbay Regional Transportation System (BIRT) Study

Appendix B: Plan Review

November 2020

Seattle Department of Transportation

Seattle Department of Transportation

Ballard-Interbay Regional Transportation System Study

Plan Review

FINAL

April 2020

NELSON NYGAARD

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INTRODUCTION

Plan Review Purpose

The Ballard-Interbay Regional Transportation System (BIRT) study legislative language requires a review of plans and studies that examine replacement of the Ballard and Magnolia bridges, transportation network, land use, and urban design recommendations in the study area. This document summarizes key plans developed between 2010 to 2020 and highlights projects, policies, recommendations, and implementation priorities relevant to the BIRT study. It is a guide for the project team to document what is most important to the Ballard-Interbay community and reflect the priorities captured in the many planning processes that affect the study area.

Study Area Context

The Ballard and Magnolia neighborhoods are experiencing significant residential and employment growth, and the Ballard-Interbay-Northend Manufacturing and Industrial Center (BINMIC) is an important local and regional economic asset. The Magnolia and Ballard bridges have been studied extensively over the last decade given that they are aging infrastructure serving increasing travel demand.

In addition to bridge studies, planning is underway for major projects and developments that will shape the future of Ballard-Interbay. These include the future Sound Transit 3 West Seattle and Ballard Link Extensions, transit-oriented development at the future Link stations and along the transit corridor, redevelopment of light industrial spaces at Terminal 91, Fishermen's Terminal redevelopment, the Armory site at Interbay, and the new Expedia corporate campus. Significant capital improvements are already underway related to these projects, and in many cases, they call for investments in the surrounding public realm and transportation networks.

Methodology and Purpose

For each of the plans and documents included in this review, the project team summarized the plan purpose, scope, and outcomes in the Appendix. The body of this report includes details from that apply to the BIRT study. Specifically, the reviewed focused on:

- Projects, policies, or recommendations that have the potential to influence study assumptions about future baseline conditions (projects or policies set to be implemented)
- Projects, policies or recommendations that are unfunded but desired by the community
- Projects, policies or recommendations that have received consistent input through various community and stakeholder processes and should be included for consideration in this study
- Planned changes to land use conditions, such as proposed development or redevelopment projects, that will change the nature of travel demand for people and goods in the area
- Construction mitigation strategies for transportation projects or other short-term strategies that are emblematic of the communities' concerns

Findings are categorized into major themes and summarized, including specific project, policy or program details such as locations, costs, and/or schedules. Source documents are referenced throughout. The Appendix serves as a guide for reviewers that may wish to understand where more detailed information about specific projects and study findings can be located.

Plans and Documents Reviewed

The documents reviewed were identified by the Seattle Department of Transportation or recommended by the project's Interagency Team which consists of staff from partner agencies. They include relevant projects or initiatives that may impact the assumptions or evaluation criteria for the BIRT study. The Ballard Municipal Center Master Plan adopted in 2001 and revised in 2013 was included in the review, though the most major projects have since been completed (e.g., Ballard Commons Park and the neighborhood library). Seattle's modal plans were reviewed to incorporate planned projects across all modes of travel and goods delivery that are planned, underway, or recently completed in the study area.

Figure 1 includes the full list of plans and documents, organized by discipline and geographic scope. Descriptions of all plans are included in the Appendix.

Figure 1 Plans and Documents Reviewed

Category	Plan or Document
Transit Expansion	▪ Sound Transit West Seattle and Ballard Link Extensions (2019) ▪ METRO CONNECTS (2017) ▪ Seattle Transit Master Plan (2016) ▪ Ballard to Downtown Transit Expansion Study (2014)
Land Use and Development	▪ Fishermen's Terminal Redevelopment (2019-2023) ▪ Terminal 91 Uplands Development (Phase I, 2019) ▪ The Interbay Project: National Guard Armory Redevelopment (2019) ▪ Expedia Environmental Impact Statement (2016) ▪ Industrial Lands Policy Discussion Summary and Recommendations (2015)
Ballard Bridge	▪ Ballard Bridge Planning Study (2019) ▪ Bridge Safety Analysis (2018) ▪ Ballard Bridge Seismic Retrofit Environmental Conditions Memorandum (2018) ▪ Ship Canal Crossing Study (2015) ▪ Ballard Bridge Sidewalk Widening Concept Study (2014)
Ballard Area	▪ Burke-Gilman Trail Missing Link (2018) ▪ Interbay Trail Connections Project (2016) ▪ Ballard Urban Design Transportation Framework (2016) ▪ Move Ballard (2016) ▪ Ballard Urban Design Existing Conditions Report (2014)
Magnolia Bridge	▪ Magnolia Bridge Planning Study Technical Memorandum (2019) ▪ Magnolia Bridge Replacement Environmental Assessment Report (2015)
Multimodal Plans	▪ Seattle Pedestrian Master Plan 5-Year Implementation Plan and Progress Report (2019) ▪ Seattle Bicycle Master Plan 2019-2024 Implementation Plan (2019) ▪ Seattle Bike and Pedestrian Safety Analysis (2016) ▪ Seattle Freight Master Plan (2016)

Key Findings

Plan review findings and recommendations are organized into three sections: transportation policy and planning priorities for the study area; upcoming capital improvements; and increasing diversity and density of land uses in Ballard-Interbay. Key findings are listed below for each section and explained in further detail starting on page 5.

Transportation Policy and Planning Priorities for the Study Area

Key policy themes shared across multiple plans and projects for the study area include:

- **Preserve freight access:** Freight and local industrial access in the Ballard-Interbay area is critical to local and regional economic vitality.
- **Maintain access during construction:** Freight and local industrial stakeholders need easy and direct access before, during, and after construction of infrastructure projects to keep people and goods moving.
- **Balance multimodal needs:** All projects including bridge alternatives must address access and connections to existing and planned networks for pedestrians, cyclists, motorists, transit, and freight.
- **Prioritize safety:** The most space-efficient travel modes and vulnerable travelers should be prioritized given deficiencies in sidewalks, intersection crossings, and physical separation between people walking, biking and motorized users.
- **Support growing transit ridership:** Future high capacity transit such as RapidRide and Link light rail extension require transit-supportive policies to grow ridership.

Planned Capital Improvements and Investments

Ballard-Interbay is home to many capital projects that are planned, funded, or pending funding and assumed to be part of a future transportation baseline for the study area:

- **Ballard Bridge Pedestrian and Bicycle Safety Improvements:** Several studies have studied the feasibility and estimated costs associated with better accommodations for pedestrians and bicyclists in a future bridge with wider facilities separated from motor vehicles.
- **Ballard Bridge Replacement:** The Ballard bridge will require replacement due to its aging infrastructure and several bridge replacement alternatives are under consideration.
- **Magnolia Bridge Replacement:** Alternatives to an in-kind bridge replacement were examined in a 2019 study in response to bridge deterioration; after a multi-criteria evaluation including cost, mobility, and technical feasibility, the two best performing options propose a new Armory Way Bridge into Magnolia and a new Western Perimeter Road to Smith Cove Park/Elliott Bay Marina ($200-$350M) or an in-kind replacement adjacent to the existing bridge ($340-$420M).
- **Freight Capacity and Access:** Several capital projects are planned to address freight traffic delays at intersections and bottleneck locations approaching Ballard bridge from the south.
- **Active Transportation Connections and Improvements:** Investments are planned to connect gaps in existing non-motorized trails and neighborhood greenway networks.

- **Transit Service and Connections:** Sound Transit is planning a new light rail line funded by ST 3 that will serve the study area with three new stations and King County Metro and SDOT are investing in speed and reliability improvements for RapidRide and other local bus service.

Increasing Diversity and Density of Land Uses in Ballard-Interbay

An expansion in the diversity of land uses and increased density is changing the Ballard-Interbay landscape, guided by the following considerations:

- **Existing Industrial and Manufacturing Uses:** Zoning in the Ballard-Interbay-Northend Manufacturing and Industrial Center (BINMIC) is intended to protect freight, fishing, maritime, and industrial uses into the future. Longtime maritime, fishing, manufacturing, and freight industries are vital to the local and regional economy.
- **Transit-Oriented Development:** The Ballard Link light rail extension will call for greater density and mixed-use development at stations and along the corridor.
- **Light Industrial Redevelopment:** Public and private redevelopment efforts to expand are underway at terminal 91 Uplands, Fishermen's Terminal, and the WA state military Armory site.
- **Neighborhood Character:** As Ballard continues to grow and densify, urban design guidelines and transportation networks are recommended to maintain its character.
- **Right-of-Way Impacts:** Any bridge replacement alternative and redevelopment efforts should minimize environmental impacts and maintain public access to key assets and the waterfront.

POLICY AND PLANNING PRIORITIES AND RECOMMENDATIONS

The plan review revealed several key categories of policy, program, project, and land use recommendations. These center around themes of preserving freight and industrial uses, providing multimodal access, ensuring safe travel, and managing travel demand amidst growth. The following section includes a synthesis of important plan review findings. Policy and planning findings will be integrated into the BIRT study goals, performance measures, and evaluation criteria to support the consideration of multimodal projects, programs, and policies.

Preserve Freight Access

Several plans emphasized the importance of maintaining freight and local industrial access to the Ballard and Magnolia areas during bridge replacement or other construction activities associated with development. Reliable freight travel is also a concern as traffic volumes increase with new development. Recommendations include the use of measures such as flaggers for traffic management and allowing designated truck travel to preserve freight and local industrial access, and to minimize delay during bridge, roadway, or redevelopment construction. Some of these actions may be complete and are indicative of the types of actions that are important to local businesses and residents.

Figure 2 Recommendations to Preserve Freight Access

Details	Plan or Document
▪ Employ flaggers or other measures during trail construction to minimize freight delays in areas heavily used by freight.	Burke-Gilman Trail Missing Link (2018)

▪ Increasing density means there are more trucks serving construction sites and delivering products, and therefore supporting freight and local access are high priorities. Ballard's active commercial core and its adjacency to the BINMIC emphasize the importance of freight movement to the neighborhood's transportation network.	Move Ballard (2016)
▪ Maintain access for over-legal loads (20 ft x 20 ft). ▪ Maintain predictability of bridge openings for marine and roadway traffic.	Ballard Bridge Planning Study (2019)
▪ Maintain freight access during replacement construction. Truck movements in and out of Terminal 91 would continue to use the Galer Flyover access from Elliott Avenue West and the Terminal 91 East Gate.	Magnolia Bridge Replacement Environmental Assessment Report (2015)
▪ The Ballard Bridge is identified as a Seaport Highway Connector and Major Freight route. It is also noted as a bottleneck on NW 15th Ave/Ballard Bridge (W Nickerson St to Market St). ▪ 15th Ave NW, Elliott Ave W, NW Market St, and Ballard Bridge are identified as major freight corridors, calling for a roadway classification of a minor arterial or higher. Dravus St is noted as a minor freight corridor, meaning a minor arterial or higher.	Seattle Freight Master Plan (2016)

Maintain Access during Construction

During bridge replacement or other redevelopment construction, the Magnolia Bridge Replacement study calls for detours that maintain general-purpose traffic and transit access to key destinations and employment centers, as well as walking and biking access to natural assets and the waterfront.

Figure 3 Recommendations to Maintain Access During Construction

Details	Plan or Document
▪ Maintain transit service to the Terminal 91 complex during construction. Re-route transit service or provide shuttle vehicles to bring transit passengers between 15th Avenue West bus stops and the complex.	Magnolia Bridge Replacement Environmental Assessment Report (2015)
▪ Traffic detours during bridge replacement construction may include existing city streets, new surface streets through Terminal 91, or staged construction and temporary ramps to keep traffic in the existing corridor.	Magnolia Bridge Replacement Environmental Assessment Report (2015)
▪ Maintain public access to waterfront during Bridge reconstruction or replacement; do not interfere with or limit public access to the waterfront. Improve waterfront access to and from the Magnolia neighborhood.	Magnolia Bridge Environmental Assessment Report (2015)

Balance Multimodal Needs

Several plans call for the desire to balance multimodal movement, access, and planned network priorities with proposed bridge alternatives. Efforts to maintain capacity must also consider multimodal needs, new high-quality, all age facilities, intuitive and connected networks, and acceptable levels of service for all modes, not just single-occupancy vehicles. Several corridors in the study area are designated priority corridors for pedestrians, bicyclists, transit, and freight according to the City of Seattle's modal plans.

Figure 4 Recommendations to Balance Multimodal Needs

Details	Plan or Document
▪ Key considerations include maintaining multimodal access to Leary Way NW, W Emerson St, and W Nickerson St.	Ballard Bridge Planning Study (2019)
▪ Identify existing accessibility and mobility challenges for all modes and enhance safety and convenience of more space efficient transportation modes (transit, bicycle, pedestrian) to enhance mobility while maintaining freight and vehicle access.	Move Ballard (2016)
▪ Balance the mobility needs of pedestrians, bicycles, transit, cars, and freight.	Ballard Urban Design Transportation Framework (2016)
▪ Create a Magnolia Bridge facility that can link with present and future multimodal transportation opportunities.	Magnolia Bridge Environmental Assessment Report (2015)
▪ The Ballard Urban Village is designated as a Pedestrian Priority Investment Area.	Seattle Pedestrian Master Plan 5-Year Implementation Plan and Progress Report (2019)

Prioritize Safety

Several plans identify the need to prioritize safety for modes of travel that require the least amount of space and that support the mobility needs of vulnerable travelers (e.g., transit, walking, cycling, and vanpooling). Analyses conducted by the City of Seattle show a history of pedestrian and bicyclist crashes in the study area. As Ballard-Interbay continues to grow, traffic volumes are projected to increase. Several plans support and deliver policies and projects that are designed to encourage more sustainable and space-efficient travel modes.

Figure 5 Recommendations to Prioritize Safety

Details	Plan or Document
▪ Enhance the safety and convenience for those who take (transit, bike, or walk to enhance mobility while maintaining freight and vehicle access.	Move Ballard (2016)
▪ The ideal solution provides efficient, safe, and improved multimodal access to and from Magnolia destinations.	Magnolia Bridge Planning Study Technical Memorandum (2019)
▪ Create a hierarchy of great streets and public spaces, with special attention to Market Street, and preserve green spaces.	Ballard Urban Design Transportation Framework (2016)
▪ 15th Ave NW is a high crash corridor. Along with intersections along the Burke Gilman Trail, safety improvements to accommodate the high volumes of bicyclists through this part of the study area are key recommendations. ▪ For pedestrians, commercial areas and locations with high transit activity have a high potential for conflicts. On-street parking also contributes to limited visibility of pedestrians. Both are key focuses for pedestrian safety improvements.	Seattle Bike and Pedestrian Safety Analysis (2016)

Support Growing Transit Ridership

Most plans focused on the Ballard neighborhood emphasize the anticipated impacts of a future light rail station in the heart of Ballard. The implications of future light rail and additional high capacity transit services (e.g., RapidRide) influence policy, design, and investment decisions regarding multimodal access to stations, mode share targets, trip generation projections, density, and costs of development. Recommendations also include managing parking and demand for drive-alone commute trips at major employment sites.

Figure 6 Recommendations to Support Growing Transit Ridership

Details	Plan or Document
▪ Identify community preferences for future potential light rail station locations and understand the transit-oriented development (TOD) potential in Ballard.	Move Ballard (2016)
▪ Prepare for potential light rail investment by making existing pedestrian, bicycle crossings and transit facilities on the edges more appealing and safer through signalization improvements, active street-level uses at the corners, wider sidewalks and landscaped buffers (e.g., 15th Ave NW, NW Leary Way, 24th Ave NW).	Ballard Urban Design Transportation Framework (2016)
▪ Connect with the existing and future transit system, including Sound Transit's Link Light Rail and the City of Seattle's South Lake Union Streetcar.	Ballard to Downtown Transit Expansion Study (2014)
▪ Consider Sound Transit's future light rail extension project when planning new routes.	Magnolia Bridge Planning Study Technical Memorandum (2019)
▪ Implement parking time limits for 16th Ave W and W Galer Street to encourage turnover and prioritize business access near high-capacity transit stops. ▪ Implement a series of strategies detailed in a Transportation Management Plan (TMP) to meet a drive-alone mode share goal of 49% at initial occupancy and a drive-alone rate of no more than 30% at full occupancy of proposed buildings.	Expedia Environmental Impact Statement (2016)

CAPITAL IMPROVEMENTS AND INVESTMENT RECOMMENDATIONS

The plans reviewed recommend several upgraded facilities and new capital infrastructure projects, both funded and unfunded. These projects shape the changing transportation context, and the results of this study and other parallel efforts may influence these projects. The projects listed below enhance safety and the structural integrity of infrastructure throughout the study area.

Ballard Bridge Pedestrian and Bicycle Safety Improvements

The Ballard Bridge has been identified in several studies as a challenging connection for people walking and biking. The population of Ballard has grown significantly during the last decade, increasing demand for bridge crossings and amplifying the impacts of insufficient bicycle and pedestrian facilities on the bridge. Connectivity challenges at the bridgeheads are also issues. Projects to address locations with the greatest risk to pedestrians and bicyclists have been identified in response to crash data and safety studies.

Figure 7 Recommendations to Improve Pedestrian and Bicycle Safety

Details	Plan or Document
Three locations were identified at or near the Ballard Bridge to improve pedestrian visibility and reduce conflicts between people walking, biking, and motorists. Improvements range from new sidewalks to curb extensions, railings, and high visibility crosswalks and cost anywhere between $200,000 and $12 million. ▪ Location 1: Ballard Bridge South (15th Ave NW and W Emerson St) ▪ Location 2: Ballard Bridge Sidewalk (Between W Emerson St and NW Ballard Way) ▪ Location 3: Ballard Bridge Northwest (On-ramp) ▪ Location 4: Ballard Bridge Northeast (Off-ramp)	Bridge Safety Analysis (2018)
Four (4) alternatives were studied to widen the Ballard Bridge sidewalks, and all four were deemed technically feasible. Each has potential challenges, including business relocation impacts, temporary construction impacts to traffic, and associated costs (from $3 million to $48 million). ▪ Alternative 1: Add an additional foot to sidewalk width by modifying the existing railing and barrier and adding a railing between the sidewalk and travel lanes ▪ Alternative 2: Widen sidewalks to either six or ten feet, including a railing between the sidewalk and travel lanes ▪ Alternative 3: Install a railing on the inside barrier between the existing sidewalk and travel lanes ▪ Alternative 4: Provide a trail connection from the southwest corner of the Ballard Bridge to the South Ship Canal Trail and the sidewalk on 15th Avenue West, south of the bridge	Ballard Bridge Sidewalk Widening Concept Study (2014)

Ballard Bridge Replacement

The Ballard Bridge was built in 1917 and is no longer in optimal condition. Studies exploring the replacement of the Ballard Bridge focused on several options and included recommendations for structural design. The Ballard Bridge Planning Study is yet to be published, but the concept with the greatest public support is a low-level moveable bridge replacement. Replacement of the bridge will cause traffic impacts during construction.

Figure 8 Recommendations for Ballard Bridge Structural Improvements

Details	Plan or Document
Several technical replacement options were considered that call for roadway grades at or less than 5% (maximum grade of 7% as necessary): ▪ High-level 150’ fixed bridge replacement: 5% slope ▪ Mid-level 60’ moveable bridge replacement: 5% slope ▪ Rehabilitation of existing movable bridge (low level): 1.5% slope ▪ Public outreach conducted in fall 2019 indicated a preference for a low-level movable bridge. The least preferred option was a high-level fixed bridge. ▪ Cost estimates and constructability findings have not been published but were noted as an important consideration among stakeholders.	Ballard Bridge Planning Study (2019)

Magnolia Bridge Replacement

The Magnolia Bridge opened in 1930 and is showing signs of deterioration. It carries one-third of the daily traffic to and from Magnolia neighborhood. Given the bridge’s age and structural compromises from the 2001 Nisqually Earthquake, it is susceptible to damage and collapse should another earthquake occur. The Magnolia Bridge Planning Study and Environmental Assessment explored four alternatives that range in costs and public acceptance but are all technically feasible. The four bridge alternatives would have a range of transportation impacts during construction.

Figure 9 Recommendations for Magnolia Bridge Structural Improvements

Details	Plan or Document
Alternatives 1 and 4 scored the highest among the project evaluation criteria and had the most public support throughout the planning process. (Cost estimates are in 2018 dollars). Alternative 4 received the highest level of public support, followed by Alternative 1. ▪ Alternative 1: Armory Way Bridge Concept: A new Armory Way Bridge into Magnolia and a new Western Perimeter Road to Smith Cove Park/Elliott Bay Marina ($200M - $350M). ▪ Alternative 2: Improvements to existing Dravus St connection into Magnolia and a new Western Perimeter Road to Smith Cove Park/Elliott Bay Marina ($190M-$350M). ▪ Alternative 3: Improvements to the existing Dravus St connection into Magnolia and a new Garfield Street bridge to Smith Cove Park/Elliott Bay Marina ($210M-$360M). ▪ Alternative 4: In-Kind Replacement Concept: In-Kind Replacement of the existing Magnolia Bridge adjacent to its current location ($340M – $420M).	Magnolia Bridge Planning Study Technical Memorandum (2019)
▪ The cost to keep the existing bridge in service for more than 10 years, including the cost for repair, strengthening and preservation, continued maintenance and full seismic retrofit, would approach the cost of replacing the existing bridge. ▪ Employ context-sensitive design for the Magnolia Bridge reconstruction. The location, design, and maintenance of a transportation facility can positively and negatively affect visual features of the landscape.	Magnolia Bridge Replacement Environmental Assessment Report (2015)

Active Transportation Connections and Improvements

The highest profile bicycle and pedestrian project in the study area is the completion of the Burke-Gilman Trail. There are additional projects identified in the City's Bicycle and Pedestrian Master Plans, including crosswalks, sidewalks, and a wider Ballard Bridge to contribute to safer active travel.

Figure 10 Recommendations for Active Transportation Connections and Improvements

Details	Plan or Document
▪ Connect the Elliott Bay Trail, the Helix Pedestrian Bridge, and on-site bicycle amenities to enhance the existing off-road facilities and upgrade existing trails.	Expedia Environmental Impact Statement (2016)
▪ Complete the Burke-Gilman Trail: Connect the 1.4-mile segment of the Burke-Gilman Trail through the Ballard neighborhood to create a complete and predictable corridor that enhances safety for pedestrians, trucks, bicycles, and cars. Trail width should generally be between 10 and 12 feet wide depending upon existing conditions and constraints throughout the corridor.	Burke-Gilman Trail Missing Link (2018)
▪ Many arterial and non-arterial streets in Ballard and its Urban Village are identified as part of the city's Pedestrian Priority Investment Network between 2018 and 2020.	Seattle Pedestrian Master Plan 5-Year

▪ Several streets in the BIRT study area have missing sidewalks. Some sidewalks were added in 2019 along W Nickerson St between Ballard Bridge and 13th Ave W in the BIRT study area. Planned improvements include a connection of the two existing portions of the Burke-Gilman Trail through the Ballard neighborhood along with pedestrian and bike crossings on NW 45th St, Shilshole Ave, and NW Market St.	Implementation Plan and Progress Report (2019)
▪ Alternatives are explored to enhance the non-motorized facilities on the Ballard Bridge, including providing enough width to accommodate people safely walking and biking across the bridge, with physical separation from motor vehicles.	Ballard Bridge Sidewalk Widening Concept Study (2014)
▪ In addition to existing bike lanes along the Elliott Bay Trail and Gilman Ave, neighborhood greenway connections to the Burke-Gilman Trail through the Ballard neighborhood are proposed. ▪ Neighborhood Greenway upgrades were proposed in 2019 to improve signal detection at 8th Ave NW on NW 58th St from Seaview Ave NW to 4th Ave NW.	Seattle Bicycle Master Plan 2019-2024 Implementation Plan (2019)

Freight Capacity and Access

Capital improvements to enhance freight access to the Ballard Bridge and ensure timely travel throughout the study area with new traffic signals have been recommended to improve freight movement in the study area.

Figure 11 Recommendations for Freight Capacity and Access

Details	Plan or Document
▪ To enhance freight access to the Ballard Bridge, add an eastbound left-turn lane at the intersection of 17th Ave & Shilshole.	Ballard Urban Design Transportation Framework (2016)
▪ Reduce vehicle delay and improve roadway systems: Intersection signalization or capacity improvements are recommended at several locations including Alaskan Way/W. Galer Flyover, 15th Ave W/W Gilman Street, and W. Galer Street/Thorndyke Ave W.	Expedia Environmental Impact Statement (2016)

Transit Service and Connections

Sound Transit's West Seattle and Ballard Link Extensions (WSBLE) and transit service improvements by SDOT and King County Metro will enhance transit access and connections to transit stations. RapidRide D Line is the first branded, frequent bus service in the study area. King County and the City of Seattle are using designated ST3 funds to continue to improve speed and reliability in the D Line corridor. Coordination between the City of Seattle and Sound Transit is critically important as preferred alternatives are finalized for the Ballard to Downtown segment, which is expected to be complete by 2035.

Figure 12 Recommendations for Transit Service and Connections

Details	Plan or Document
▪ King County Metro envisions 26 RapidRide routes by 2040. RapidRide D Line already serves the Ballard-Interbay area along 15th Ave. METRO CONNECTS and other service planning efforts related to North Link envision new bus services from east Seattle and east King County terminating in the Interbay area. Other planned investments include bus-only lanes and transit priority features. METRO	METRO CONNECTS (2017)

Details	Plan or Document
CONNECTS' 2040 network anticipates travel time improvements between Ballard and the University District of 48% (29 minutes).	
▪ Sound Transit is planning a future high-capacity transit corridor from Ballard to downtown Seattle. The project will add 7.1 miles of light rail service, including a new downtown Seattle rail-only tunnel. The corridor includes 9 new stations between Chinatown-International District and Market Street. The Draft EIS will be released in 2021 for public review and comment. Three stations are planned in the BIRT study area: Smith Cove, Interbay, and Ballard Stations.	Sound Transit West Seattle and Ballard Link Extensions

Summary Map of Capital Improvements

The capital projects described in this section will be included in the baseline and future assumptions for traffic analysis and forecasting. Planned or recommended investments will be incorporated in the future scenarios used in this study. A summary of capital projects is illustrated in Figure 13.

Figure 13 Map of Recommended Infrastructure and Capital Projects

INCREASING RANGE AND DENSITY OF LAND USE RECOMMENDATIONS

The following recommendations describe existing and planned land uses, zoning, and guidelines for new or redeveloped areas. As the study area experiences rapid growth and redevelopment, along with transit-supportive mixed-use development, it will become home to more people and businesses. This will lead to more trips, which must be factored into future traffic forecasts.

Existing Industrial and Manufacturing Uses

Most of Interbay is currently zoned for industrial use and is in a designated as the Ballard-Interbay-Northend Manufacturing Industrial Center (BINMIC). As the BINMIC and surrounding areas grow, it will be critical analyze the preservation of industrial and manufacturing activities and land uses.

Figure 14 Recommendations for Industrial and Manufacturing Uses

Details	Plan or Document
▪ Modify development standards to protect industrial and manufacturing activities. Consider small changes to development standards to support the continued vitality of industrial and manufacturing activities within Industrial Commercial zoned sites in the Urban Village and adjacent industrial lands.	Ballard Urban Design Transportation Framework (2016)
▪ Maintain Industrial Zoning to Preserve Maritime and Commercial Uses: Future land use and zoning in the study area would not change substantially. Most of the land would remain industrial and retain industrial zoning.	Magnolia Bridge Environmental Assessment Report (2015)

Transit-Oriented Development

Anticipated investments in high-capacity transit, including RapidRide and Link light rail, call for higher-density development at stations, transit hubs, and along transit corridors. Accessible and convenient connections to transit stops and stations—for buses and light rail— are identified as critical for ensuring that transit is a viable mode for residents and workers in the area.

Figure 15 Recommendations for Transit-Oriented Development

Details	Plan or Document
▪ Plan for Transit-Oriented Development around Light Rail Stations: Identify community preferences for future potential light rail station locations and understand the transit-oriented development (TOD) potential in Ballard.	Move Ballard (2016)
▪ Support sustainable urban growth in the Ballard Link Extension corridor. One of the goals of the Ballard to Downtown Transit Expansion Study is to support economic and transit-oriented development in the corridor, including compact communities.	Ballard to Downtown Transit Expansion Study (2014)
▪ METRO CONNECTS envisions a TOD program that would include high density development within a convenient 10-minute walk from transit stops or stations, mixed-use development, street amenities that support safe walking and biking, parking management to optimize land uses, and integrated street trees and lighting.	METRO CONNECTS (2017)

Light Industrial Redevelopment

The redevelopment of Terminal 91 Uplands, the National Guard Armory site, and Fishermen's Terminal will increase light industrial space in the BINMIC and support continued growth of manufacturing and industrial uses. Armory site development proposals include a mix of uses including industrial, manufacturing, housing, office, and open space The Armory's land uses have yet to be determined.

Figure 16 Recommendations for Light Industrial Redevelopment

Details	Plan or Document
▪ Develop Terminal 91 Uplands Over the Next 10-15 Years: Develop two 50,000 square foot parcels (100,000 total) of light industrial space and associated site infrastructure improvements including, but not necessarily limited to: paving, water, sanitary sewers, storm sewers, lighting, electrical power, natural gas, communications, and landscaping. Phase II will develop another 300,000 square feet of light industrial facilities.	Terminal 91 Uplands Development (Phase I, 2019)
▪ The Department of Commerce explored six redevelopment scenarios of the Armory that could include market-rate housing, affordable housing, commercial and industrial uses, and open space.	The Interbay Project: National Guard Armory Redevelopment (2019)
▪ Roughly 60,000 square feet of new light industrial space will be developed for complementary maritime businesses by the end of 2023. The new "Gateway" building is planned in the area of the existing vacant bank building and Net Sheds 7 and 8.	Fishermen's Terminal Redevelopment (2019-2023)

Neighborhood Character

Several plans recommend zoning frameworks to protect the historic neighborhood character of Ballard as it continues to grow. Active uses at the ground-floor level are recommended in pedestrian-designated areas, with more industrial activities focused outside of civic centers and residential neighborhoods. The Ballard library and proposed park opened in 2005, creating new civic neighborhood anchors.

Figure 17 Recommendations for Neighborhood Character

Details	Plan or Document
▪ Protect the Historic Character of the Ballard Neighborhood: Protect and support Ballard's thriving industries while ensuring appropriate balance between maritime/industrial, retail, and restaurants. Prioritize active ground floor uses along Ballard's key commercial streets and require them in pedestrian-designated areas. In other areas, ground-level residential is acceptable or preferred.	Ballard Urban Design Transportation Framework (2016)
▪ Develop an integrated land use and transportation strategy by coordinating with the Ballard Urban Design Framework.	Move Ballard (2016)

Right-of-Way Impacts

Several studies recommend that any bridge replacement scenario have a minimal impact on the existing right-of-way. Specific considerations include maintaining and enhancing access to the waterfront, creating connections to natural assets and trails, and avoiding environmental impacts.

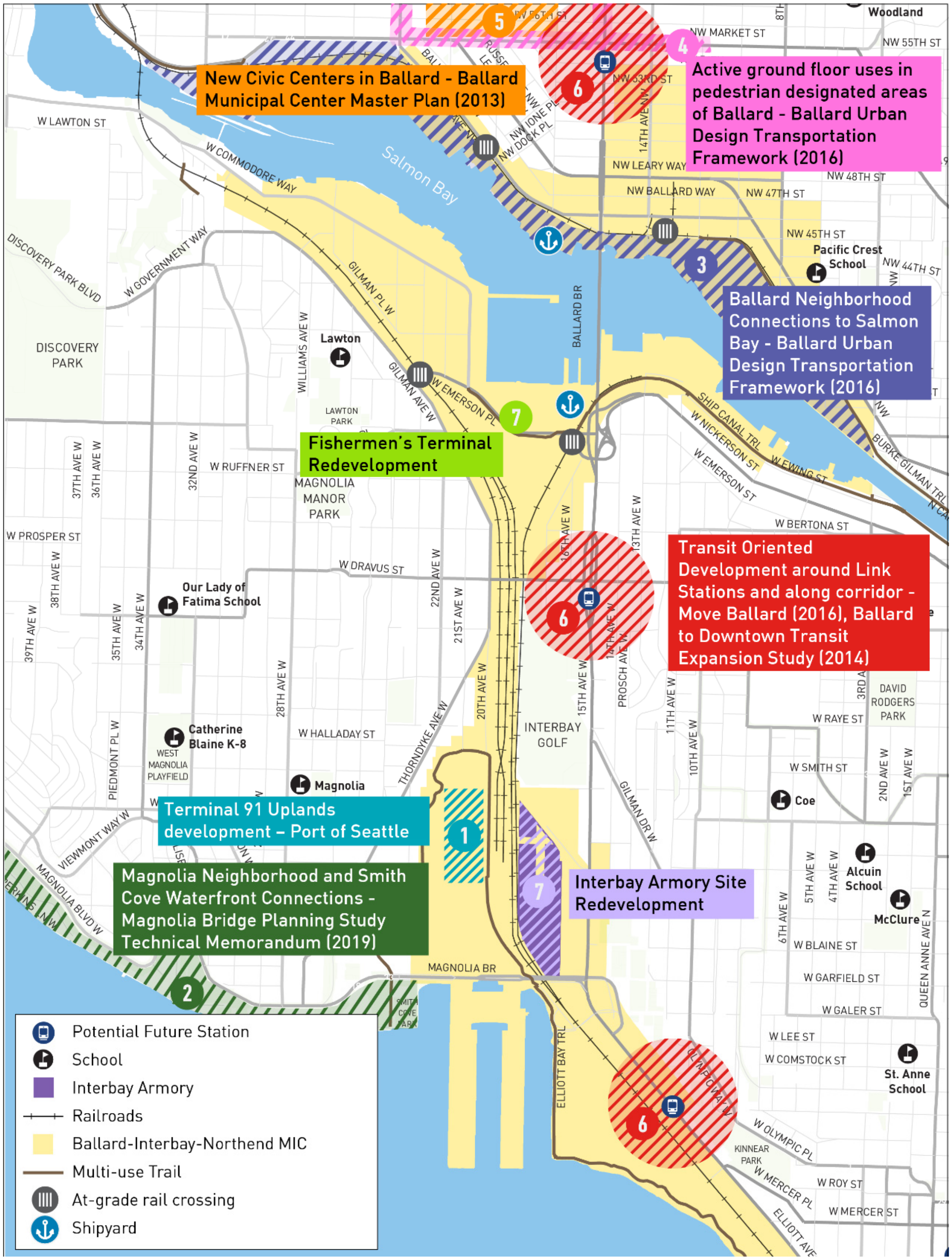
Figure 18 Recommendations for Right-of-Way Impacts

Details	Plan or Document
▪ Provide walking access along the waterfront, from downtown Ballard to the waterfront and to Salmon Bay. ▪ Coordinate infrastructure projects to support existing and new businesses and residents, increase waterfront access, improve multimodal mobility, and steward public investments.	Ballard Urban Design Transportation Framework (2016)
▪ Limit Environmental Impacts and Right-of-Way Acquisition with Bridge Alternatives: The ideal solution avoids or mitigates impacts to environmentally sensitive areas, minimizes impacts to natural hazards, and limits right-of-way acquisition as well as noise and visual pollution impacting adjacent residents and businesses.	Magnolia Bridge Planning Study Technical Memorandum (2019)
▪ Maintain access to the Smith Cove waterfront and improve connections between the Magnolia neighborhood and the Smith Cove waterfront.	Magnolia Bridge Planning Study Technical Memorandum (2019)

Summary Map of Density and Land Use Recommendations

The Ballard-Interbay area can expect that demand for people and goods movement will grow over time as additional development occurs. Growth will shape future scenarios and inform the project team and stakeholders' thinking about appropriate projects and programs that could emerge from the BIRT study. A summary of developments and changing land uses is illustrated in Figure 19.

Figure 19 Map of Recommended Density and Land Use Recommendations



CONCLUSION

The projects and recommendations summarized in this review cover years of planning and investments in the study area. Priorities of partner agencies, residents, businesses, and stakeholders are reflected, but it should be recognized that many planning efforts are ongoing and priorities continue to evolve. Replacement or rehabilitation of the Ballard and Magnolia Bridges and the Sound Transit WSBLE project, represent major infrastructure improvements that will improve transportation access and change circulation patterns in the Ballard-Interbay area. These projects will influence decisions about other local street and intersection improvements and present opportunities to refine connectivity for all modes of travel.

The findings from this plan review set the foundation for the Ballard-Interbay Regional Transportation System project goals, assumptions, and scenario development, as well as performance measures that will be used to evaluate scenarios. The project team will use proposed bridge alternatives, transportation network investments, and potential land use changes to shape forecasts and alternatives that will be evaluated in the BIRT study process.

Appendix A List of Plans and Documents

The following plans and documents are organized by the categories shown in Figure 1. They include the plan or document title, date, and a brief summary of the plan's purpose, leading and partner agencies.

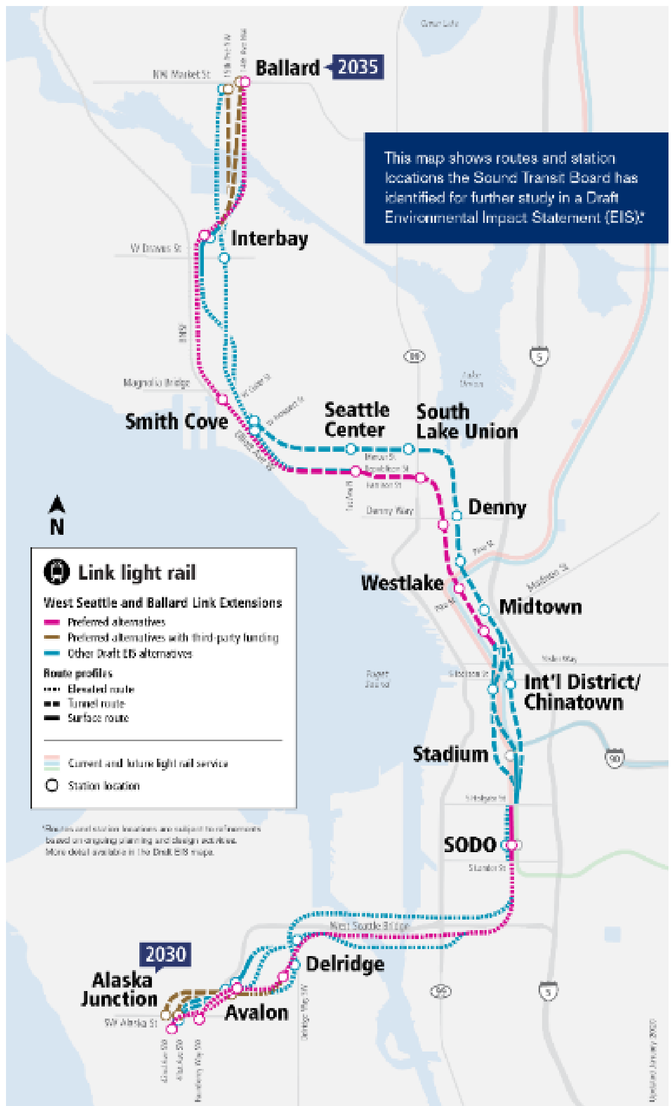
Transit Expansion

Sound Transit West Seattle and Ballard Link Extensions

In November 2016, voters approved the Sound Transit 3 West Seattle and Ballard Link Extensions which will provide fast, reliable light rail connections to West Seattle and Ballard and neighborhoods in between, such as SODO, Chinatown-International District, Downtown, South Lake Union, Smith Cove, and Interbay. Following an extensive alternatives development phase, the Sound Transit Board identified routes and station locations (Figure A-1) to study in a Draft Environmental Impact Statement (EIS). The Draft EIS includes preferred alternatives, preferred alternatives with third-party funding, and other draft EIS alternatives.

The finalization of station locations at Smith Cove, Interbay, and Ballard will have a significant influence on local mobility in the study area. Sound Transit and the City of Seattle are working in partnership to define station access priorities and options to fund those projects through ST3 and local source funds.

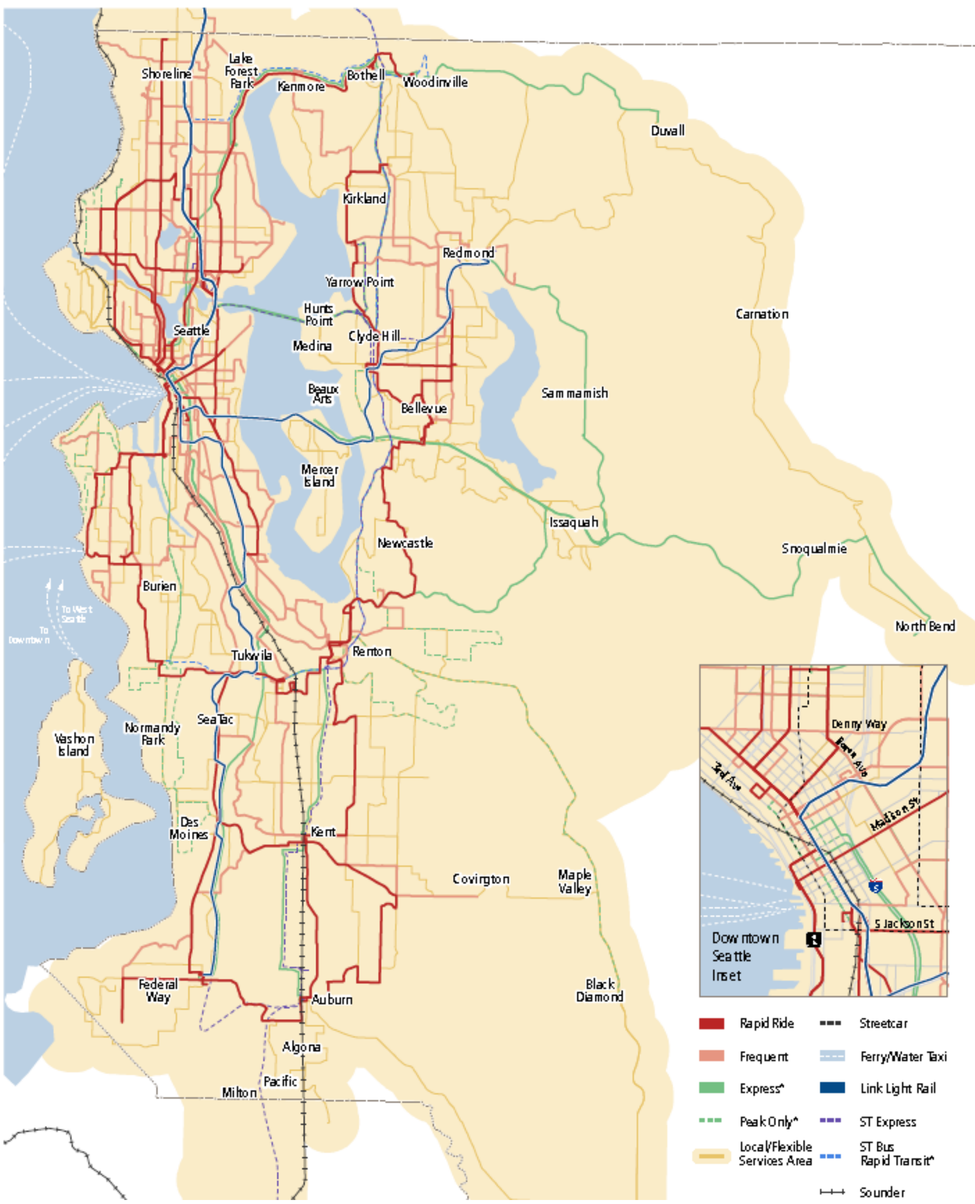
Figure A-1 West Seattle/Ballard Project Map



METRO CONNECTS (2017)

METRO CONNECTS is a 25-year vision for improved transit service throughout King County. The plan outlines a network of frequent, express, local, and flexible services designed around a system of high-capacity transit (HCT) routes including light rail, bus rapid transit (BRT), and RapidRide service that extends north and south of Downtown Seattle. The network allows for the quick movement of passengers across King County and the metro region, while establishing connections to destinations beyond the HCT lines. Key components of the plan include investments in the RapidRide network, which are the trunk transit routes operating at the highest frequencies and carrying large volumes of passengers daily. Among the high-level service concepts proposed in Metro Connects are new or revised bus routes that travel east-west through Seattle and terminate in Interbay.

Figure A-2 2040 METRO CONNECTS Service Network

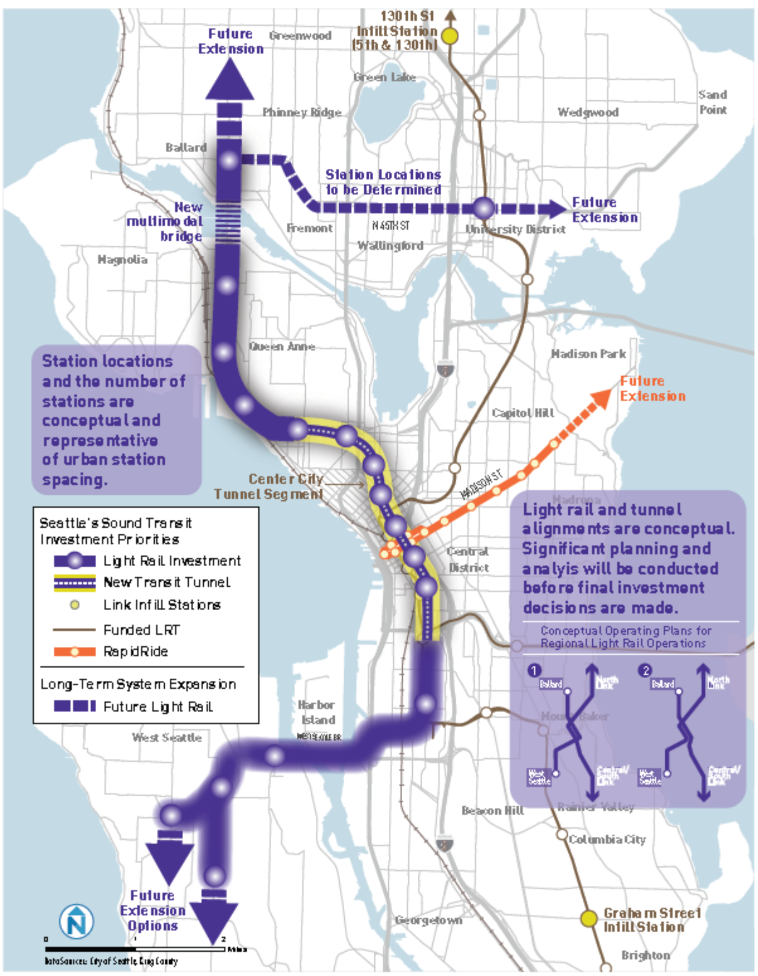


Seattle Transit Master Plan (2016)

The City of Seattle Transit Master Plan (TMP) is a 20-year plan that identifies capital investments in transit facilities, services, programs, and system features. While planning and design of Link light rail service is the responsibility of Sound Transit, the TMP outlines the city's policy guidance regarding desired future transit investments. The original TMP in 2012 identified extensions of light rail to Ballard and West Seattle as top priority projects and includes them in the long-range high capacity transit vision in Figure A-3. There is also interest in a future Ballard to University District light rail corridor as two of the most rapidly growing Urban Village/Centers. (As of 2020, the City of Seattle is working with Sound Transit to refine the station locations and rail alignment in Ballard-Interbay. The option of a tunnel underneath the Salmon Bay/Ship Canal is in discussion if third party funding can be determined.)

The TMP identifies several recommendations to enhance transit access in the BIRT study area. It includes Facility Design Guidelines for a Transportation Center at 15th Ave NW and Market and priority access nodes on either head of the Ballard bridge. There are also recommendations for a 10-minute walkshed from transit corridors in the BIRT study area north of the Ballard bridge, and a 10-minute bikeshed from transit corridors south of the Ballard bridge in the Magnolia neighborhood.

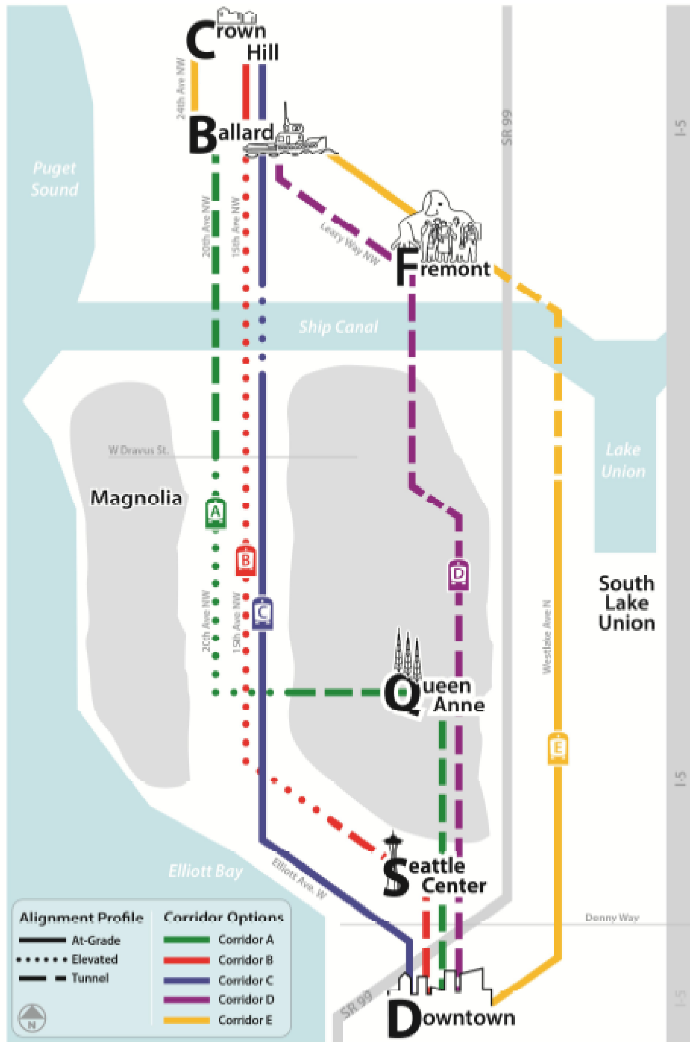
Figure A-3 Transit Master Plan High-Capacity Transit Vision



Ballard to Downtown Transit Expansion Study (2014)

Sound Transit and the City of Seattle partnered to develop the Ballard to Downtown Transit Expansion Study to explore concepts for improved transit connections between Ballard and downtown Seattle, in anticipation of the ST3 vote. A set of candidate corridors was identified based on previous planning studies and community input, generally paralleling surface streets. A multi-tiered alternatives review process incorporated project goals and objectives to screen the segments and alignment alternatives. Some segments and alignments were immediately removed from consideration due to known engineering or environmental challenges, or community opposition. Five corridor options (Figure A-4) were carried forward for evaluation in the final screening review. The study did not recommend a specific corridor, but the results informed the Sound Transit 3 System Plan Representative Project in the System Plan, approved by the Sound Transit board in June 2016.

Figure A-4 Ballard to Downtown Seattle Transit Expansion Study Area



Land Use and Development

Fishermen's Terminal Redevelopment (2019-2023)

The Port of Seattle is improving the long-term financial stability of the Port by developing new light industrial space and creating new jobs at Fishermen's Terminal. The project will provide roughly 60,000 square feet of new light industrial space for complementary maritime businesses.[1] Improvements to the Terminal facility will include parking restriping, lighting upgrades, wayfinding, and new public interpretive displays. The new "Gateway" building is planned in the area of the existing vacant bank building and Net Sheds 7 and 8. The project is expected to cost about $25 million and will be completed in late 2023. The Fishermen's Terminal redevelopment also includes a new Maritime Innovation Center at the historic Seattle Ship Supply building. It will include an incubator and/or business accelerator, active connections between local industry and academia within a focused maritime innovation network, and education and training resources to serve the maritime community.

Figure A-5 Proposed Gateway Building Area

[1] https://www.portseattle.org/projects/fishermens-terminal-redevelopment

Terminal 91 Uplands Development (2019-2023)

The Port of Seattle plans to develop 100,000 square feet of light industrial space and associated site infrastructure at Terminal 91 Uplands, the area north of the pier and Magnolia Bridge.[2] The Port of Seattle Commission approved $4 million for the project, which will include two 50,000 square-foot buildings to support the expansion of fishing and maritime supply chain companies within the existing Ballard-Interbay Manufacturing Industrial Center. Phase 1 will focus on the planning, design, and environmental review for the entire redevelopment area, including partial construction and stormwater improvements. Phase 1 is funded in the Port's 2019-2023 Capital Improvement Plan. Phase 2 will provide another 300,000 square feet of light industrial space, while the third phase of development anticipates adding another 600,000 square feet. The Port will assess the success of the first two phases before considering proceeding with Phase 3.

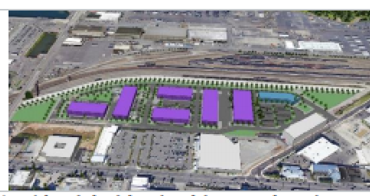
Figure A-6 Phases 1 and 2 of Terminal 91 Uplands Development

[2] https://www.portseattle.org/projects/terminal-91-uplands-development-project

The Interbay Project: National Guard Armory Redevelopment (2019)

In 2018, the Department of Commerce was tasked by the Washington State Legislature to explore potential future uses of its Interbay Property. Located in the Ballard-Interbay Manufacturing Industrial Center, the property is currently used as a readiness center by the Washington National Guard. The Guard plans to move to a location with better transportation access in cases of emergency, and with buildings better suited to their needs. The Department of Commerce studied the options of market-rate housing, affordable housing, commercial and industrial uses, and open space. Six high-level options have been developed that mix and match these priorities. The Interbay Public Development Advisory Committee created an in-depth report with recommendations on the highest public benefit and future economic development uses for the site.

Figure A-7 Armory Redevelopment Concepts

Concept	Concept Image
Mixed use commercial/residential with mixed-income housing framework	
(1) High-Rise Concept	
(2) Mid-Rise Concept	
Industrial framework	
(3) Industrial-Only Concept	
Mixed use light industrial/residential with mixed-income housing framework	
(4) Housing Next to Industrial (mid-rise) (5) Housing Next to Industrial (high-rise)	
(6) Housing Above Industrial	

Expedia Environmental Impact Statement (2016)

Expedia Group Inc. completed an Environmental Impact Statement (EIS) in preparation for its move to a new campus in Interbay, including a 546,000-square-foot office building and parking facilities for 4,500 workers. The Final Environmental Impact Statement for the Expedia Campus Major Phased Development analyzed the probable environmental impacts associated with 13 key environmental parameters, including transportation/circulation and parking, and land use. Transit facility improvements, employee shuttle service and stops on public streets, and transit service upgrades were suggested for coordination with SDOT and King County Metro. Coordination with Sound Transit on the future Ballard Link Extension and station was also recommended. Expedia occupied the first phase of its development in the fall of 2019 and early winter of 2020. Projects delivered as part of the company's transportation mitigation include a major upgrade to the Elliott Bay Trail adjacent to the campus.

Figure A-8 Elliott Bay Trail Improvements Underway near Expedia's Campus, Summer 2019

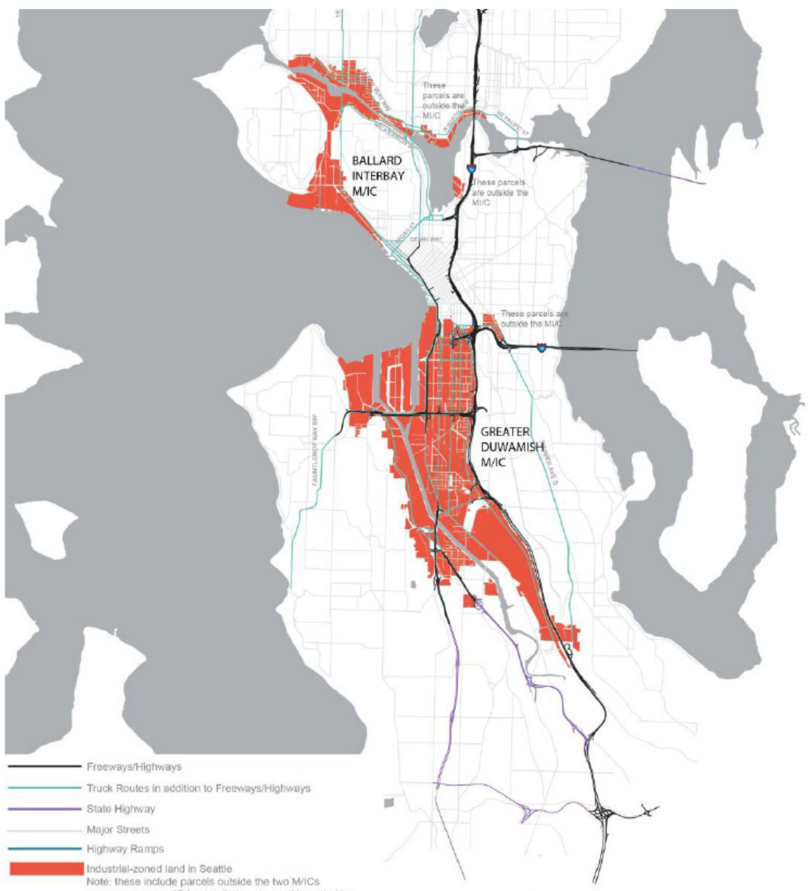
Industrial Lands Policy Discussion Summary and Recommendations (2015)

This report provides background information and summaries of City Seattle studies related to industrial land policies. It also reports on the Department of Planning and Development's public outreach in 2014 and 2015 to obtain feedback on recommended Comprehensive Plan policies intended to strengthen the City's commitment to protect industrial land. The document examines the importance of Seattle's designated Manufacturing/Industrial Centers (MICs) to the local, regional, and global economy, and describes the physical characteristics, challenges, and opportunities for the future of each, including the Ballard-Interbay-Northend MIC.

The proposed industrial lands policies were included as part of Seattle 2035, the city's comprehensive plan, including two new policies:

- GS2.20: Retain land in the Manufacturing/Industrial Centers for industrial uses and develop criteria for evaluating requests to remove land from a MIC, recognizing the important economic resource the land in these centers represents.
- LU1.22: Limit the future application of the Industrial Center zone inside the MIC boundaries to prevent the expansion of offices and other non-industrial uses.

Figure A-9 Map of Industrially Zoned Land

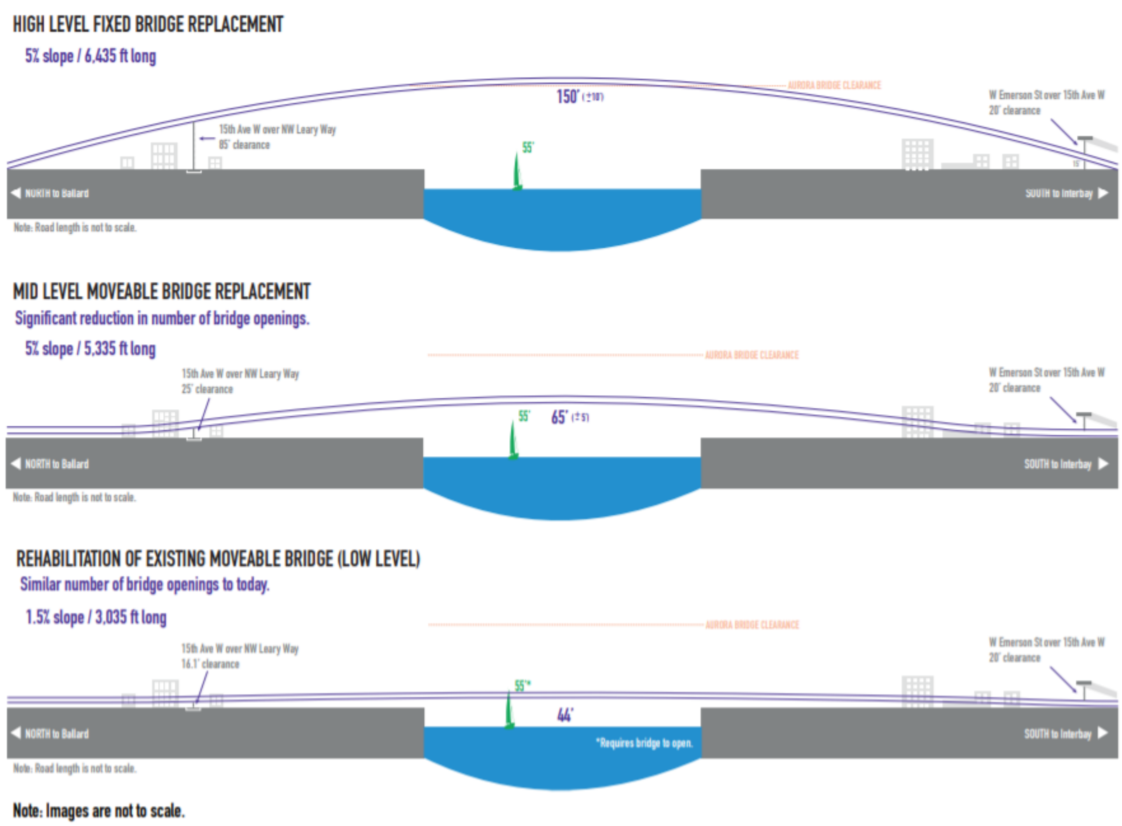


Ballard Bridge

Ballard Bridge Planning Study (2019)

The Ballard Bridge Planning Study explores rehabilitation and replacement options for the long-term future of the Ballard Bridge, built in 1917. It is one of ten studies to assess roadway structure maintenance needs, and understand the extent of Seattle's maintenance backlog. Agency partners, advisory boards, and community members identified needs and values and screened alternatives that explored high-, mid-, and low-level bridge options. Options were evaluated on mobility and connectivity, environmental and permitting considerations, implementation characteristics, cost, and community input. The final report will be published in 2020 and will provide a comparison of alternatives and a summary of public input

Figure A-6 Ballard Bridge Options



Bridge Safety Analysis Report (2018)

The Bridge Safety Analysis Report reviews and evaluates existing conditions and collision history at nine bridge locations within the city of Seattle, four of which are near the Ballard Bridge (see Figures A-11 and A-12). Lack of signage and pavement to establish pedestrian right-of-way and limited dedicated bicycle and pedestrian facilities are the main issues near the Ballard Bridge. Safety improvements to benefit pedestrians and bicyclists include preliminary design and planning-level cost estimates.

Location 1: Ballard Bridge South (15th Ave NW and W Emerson St, Figure A-11): Concept provides a crossing on the east leg at the intersection of W Emerson St and W Nickerson St, west of 15th Ave; provides stop control at all three intersection segments; adds a sidewalk and shared use path to the SW curb. Estimated cost: $1,019,000 to $1,325,000.

Location 2: Ballard Bridge Sidewalk (Between W Emerson St and NW Ballard Way): Provide a railing along the bridge between the sidewalk and vehicle travel lane to reduce conflicts between sidewalk users and motorists. Estimated cost: $9,271,000 to $12,053,000.

Location 3: Ballard Bridge Northwest (On-ramp, Figure A-12): Provide curb extensions and high visibility crosswalks to increase pedestrian visibility and reduce turning vehicle speeds. Estimated cost: $207,000 to $270,000.

Location #4: Ballard Bridge Northeast (Off-ramp): Provide crosswalks, bicycle wayfinding, and signage and pavement markings to direct turning vehicles. Implement parking restrictions and enhance and extend the barrier area farther south to provide increased separation between vehicles and pedestrians. Estimated cost: Included in Location #3 estimates.

Figure A-7 Location 1: Ballard Bridge South

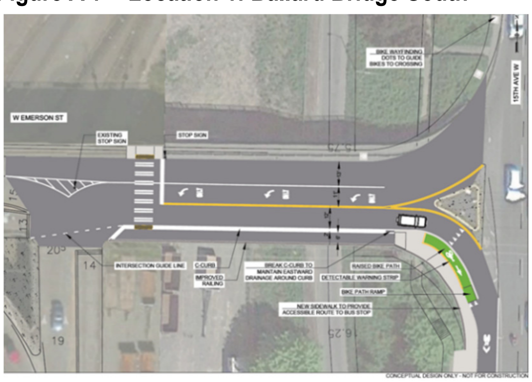
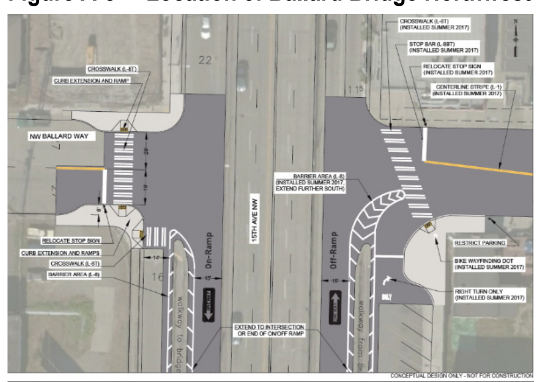


Figure A-8 Location 3: Ballard Bridge Northwest



Ballard Bridge Seismic Retrofit Environmental Conditions Memorandum (2018)

The Ballard Bridge Seismic Retrofit Project called for an identification of existing conditions related to environmental resources for two retrofit scenarios. The first scenario includes foundation retrofit work that would require construction below the ordinary high-water mark. The second scenario would *not* require construction below the ordinary high-water mark. Environmental resources considered include shoreline and waterways, wildlife and critical habitat, cultural (historic and archaeological) resources, public properties and parks, and sensitive noise receptors. Potential environmental approvals, permits, and required time frames for approval, and completion, are described to inform the conceptual engineering design.

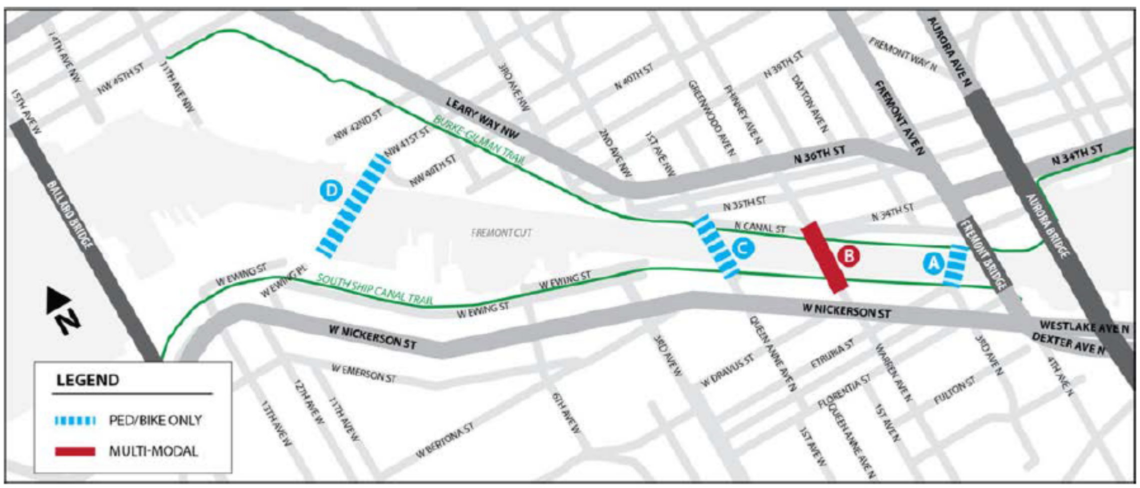
Ship Canal Crossing Study (2015)

The Ship Canal Crossing Study responds to needs identified in the city's Pedestrian, Bicycle, and Transit Master Plans to improve multimodal crossings of the Lake Washington Ship Canal in the vicinity of the Ballard and Fremont neighborhoods. This study is intended to guide future investments that improve mobility across the ship canal, including replacement of the Ballard Bridge and Sound Transit's high capacity transit from Ballard to Downtown. It identifies deficiencies for bicycle and pedestrian crossings on both the Ballard and Fremont bridges, and multimodal needs based upon multiple modal plans. Conceptual designs and cost estimates were developed for two types of potential crossings of the Ship Canal:

1) A movable pedestrian/bicycle-only bridge, and
2) A movable bridge that would accommodate pedestrians, bicycles, and transit, as well as potentially accommodate general purpose traffic.

Four water-crossing options were selected as representative for the study area to serve as points of comparison for constructability, conceptual cost, and mobility and connectivity benefits. All crossings were assumed to be low-level bridges incorporating a movable bridge.

Figure A-9 Proposed Locations for Improved Ship Canal Crossings



Location A: Burke Gilman Trail to Nickerson and Florentia St.
Location B: Phinney Ave N to Warren Ave N
Location C: 1st Ave NW to Queen Anne Ave N
Location D: NW 41st to W Ewing St.

Ballard Bridge Sidewalk Widening Concept Study (2014)

The Ballard Bridge Sidewalk Widening Concept Study analyzed potential improvements to the bridge for pedestrians and bicyclists. The study evaluated the feasibility of widening the sidewalks on the bridge approaches, installing a railing between the travel lanes and the existing sidewalks, and providing a multi-use connector trail between the southwest corner of the Ballard Bridge, 15th Avenue West, and the South Ship Canal Trail.

- Alternative 1: Adding an additional foot to sidewalk width by modifying the existing railing and barrier and adding a railing between the sidewalk and travel lanes
- Alternative 2: Widening sidewalks to either six or ten feet, including a railing between the sidewalk and travel lanes
- Alternative 3: Installing a railing on the inside barrier between the existing sidewalk and travel lanes
- Alternative 4: providing a trail connection from the southwest corner of the Ballard Bridge to the South Ship Canal Trail and the sidewalk on 15th Avenue West, south of the bridge

All were deemed technically feasible, though each had potential challenges, including business relocation impacts, temporary construction impacts to traffic, and associated costs ranging from $3 million to $48 million.

Figure A-10 Possible Pedestrian and Bicycle Improvements to Ballard Bridge

Ballard Area

Burke-Gilman Trail Missing Link Project (2018)

The Burke-Gilman Trail is a 27-mile trail that runs from Golden Gardens Park in Seattle to the Sammamish River Trail in Bothell. It is one of the most heavily used walking and bicycling routes in Seattle and serves as a major transportation corridor. The trail is complete except for a 1.4-mile segment through the Ballard neighborhood, known as the “Missing Link.” The Missing Link has been included in the City’s Comprehensive Plan since the early 1990s and is identified as one of Seattle’s top-rated trail priorities in the 2014 Bicycle Master Plan. An Environmental Impact Study identified a preferred alternative, and design was completed in 2018.

Construction is anticipated to be completed in three phases. The Market Phase (I) includes segments of the corridor that run along NW 54th St and NW Market St. The Shilshole Phase (II) includes segments of the corridor along Shilshole Ave NW. The 45th Phase (III) includes segments of the corridor along Shilshole Ave NW and NW 45th St.

Figure A-11 The Missing Link on the Burke-Gilman Trail

Interbay Trail Connections Project (2016)

SDOT's Interbay Trail Connections Project aimed to create family-friendly connections for people traveling between the Ship Canal Trail, Elliott Bay Trail, and the Ballard Locks to more easily reach Westlake, downtown Seattle, and points along the Burke-Gilman Trail. This project built on the Bicycle Master Plan's recommendations for the Interbay and Magnolia communities to connect major trails. The project concepts included a redesign of 20th Ave W, Gilman Ave W, and W Emerson Place to have protected bike lanes and improved intersections that are more comfortable for bicyclists and efficient for motorists and goods delivery. Recommended improvements were built in 2017.

Figure A-12 Project Details

Ballard Urban Design and Transportation Framework (2016)

The Ballard Urban Design and Transportation Framework defines urban design recommendations, including streetscape design, land use regulations, and design guidelines, that will guide future development while ensuring Ballard's people and places can thrive. The Transportation Framework and recommendations are also known as *Move Ballard*, a set of 10 near-term multimodal transportation studies and improvements. The City Council adopted the recommended amendments to development standards and zoning changes in September 2016.

Urban design recommendations include the development of character areas, land use and zoning changes to reinforce the desired mix of land uses; development standards for building massing and scale; and future station area planning to accommodate future high capacity transit.

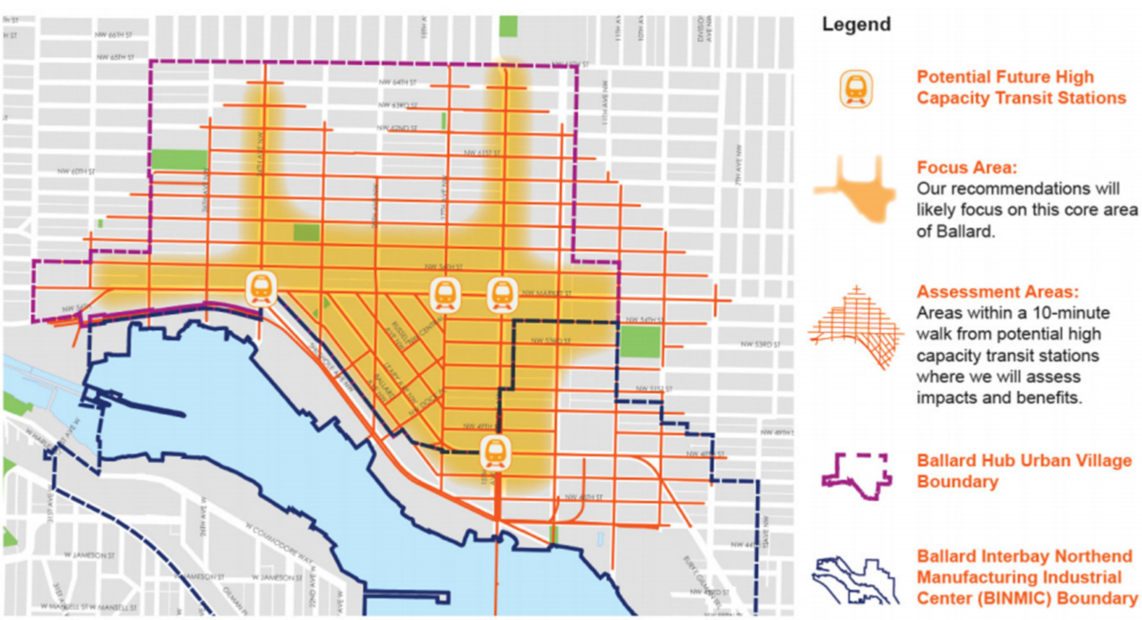
Figure A-17 Character Areas

Move Ballard (2016)

This plan identifies and prioritizes near-term multimodal transportation studies and improvements to help meet the transportation demands of the Ballard neighborhood. Developed in coordination with the Office of Planning and Community Development, the Ballard Urban Design Transportation Framework (2016), these documents work together to articulate a shared vision and strategies to guide future development and transportation investments in Ballard.

Move Ballard incorporates the goals and objectives of other planning work, including existing neighborhood plans, previous transportation studies, and citywide modal plans. In anticipation of the Sound Transit 3 project list, this study evaluates and prioritizes potential future light rail stations identified in the Ballard to Downtown Seattle Transit Expansion Study (2014). The study captures the neighborhood's preference for high capacity transit station locations and connectivity, and identified a list of 10 projects to be implemented in the next one-to-three years, as well as longer-term projects that address major transportation needs.

Figure A-18 Move Ballard Study Area



Ballard Urban Design Existing Conditions Report (2014)

In support of the Ballard Urban Design and Transportation Framework, the Existing Conditions Report documents the area's existing conditions and trends. The report found that population grew by 24 percent between 2000 and 2010, concentrated in the commercial and multifamily areas in the Ballard Urban Village, ranking among the ten most rapidly growing Urban Villages in Seattle. The report focused the Ballard Urban Village and areas within a 10-minute walk of Sound Transit's potential light rail station locations given anticipated future growth, and identified five opportunity areas to ensure people have access to economic opportunity and the amenities for a healthy life (Figure A-19):

1. 24th Ave NW at Market Street
2. 20th and 22nd Ave NW at NW Market Street
3. 15th and 17th Ave NW at Market Street
4. 15th and 14th Ave NW at NW Leary Way
5. 22nd Ave NW at NW 56th Street

These are the areas with the most potential and likelihood of future development and are recommended to have densities, block structures, land use mixes, and streetscapes that will accommodate future growth, access to transit, and access to jobs and other local destination.

Figure A-13 Opportunity Areas in the Ballard Urban Village

Magnolia Bridge

Magnolia Bridge Planning Study Technical Memorandum (2019)

The Magnolia Bridge Planning Study identified three alternatives to the 2006 recommended In-Kind Replacement option. These alternatives, along with the In-Kind Replacement option, have been analyzed and compared through a multi-criteria evaluation process. The evaluation process focused on key metrics including mobility and connectivity, environmental impacts, cost estimates, implementation characteristics, and community support. After scoring the alternatives and applying a sensitivity analysis to the metric weights, two options consistently performed best: a new Armory Way Bridge into Magnolia and a new Western Perimeter Road to Smith Cove Park/Elliott Bay Marina ($200M – $350M), and In-Kind Replacement of the existing Magnolia Bridge adjacent to its current location ($340M – $420M). The Magnolia community prefers the In-Kind Replacement option.

Figure A-14 Alternative 1: Armory Way Bridge Concept

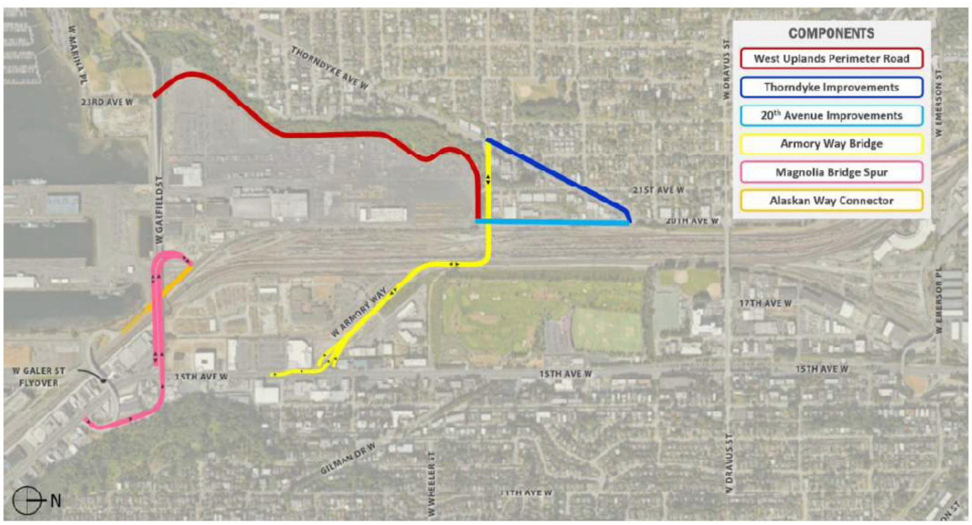


Figure A-15 Alternative 4: In-Kind Replacement Concept

Magnolia Bridge Replacement Environmental Assessment Report (2015)

In March 2006, SDOT recommended a Preferred Alternative to replace the existing Magnolia Bridge. The replacement bridge would lie immediately south of the existing bridge between the Magnolia Bluff and Pier 90, and very close to the same alignment as the existing bridge between Pier 90 and 15th Avenue West/Elliott Avenue West. This environmental assessment report evaluates probable environmental effects that could result from the bridge replacement. This report also contains the measures to avoid or minimize adverse effects of constructing and operating the project, such as construction detours shown in Figure A-22. The Preferred Alternative in this report was developed prior to the existence of Seattle's two-berth cruise ship terminal. The concept may be re-designed to reflect new access needs.

Figure A-16 Possible Detour During Magnolia Bridge Replacement

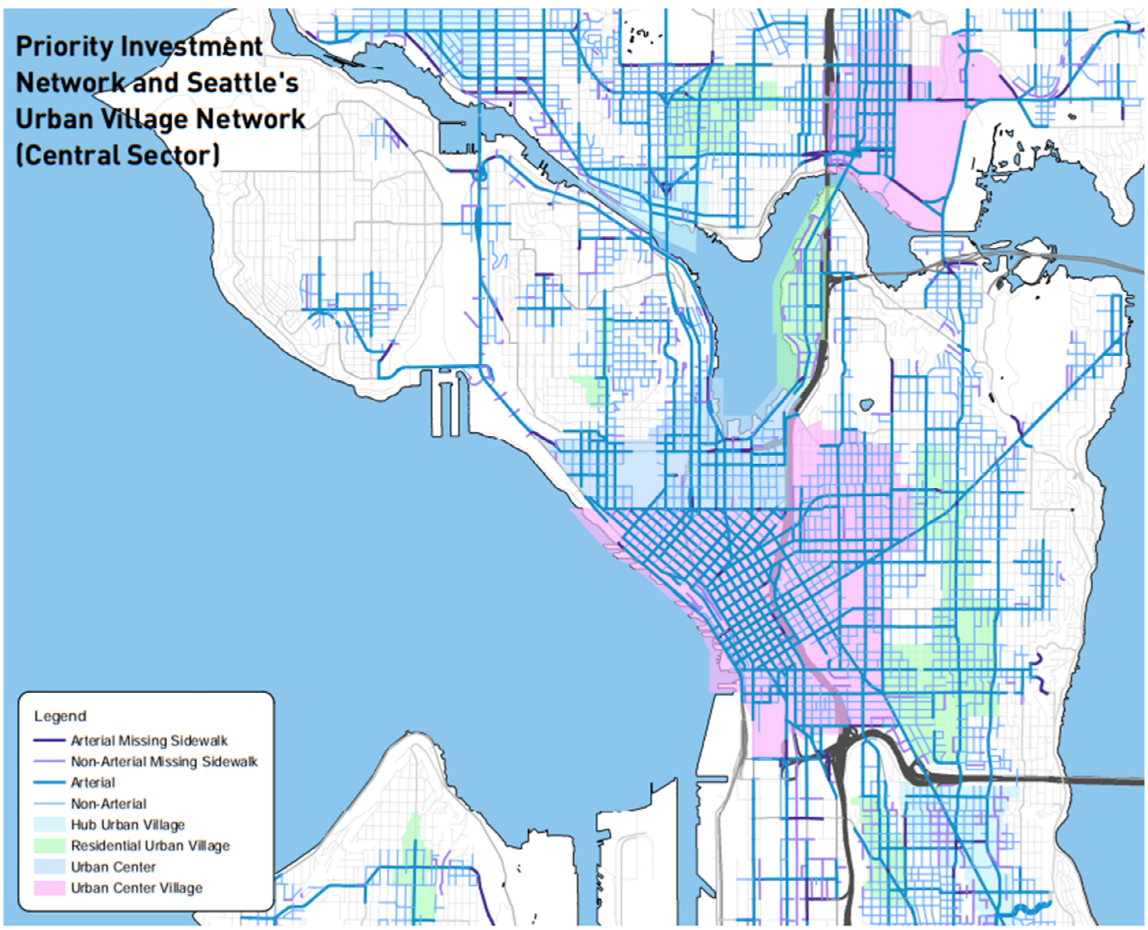
Multimodal Plans

Seattle Pedestrian Master Plan (PMP) 5-Year Implementation Plan and Progress Report (2019)

The PMP Implementation Plan addresses near-term improvements to the pedestrian environment in Seattle, focused on the 26% of all block-faces that lack sidewalks. It includes improvements developed by both public and private stakeholder input and identifies projects and programs that, combined with existing facilities, will make considerable progress toward achieving the PMP vision within five years, from 2019 to 2024. The implementation plan includes a prioritized list of SDOT's pedestrian capital investments, cost and funding summary, summary of pedestrian-related initiatives, and cost-sharing opportunities with utilities and private investment.

Since the plan's adoption, sidewalks were added along W Nickerson St between the Ballard Bridge and 13th Ave W in the BIRT study area. Other planned improvements include a connection of the two existing portions of the Burke-Gilman Trail through the Ballard neighborhood along with pedestrian and bike crossings on NW 45th St, Shilshole Ave, and NW Market St.

Figure A-17 Priority Investment Network

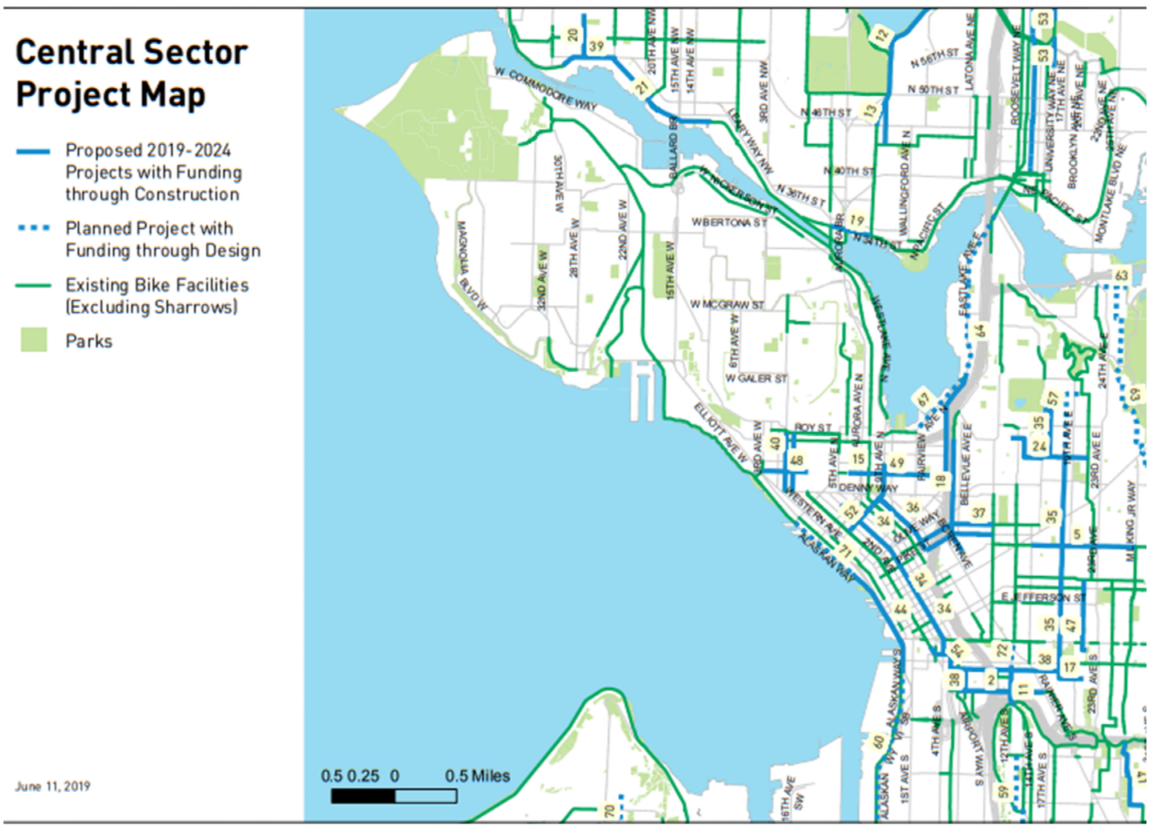


Seattle Bicycle Master Plan (BMP) 2019-2024 Implementation Plan (2019)

The Seattle BMP identifies projects and programs to be implemented from 2014 to 2033 to achieve the vision and meet the plan's goals for safety, ridership, equity, connectivity, and livability. The BMP outlines an infrastructure plan for a connected network that includes approximately 100 miles of protected bicycle lanes and nearly 250 miles of neighborhood greenways. The BMP Implementation Plan describes the work that SDOT and partners have completed and plan to undertake in the next six years, including specific infrastructure projects. A progress report is submitted to City Council each year.

In Ballard, neighborhood greenway upgrades were planned for 2019 (Ballard East-West signal detection improvement at 8th Ave NW on NW 58th Street from Seaview Ave NW to 4th Ave NW). The completion of the Burke Gilman Missing Link is targeted for phased completion in 2020 and 2021.

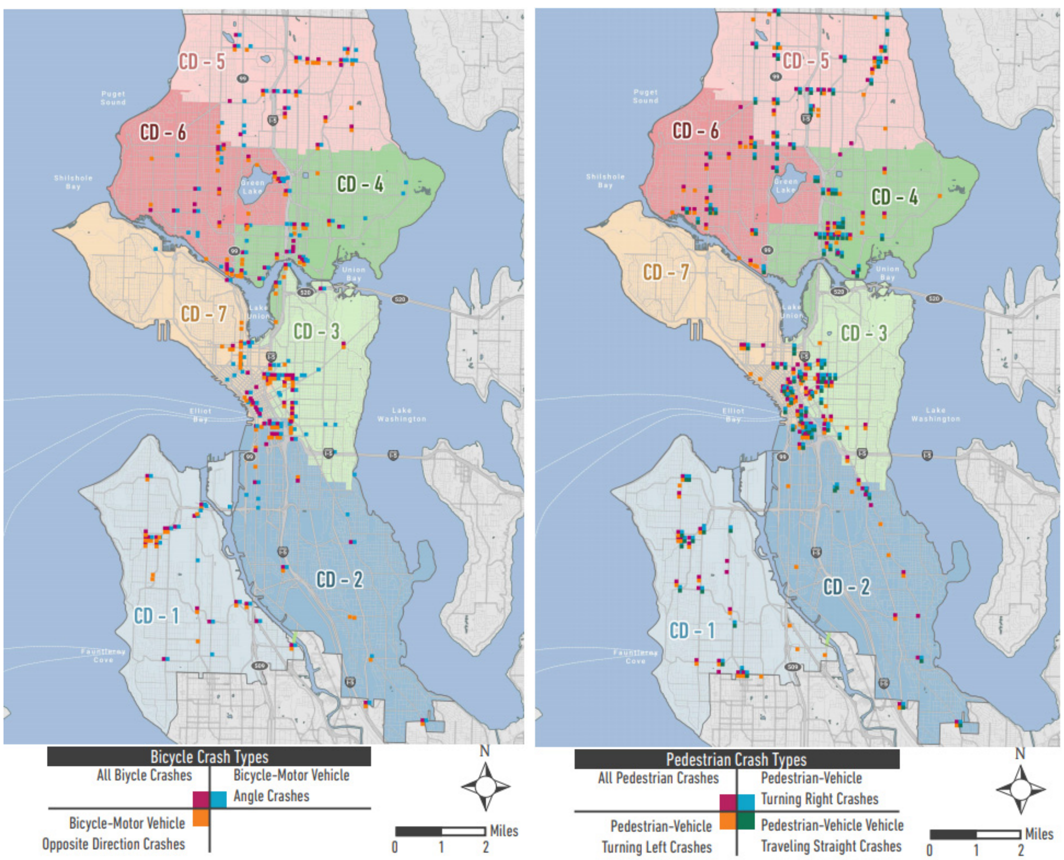
Figure A-18 Planned Bicycle Master Plan Projects 2019 - 2024



Seattle Bike and Pedestrian Safety Analysis Phase 2 (2020)

The initial Bike and Pedestrian Safety Analysis was conducted in 2016. The 2020 update included analysis of three additional years of crash data (2014 – 2017) and signal phasing data that was not previously available. This analysis also refined and confirmed exposure estimates to help understand crash risk across the city. As a result, the analysis identified locations that are a higher priority for safety improvements to proactively address safety issues before a crash occurs. The Ballard neighborhood has a high level of bicycle activity and many bike- and pedestrian-related collisions. There are several locations identified as top priority locations for bike and pedestrian safety improvements, many just north of the Ballard Bridge. There are very few crashes cited in the Interbay neighborhood.

Figure A-19 Top 20 Priority Bicycle (Left) and Pedestrian (Right) Locations per Council District

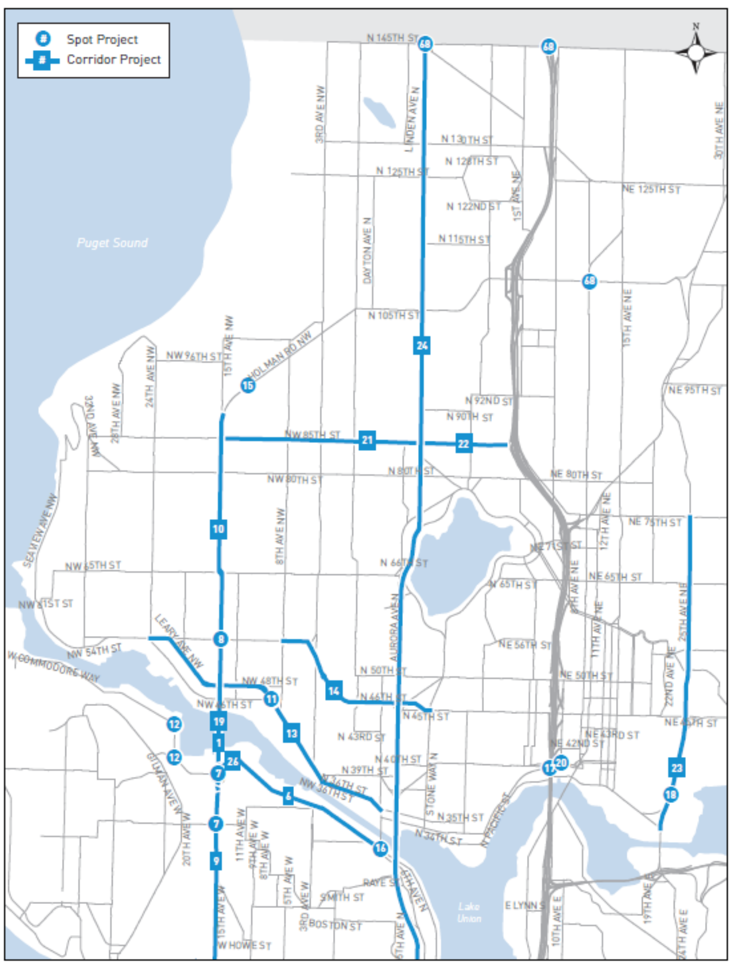


Seattle Freight Master Plan (2016)

The Freight Master Plan focuses primarily on urban truck movement to support Seattle's increasing demand for the delivery of goods and services in a safe and reliable manner. As one of two Manufacturing and Industrial Centers (MICs) in the City of Seattle, the Ballard-Interbay-Northend MIC (BINMIC) is the region's smallest MIC at 932 acres. Uses span light manufacturing, maritime, food processing, warehouse uses, a rail yard, and several Port of Seattle facilities. The FMP identifies major and minor freight corridors within the BIRT study area and includes a toolbox to address bottlenecks and safety locations; the Ballard Bridge is noted as a *high* bottleneck location.

There are 22 recommended project concepts (see Figure A-26) that build upon an inventory of freight and mobility connectivity projects from other planning efforts (e.g., Levy to Move Seattle, SDOT's Large Capital Program prioritization, Freight Access Project, and the 2014 Washington State Freight Mobility Plan). They include traffic signal improvements, interchange ramp improvements, turn-restrictions, elimination of height restrictions on pedestrian bridges, and dynamic messaging to communicate travel conditions, and modifications to turning radii. Replacement of the Ballard bridge is noted as a catalyst project that is located at a choke point in the network.

Figure A-26 North Seattle Freight Projects



Ballard Interbay Regional Transportation System (BIRT) Study

Appendix C: Transportation Methods and Assumptions

November 2020

Seattle Department of Transportation

APPENDIX C: TRANSPORTATION METHODS & ASSUMPTIONS

This is a high-level overview of the transportation analysis approach for the Ballard-Interbay Regional Transportation System (BIRT) study. This overview was informed by the Interagency Team (IAT) members following the March 18, 2020 meeting.

Study Area Roadways & Intersections

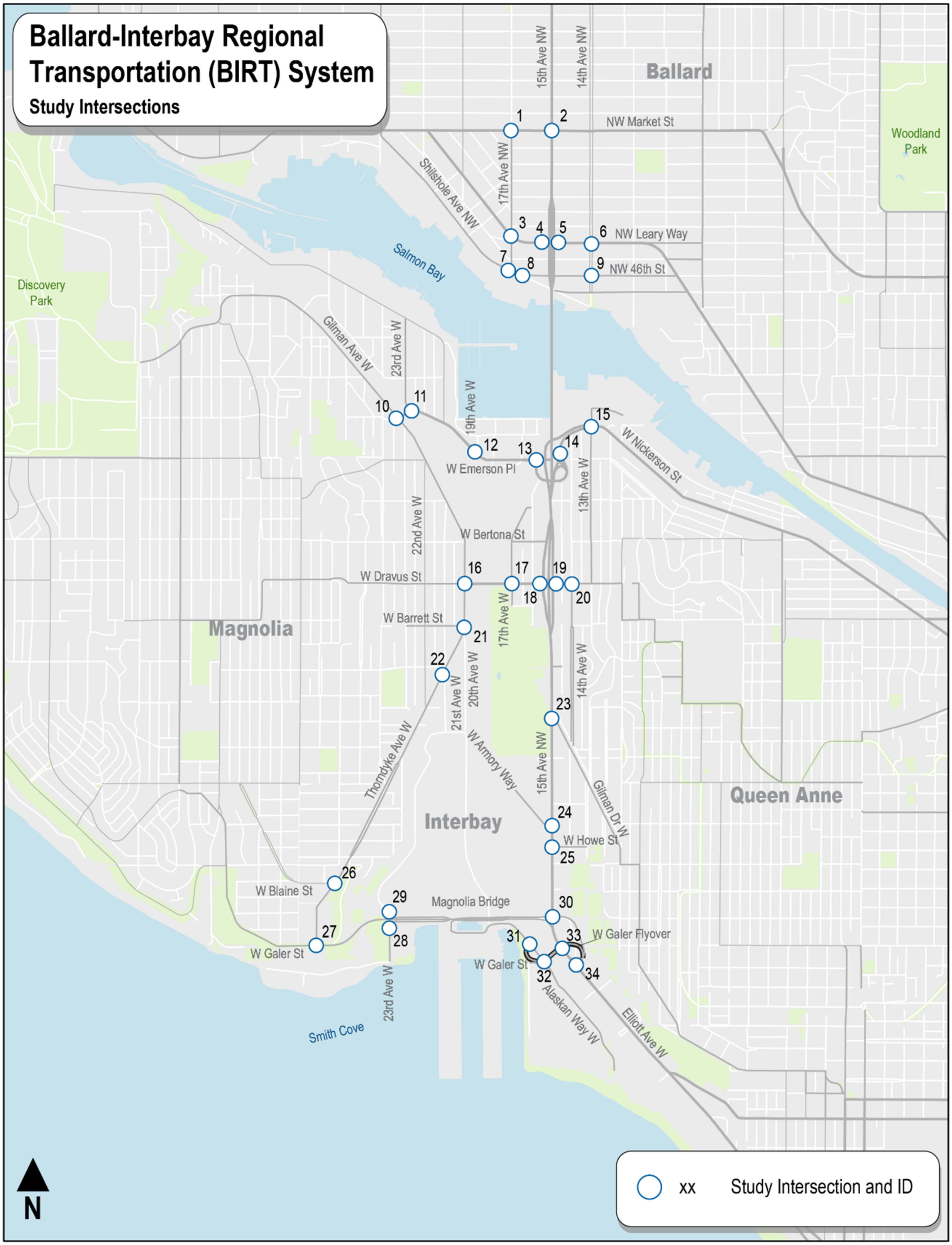
The study area for the BIRT project is generally bound by Market Street to the north, Terminal 91 and the Expedia campus to the south, 10th Avenue West to the east, and 28th Avenue West to the west. Key roadways and intersections are shown in Table 1 and Figure 1.

Table 1. BIRT – Key Study Area Roadways

Roadway Name	Classification	Speed Limit	AWDT[1]	Other Classifications
15th Avenue W at Ballard Bridge	Principal Arterial	30 mph	59,000	Major Freight Corridor
Shilshole Avenue NW at Ballard Bridge	Minor Arterial	30 mph	15,300	Major Freight Corridor
15th Avenue W at Dravus Street	Principal Arterial	30 mph	36,000	Major Freight Corridor
15th Avenue W at Gilman Drive W	Principal Arterial	30 mph	46,000	Major Freight Corridor
W Emerson Place	Principal Arterial	25 mph	19,800	Minor Freight Corridor Pedestrian Priority Corridor
Gilman Avenue W	Minor Arterial	30 mph	10,800	Protected Bike Lane
W Nickerson Street	Principal Arterial	30 mph	18,700	Major Freight Corridor
W Dravus Street	Principal Arterial	30 mph	21,100	Minor Freight Corridor
20th Avenue W	Minor Arterial	30 mph	6,000	Minor Freight Corridor Protected Bike Lane
Thorndyke Avenue W	Minor Arterial	30 mph	4,700	
W Galer Street	Non-Arterial	20 mph	6,600	Industrial Freight Corridor
Elliott Avenue W	Principal Arterial	30 mph	52,000	Major Freight Corridor
Magnolia Bridge	Minor Arterial	35 mph	20,000	Industrial Freight Corridor

Notes:
1. AWDT (Average Weekday Traffic) are 2017 Seattle traffic flow data presented in the 2018 SDOT Traffic Report.

Figure 1. BIRT Study Intersections



Multimodal Traffic Counts

Traffic volume data and corridor travel time data (where available) will be compiled from recent transportation studies completed in this area, which are summarized in Table 2.

Table 2. BIRT – Previous Plans and Studies Referenced

Category	Plan or Document
Transit Expansion	▪ Sound Transit West Seattle and Ballard Link Extensions (2019) ▪ METRO CONNECTS (2017) ▪ Seattle Transit Master Plan (2016) ▪ Ballard to Downtown Transit Expansion Study (2014)
Land Use and Development	▪ Fishermen's Terminal Redevelopment (2019-2023) ▪ Terminal 91 Uplands Development (Phase I, 2019) ▪ Terminal 91 2019 Traffic Monitoring Study (2019) ▪ The Interbay Project: National Guard Armory Redevelopment (2019) ▪ Expedia EIS and FEIS(2016) ▪ Industrial Lands Policy Discussion Summary and Recommendations (2015) ▪ The Interbay Public Development Advisory Committee's Recommendations and Implementation Plan (2019)
Ballard Bridge	▪ Ballard Bridge Planning Study Materials (2020) ▪ Ballard Bridge Planning Study: Transportation Discipline Report (2019) ▪ Ballard Bridge Outreach Summary (November 2019) ▪ Bridge Safety Analysis (2018) ▪ Ballard Bridge Seismic Retrofit Environmental Conditions Memorandum (2018) ▪ Ship Canal Crossing Study (2015) ▪ Missed Connection: Ballard Bridge Safety Recommendations (2015) ▪ Ballard Bridge Sidewalk Widening Concept Study (2014) ▪ Ballard Bridge Planning Study Draft Alternatives Comparison Report (March 2020)
Ballard Area	▪ Burke-Gilman Trail Missing Link (2018) ▪ Interbay Trail Connections Project (2016) ▪ Ballard Urban Design Transportation Framework (2016) ▪ Move Ballard (2016)
Magnolia Bridge	▪ Magnolia Bridge Planning Study Technical Memorandum (2019) ▪ Magnolia Bridge Replacement Environmental Assessment Report (2015)
Multimodal Plans	▪ Seattle Pedestrian Master Plan (2017) ▪ Seattle Bicycle Master Plan (2014) ▪ Seattle Bike and Pedestrian Safety Analysis (2020) ▪ Seattle Freight Master Plan (2016)

It was originally assumed that new multimodal traffic counts would be collected for study roadways and study intersections where counts are more than two-years old (pre March 2018) or in areas where traffic is suspected to have increased due to new development (such as in the south end of the study area near the new Expedia campus). Given the impacts of COVID-19 on travel behavior and the tight timeline for this study, the project team will use existing sources such as technical files developed for the Magnolia and Ballard Bridge studies, draft WSBLE analysis, and other documents listed above..

Future Scenarios

We will develop and evaluate up to four (4) future-year alternatives, which will vary in terms of land use and transportation assumptions. Each of these scenarios will leverage options described in existing efforts including the Seattle Comprehensive Plan, Magnolia and Ballard bridge studies, and Sound Transit's West Seattle and Ballard Link Extensions (WSBLE) project. At this point, we have identified two potential network alternatives, which are summarized in Table 3.

Table 3. BIRT – Future Investment Scenarios

<table>
<tr><th>Investment Scenario</th><th>Magnolia Bridge</th><th>Ballard Bridge</th><th>Land Use</th><th>Transportation Infrastructure</th></tr>
<tr><td>One</td><td>In-Kind Replacement</td><td>Mid Level</td><td rowspan="2">2042 land uses consistent with West Seattle and Ballard Link Extension study, plus updated assumptions for:
• Armory
• Terminal 91
• Fishermen's Terminal</td><td rowspan="2">• ST Ballard Link Extension
• Bike Master Plan
• Additional supporting facilities TBD</td></tr>
<tr><td>Two</td><td>Armory Way Concept</td><td>Low Level</td></tr>
</table>

It is assumed that other future alternatives would leverage the above network alternatives, but vary in terms of citywide land use assumptions following alternatives being considered within the Seattle Industrial Maritime Strategy EIS.

Project Evaluation

Working with the SDOT project management team and the IAT, Fehr & Peers identified a set of project evaluation criteria, shown in Table 4. These criteria provide a mechanism to evaluate potential transportation investments' ability to advance the overall goals of this study.

Table 4. Project Evaluation Metrics

Goals	Outcomes	Evaluation Criteria	Description	Low - 0	Medium - 1	High - 2
1. Improve mobility for people and freight	Increase person mobility in the study area	**Throughput:** Project increases person trips and person throughput.	Improves capacity for additional person trips compared to existing conditions.	Project does not provide additional person trip capacity.	Project improves person trip capacity in the midday period only.	Project improves person trip capacity in the peak period.
		Transit Mobility: Project improves transit mobility.	Improves corridor transit travel time and on-time reliability.	Project provides no benefit to transit mobility.	Project provides an indirect benefit to transit mobility.	Project provides an explicit and direct benefit to transit mobility.
		Access: Project increases the geographic reach of who can walk/bike to a key destination (light rail station, existing RapidRide Stop, or major jobs center (Terminal 91, Expedia, Armory)) under low-stress conditions.	Increases the number of homes and businesses within a 10-minute walk and low-stress bike ride.	Project does not change the size of the walk/bike sheds.	Project provides greater access for bicyclists and pedestrians, but doesn't expand the shed (e.g. new greenway, adding to the sidewalk network but there's a trail nearby)	The project increases the size of the low-stress shed (e.g. new bridge or connection, high to low bike stress conversion, etc.)
		Connectivity: Project improves the number of high-quality travel choices through improved connectivity.	Improves the number of high-quality connections, which are defined by mode as follows: Pedestrians – facilities are comfortable, flat, accessible, and buffered Bicycles – facilities are LTS 1 Transit – service is frequent and reliable	Project does not change the number of high-quality travel options.	Project provides a high-quality travel option, but reasonable alternatives exist.	Project creates a new high-quality travel option where no reasonable alternatives exist.
	Accommodate the needs of freight and goods movement	**Travel Time & Reliability:** Project reduces or maintains freight travel times on key corridors.	Results in less roadway delay for freight vehicles.	Project provides no benefit to freight transit travel time and/or reliability.	Project provides an indirect benefit to freight travel time and/or reliability.	Project provides an explicit and direct benefit to freight travel time and/or reliability.
		Route Resiliency: Project adds to available freight paths at key locations in the study area.	Additional freight pathways are available as a result of the project.	Project does not increase freight pathways.	Project enhances existing freight routes (e.g. improves roadway conditions, addresses hot spots, revises intersection geometrics to be more freight viable).	Project provides one or more additional freight pathways than are available today.

Goals	Outcomes	Evaluation Criteria	Description	Low - 0	Medium - 1	High - 2
2. Provide a system that safely accommodates all travelers	Protect the most vulnerable travelers	**Safe and Comfortable Options:** Project makes biking safer and more comfortable for people of all ages and abilities.	A right-of-way enhancement to improve the Bicycle Level of Traffic Stress (LTS) score (e.g. protected bike lane, multi-use path)	Project does not improve LTS score.	Project improves LTS score by 1 point.	Project improves LTS score by at least 2 points.
		Safe and Comfortable Options: Project makes walking and rolling safer and more comfortable.	Pedestrian improvement (e.g. sidewalk widening, new sidewalk, sidewalk buffer, more ADA compliant facilities)	Project does not improve pedestrian realm.	Project improves pedestrian realm (e.g. increasing sidewalk width, adding buffer, improving ADA compliance).	Project improves pedestrian realm (e.g. increasing sidewalk width, adding buffer, improving ADA compliance) and is in high pedestrian-use area (adjacent to a light rail station or commercial uses).
		Safe and Comfortable Options: Project makes using transit safer and more comfortable.	Improves illumination, makes transit more visible, and/or provides more "eyes on the street" at or near transit facilities.	Project does not improve lighting, make transit more visible, or provide more "eyes on the street" near transit facilities.	n/a	Project improves lighting conditions, makes transit more visible, and/or provides more "eyes on the street" near transit facilities.
		Crossing Safety: Project makes crossing roadways safer and more comfortable for those walking, rolling, biking, and accessing transit.	Provides new or improved crossing treatment (e.g. restriping, RRFB, curb ramps, crossing island, curb extension, reduced pedestrian exposure, new signal, reduced motor vehicle turning speed, narrowed curb return, etc.)	Project does not provide a crossing improvement.	Project improves or adds a crossing (e.g. restriping existing crosswalk, adding curb ramps, RRFB).	Project improves or adds a crossing (e.g. restriping existing crosswalk, adding curb ramps, RRFB) and is in a high pedestrian use area (adjacent to a light rail station or commercial uses) or along a route identified in the Seattle Bike Plan.

Goals	Outcomes	Evaluation Criteria	Description	Low - 0	Medium - 1	High - 2
		Collision Histories and Factors: Project addresses safety at a location where many collisions have occurred or are identified in the City's Bicycle and Pedestrian Safety Analysis.	Provides a safety benefit at a location with a high collision rate (autos, bicycles, and/or pedestrians).	No collisions involving bicyclists or pedestrians have occurred in the last 5 years at this location, or the project does not provide a safety benefit for bicyclists/pedestrians (e.g. a purely freight or transit project).	Collisions involving bicyclists or pedestrians have occurred in the last 5 years at this location, but they were not serious or fatal.	Serious or fatal collisions involving bicyclists or pedestrians have occurred in the last 5 years at this location or location is identified as a Top 20 bike/pedestrian project location by Council District in City's Bicycle and Pedestrian Safety Analysis.
	Recognize the unique needs to safely accommodate freight	**Roadway Geometrics:** Project improves mobility for trucks and deliveries.	Improves freight mobility by enhancing roadway elements necessary for optimal industrial freight and delivery operations.	Project maintains current freight and delivery conditions.	n/a	Project includes features to improve freight loading and/or enhances freight ingress/egress.
		Modal Separation: Project limits conflicts with other modes.	Improves multimodal use of freight corridor by limiting conflicts with other modes.	Project maintains current freight and delivery conditions.	n/a	Project enhances turn radii for freight and/or provides protected space for non-motorized uses to remove conflicts.
3. Equity	Advance projects that meet the needs of communities of color and those of all incomes, abilities, and ages.	**Social Impacts - Residents:** Project minimizes impacts on low-income households and people of color that live in the BIRT study area.	Improves access or safety for priority communities including low-income households and people of color (e.g. crosswalk improvements in low-income neighborhood).	Project does not improve access or safety for low-income households and people of color.	n/a	Project improves access or safety for low-income households and people of color.
		Social Impacts - Employees: Project minimizes impacts on low-wage workers and people of color that work in the BIRT study area.	Improves access or safety for low-wage workers and people of color (e.g. crosswalk improvements near jobs with low-income employees).	Project does not improve access or safety for low-wage workers and people of color.	n/a	Project improves access or safety for low-wage workers and people of color.
		ADA Access: Project makes it easier for people with disabilities to travel in the study area.	Improves access or safety for people with disabilities (e.g. crosswalk improvements, sidewalk condition	Project does not improve access or safety for people with disabilities.	n/a	Project improves access or safety for people with disabilities.

Goals	Outcomes	Evaluation Criteria	Description	Low - 0	Medium - 1	High - 2
			improvements, improved transit service quality/experience, etc.)			
4. Support timely and coordinated implementation	Maintain the current and future capacities of the Ballard and Magnolia Bridges. Provide other necessary infrastructure in Ballard-Interbay to facilitate overall mobility.	**Funding Viability:** Project is likely to be funded through local, regional, state, or federal funding.	Has earmarked funds (or high potential to receive earmarked funds), is competitive for grant funding, or can be included as part of another funded project.	No	n/a	Yes
		Timely Implementation: Project is implementable within a reasonable timeframe given technical and right-of-way considerations.	Is feasible and achievable in a reasonable timeframe.	May take more than 20 years to implement, or is not within the City of Seattle's jurisdiction.	Would require agency partnerships (but could be led by the City) and/or could take 7-20 years to implement.	Within the City's jurisdiction and can be done quickly (within 6 years).
		Constructability, Risk, and Complexity: Project limits construction impacts.	Does not provide undue disruptions in the transportation system during construction.	Construction of project would require extended closure of a route or travel path that has no or limited alternate routes.	Construction of project may have impacts, but alternative routes exist.	Construction of project would have minor or no impacts on travelers or goods movement.
		Environmental Impacts: Project minimizes impacts on the ecological environment.	Supports sustainability (e.g. adds vegetation to reduce heat island effect, reduces street width, uses permeable surfaces, encourages mode shifts away from SOV).	Does not include sustainability improvements.	Encourages mode shift, but doesn't make other sustainability improvements.	Increases vegetation, reduces street width, and/or uses permeable surfaces/other stormwater treatments.
		Economic Impacts: Project supports the Manufacturing and Industrial Center (BINMIC) and maritime industries.	Supports and promotes economic viability of the BINMIC and maritime industries.	Doesn't do so	Supports/promotes economic viability to medium extent	Promotes economic viability of BINMIC and maritime industries.
		Responds to Urgent Needs: Project addresses an identified seismic or structural deficiency.	Addresses an identified seismic or structural deficiency.	No, there is no seismic or structural deficiency to address.	Improves identified deficiency	Yes, resolves seismic or structural deficiency.

Ballard Interbay Regional Transportation System (BIRT) Study

Appendix D: Multimodal Needs Assessment

November 2020

Seattle Department of Transportation

Ballard-Interbay Regional Transportation System:

Multimodal Needs Assessment – Background Report

Prepared for:
Seattle Department of Transportation

June 2020

FEHR PEERS

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1

Introduction

This background report describes existing and anticipated future conditions in the study area for the Ballard-Interbay Regional Transportation (BIRT) project. It identifies existing and possible future deficiencies and highlights areas in need of access and comfort improvements for all modes of travel – walking, bicycling, taking transit, driving and moving freight. Each chapter of this report covers the unique needs and opportunities for each mode within the study area. This analysis will be used to identify potential projects in the study area that improve transportation access and comfort for people using the system, which will subsequently be evaluated for inclusion in the final BIRT report to the Washington State Legislature.

Study Area & Adopted Plans

Figure 1: Study Area illustrates the BIRT project study area, which includes the Ballard, Interbay, Magnolia, and Queen Anne neighborhoods. The study area is generally bound by NW Market Street to the north, Terminal 91 and the Expedia campus to the South, 10th Avenue West to the east, and 28th Avenue West to the west. The Ballard and Interbay neighborhoods are experiencing significant residential and employment growth, and the Ballard-Interbay-Northend Manufacturing and Industrial Center (BINMIC) is an important local and regional economic and employment asset. The BINMIC includes maritime, commercial, and industrial uses, local and regional freight routes, and an evolving transportation system that includes three future Sound Transit light rail stations. The Manufacturing Industrial Center is highlighted in yellow in **Figure 1**.

Figure 1: Study Area

*The graphic depicts the Preferred Alternative identified by the Sound Transit Board for study in the Draft EIS for the West Seattle and Ballard Link Extensions project. The Draft EIS will also examine a "Preferred Alternative with Third Party Funding" and other alternatives and will be published in early 2021. Final selection of the project to be built will follow publication of the Final EIS in 2022.

The Ballard-Interbay area has been studied extensively over the years, and this report builds on findings from a variety of previous plans and studies, which are listed in **Table 1**. The Magnolia and Ballard bridges have been studied at length over the last decade due to the 2001 Nisqually earthquake and because they are aging infrastructure serving increasing travel demand. In 2002, the year after the Nisqually earthquake, SDOT received a grant to identify a Magnolia bridge alternative that would meet community needs and be well-suited to environmental conditions in the area. The community's preference was for an in-kind replacement that would parallel the existing bridge to the south. In 2014, SDOT's Bridge Seismic Retrofit Program completed work to minimize movement on the Ballard bridge in the event of an earthquake.[1]

In addition to bridge studies, planning is underway for major projects and developments that will shape the future of the Ballard-Interbay area. These include the future West Seattle and Ballard Link light rail extension (WSBLE), transit-oriented development at the future Link stations and along the high-capacity transit corridor, and redevelopment of several major properties, including Terminal 91, Fishermen's Terminal, the Armory, and the new Expedia corporate campus. Significant capital improvements are already underway related to these projects, and in many cases, they call for investments in the surrounding public realm and transportation networks.

Planning for the WSBLE project is currently in progress, and the final station locations and rail alignments are not yet determined. The Draft EIS has several options for station locations and alignments, but this report's graphics only show the Preferred Alternative for each station in the study area. The light rail stations in Ballard, Interbay, and Smith Cove will influence how people travel in the study area, so it is important to consider how people will access the stations using all modes of transportation, as well as how bus and light rail service will interact at the stations.

Table 1. Previous Plans and Studies Referenced

Category	Plan or Document
Transit Expansion	▪ Sound Transit West Seattle and Ballard Link Extensions (2019) ▪ METRO CONNECTS (2017) ▪ Seattle Transit Master Plan (2016) ▪ Ballard to Downtown Transit Expansion Study (2014)
Land Use and Development	▪ Fishermen's Terminal Redevelopment (2019-2023) ▪ Terminal 91 Uplands Development (Phase I, 2019) ▪ Terminal 91 2019 Traffic Monitoring Study (2019) ▪ The Interbay Project: National Guard Armory Redevelopment (2019) ▪ The Interbay Public Development Advisory Committee's Recommendations and Implementation Plan (2019) ▪ Expedia Environmental Impact Statement (2016) ▪ Industrial Lands Policy Discussion Summary and Recommendations (2015)

[1] https://sdotblog.seattle.gov/2014/04/08/seven-bridges-retrofitted-to-rock-n-roll/

Category	Plan or Document
Ballard Bridge	▪ Ballard Bridge Planning Study Draft Alternatives Comparison Report (2020) ▪ Ballard Bridge Planning Study (2020) ▪ Ballard Bridge Planning Study: Transportation Discipline Report (2019) ▪ Ballard Bridge Outreach Summary (2019) ▪ Bridge Safety Analysis (2018) ▪ Ballard Bridge Seismic Retrofit Environmental Conditions Memorandum (2018) ▪ Ship Canal Crossing Study (2015) ▪ Missed Connection: Ballard Bridge Safety Recommendations (2015) ▪ Ballard Bridge Sidewalk Widening Concept Study (2014)
Ballard Area	▪ Burke-Gilman Trail Missing Link (2018) ▪ Interbay Trail Connections Project (2016) ▪ Ballard Urban Design Transportation Framework (2016) ▪ Move Ballard (2016)
Magnolia Bridge	▪ Magnolia Bridge Planning Study Technical Memorandum (2019) ▪ Magnolia Bridge Replacement Environmental Assessment Report (2015)
Multimodal Plans	▪ Seattle Bike and Pedestrian Safety Analysis: Phase 2 (2020) ▪ Seattle Pedestrian Master Plan 5-Year Implementation Plan and Progress Report (2019) ▪ SDOT 2019-2024 Implementation Plan: Bicycle Master Plan (2019) ▪ SDOT Sidewalk Condition Assessment Report (2018) ▪ Seattle Pedestrian Master Plan (2017) ▪ Seattle Trails Upgrade Plan (2017) ▪ Seattle Freight Master Plan (2016) ▪ Seattle Bicycle Master Plan (2014)

2

Pedestrian Network

This section describes the facilities currently available for people walking in the study area. It includes considerations such as sidewalk presence and condition, crosswalk presence, distance between formal crossings along arterials, access to existing RapidRide bus stops, and proximity to the future light rail stations. This section is organized by the neighborhoods receiving future Sound Transit light rail stations – Ballard, Interbay, and Smith Cove.

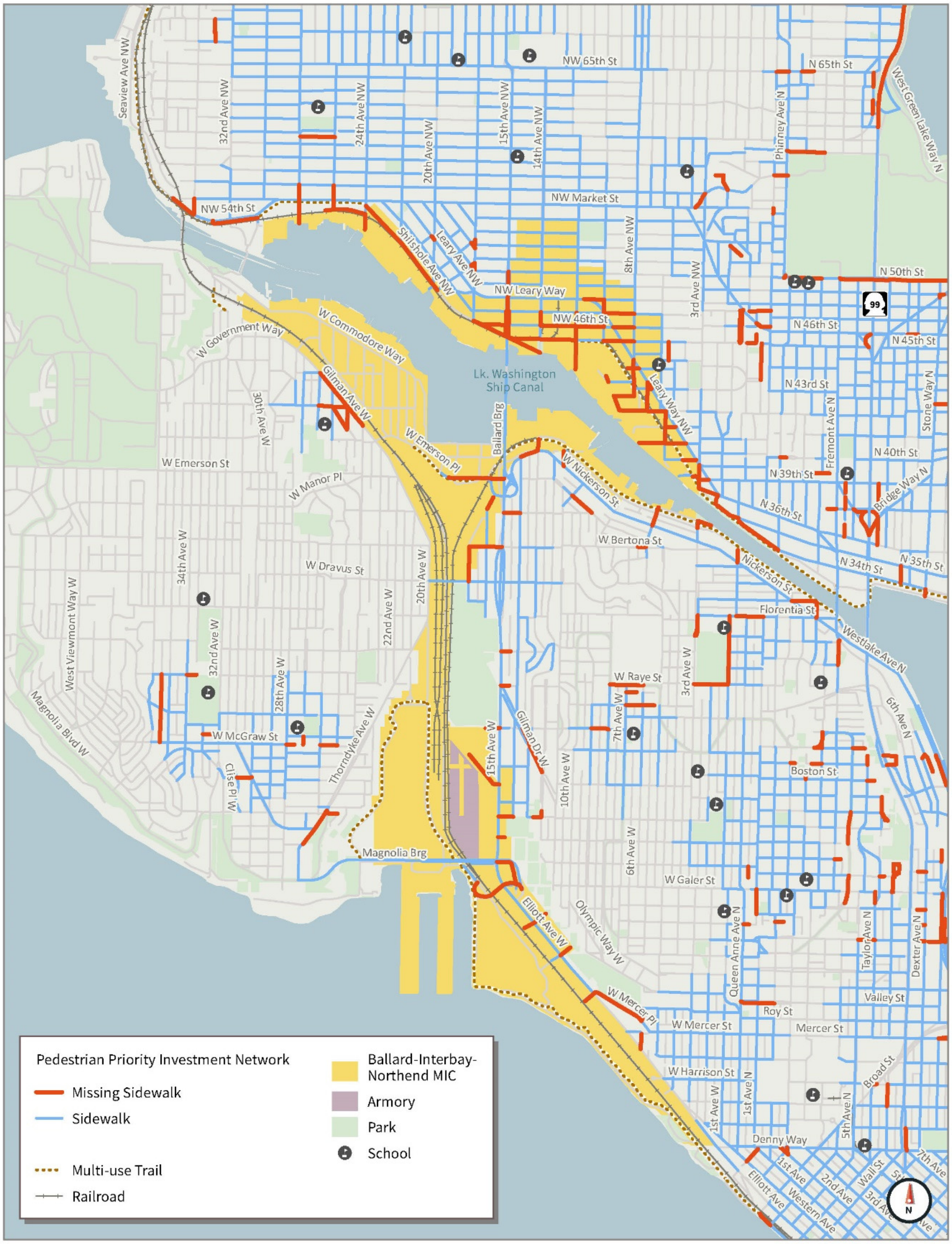
10-Minute Walksheds to Light Rail Stations

The future light rail stations will be key destinations for people walking in the study area. To help identify opportunities and challenges for accessing the stations, this analysis considers 10-minute walksheds – or the distance a fully mobile person can walk in 10 minutes – from each station. This translates to roughly a half-mile walk distance from a station via streets and trails. Signalized crossing delay at intersections and topography were factored into the analysis because they affect travel times and travel choices, particularly for people with disabilities.

Pedestrian Priority Investment Network

The City of Seattle's adopted 2017 Pedestrian Master Plan (PMP) presents a Priority Investment Network, which identifies the street segments that are priorities for improvements, such as adding sidewalks where they are currently missing. This network, shown in **Figure 2**, provides guidance on the components of the pedestrian network in the study area that the City finds to be most important and will be referenced in the sections below. It should be noted that many of the missing sidewalks in the study area are unlikely to be a City priority in the upcoming years considering economic conditions and the City's emphasis on equity.

Figure 2: Seattle Pedestrian Priority Investment Network



Data Source: Seattle Pedestrian Master Plan, 2017

Ballard

Existing Conditions

This subarea focuses on the BINMIC near the future Ballard light rail station and the southern portion of the Ballard Urban Village near NW Market Street. Sidewalks exist on most streets in Ballard, providing various walking route options to access the future light rail station, RapidRide bus stops, and key destinations. The condition of these sidewalks varies, with some sidewalks in excellent condition and others needing improvements, as shown in **Figure 3.** The most noteworthy sidewalk gaps and challenges are highlighted below.

- **Generally poor conditions for walking around industrial land uses.** Sidewalks are either missing (many industrial properties have parking that abuts the property line, making it challenging to navigate the roadway on foot) or can be narrow and have impediments to ADA access, such as fire hydrants in the middle of the sidewalk. An example of this condition can be found on NW Ballard Way west of the Ballard Bridge.
- **The Burke-Gilman Trail "missing link."** This important east-west pedestrian and bicycle connection in Ballard does not continue on Shilshole Avenue NW and NW 45th Street between the Ballard Locks and the Fred Meyer near Leary Way NW east of the Ballard Bridge. This segment generally lacks sidewalks, forcing pedestrians to walk in the roadway or on adjacent routes. Additional impediments that make the missing link challenging to navigate on foot include haphazard parking for the industrial uses, long block lengths, and freight presence.
- **The Ballard Bridge is an extremely challenging environment for walking.** The sidewalk is narrow (3-5 feet at its narrowest) leaving little room for pedestrians and bicyclists traveling in the same or opposite direction to pass one another. The sidewalk has minimal separation from vehicle traffic and high vehicle speeds. There is only a 12-inch high concrete curb, which lacks a railing to separate moving vehicles from bicyclists and pedestrians using the sidewalk. Additionally, the on/off ramps at NW Ballard Way are uncomfortable for people walking. On the northbound side, the sidewalk ends, forcing pedestrians to walk through a circuitous series of unclear crossings to exit the off-ramp.

Marked crosswalks exist at most key intersections on arterial and collector streets but are generally not found on residential streets, as they are not typically provided on this roadway type. **Figure 4** shows locations on arterials that are more than 300 feet from a signalized intersection crossing. These locations serve as a starting point for analyzing where additional enhanced crossings might be considered.

Seattle's 2020 *Bicycle and Pedestrian Safety Analysis: Phase 2* identifies the top 20 priority pedestrian locations by Council District to address locations that exhibit one or more characteristics found to be significantly associated with pedestrian crashes and/or have a crash history. Several of these priority locations are located in Ballard and serve as a starting point for identifying safety enhancements. As described in Chapter 4, there was one pedestrian fatality in the study area between 2014-2018[2], which

[2] https://www.seattle.gov/Documents/Departments/SDOT/VisionZero/2019_Traffic_Report.pdf

occurred on NW 45th Street near the Ballard Bridge, though studies have shown that collisions involving pedestrians are often underreported.

Future Conditions

As shown in **Figure 2**, Seattle's adopted 2017 *Pedestrian Master Plan* (PMP) identifies high priority streets where the City desires to add sidewalks where they are currently missing. There are no projects included in the 2020-2024 Pedestrian Master Plan Implementation Plan that are in Ballard, though there are several missing sidewalks on high priority streets in the study area.

Under the preferred light rail station alternative, people walking to the Ballard station would likely walk along 14th Avenue NW or NW Market Street. There would be station entrances on both sides of NW Market Street at 14th Avenue NW, and the elevated station platform would cross NW Market Street to connect the entrances. This will minimize the need for people walking to the station to cross NW Market Street at grade. There would also be a pedestrian and bicycle bridge across 14th Avenue NW connecting the station entrances on either side of 14th Avenue NW.

Opportunities and Potential Projects

Ballard Bridge

In the near-term, the pedestrian environment of the existing bridge could be improved by redesigning the on/off ramps and sidewalks per the recommendations in the *City of Seattle Bridge Safety Analysis Report*, which calls for curb extensions and high-visibility crosswalks for the ramps, as well as railings on the bridge. The ideal replacement of the Ballard Bridge would provide wide, comfortable facilities for pedestrians to ensure that people of all ages and abilities feel safe walking. The on and off ramps should clearly indicate how pedestrians are intended to use the roadway, making it clear to motorists to look for these vulnerable users. Three options are being considered as part of the Ballard Bridge Planning Study, which will release its final report in 2020, though options 1 and 2 have the most support. All three options provide improved facilities for bicycles and pedestrians, including:

- **Option 1** – **Low-Level Bridge Rehabilitation**: creates a 14-foot wide shared use path on the west side of the existing bridge, extending from Ballard Way at the north end to a new Emerson-Nickerson interchange at the south end (discussed under the Interbay section below). The east sidewalk on the approach structures would also be widened to 6-feet to match the existing bascule bridge.
- **Option 2 – Mid-Level Movable Bridge Alternative:** creates a 14-foot wide shared use path on the west side of the bridge, extending from NW Leary Way to a new Emerson-Nickerson interchange at the south end. No bicycle or pedestrian facilities are provided on the east side of the bridge.
- **Option 3 – High-Level Fixed Bridge Alternative:** creates a 14-foot wide shared use path on the west side of the bridge, extending from NW Market Street to a new Emerson-Nickerson interchange at the south end. An elevated signalized intersection would also provide a connection to 14th Avenue. No bicycle or pedestrian facilities are provided on the east side of the bridge.

Options 1 and 2 provide the most comfortable and accessible facilities for pedestrians and are therefore preferable over Option 3. Elevators could be explored as a way of improving bridge access for pedestrians. These options are discussed in greater detail in Chapter 4 on the auto and freight network and Chapter 5 on the transit network.

A second, new bridge adjacent to the Ballard Bridge may carry the light rail extension to Ballard. The Draft Environmental Impact Statement for the WSBLE project does not include bicycle and pedestrian facilities on this bridge.

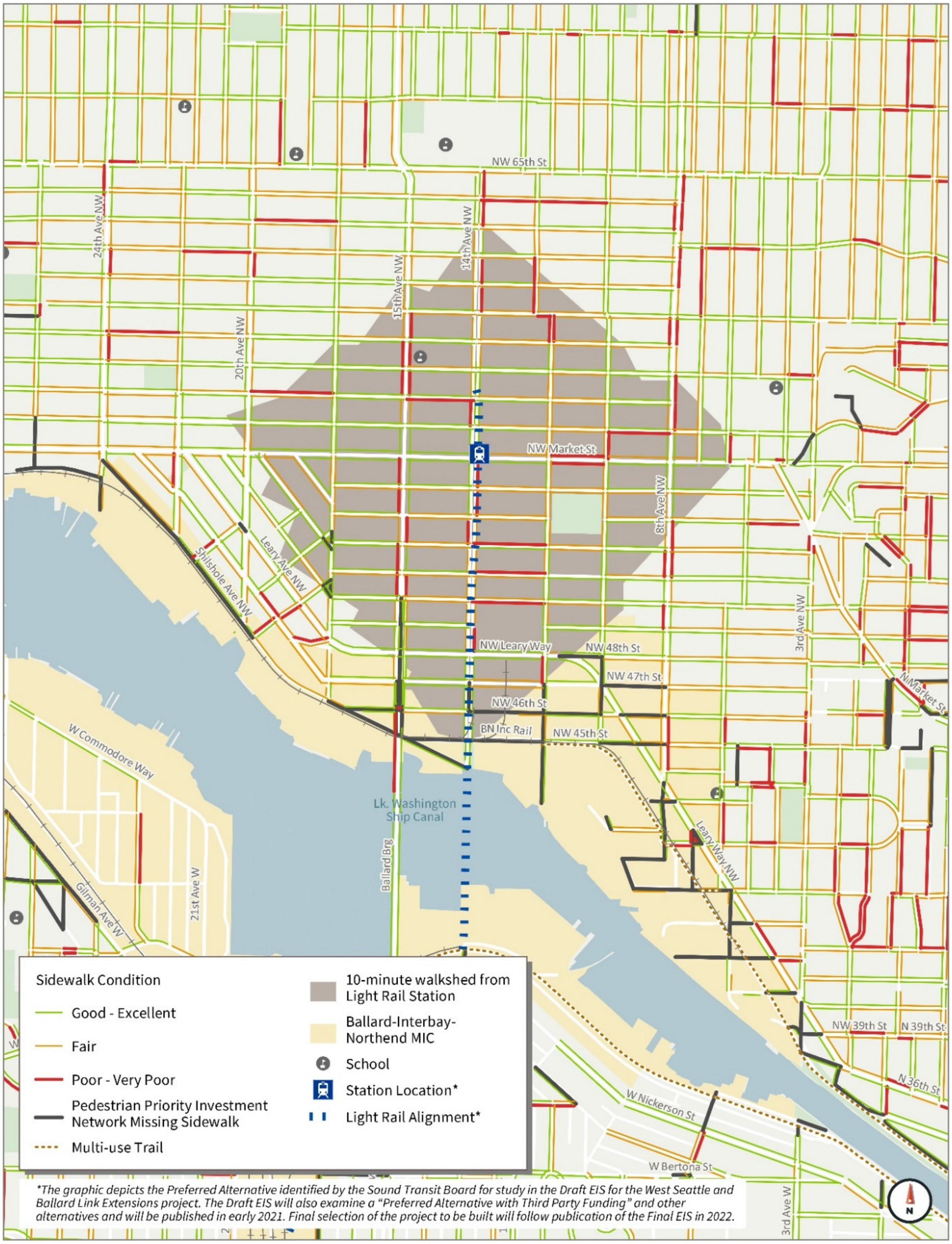
Light Rail Station and RapidRide Access

At the light rail station, it will be important to provide infrastructure that facilitates safe walking and minimizes barriers to people with disabilities. This includes sidewalks in good condition with widths wide enough to support future demand, well-maintained elevators and escalators, and wayfinding within the station area. It will also be important to provide infrastructure and wayfinding on adjacent roadways to ensure that people of all ages and abilities can access the light rail station and RapidRide bus stops. This will in part be achieved by implementing projects included in the PMP, but there are also opportunities for additional improvements, highlighted below.

Additional Opportunities

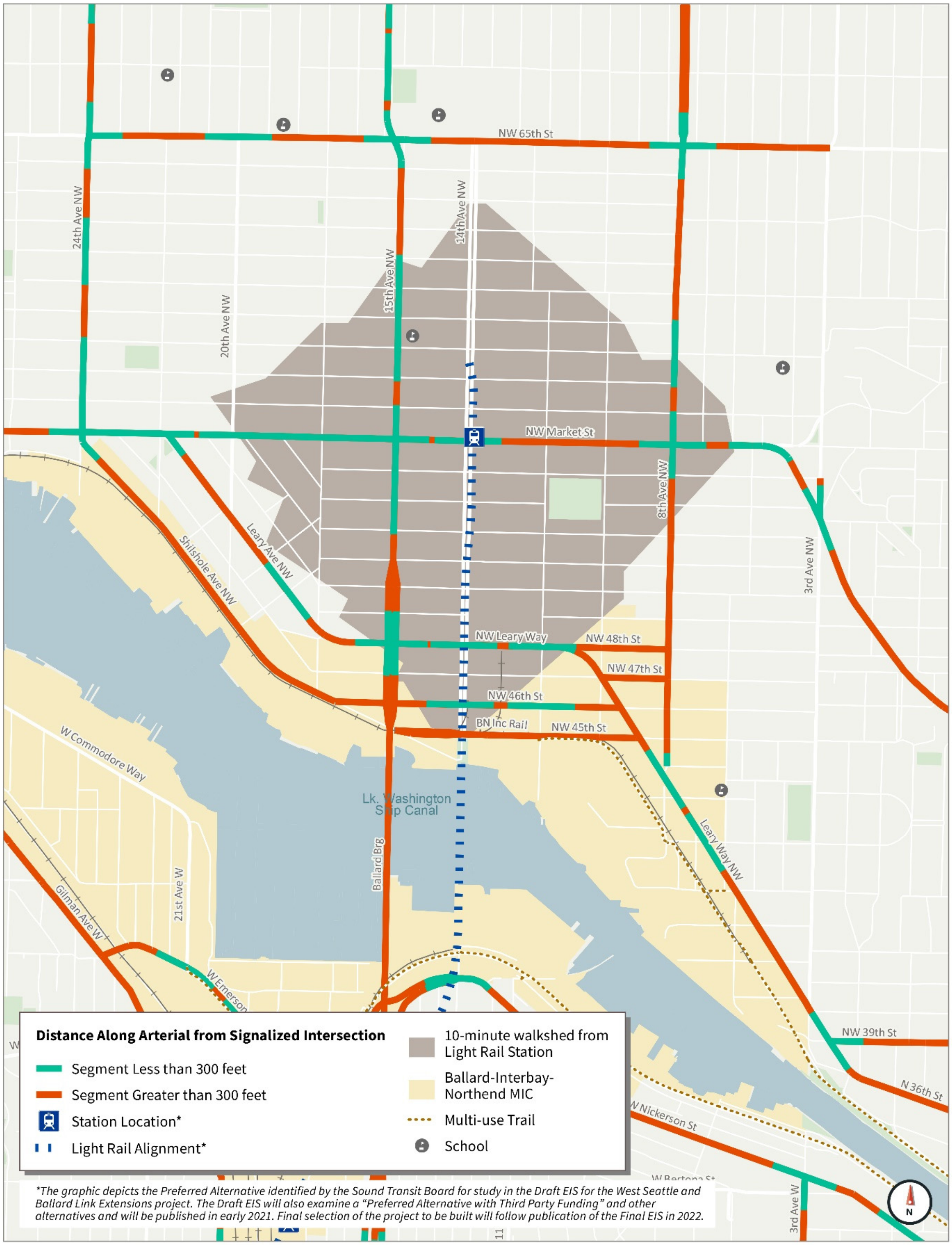
See **Figure 9** for an overview of pedestrian opportunities in the study area.

Figure 3: Ballard Sidewalk Condition and 10-Minute Walkshed to Light Rail



Data Sources: City of Seattle GeoData, 2019 (Sidewalks); Seattle Pedestrian Master Plan, 2017 (Pedestrian Priority Investment Network).

Figure 4: Ballard Proximity to Signalized Intersection Crossing on Principal and Minor Arterials



Interbay

Existing Conditions

This subarea focuses on the BINMIC near the future Interbay light rail station and the areas of Magnolia and Queen Anne immediately adjacent to it. There are generally sidewalks on at least one side of most streets in Interbay, but there are several gaps in coverage, interruptions by parking near industrial land uses, and some sidewalks are narrow, unbuffered, and/or have impediments to ADA access. The condition of these sidewalks varies, with some sidewalks in excellent condition and others needing improvements, as shown in **Figure 5**. The most noteworthy sidewalk gaps and challenges are highlighted below.

- **The intersection of 15th Avenue W and W Emerson Street at the southern terminus of the Ballard Bridge is very challenging for pedestrians.** There is no at-grade pedestrian crossing of W Emerson Street or of 15th Avenue W, so pedestrians must use staircases that travel underneath these roadways. This makes accessing the RapidRide bus stops and navigating the intersection on foot inconvenient for many and unnavigable for people who use mobility devices.
- **The W Emerson Street bridge lacks facilities on the southside, funneling everyone to the northside**. The W Emerson Bridge between 15th Avenue W and 16th Avenue W has a 5-foot sidewalk along its north side, but no sidewalk along the south side. Pedestrians and bicyclists typically share this narrow space, which is separated from the vehicle lanes by a low metal railing.
- **17th Avenue West near the future light rail station has an intermittent sidewalk** on the west side of the street that is interrupted by parking for the industrial uses. Additional impediments include a lack of a physical curb separating the sidewalk from the roadway, long block lengths, and freight presence.
- **20th Avenue W lacks a sidewalk on the east side of the roadway** between W Dravus Street and W Bertona Street, which **continues on Gilman Avenue W** between 23rd Avenue W and W Government Way. This is problematic due to bus stops on this side of the roadway, and there is clear demand for a pedestrian facility, as evidenced by the well-worn goat trail that exists.
- **The industrial areas east of Gilman Avenue W and north of W Emerson Place have several missing sidewalks** on at least one side of the roadway with parking that abuts the property line, making it challenging to navigate the roadway on foot. Sidewalks that exist near industrial land uses can be narrow and have impediments to ADA access.
- The sidewalk on **W Nickerson Street** is interrupted by a gravel parking lot west of 13th Avenue W on the south side of the street.
- The **industrial areas north of the Ship Canal Trail and east of the Ballard Bridge** lack sidewalks, and there are no designated crossings across the railroad tracks for pedestrians.
- **W Dravus Street between 20th Avenue W and 17th Avenue W** has narrow sidewalks without a buffer, which forces pedestrians to walk directly next to motor vehicles traveling at high speeds. The bridge over the BNSF railroad tracks has narrow sidewalks with a low concrete barrier separating pedestrians from motor vehicles.

The **Ship Canal Trail** is an east-west pedestrian and bicycle connection in Interbay. The trail starts under the south end of the Fremont Bridge and runs west mostly along the water following an abandoned railroad grade, ending just south of the Fishermen's Terminal marina before turning into the Emerson Street Bike Trail that connects to the protected bike lanes on Gilman Avenue W. The trail is more industrial through this Interbay section, flanked on both sides by marine industries and chain link fences. The trail has the potential to be an important connection for the neighborhoods surrounding Interbay, but a lack of connectivity and adequate width limits its current use. There is no connection to 15th Avenue W or Thorndyke Avenue W where the light rail station will be, so pedestrians currently have to take the trail to W Emerson Street & 16th Avenue W and walk east on W Emerson Street using the sidewalk on the north side. Since there is no crossing on W Emerson Street at 15th Avenue W (as discussed above), people take the stairs to cross underneath W Emerson Street in order to continue walking south. This makes navigating this route on foot inconvenient for many and unnavigable for others. Additionally, there is no pedestrian-scale lighting on the trail.

Marked crosswalks exist at most key intersections on arterial and collector streets, but due to long block lengths, they can be more than 600 feet apart. They are generally not found on residential streets, as they are not typically provided on this roadway type. As mentioned above, the intersection of 15th Avenue W and W Emerson Street is particularly challenging. **Figure 6** shows locations on arterials that are more than 300 feet from a signalized intersection crossing. These locations serve as a starting point for analyzing where additional enhanced crossings might be considered.

Steep topography is another challenge for pedestrians in the Interbay area. Gilman Avenue W, W Emerson Place, W Nickerson Street, and W Dravus Street are the main roadways through the study area and they all have slopes, making walking more difficult. Several of the roadways west of Gilman Avenue W and east of 15th Avenue W have slopes greater than 10 percent. Slopes with these grades are uncomfortable to walk for many and can be impassable for pedestrians with limited mobility. Having direct connections to destinations are critical in areas with steep topography, as they shorten distances and can potentially reduce grades.

Seattle's 2020 *Bicycle and Pedestrian Safety Analysis: Phase 2* identifies the top 20 priority pedestrian locations by Council District to address locations that exhibit one or more characteristics found to be significantly associated with pedestrian crashes and/or have a crash history, but none of the top locations for Council District 7 fall within Interbay. As described in Chapter 4, there was two pedestrian fatalities in the study area between 2014-2018[3], which occurred on 15th Avenue W near W Armory Way, though studies have shown that collisions involving pedestrians are often underreported.

Future Conditions

As shown in **Figure 2**, Seattle's adopted 2017 PMP identifies in the Priority Investment Network which roadway segments are priorities for improvements, such as adding sidewalks where they are currently

[3] https://www.seattle.gov/Documents/Departments/SDOT/VisionZero/2019_Traffic_Report.pdf

missing. There is only one project included in the 2020-2024 Pedestrian Master Plan Implementation Plan that is in Interbay:

- Add a sidewalk on Gilman Avenue W between W Emerson Place and W Jameson Street

Under the preferred light rail station alternative, people walking to the Interbay station would likely use W Dravus Street or the new trail connection proposed in the Bicycle Master Plan that connects the Ship Canal Trail to Thorndyke Avenue W. There are no new pedestrian bridges, crossings, or other improvements assumed as part of the station design for this alternative.

Opportunities and Potential Projects

15th Avenue W & W Emerson Street Intersection

In the near-term, the intersection should be redesigned per the recommendations in the *City of Seattle Bridge Safety Analysis Report*, which calls for adding a crosswalk at W Emerson Street & W Nickerson Street and a 6-foot wide shared use path on the south side of W Emerson Street that connects between W Nickerson Street and 15th Avenue W. In the longer-term, the intersection will be completely redesigned when the Ballard Bridge is replaced, as it will terminate at this intersection. All three bridge alternatives call for a Modified Single Point Urban Interchange (MSPUI) at this intersection. While this design improves upon existing conditions, it is still challenging for people of all ages and abilities to navigate, so there are opportunities to improve upon the design. Beyond this intersection, there are opportunities to repurpose right-of-way along 15th Avenue W to ensure comfortable and convenient access for all modes of transportation.

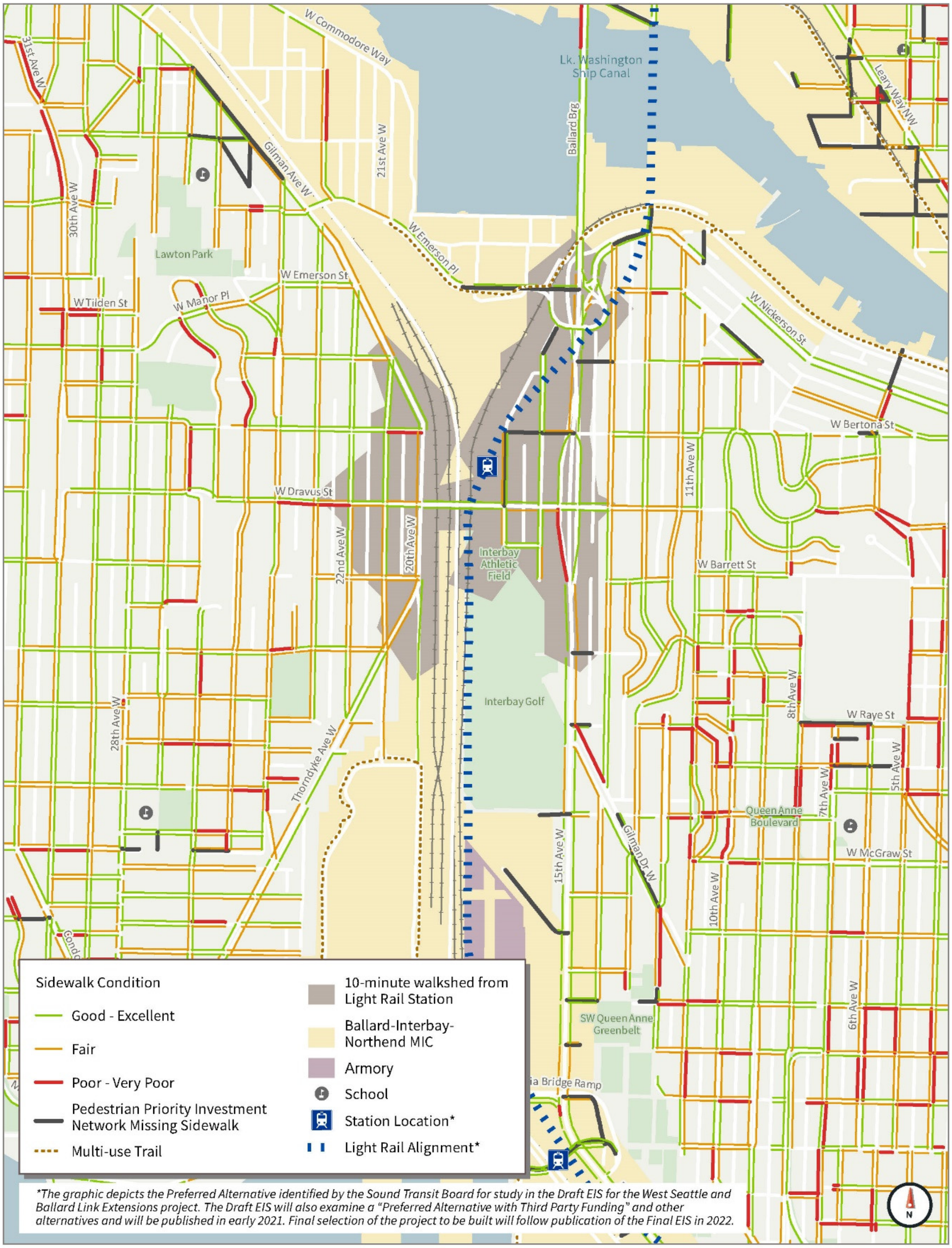
Light Rail Station and RapidRide Access

At the light rail station, it will be important to provide infrastructure that facilitates safe walking and minimizes barriers to people with disabilities. This includes sidewalks in good condition with widths wide enough to support future demand, well-maintained elevators and escalators, and wayfinding within the station area. It will also be important to provide infrastructure and wayfinding on adjacent roadways to ensure that people of all ages and abilities can access the light rail station and RapidRide bus stops. This will in part be achieved by implementing projects included in the PMP, but there are also opportunities for additional improvements, highlighted below.

Additional Opportunities

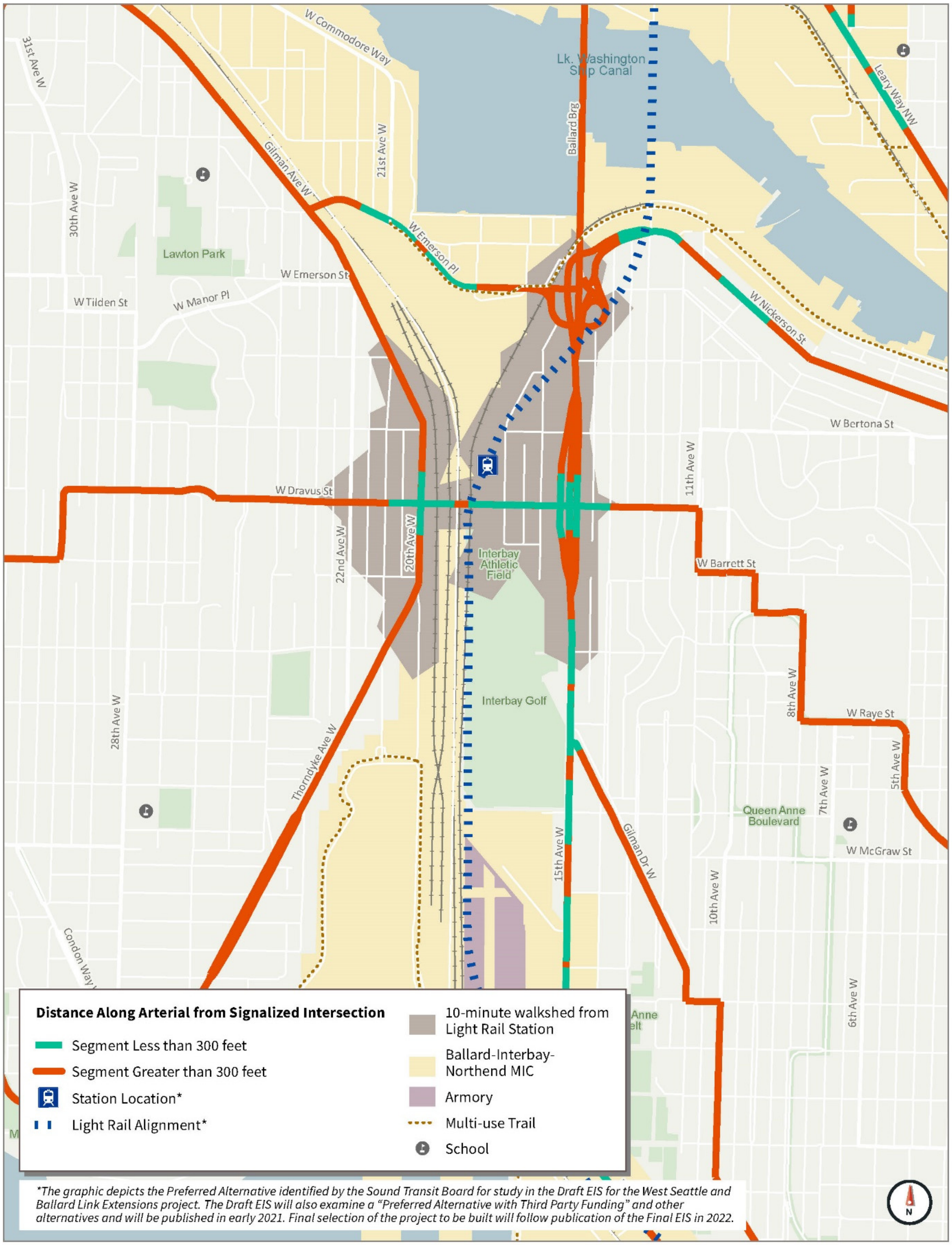
See **Figure 9** for an overview of pedestrian opportunities in the study area.

Figure 5: Interbay Sidewalk Condition and 10-Minute Walkshed to Light Rail



Data Sources: City of Seattle GeoData, 2019 (Sidewalks); Seattle Pedestrian Master Plan, 2017 (Pedestrian Priority Investment Network).

Figure 6: Interbay Proximity to Signalized Intersection Crossing on Principal and Minor Arterials



Smith Cove

Existing Conditions

This subarea focuses on the BINMIC near the future Smith Cove light rail station and the areas of Magnolia and Queen Anne immediately adjacent to it. There are generally sidewalks on both sides of the roadway in Smith Cove, but there are some gaps in coverage. The condition of these sidewalks varies, with some sidewalks in excellent condition and others needing improvements, as shown in **Figure 7**. The most noteworthy sidewalk gaps and challenges are highlighted below.

- Smith Cove has several **areas that are in the process of redeveloping or that may redevelop in the future**, such as the Seattle Armory site, the commercial area between the Armory and Interbay Golf Center, and Expedia campus. Sidewalk presence in these areas are inconsistent.
- Smith Cove has several **industrial areas**, such as Terminal 91, freight buildings associated with the Port of Seattle north of the Magnolia Bridge and west of the railroad tracks, and the grain elevator facility south of Expedia. While much of this land use is private property, some areas are open to the public and can be challenging to navigate as a pedestrian due to lack of sidewalks, marked crosswalks, etc.
- **15th Avenue W** has sidewalks on both sides of the roadway with a landscaped buffer in some locations, but the sidewalk is frequently only 4-feet wide, lacks a buffer in most locations, and has obstructions like telephone poles in some places. Since this corridor has six to seven lanes of motor vehicle traffic, heavy vehicle volumes, and high vehicle speeds, it is not comfortable for pedestrians to walk along or cross, even though people must do so to access RapidRide bus stops. There are long stretches on this corridor without crosswalks, as shown **Figure 8** and discussed further below, which forces people to jaywalk or walk out of the way to access a crosswalk.
- **W Mercer Place** east of Elliott Avenue W (just outside the study area) is a key route into Lower Queen Anne, and it lacks a sidewalk on both sides of the street.

The **Magnolia Bridge** is a challenging environment for walking. There is a contiguous, narrow sidewalk on the south side that is approximately five-feet wide. Portions of the sidewalk are separated from vehicle traffic by a short concrete or metal barrier, but many sections have no buffer, providing minimal protection from vehicle traffic traveling at high speeds. Since there are no marked bicycle facilities, some bicyclists use the sidewalk as opposed to riding in one of the vehicles lanes, which creates conflicts with pedestrians. There is a pedestrian stairway linking the south side sidewalk to Terminal 91. There is a short segment of sidewalk on the north side of the bridge, connecting a distribution building to a bus stop and a second pedestrian stairway to Terminal 91, though the sidewalk dead-ends part way down the Magnolia Bridge off-ramp to Terminal 91.

The **Elliott Bay Trail** links Smith Cove to Downtown Seattle, Magnolia, Interbay, and other neighborhoods. The Elliott Bay Trail is primarily located along the western edge of BNSF's railroad tracks and connects south through Centennial Park and Myrtle Edwards Park to downtown. A spur of this trail loops to the west side of Terminal 91, connecting to 20th Avenue W and Smith Cove Park and Marina. The northern portion of the trail, starting at the Magnolia Bridge, is flanked by fences on both sides and extremely narrow in some places, which hinders shared use travel in two directions and is a safety hazard.

Marked crosswalks exist at most key intersections on arterial and collector streets, but are not typically found on residential streets, as they are not typically provided on this roadway type. **Figure 8** shows locations on arterials that are more than 300 feet from a signalized intersection crossing. These locations serve as a starting point for analyzing where additional enhanced crossings might be considered.

While much of the area in Smith Cove is relatively flat, steep topography is a challenge for pedestrians walking to Smith Cove from Queen Anne or Magnolia. Several of the roadways west of 23rd Avenue W in Magnolia and east of 15th Avenue W/Elliott Avenue W have slopes greater than 10 percent. Slopes with these grades are uncomfortable to walk for many and can be impassable for pedestrians with limited mobility. Having direct connections to destinations are critical in areas with steep topography, as they shorten distances and can potentially reduce grades.

Seattle's 2020 *Bicycle and Pedestrian Safety Analysis: Phase 2* identifies the top 20 priority pedestrian locations by Council District to address locations that exhibit one or more characteristics found to be significantly associated with pedestrian crashes and/or have a crash history, but none of the top locations for Council District 7 fall within Smith Cove.

Future Conditions

As shown in **Figure 2**, Seattle's adopted 2017 PMP identifies in the Priority Investment Network which street segments are priorities for improvements, such as adding sidewalks where they are currently missing. There is only one project included in the 2020-2024 Pedestrian Master Plan Implementation Plan that is in Smith Cove:

- Install a crossing at Elliott Avenue W & W Lee Street

Under the preferred light rail station alternative, people walking to the Smith Cove station from Terminal 91 and Expedia would likely use the Elliott Bay Trail and the non-motorized ramp on the West Galer Street Flyover. People walking from residential areas in Queen Anne and the Armory would walk along 15th Avenue W/Elliott Avenue W. People are not likely to walk to this station from Magnolia, as it is too far away. There would be a bridge connecting the Galer Street flyover facility for pedestrians and bicycles to the station mezzanine under this alternative.

Opportunities and Potential Projects

Magnolia Bridge

The replacement Magnolia Bridge should provide wide, comfortable facilities for bicycles and pedestrians to ensure that people of all ages and abilities feel safe walking. The on and off ramps should clearly indicate how pedestrians are intended to use the roadway, making it clear to motorists to look for these vulnerable users. The Magnolia Bridge planning study considers four bridge replacement options, and two options are being considered by this study, both of which provide improved facilities for bicycles and pedestrians, including:

- **Alternative 1** – **Armory Way**: constructs a new bridge over the railroad tracks connecting 15th Avenue W & W Armory Way to Thorndyke Avenue W just south of W Raye Street. The new Armory Way bridge would include a shared use path on the south side. It provides a new connection to the Elliott Bay Trail.
- **Alternative 4 – In-Kind Replacement:** constructs a new bridge immediately south of the existing Magnolia Bridge. The existing "center ramps" to Terminal 91 would be eliminated. The new bridge would feature a 10-foot wide shared use path on the south side, though it would not connect to the Elliott Bay Trail.

While it is important to provide facilities for pedestrians on the bridge, people will likely continue using existing travel routes regardless of the alternative chosen because of the steep grades under both bridge replacement options. Speeding on the Magnolia Bridge is a key safety concern, so it will be important to keep vehicle speeds at the 35 mph speed limit and add signage to make motorists aware of pedestrians. Elevators could be explored as a way of improving bridge access for pedestrians.

Light Rail Station and RapidRide Access

At the light rail station, it will be important to provide infrastructure that facilitates safe walking and minimizes barriers to people with disabilities. This includes sidewalks in good condition with widths wide enough to support future demand, well-maintained elevators and escalators, and wayfinding within the station area. It will also be important to provide infrastructure and wayfinding on adjacent roadways to ensure that people of all ages and abilities can access the light rail station and RapidRide bus stops. This will in part be achieved by implementing projects included in the PMP, but there are also opportunities for additional improvements, highlighted below.

Additional Opportunities

See **Figure 9** for an overview of pedestrian opportunities in the study area.

Figure 7: Smith Cove Sidewalk Condition and 10-Minute Walkshed to Light Rail

Data Sources: City of Seattle GeoData, 2019 (Sidewalks); Seattle Pedestrian Master Plan, 2017 (Pedestrian Priority Investment Network).

Figure 8: Smith Cove Proximity to Signalized Intersection Crossing on Principal and Minor Arterials

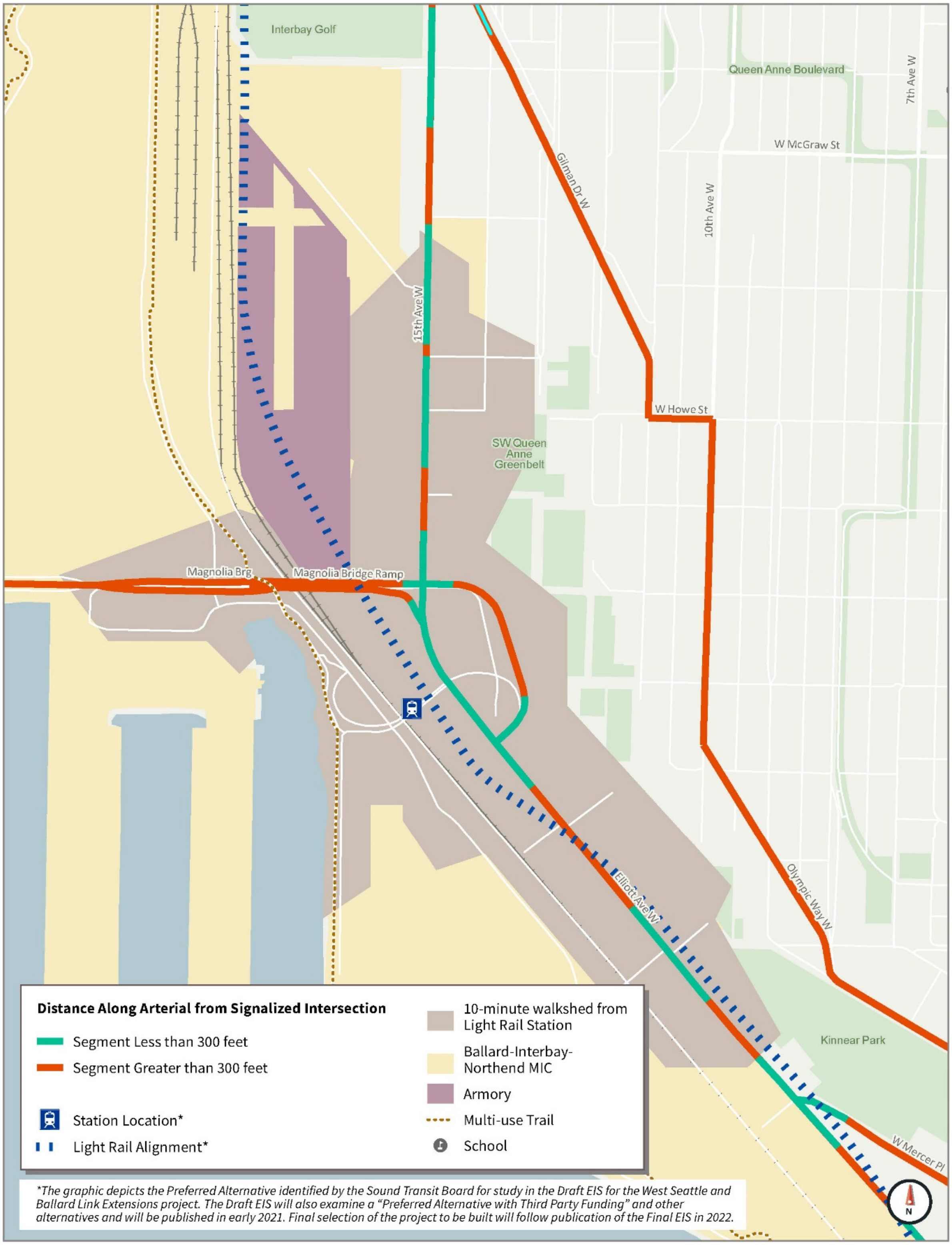
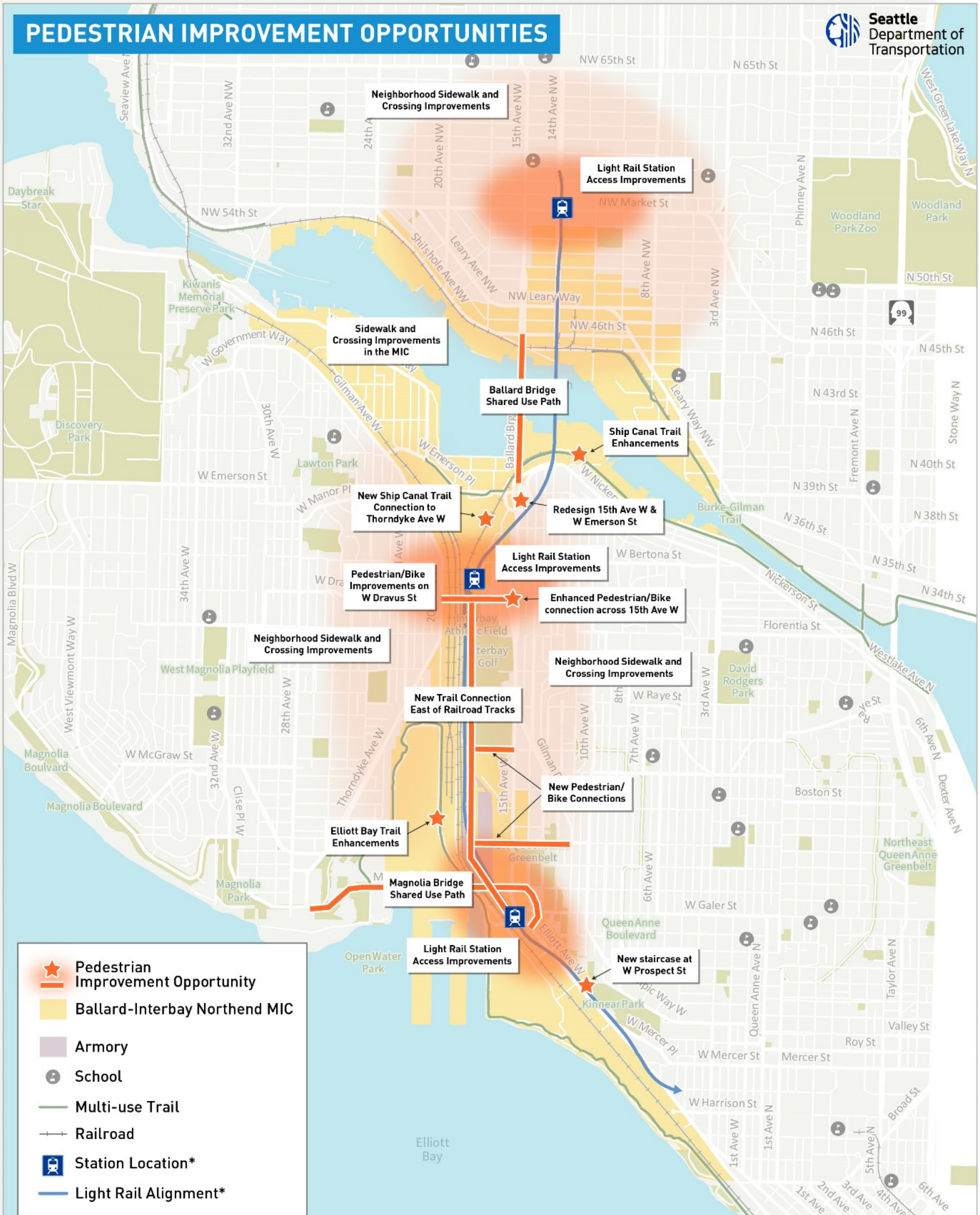


Figure 9: Overview of Pedestrian Opportunities in Study Area



*The graphic depicts the Preferred Alternative identified by the Sound Transit Board for study in the Draft EIS for the West Seattle and Ballard Link Extensions project. The Draft EIS will also examine a "Preferred Alternative with Third Party Funding" and other alternatives and will be published in early 2021. Final selection of the project to be built will follow publication of the Final EIS in 2022.

3

Bicycle Network

This section describes the transportation network for people bicycling in the study area. This includes considerations such as bicycle facility presence and type, level of comfort for users of all ages and abilities, distance to the nearest crosswalk along arterials, access to existing RapidRide bus stops, and proximity to the future light rail stations. This section is organized by the neighborhoods receiving future Sound Transit light rail stations – Ballard, Interbay, and Smith Cove.

Bicyclist Comfort & Level of Traffic Stress

How comfortable people feel while bicycling is a major factor in the number of trips people make by bicycle. Where streets are stressful due to heavy traffic or auto speeds, many people will feel uncomfortable and may avoid making trips by bike altogether. On low-stress, highly comfortable streets, studies have shown that more people report interest in making trips by bike.[4]

One way of measuring comfort is using the Level of Traffic Stress (LTS) metric. LTS describes the experiential quality of biking based on user comfort. It measures cyclist comfort on every street based on traffic speeds, number of travel lanes, bicycle facilities present, and other roadway characteristics.[5] Based on those variables, a score from 1 to 4 is used to classify streets based on the type of cyclist who typically tolerates the level of stress. LTS 1 represents the least stressful facility that is often tolerable to children or the most concerned and/or inexperienced adult bicyclists. These are typically shared-use paths; separated

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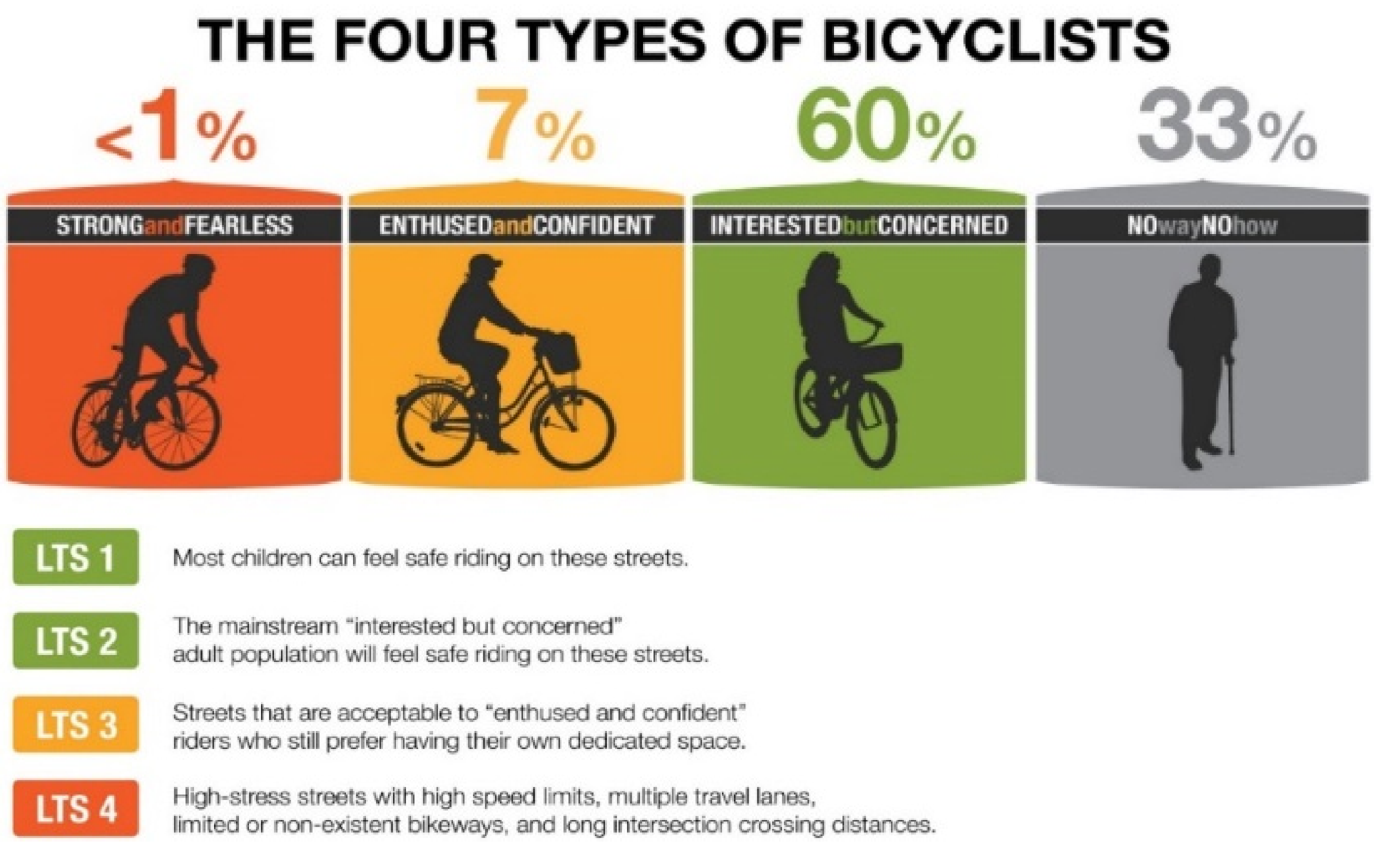
[4] Jennifer Dill and Nathan McNeil, “Revisiting the Four Types of bicyclists: Findings from a National Survey,” Transportation Research Record: Journal of the Transportation Research Board, 2587: 90-99, 2016.
[5] Mekuria, Furth, and Nixon, “Network Connectivity for Low-Stress Bicycling,” Transportation Research Record, Vol. 2587, 2016.

bikeways; low-volume, low-speed residential streets; or bicycle lanes on calm, narrow streets. LTS 4 represents the most stressful type of facility that is only tolerable to the most experienced bicyclists, who do so out of necessity (e.g. it is the only route to get to their destination or they are riding fast enough that it may be less of a concern). These are typically major arterials with multiple lanes of traffic (with or without bicycle lanes in some cases, depending on speeds) or narrower streets with high speed limits.

Research has shown that LTS generally matches up with how people identify as a bicyclist:

- **"Strong and Fearless"**: the most experienced bicyclists, long-haul commuters, and recreational riders who feel comfortable sharing travel lanes with autos.
- **"Enthused but Confident"**: often more utilitarian bicyclists who enjoy biking, have a high degree of skill, but prefer biking in more comfortable conditions than shared travel lanes.
- **"Interested but Concerned":** people interested in biking but who are not making trips by bicycle today. They may have less bicycling experience, but can be encouraged to make more biking trips with more comfortable bicycle facilities and increased experience.
- **"No Way, No How"**: these people are simply not interested in biking or may not physically be able to do so.

Most people fall into the "interested but concerned" category of bicyclists. To attract new bicycle trips from this group, it is essential to provide a connected network of comfortable, low stress (LTS 1 or a maximum of LTS 2) facilities. For the purposes of this analysis, roadways that are LTS 1 and LTS 2 are deemed low stress to be consistent with prior work done as part of the WSBLE project. While LTS 2 roadways may not be truly low stress for all users, most roadways in the study area are LTS 1.



10-Minute Bikesheds to Light Rail Stations

The future light rail stations will be key destinations for people biking in the study area. To help identify opportunities and challenges for accessing the stations, this analysis considers 10-minute bikesheds – or the distance a person can bicycle in 10 minutes from each station using any available roadway or trail. While some people may be willing to bike longer distances to access light rail stations, these bikesheds are intended to capture a typical user, especially since there is steep topography in the surrounding neighborhoods. It also considers 10-minute low-stress bikesheds – or the distance a person can bicycle in 10 minutes from each station using only roadways or trails that are LTS 1 or 2. This translates to roughly a 1.5-mile bicycle distance from a station via streets and trails. Signalized crossing delay at intersections and topography were factored into the analysis because they affect travel times and travel choices.

Existing and Future Bicycle Demand

A key consideration is how many bicyclists currently ride through the study area, and how many bicyclists are anticipated in the future. Future demand will be affected by changes in land use and/or the transportation network, such as the development of the light rail stations, implementation of BMP projects, and land use changes involving Expedia and the Armory development.

Unfortunately, there are not accurate methods for estimating existing and future bicycle demand. Studies have shown that many people are interested in bicycling, but do not currently bike because they do not feel comfortable on existing infrastructure. Additionally, travel models do not provide accurate estimates of forecasted bicycle counts because they do not account for the "build it and they will come" phenomenon. Therefore, this analysis qualitatively assesses bicycle demand based on the land use and transportation network changes.

Ballard

Existing Conditions

Ballard's existing bicycle network is composed of a variety of different facility types – bicycle lanes without separation, neighborhood greenways, and multi-use trails, as shown in **Figure 10**. The main north-south spines are 8th Avenue Northwest, the 17th Avenue Northwest neighborhood greenway, and 24th Avenue Northwest. The main east-west spines are the Burke-Gilman Trail, which provides access for recreational users and commuters from Sunset Hill, Fremont, and Wallingford, and NW 58th Street, which is a neighborhood greenway farther to the north.

There are several challenges for bicyclists in Ballard today. First, Ballard's bicycle network **lacks connectivity for people of all ages and abilities**. There are many gaps in the network, and most facilities that do exist have an LTS score of 3 or 4, which are not comfortable for most users, as shown in **Figure 11**. As a result, fewer people choose to ride a bicycle. For example, the Burke-Gilman Trail is an essential bicycle connection for recreational users and commuters, but as mentioned in the Pedestrian Network chapter, there is a **"missing link"** between the Ballard Locks and the Fred Meyer near Leary Way NW that requires bicycling on roadways without designated bicycle facilities and crossing in-street railroad tracks. This deters less confident bicyclists from traveling by bicycle.

The **Ballard Bridge** is an important facility that could connect bicyclists to Interbay, Downtown Seattle, and the region at large, as there are few comparable alternatives for those traveling between Ballard and points south (described in more detail below). However, it is a choke point and a challenging environment for bicyclists for several reasons:

- Since there are no designated sidewalks on the bridge, bicyclists must either "take the lane" in vehicle traffic and ride over the bridge grating, which can be challenging, or share the narrow sidewalk with pedestrians, which has minimal separation from traffic lanes. There is only a 12-inch high concrete curb, which lacks a railing to separate moving vehicles from bicyclists and pedestrians using the sidewalk.
- The sidewalk is narrow (3-5 feet at its narrowest) leaving little room for bicyclists and pedestrians traveling in the same or opposite direction to pass one another. Standard bike handlebars can be almost 3 feet wide, which doesn't allow a margin of safety when people meet or have to pass.
- The Ballard Bridge on/off ramps at NW Ballard Way are uncomfortable for people biking.
- There is no clear, designated route connecting the Ballard Bridge and the Burke-Gilman Trail.
- The southern terminus of the bridge is challenging and will be addressed in the Interbay section.

As a result, people who may be interested in biking south from Ballard to Downtown Seattle or other destinations must either navigate this tough environment that is challenging even for the most confident rider, or divert to alternate crossings via the Ballard Locks or Fremont Bridge, which are significantly out of the way and take longer. The Ballard Locks crossing is also not ideal since people must dismount and walk their bikes across the canal. The Fremont Bridge provides a higher-quality crossing environment, but it is still out of the way.

Seattle's 2020 *Bicycle and Pedestrian Safety Analysis: Phase 2* identifies the top 20 priority bicycle locations by Council District to address locations that exhibit one or more characteristics found to be significantly associated with bicycle crashes and/or have a crash history. Several are located in Ballard and serve as a starting point for identifying safety enhancements. As described in Chapter 4, no fatal bicycle collisions were reported in the study area between 2014-2018 in SDOT's *2019 Traffic Report*[6], though studies have shown that collisions involving bicyclists are often underreported.

Future Conditions

The City of Seattle's adopted 2014 *Bicycle Master Plan* (BMP) outlines the proposed improvements to the City's bicycle network, which are intended to be installed by 2034. The full list of projects for the study area are included in **Figure 10**, but the most relevant projects for Ballard that have not yet been implemented include:

[6] https://www.seattle.gov/Documents/Departments/SDOT/VisionZero/2019_Traffic_Report.pdf

- Complete the missing link of the Burke-Gilman Trail
- Provide a shared use path on the new Ballard Bridge (though the BMP does not provide specifics)*
- Add bicycle lanes on 14th Avenue NW and 32nd Avenue NW*
- Create a variety of neighborhood greenways that are both north-south and east-west oriented, providing additional route options*
- Build an additional ship canal bicycle-pedestrian crossing between the Ballard and Fremont bridges to provide a new connection between the Burke-Gilman Trail and Ship Canal Trail, though the BMP doesn't specify an exact location*

It should be noted that projects that are not in the *2019-2024 Implementation Plan* (indicated with an asterisk in the bulleted list above) are currently unfunded and do not have a clear path to delivery.

Implementation of projects in the BMP would generally provide comfortable facilities for bicyclists of all ages and abilities wishing to access the new light rail station in Ballard. Based on facilities that exist or are currently planned, bicyclists would generally access the Ballard light rail station via bicycle lanes on 14th Avenue NW (where the station is located), the Burke Gilman Trail, one of the many planned neighborhood greenways running both north-south and east-west, and bicycle lanes on 32nd Avenue NW, 24th Avenue NW, and 8th Avenue NW, but steep topography is a limiting factor and may limit people's ability or decision to bicycle to the Ballard Station.

Opportunities and Potential Projects

Ballard Bridge

In the near-term, the on and off ramps and sidewalks on the bridge should be redesigned per the recommendations in the *City of Seattle Bridge Safety Analysis Report*, which calls for curb extensions and high-visibility crosswalks for the ramps, as well as railings on the bridge. The replacement Ballard Bridge should provide wide, comfortable facilities for bicycles and pedestrians to ensure that people of all ages and abilities feel safe bicycling. The on and off ramps should clearly indicate how bicyclists and pedestrians are intended to use the roadway, making it clear to motorists to look for these vulnerable users. Three options are being considered as part of the Ballard Bridge Planning Study, which will release its final report in 2020, though options 1 and 2 have the most support. All three options provide improved facilities for bicycles and pedestrians, including:

- **Option 1** – **Low-Level Bridge Rehabilitation**: creates a 14-foot wide shared use path on the west side of the existing bridge, extending from Ballard Way at the north end to a new Emerson-Nickerson interchange at the south end (discussed under the Interbay section below). The east sidewalk on the approach structures would also be widened to 6-feet to match the existing bascule bridge.
- **Option 2 – Mid-Level Movable Bridge Alternative:** creates a 14-foot wide shared use path on the west side of the bridge, extending from NW Leary Way to a new Emerson-Nickerson

interchange at the south end. No bicycle or pedestrian facilities are provided on the east side of the bridge.

- **Option 3 – High-Level Fixed Bridge Alternative:** creates a 14-foot wide shared use path on the west side of the bridge, extending from NW Market Street to a new Emerson-Nickerson interchange at the south end. An elevated signalized intersection would also provide a connection to 14th Avenue. No bicycle or pedestrian facilities are provided on the east side of the bridge.

A second, new bridge adjacent to the Ballard Bridge may carry the light rail extension to Ballard. The Draft Environmental Impact Statement for the WSBLE project does not include bicycle and pedestrian facilities on this bridge.

Light Rail Station and RapidRide Access

At the light rail station, it will be important to provide infrastructure that minimizes barriers to bicyclists to capture this potential user group. This includes safe and secure bicycle parking, such as lockers, well-maintained elevators, and wayfinding within the station area. It will also be important to provide infrastructure and wayfinding on adjacent roadways to ensure that bicyclists of all ages and abilities can access the light rail station and RapidRide bus stops, which will generally be achieved by implementing projects included in the BMP. However, the BMP does not identify specific intersections where crossing improvements for bicyclists will be necessary, so locations where bicycle routes cross arterials and collector roadways should be evaluated. These locations could include, but are not limited to:

- 14th Avenue NW & NW 50th Street
- 14th Avenue NW & NW 64th Street
- NW Market Street & 14th Avenue NW
- NW Market Street & 11th Avenue NW
- NW Market Street & NW 64th Street

Additional Opportunities

See **Figure 12** for an overview of bicycle opportunities in the study area.

Interbay

Existing Conditions

Interbay's existing bicycle network is composed of a variety of bicycle lanes (both with and without separation) and multi-use trails, as shown in **Figure 10**. The main north-south spines are Gilman Avenue W/20th Avenue W/Thorndyke Avenue W and the Elliott Bay Trail, both west of the railroad tracks. The Ballard Locks and Fremont Bridge also serve as key north-south alternatives over the ship canal to the Ballard Bridge, but as discussed earlier, they require substantial detours for many trips. The main east-west spines are W Emerson Place/the Ship Canal Trail and W Dravus Street.

There are several challenges for bicyclists in Interbay today:

- A chief challenge is that Interbay **lacks a north-south spine for bicyclists east of the railroad tracks**. There are no designated bicycle facilities on the Ballard Bridge or 15th Avenue W, so bicyclists wanting a direct southerly route must either share the lane with fast-moving cars and buses on 15th Avenue W or ride on the sidewalk. Many bicyclists on the Ballard Bridge opt for a less-direct route, which requires detouring nearly a mile west along W Emerson Street to Gilman Avenue W and then the Elliott Bay Trail.
- The **intersection of 15th Avenue W and W Emerson Street** at the southern terminus of the Ballard Bridge lacks dedicated bicycle facilities or treatments through the intersection to provide space for or awareness of bicyclists using the facility. Currently, southbound bicyclists that wish to continue south on 15th Avenue W must come to a stop just north of W Emerson Street, turn to look back at oncoming southbound traffic, and wait for a gap before entering the roadway nearly perpendicular to oncoming traffic, then quickly accelerate to merge with traffic. There is limited signage for motorists to let them know bicyclists are entering the roadway. Southbound bicyclists that wish to head west or east must travel west on W Emerson Street to connect to the Ship Canal Trail.

Challenging merge for southbound bicyclists at 15th Avenue W & W Emerson Street

- There is a **lack of bicycle facilities** to connect adjacent neighborhoods to the Ship Canal Trail, Elliott Bay Trail, and protected bicycle lanes on Gilman Avenue W/20th Avenue W. For instance, there are no neighborhood greenways in Interbay.
- **Steep topography** is a challenge. Gilman Avenue W, W Emerson Place, W Nickerson Street, and W Dravus Street are the main roadways through the study area and they all have slopes, making bicycling more difficult. Several of the roadways west of Gilman Avenue W and east of 15th Avenue W have slopes greater than 10 percent. If slopes are too steep, it can deter people from biking. Having direct route options to key destinations that avoid steep slopes are that much more important in areas with steep topography.

Seattle's 2020 *Bicycle and Pedestrian Safety Analysis: Phase 2* identifies the top 20 priority bicycle locations by Council District to address locations that exhibit one or more characteristics found to be significantly associated with bicycle crashes and/or have a crash history. W Emerson Place & 23rd Avenue W is identified as a top location for Council District 7, which serves as a starting point for identifying safety enhancements. As described in Chapter 4, no fatal bicycle collisions were reported in the study area between 2014-2018 in SDOT's *2019 Traffic Report*[7], though studies have shown that collisions involving bicyclists are often underreported.

[7] https://www.seattle.gov/Documents/Departments/SDOT/VisionZero/2019_Traffic_Report.pdf

Future Conditions

The City of Seattle's adopted 2014 BMP outlines the proposed improvements to the City's bicycle network, which are intended to be installed by 2034. The full list of projects for the study area are included in **Figure 10**, but the most relevant projects for Interbay that have not yet been implemented include:

- A north-south neighborhood greenway on 32nd Avenue W that turns into protected bicycle lanes at W Barrett Street*
- An east-west neighborhood greenway connecting 32nd Avenue W to 20th Avenue W, using W Raye Street and other local streets*
- Construct a new trail connection to link the Ship Canal Trail to Thorndyke Avenue W and a neighborhood greenway along 16th Avenue W*
- Construct a cycle track on W Dravus Street between 20th Avenue W and 14th Avenue W*
- A north-south neighborhood greenway on 14th Avenue W and other local streets connecting W Nickerson Street to 10th Avenue W*
- Construct a new north-south, off-street trail through Interbay. The trail would connect to the Elliott Bay Trail to the south, run along the western edge of the Interbay Golf Course, and connect to W Dravus Street near 16th Avenue W. This is essentially a northern leg of the Elliott Bay Trail on the east side of the railroad tracks.*

It should be noted that none of these projects are in the *2019-2024 Implementation Plan* (indicated with an asterisk in the bulleted list above), so they are currently unfunded and do not have a clear path to delivery.

Based on facilities that exist or are currently planned, bicyclists would generally access the Interbay light rail station via W Dravus Street, the Ship Canal Trail, and a new trail connecting the Ship Canal Trail to Thorndyke Avenue W. Planned neighborhood greenways, bicycle lanes, and protected bicycle lanes would greatly improve access to the station from Queen Anne and Magnolia, as existing infrastructure in these neighborhoods is minimal, but steep topography is a limiting factor and may limit people's ability or decision to bicycle to the Smith Cove Station.

Opportunities and Potential Projects

15th Avenue W & W Emerson Street Intersection

In the near-term, the intersection should be redesigned per the recommendations in the *City of Seattle Bridge Safety Analysis Report*, which calls for adding a crosswalk at W Emerson Street & W Nickerson Street and a 6-foot wide shared use path on the south side of W Emerson Street that connects between W Nickerson Street and 15th Avenue W. In the longer-term, the intersection will be completely redesigned when the Ballard Bridge is replaced, as it will terminate at this intersection. All three bridge alternatives call for a Modified Single Point Urban Interchange (MSPUI) at this intersection. While this design improves upon existing conditions, it is still challenging for bicyclists and pedestrians of all ages and abilities to navigate, so there are opportunities to improve upon the design. Beyond this intersection, there are opportunities to repurpose right-of-way along 15th Avenue W to ensure comfortable and convenient access for all modes of transportation.

Light Rail Station and RapidRide Access

At the light rail station, it will be important to provide infrastructure that minimizes barriers to bicyclists to capture this potential user group. This includes safe and secure bicycle parking, such as lockers, well-maintained elevators, and wayfinding within the station area. It will also be important to provide infrastructure and wayfinding on adjacent roadways to ensure that bicyclists of all ages and abilities can access the light rail station and RapidRide bus stops, which will generally be achieved by implementing projects included in the BMP. However, the BMP does not identify specific intersections where crossing improvements for bicyclists will be necessary, so locations where bicycle routes cross arterials and collector roadways should be evaluated. These locations could include, but are not limited to:

- W Dravus Street & 16th Avenue W (or 17th Avenue W, depending on where the new Elliott Bay Trail extension connection ends)
- W Dravus Street & 14th Avenue W
- Thorndyke Avenue W & 20th Avenue W
- Thorndyke Avenue W & W Armour Street

Additional Opportunities

See **Figure 12** for an overview of bicycle opportunities in the study area.

Smith Cove

Existing Conditions

The primary bicycle facility in Smith Cove is the Elliott Bay Trail, as shown in **Figure 10**. The Elliott Bay Trail links Smith Cove to Downtown Seattle, Magnolia, Interbay, Ballard, and other neighborhoods. The Elliott Bay Trail is primarily located along the western edge of BNSF's railroad tracks and connects south through Centennial Park and Myrtle Edwards Park to downtown. A spur of this trail loops to the west side of Terminal 91, connecting to 20th Avenue W and Smith Cove Park and Marina. In 2018, the City completed the protected bike lanes on 20th Avenue W/Gilman Avenue W, connecting the Elliott Bay Trail to Interbay and beyond.

There are several challenges for bicyclists in Smith Cove today:

A narrow section of the Elliott Bay Trail.

- Due to limited right-of-way, the northern portion of the Elliott Bay Trail, starting at the Magnolia Bridge, is flanked by fences on both sides and **extremely narrow** in some places, which hinders shared use travel in two directions and can be a safety hazard. bicyclists handlebars can get caught in the fencing or clip those of other bicyclists.
- The Elliott Bay Trail has **inconsistent pedestrian and bicycle markings and trail speed signage** that needs to be brought up to consistent trail standards.
- While much of the area in Smith Cove is relatively flat, steep **topography** is a challenge for people bicycling between Smith Cove/the Elliott Bay Trail and Queen Anne/Magnolia. Several of the roadways west of 23rd Avenue W in Magnolia and east of 15th Avenue W/Elliott Avenue W have slopes greater than 10 percent. If slopes are too steep, it can deter people from biking. Having direct route options to key destinations that avoid steep slopes are that much more important.
- The **Magnolia Bridge** is a challenging environment for biking, as there are no marked bicycle facilities. There is a contiguous, narrow sidewalk on the south side that is approximately 5-feet wide, which some bicyclists use instead of riding in one of the vehicles lanes, which creates conflicts with pedestrians. Portions of the sidewalk are separated from vehicle traffic by a short concrete or metal barrier, but many sections have no buffer, providing minimal protection from heavy vehicle volumes and high vehicle speeds. There is a pedestrian stairway linking the south side sidewalk to Terminal 91.

Seattle's 2020 *Bicycle and Pedestrian Safety Analysis: Phase 2* identifies the top 20 priority bicycle locations by Council District to address locations that exhibit one or more characteristics found to be significantly associated with bicycle crashes and/or have a crash history, but none of the top locations for Council District 7 fall within Smith Cove. As described in Chapter 4, no fatal bicycle collisions were reported in the study area between 2014-2018 in SDOT's *2019 Traffic Report*[8], though studies have shown that collisions involving bicyclists are often underreported.

Future Conditions

The City of Seattle's adopted 2014 BMP outlines the proposed improvements to the City's bicycle network, which are intended to be installed by 2034. The full list of projects for the study area are included in **Figure 10**, but the most relevant projects for Smith Cove that have not yet been implemented include:

- Construct off-street bicycle lanes on the Magnolia Bridge and Galer Flyover that connect to a new cycle track on Magnolia Boulevard W/Clise Place W and 34th Avenue W*

[8] https://www.seattle.gov/Documents/Departments/SDOT/VisionZero/2019_Traffic_Report.pdf

- Construct bicycle lanes on Thorndyke Avenue W to close the gap*
- Protected bicycle lanes on 10th Avenue W and Olympic Way W/W Olympic Place in Queen Anne*
- Construct a new north-south, off-street trail through Interbay/Smith Cove, as mentioned in the Interbay section. The trail would connect to the Elliott Bay Trail to the south, run along the western edge of the Interbay Golf Course, and connect to W Dravus Street near 16th Avenue W. This is essentially a northern leg of the Elliott Bay Trail on the east side of the railroad tracks.*

It should be noted that none of these projects are in the *2019-2024 Implementation Plan* (indicated with an asterisk in the bulleted list above), so they are currently unfunded and do not have a clear path to delivery.

Based on facilities that exist or are currently planned, bicyclists coming from the Armory or Expedia would generally access the Smith Cove light rail station via the Elliott Bay Trail and W Galer Street Flyover. There are several planned neighborhood greenways, bicycle lanes, and protected bicycle lanes that provide east-west connections to access the station from Queen Anne and Magnolia, including separated bicycle-pedestrian facilities on the new Magnolia Bridge, but steep topography is a limiting factor and may limit people's ability or decision to bicycle to the Smith Cove Station.

Opportunities and Potential Projects

Magnolia Bridge

The replacement Magnolia Bridge should provide wide, comfortable facilities for bicycles and pedestrians to ensure that people of all ages and abilities feel safe bicycling. The on and off ramps should clearly indicate how bicyclists and pedestrians are intended to use the roadway, making it clear to motorists to look for these vulnerable users. The Magnolia Bridge planning study considers four bridge replacement options, and two options are being considered by this study, both of which provide improved facilities for bicycles and pedestrians, including:

- **Alternative 1** – **Armory Way**: constructs a new bridge over the railroad tracks connecting 15th Avenue W & W Armory Way to Thorndyke Avenue W just south of W Raye Street. The new Armory Way bridge would include a shared use path on the south side. It provides a new connection to the Elliott Bay Trail.
- **Alternative 4 – In-Kind Replacement:** constructs a new bridge immediately south of the existing Magnolia Bridge. The existing "center ramps" to Terminal 91 would be eliminated. The new bridge would feature a 10-foot wide shared use path on the south side, and the off-ramp to Smith Cove will connect to the Elliott Bay Trail.

While it is important to provide facilities for bicyclists on the bridge, many bicyclists have indicated through public outreach that they will likely continue using existing travel routes to Ballard, Fremont, the shared use trails, and W Dravus Street regardless of the alternative chosen because of the steep grades under both bridge replacement options. Speeding on the Magnolia Bridge is a key safety concern, so it will be important to keep speeds at the speed limit and add signage to make motorists aware of bicyclists and pedestrians.

Light Rail Station and RapidRide Access

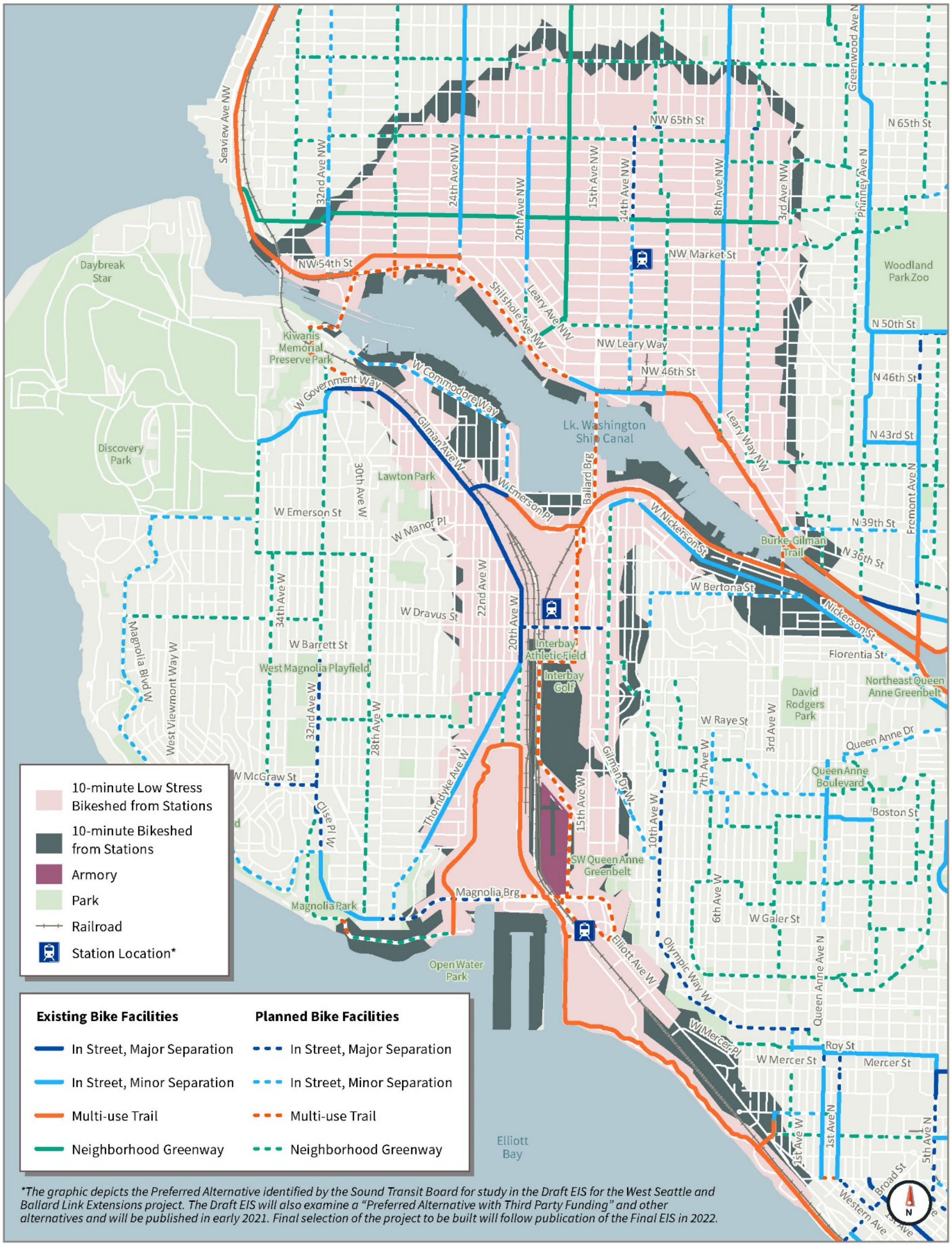
At the light rail station, it will be important to provide infrastructure that minimizes barriers to bicyclists to capture this potential user group. This includes safe and secure bicycle parking, such as lockers, well-maintained elevators, and wayfinding within the station area. It will also be important to provide infrastructure and wayfinding on adjacent roadways to ensure that bicyclists of all ages and abilities can access the light rail station and RapidRide bus stops, which will generally be achieved by implementing projects included in the BMP. However, the BMP does not identify specific intersections where crossing improvements for bicyclists will be necessary, so locations where bicycle routes cross arterials and collector roadways should be evaluated. These locations could include, but are not limited to:

- Elliott Avenue W & W Galer Street
- 15th Avenue W & the Magnolia Bridge on/off ramps
- W Galer Street & Thorndyke Avenue W
- W Galer Street & 29th Avenue W

Additional Opportunities

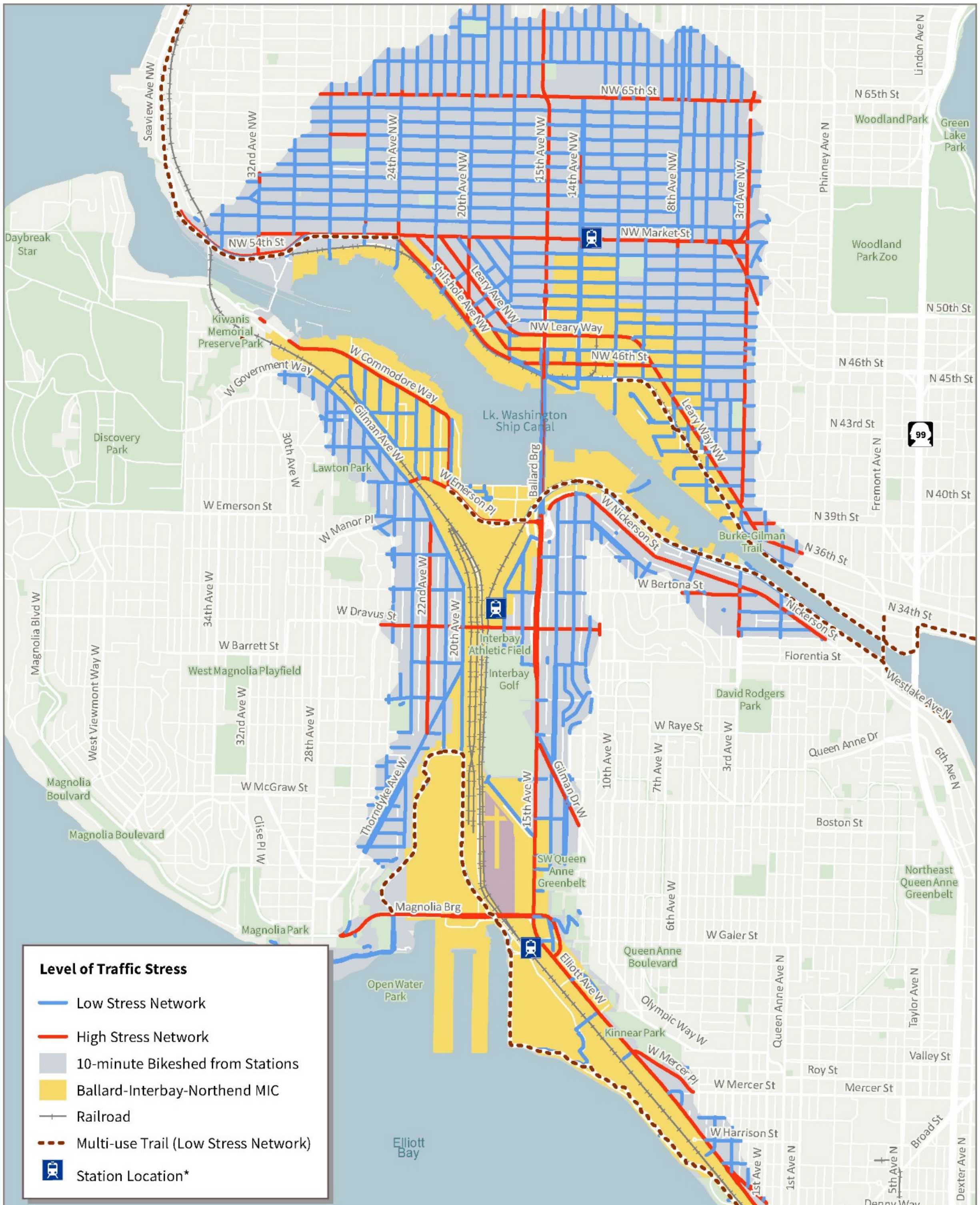
See **Figure 12** for an overview of bicycle opportunities in the study area.

Figure 10: Existing / Planned Bicycle Network and 10-Minute Bikeshed to Light Rail



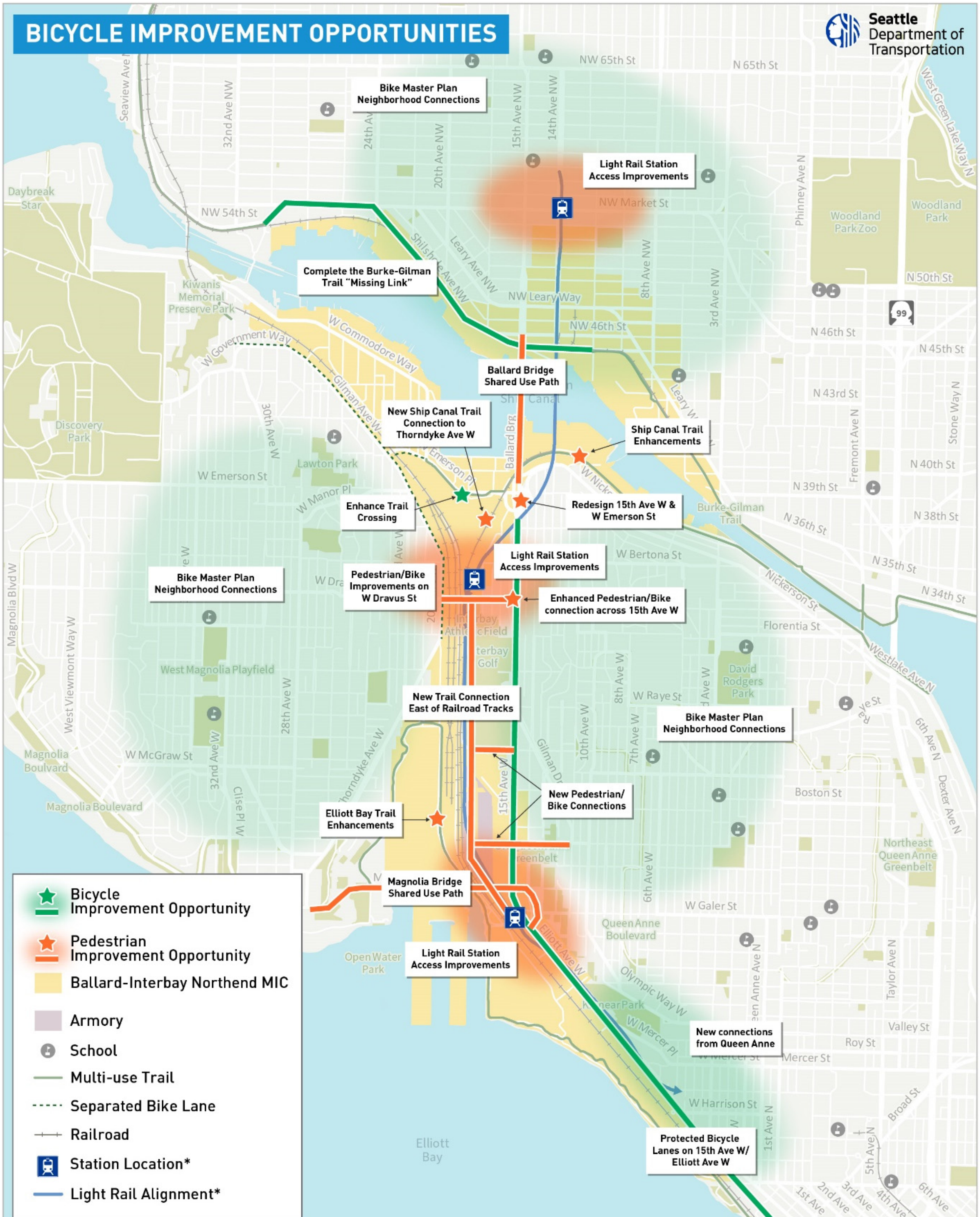
*The graphic depicts the Preferred Alternative identified by the Sound Transit Board for study in the Draft EIS for the West Seattle and Ballard Link Extensions project. The Draft EIS will also examine a "Preferred Alternative with Third Party Funding" and other alternatives and will be published in early 2021. Final selection of the project to be built will follow publication of the Final EIS in 2022.

Figure 11: Existing Level of Traffic Stress and 10-minute Bikeshed to Light Rail



The graphic depicts the Preferred Alternative identified by the Sound Transit Board for study in the Draft EIS for the West Seattle and Ballard Link Extensions project. The Draft EIS will also examine a "Preferred Alternative with Third Party Funding" and other alternatives and will be published in early 2021. Final selection of the project to be built will follow publication of the Final EIS in 2022.

Figure 12: Overview of Bicycle Opportunities in Study Area



*The graphic depicts the Preferred Alternative identified by the Sound Transit Board for study in the Draft EIS for the West Seattle and Ballard Link Extensions project. The Draft EIS will also examine a "Preferred Alternative with Third Party Funding" and other alternatives and will be published in early 2021. Final selection of the project to be built will follow publication of the Final EIS in 2022.

4

Auto & Freight Network

The existing street network in the BIRT study area serves a variety of land uses. This section focuses on mobility for those traveling by private vehicle and moving freight in the study area. Traffic analysis provides an overview of how auto and freight modes operate within the shared roadway space on key corridors.

As the epicenter of Seattle's fishing and maritime industry, there are several critical freight corridors that pass through the BIRT study area. 15th Avenue W/NW serves as the primary north-south spine for this mode as well, highlighting the importance for the Ballard Bridge and connectivity within the overall study area.

Modal priority is assigned to roadways within the study area by SDOT, and in some cases modal priority overlaps on roadway segments, as shown in **Figure 13**. By 2042, it is assumed that the area would be served by light rail connecting downtown Seattle to Ballard via Interbay and related changes to the bus network. Additional major changes anticipated over the next 20 years include development of the Armory site and replacement of the Magnolia and Ballard Bridges.

Figure 13: Existing Motorized Transit Network and Key Modal Corridors

Existing Roadway Environment

Auto/Personal Vehicle

The existing auto network consists of several key corridors including 15th Avenue W/NW, Gilman Avenue West, West Nickerson Street, West Dravus Street, 20th Avenue West, Thorndyke Avenue West, West Galer Street, Elliott Avenue West, and the Magnolia Bridge and access ramps. All of these corridors are listed as arterials by SDOT, each providing the capacity to accommodate thousands of vehicles per day, as shown in **Figure 14**. Connecting to these arterials are local streets and key intersections that were evaluated for how well they accommodate vehicles based on average vehicle delay, as described by level of service (LOS) during the AM and PM peak hours. Study intersections were identified in coordination with SDOT and project stakeholders to ensure that this effort was adequately considering roadway operations throughout the study area.

Collision History

Within the study area there were three pedestrian fatalities, one vehicle fatality, and three serious injury collisions in 2018, as indicated in the Seattle Department of Transportation 2019 Traffic Report[9]. There were no bicycle fatalities in the study area. The pedestrian fatalities were located on 15th Avenue W near W Armory Way and on NW 45th Street near the Ballard Bridge; the vehicle fatality was located on Thorndyke Avenue W near W Boston Street. Serious injury collisions can involve persons driving cars, bicyclists, pedestrians, or a user of any other transportation mode. In 2018, serious injury collisions were located primarily on 15th Avenue W and in downtown Ballard.

According to SDOT's Annual Traffic Reports, between 2014 and 2017, no pedestrian or bicycle fatalities were reported in the study area; however, studies have shown that non-fatal collisions involving pedestrians and bicyclists are often underreported. Across the five-year timeframe, additional bicycle and pedestrian collisions that did not involve fatal or serious injuries were generally concentrated in the Ballard downtown historic area, east of the Ballard bridge/south of NW Leary Way, and in Magnolia along 28th Avenue W. While 15th Avenue W/NW did not have any serious injury or fatal bicycle or pedestrian collisions between 2014 and 2017, this trend may not hold in the future as walking and biking increases related to the opening of the light rail stations. Citywide, the fatal and serious injury trends have been growing over the last decade, with 2019 being the biggest year since 2006.

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[9] https://www.seattle.gov/Documents/Departments/SDOT/VisionZero/2019_Traffic_Report.pdf

Figure 14: Existing Auto Network and Average Daily Volumes (All-Way)

Freight Mobility

SDOT classifies freight corridors in the Freight Master Plan as Major and Minor Truck Streets, First/Last Mile Connectors, and roadways with Limited Access to freight. 15th Avenue W/NW is a key freight corridor in the City of Seattle, providing a connection between port and maritime uses in Interbay to Ballard and areas of North Seattle, as well as downtown and areas south of Downtown Seattle. Few roadway alternatives are available for freight, so resiliency of the existing network is important to maintain freight operations. Within the study area, 15th Avenue W/ NW, NW Market Street, NW Leary Way, and Shilshole Avenue NW are all listed as Major Truck Streets; while W Emerson Place, Gilman Avenue W, and W Dravus Street create a Minor Truck Street loop serving Fisherman's Terminal. **Figure 15** shows freight corridors, classifications, and important freight land use areas.

Within the study area, the areas near 15th Avenue W/NW, Smith Cove, Salmon Bay and the Fremont Cut, are all classified as Manufacturing and Industrial Centers in the Freight Master Plan, as shown in **Figure 15**. Areas to the south generally include the cruise ship terminal at Terminal 91 and provide access to rail freight, while areas in the north generally include fishing industries and shipyards. Manufacturing and Industrial Centers are key destinations for local and regional freight travel and freight access to these areas should be maintained and enhanced when possible to ensure safe and efficient travel.

As discussed in Chapters 2 and 3, generally there are poor conditions for walking and biking around industrial land uses. Sidewalks are either missing (many industrial properties have parking that abuts the property line, making it challenging to navigate the roadway on foot) or can be narrow and have impediments to ADA access, such as fire hydrants in the middle of the sidewalk. An abundance of driveways around industrial land uses can be particularly challenging for bicyclists, such as along Shilshole Avenue NW. These conditions create conflicts between freight and people walking and biking – both employees and customers.

Dedicated curbspace for freight and deliveries are limited in Interbay, primarily concentrated around the denser commercial areas in Magnolia Village and W Dravus Street. Downtown Ballard has dedicated loading areas throughout the historic district to serve the dense area with narrow street right-of-way. Downtown Ballard can be a popular destination for non-industrial activity, so maintaining freight access and loading areas is important for freight access and resiliency.

Ballard & Magnolia Bridges – Alternative Routing

The City recognizes the critical importance of the Ballard and Magnolia bridges to moving people and goods in the BIRT study area. As described earlier in this memo, the City has done a substantial amount of planning for replacement of the Ballard and Magnolia bridges. As such, this planning has included consideration of alternative routing, should the bridges need to be closed during reconstruction. While the BIRT study is considering the infrastructure needs associated with each bridge replacement, it is important to note that potential bridge closure scenarios have also been considered by the City.

Figure 15: Freight Corridors

Future Roadway Environment

To develop the future (year 2042) forecasts for this project, Fehr & Peers applied a version of the PSRC model that is currently being used for the WSBLE project. This version of the PSRC model is an appropriate tool for the BIRT effort given its level of detail in the study area (in terms of both land uses and transportation network), built in assumptions for transit investments, and future land use assumptions that are consistent with growth anticipated through 2042. The model contains household and employment land use control totals from Sound Transit that closely align with PSRC data and are distributed in accordance with the 2035 Comprehensive Plan/Mandatory Housing Affordability (MHA) EIS land use distribution throughout the City of Seattle. For locations outside Seattle, the 2042 WSBLE model uses Sound Transit land use and growth assumptions. Post-processing of traffic volumes incorporated future pipeline projects such as T-91 development, Expedia Campus, and Armory Development for the baseline scenario. The 2042 model also incorporates planned transportation facilities into the model network. Overall, this study will evaluate up to four future scenarios in 2042 for the AM and PM peak periods; two of these scenarios have been defined for evaluation in this Needs Assessment memo and up to two are anticipated to coincide with the Mayor's Seattle Industrial Maritime Strategy EIS project.

Scenarios 1 and 2 incorporate two different bridge options for the Ballard Bridge: low-height and mid-height; and two for the Magnolia Bridge: one-to-one replacement of existing bridge and a new bridge on Armory Way that replaces the current bridge. These scenarios provide varying access to and from the Ballard Bridge, the Magnolia neighborhood, and 15th Avenue W/NW.

The low-height Ballard Bridge option includes enhanced access to the bridge on the southern section while access on the northern part in Ballard is the same as current and baseline conditions. For the purposes of this report, the roadway system in Network Scenario 1 is assumed to be the same as the future baseline except at W Nickerson Street/W Emerson Street where a modified SPUI design is assumed for both Scenario 1 and 2. It is assumed the low and high Ballard bridge options would have the same capacity as the current bridge in both Network Scenario 1 and 2. **Figure 17** shows the low-height bridge alignment.

1. **Network Scenario 1:** Land uses and transportation network consistent with WSBLE model and inclusion of interim Armory Development land use; low-height Ballard Bridge (one-to-one replacement of Ballard Bridge) and Magnolia Bridge Alternative 4 (one-to-one replacement of Magnolia Bridge)
2. **Network Scenario 2:** Land uses and transportation network consistent with WSBLE model and inclusion of interim Armory Development land use; mid-height Ballard Bridge and Armory Bridge Alternative 1 (new bridge between 15th Avenue W & Armory Way and Thorndyke Avenue), new intersections at 20th Avenue W and Thorndyke Avenue, and new flyover ramp access at Galer Street for access across BSNF rail to Pier 91 and adjacent facilities
3. **Network Scenario 3:** (to be defined at later date)
4. **Network Scenario 4:** (to be defined at later date)

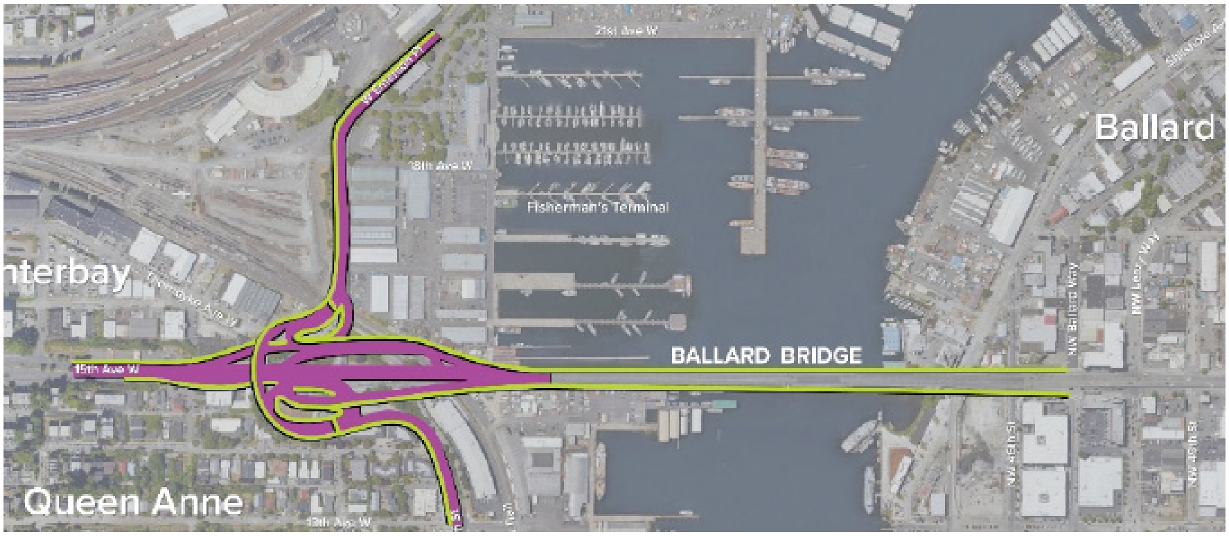
As noted above, Scenarios 1 and 2 each combine a Magnolia Bridge and Ballard Bridge option, however future analysis for this project will consider revising the scenarios to evaluate low and high cost options, as shown in **Figure 16.**

Figure 16: Potential Future Investment Scenarios for Evaluation

<table>
<tr><th>Investment Scenario</th><th>Magnolia Bridge</th><th>Ballard Bridge</th><th>Land Use</th><th>Transportation Infrastructure</th></tr>
<tr><td>One</td><td>In-Kind Replacement</td><td>Mid Level</td><td rowspan="2">2042 land uses consistent with West Seattle and Ballard Link Extension study, plus updated assumptions for:
• Armory
• Terminal 91
• Fishermen’s Terminal</td><td rowspan="2">• ST Ballard Link Extension
• Bike Master Plan
• Additional supporting facilities TBD</td></tr>
<tr><td>Two</td><td>Armory Way Concept</td><td>Low Level</td></tr>
</table>

Source: BIRT Interagency Team Meeting #3 (May 21, 2020)

Figure 17: Proposed Low-Height Ballard Bridge Option



The mid-height Ballard Bridge option, assumed in Network Scenario 2, would replace the existing structure and re-design access to and from the bridge on the northern and southern ends. The modified SPUI would connect W Nickerson Street to W Emerson Street across 15th Avenue W and provide longer on and off ramps from 15th Avenue W on the southern end of the bridge. On the northern side in Ballard, a southbound on-ramp from 17th Avenue NW & NW Leary Way would replace existing southbound bridge access, and a northbound off-ramp at NW 49th Street on the east side would replace the existing off-ramp access. The 17th Avenue NW & NW Leary Way intersection would be reconfigured to enhance freight mobility from Shilshole Avenue NW via 17th Avenue NW and includes two new signals to move vehicles through the intersection.

Figure 18 shows the mid-height Ballard Bridge alignments.

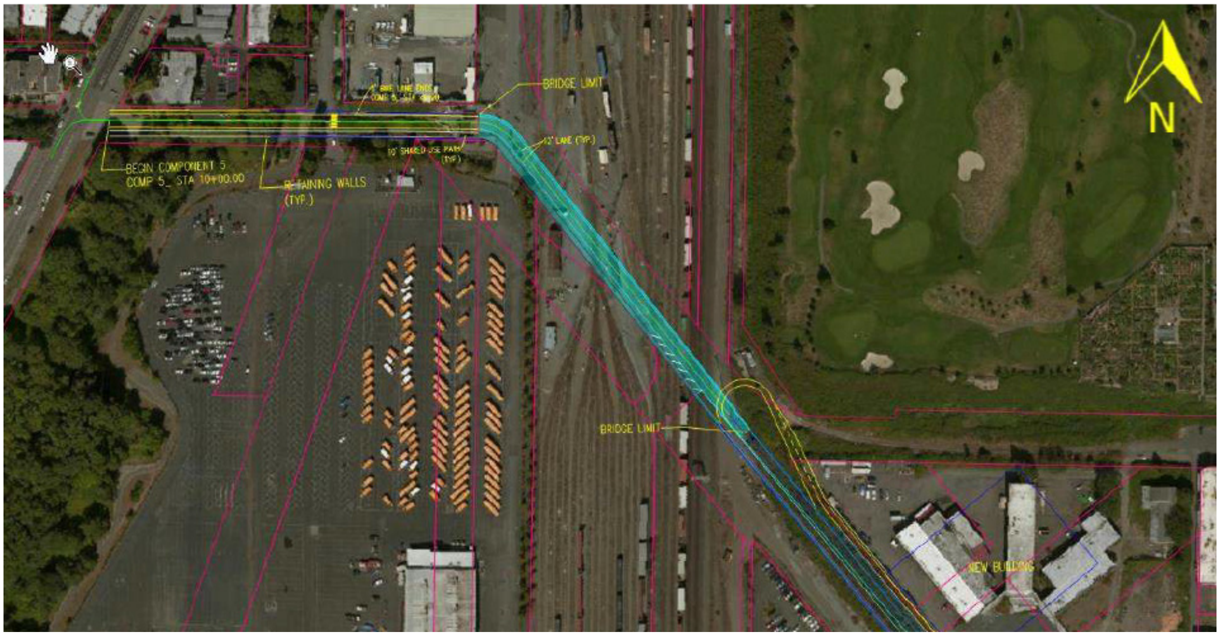
Figure 18: Proposed Mid-Height Ballard Bridge Option

The Magnolia Bridge Alternative 4 option is a one-to-one replacement of the existing bridge. The Armory Way Bridge described in Network Scenario 2 would replace the existing Magnolia Bridge by providing an elevated connection to Thorndyke Ave W from 15th Avenue W & Armory Way. This alignment includes an elevated northbound-left movement from 15th Avenue W which is then at-grade on part of Armory Way to allow local access to and from the bridge, then is elevated over the tracks and up the hillside. The bridge alignment assumed in this study is based on the Magnolia Bridge Planning Study (2019)[10]. Additional improvements to Thorndyke Avenue W, 20th Avenue W, West Uplands Perimeter Road, and the W Galer Street Overpass and flyover.

Figure 19 shows the proposed Armory Way bridge alignment.

Figure 19: Proposed Armory Way Bridge Alignment – Component 5B

[10] https://www.seattle.gov/Documents/Departments/SDOT/BridgeStairsProgram/bridges/Magnolia/MBPS-AlternativeAnalysisMemo-Spring2019.pdf



The future freight network is assumed to be similar to what currently exists, as available right-of-way and land to create new freight network connections is limited in the study area. While most of the key freight destinations are assumed to still be in place in 2042, the Mayor's Seattle Industrial and Maritime Strategy project will identify changes to the study area, specifically at the Armory Development, including potential changes to the freight network. The evaluation in this section focuses on the land use and roadway network assumptions for future baseline, Scenario 1, and Scenario 2.

Roadway Operational Conditions

This section considers auto and freight operations and discusses current and future impacts to the roadway network. Auto and freight frequently share the same roadway space and are both impacted by delay within the street network. Intersection operations analysis can be used as a proxy to assess freight mobility, including access and travel time.

Roadway Operations at Key Locations

This section discusses vehicle operational characteristics at key locations in the study area where existing and/or future analysis shows a need for improvement. Based on the technical analysis, most study intersections experience for acceptable levels of delay in existing and future baseline conditions in the AM and PM peak periods, though general congestion is experienced throughout the 15th Avenue W/NW corridor during these periods, especially towards downtown in the morning and northbound in the afternoon and evening.

Operations analysis was conducted in Synchro software utilizing the networks and traffic volumes assumed in the both the Magnolia and Ballard Bridge studies. Due to changes in travel patterns and trips related to COVID-19 during existing conditions phase of this project, new traffic counts were not collected as this would not have been reflective of typical roadway traffic volumes. The project team started with 2017 traffic counts provided in the existing bridge study Synchro networks and included additional recent traffic counts from relevant studies. Maps showing existing and future operations results can be found in **Appendix A**.

The locations described in the next several pages include details related to average intersection delay and delay for the worst movement that a vehicle experiences while at that intersection. These seven locations are:

- Elliott Avenue W/15th Avenue W & W Galer Street Flyover
- 15th Avenue W & W Howe Street
- 15th Avenue W & W Armory Street
- 15th Avenue W & W Gilman Street
- 15th Avenue W & W Nickerson Street/W Emerson Street
- 15th Avenue W & NW Leary Way
- 15th Avenue NW & NW Market Street

To understand what this experience is like to the average person in a vehicle, **Table 2** lists ranges of delay and how it corresponds to roadway conditions. The 2042 Baseline and Network Scenario 1 roadway environments are assumed to be the similar for all of the key locations listed below, except at the 15th Avenue W & W Emerson Street/W Nickerson Street interchange where the roadway design for Scenarios 1 and 2 are the same.

Table 2. Level of Service for Signalized Intersections

Average Control Delay (sec/veh)	Roadway Environment
< 10 seconds	Free Flow
> 10- 20 seconds	Slight Delays (stable roadway flow)
> 20 – 35 seconds	Acceptable Flow (stable roadway flow)
> 35 – 55 seconds	Noticeable, Inconvenient Flow (tolerable Delay, may wait through more than one signal cycle before proceeding)
> 55 – 80 seconds	Intolerable flow
> 80 seconds	Highly congested (traffic jam)

Notes: Average control delay from HCM 2010. Study intersections were evaluated in Synchro using HCM 2000 methodology

Elliott Avenue W/15th Avenue W & W Galer Street Flyover

Figure 20: Elliott Ave W at W Galer Street Flyover, looking south

<u>Current Conditions:</u> In current conditions, most movements experience acceptable flow levels except for those users accessing Elliott Avenue W from the W Galer Street flyover during the AM peak period, which experience about 80 seconds of delay; and roadway users accessing the flyover from southbound 15th Avenue W during the PM, which experience almost 70 seconds of delay.

<u>2042 Baseline and Network Scenario 1 Conditions:</u> Roadway users at Elliott Avenue W & W Galer Street flyover are expected to experience substantially greater delays by 2042 due to increased volume along 15th Avenue W, especially northbound in the PM peak hour. Peak vehicle volumes are generally northbound throughout the study area during the PM peak as people travel from downtown to Ballard, Magnolia, and neighborhoods north. As such, vehicles in the NB through lanes experience over 300 seconds of delay during the PM peak by 2042. Traffic volumes developed for this study represent a 13 percent increase in the AM and 10 percent PM increase over 2035 volumes assumed in the Magnolia Bridge Planning Study which may be contributing to delay, as the roadway operates at or over capacity.

<u>Network Scenario 2 (Armory Way Bridge):</u> Roadway users can expect a similar roadway environment compared to the 2042 Baseline/Network Alternative 1 with slightly less overall intersection delay, likely due to the new W Galer Street flyover removing access to westbound vehicles at this intersection, which in turn removes the side street phase from the signal. Eastbound vehicles accessing 15th Avenue W will do so via W Garfield Street.

15th Avenue W & W Howe Street

Figure 21: 15th Avenue W at W Howe Street, looking north

<u>Current Conditions:</u> This signalized intersection provides access to retail and grocery to the west and storage and a gas station to the east. While on average roadway users at this intersection experience acceptable levels of delay, westbound users experience congestion during both the AM and PM peaks. Southbound-right users may be experiencing delay during the AM peak due to the curbside lane operating as a BAT lane during this period where transit may be bunched and/or personal vehicles are driving in the BAT lane through the intersection. Currently, a roadway runs between Armory Way and retail parking lot that provides additional options for users to access southbound 15th Avenue W and serves as delivery access.

<u>2042 Baseline and Network Scenario 1 Conditions:</u> The 15th Avenue W & W Howe Street intersection is anticipated to experience additional AM and PM peak hour delay compared to existing conditions by 2042 in large part due to redevelopment of the Armory. This study assumes 515 inbound and 425 outbound trips related to the Armory Development by 2042, with access points to 15th Avenue W at both Armory Way and at W Howe Street. These additional trips, in addition to assumed background growth in vehicle traffic by 2042, are likely to lead to noticeable increases in intersection delays – estimated to be 85 seconds on average in the AM peak hour for all users and 63 seconds in the PM peak hour. The northbound left movement from 15th Avenue W on to W Howe Street is forecast to experience very long delays if current intersection geometries are maintained - over 230 seconds of delay in the AM, with the eastbound left turn lane from the development waiting 110 seconds to enter 15th Avenue W in the afternoon.

<u>Network Scenario 2 (Armory Way Bridge):</u> Roadway users can expect a similar environment to the 2042 baseline/network alternative 1, with additional delay for the through movements as users travel through the intersection to access the new Armory Way bridge since the Magnolia Bridge no longer exists. As a result, southbound delays in the morning are forecast to grow to 243 seconds; with similar delays expected for northbound traffic in the afternoon (205 seconds).

15th Avenue W & W Armory Way

Figure 22: 15th Avenue W at W Armory Way, looking north

Current Conditions: This intersection currently operates with minimal amounts of delay given the site today contains a number of retail stores on a short access street, with most of the signal time being given to 15th Avenue W. Users to and from Armory Way can experience congestion due to the high number of vehicles passing through this intersection on 15th Avenue W northbound and southbound.

2042 Baseline and Network Scenario 1 Conditions: In 2042 baseline conditions, this site is one of two access points for the Armory Development, with the other on W Howe Street. As described above, the site is assumed to generate 515 inbound and 425 outbound trips during the PM peak, split between the two access points. As a result of the increase in development and background growth vehicle trips, the intersection is expected to experience more delay than is seen today, 69 seconds of average delay in the AM peak, with the most noticeable levels of delay experienced by users making the northbound left and southbound through movements, 248 and 93 seconds of delay, respectively. PM peak delay is experienced primarily for users coming out of the Armory Development, with the eastbound left and right-turn movements experiencing 69 seconds and 57 seconds of delay, respectively.

Network Scenario 2 (Armory Way Bridge): This scenario assumes a new bridge from 15th Avenue W & Armory Way to Magnolia over the BNSF tracks, which would replace the Magnolia Bridge. As a result, the vehicle trips that once used the Magnolia Bridge now use this new Armory Way bridge. This scenario assumes an elevated bridge serves the northbound left-turning movement from 15th Avenue W. While this movement will be grade separated and no longer experience delays at the intersection, eastbound vehicles from the Armory Way bridge mix with at-grade vehicles leading to congestion during the AM and PM peak periods. The southeast bound right-turn movement from the Armory Way Bridge is expected to experience over 300 seconds of delay during the AM peak and 146 seconds in the PM peak, while southbound vehicles in the AM and northbound vehicles in the PM travelling through the intersection also experience congestion. Deliveries and freight drivers accessing Magnolia would experience this delay and dedicated transit and freight lanes or alternate freight pathways would be necessary to provide efficient transit and freight pathways.

15th Avenue W & Gilman Drive W

Figure 23: 15th Avenue W at Gilman Drive W, looking north

Current Conditions: The 15th Avenue W & Gilman Drive W intersection connects Queen Anne Hill to the east and the Interbay Golf course to the west. The intersection currently experiences minimal amounts of intersection delay, though roadway users to and from W Gilman Street experience congestion during the AM and PM peak periods.

2042 Baseline and Network Scenario 1 Conditions: Roadway users are expected to experience increased delay due to the background growth in vehicle traffic, with the same movements experiencing delay as in current conditions. Overall average intersection delays are expected to grow to 80 seconds in the AM peak, and 108 in the PM peak. Northbound and southbound users will experience additional delay compared to existing conditions, likely due to the increased green time needed for users going to and from W Gilman Street.

Network Scenario 2 (Armory Way Bridge): Roadway users would experience similar conditions compared to the 2042 baseline scenario, with slightly improved delay in the AM peak due to southbound users having to access Magnolia via W Dravus Street since the southbound right-turn movement would be restricted at 15th Avenue W & Armory Way. As a result, there will be fewer southbound users travelling through the intersection during the AM peak.

15th Avenue W & W Nickerson Street/W Emerson Street

Figure 24: 15th Avenue NW at NW Market Street, looking north

Current Conditions: This complex interchange allows for access to 15th Avenue W and the Ballard Bridge via W Nickerson Street and W Emerson Street. Northbound users coming from Queen Anne use access ramps on the east side of 15th Avenue W, while northbound users from Magnolia use a flyover ramp before merging with traffic at an all -way stop control and on to the bridge on-ramps. Southbound users from Queen Anne use the underpass ramp to beginning at 13th Avenue W then proceed onto the 15th Avenue W on-ramps. Southbound users to and from Magnolia can merge directly to/from 15th Avenue W via on and off-ramps. East-west travel on W Nickerson Street and W Emerson Street must currently travel through the interchange. RapidRide buses are located on 15th Avenue W within the interchange and must merge into traffic after serving either of the northbound or southbound stops.

Users experience minimal delay at either of the stop-controlled intersections, with the most the most delay occurring for users accessing the northbound bridge on-ramps during the PM peak, which experience 43 seconds of delay.

2042 Baseline Conditions: The roadway environment is similar to existing conditions, with additional delay experienced northbound during the AM and PM periods. Northbound users accessing the bridge during the AM period experience 63 seconds of delay in the AM peak with a slight increase in delay compared to existing conditions in the PM peak. An increase in northbound volumes at the W Emerson St & W Nickerson St stop-control intersection leads to congestion during the PM peak.

Network Scenario 1 and Network Scenario 2 Conditions: While Scenario 1 assumes the low-height (one-to-one replacement of the Ballard and Magnolia bridges) and Scenario 2 assumes the mid-height Ballard bridge and a new Armory Way bridge to Magnolia, access at the southern part of the Ballard bridge is the same. This includes a modified SPUI design allowing for better east-west connectivity on W Nickerson Street and W Emerson Street, longer on and off-ramps to/from the Ballard Bridge, and revised access to and from 15th Avenue W. Existing stop-controlled intersections are assumed to be signals in these scenarios, allowing for efficient travel through intersections. Users are expected to experience minimal delay through the interchange, similar to existing and baseline conditions with improved conditions for outside lanes as vehicles are able to exit the roadway earlier due to lengthened on-ramps.

NW Leary Way & 15th Avenue NW

Figure 25: NW Leary Way at 15th Avenue NW, looking east

Current Conditions: The NW Leary Way & 15th Avenue NW intersections are located at the confluence of the Ballard Bridge on and off-ramps, and both roadways are key freight corridors. 15th Avenue NW is three separate roadways – the main elevated bridge and a north/south couplet serving one-way traffic on both sides of the bridge. Transit operates on both the couplets and on the bridge, with RapidRide stops located at the intersections. NW Leary Way provides access to downtown Ballard and is part of a freight network that serves Shilshole Avenue NW via 17th Avenue NW. NW Leary Way eventually transitions into N 36th Street between Fremont and Ballard, which then provides access to the Fremont and University Bridges, as well as the University of Washington. Access to the Aurora Bridge and SR 99 is possible via N 39th Street. These corridors are important linkages for regional freight. Roadway users currently experience minimal delay traveling through either of the northbound or southbound ramps at 15th Avenue NW & NW Leary Way.

2042 Baseline and Network Scenario 1 Conditions: By 2042, roadway users at both of the intersections are anticipated to experience significantly higher levels of congestion for most movements during the AM and PM peaks due to the increase in vehicle traffic. Users can experience over 100 seconds of delay when making a northbound-left movement in the AM and 70 seconds in the PM; while drivers making a southbound-left experience about 56 seconds of delay and drivers on NW Leary Way making a right onto

15th Avenue NW to access the bridge experience 72 seconds of delay in the AM. Since Network Scenario 1 assumes the low-height bridge scenario, conditions are expected to be similar to those in the Baseline scenario.

<u>Network Scenario 1 and Network Scenario 2 (Mid-Height Bridge):</u>

The mid-height bridge scenario includes revised connections to the Ballard Bridge. Southbound vehicles will use a new ramp that begins near the 17th Avenue NW & NW Leary Way intersection, and northbound bridge users will exit via a new off-ramp at NW 49th Street. New signals at 17th Avenue NW & NW Leary Way will help to efficiently move vehicles through the intersection. As a result of these improvements, the delay a roadway user experiences decreases overall at both intersections. At the on-ramp, delay is below 16 seconds in the AM and PM peak hours, and southbound-through vehicles at 14th Avenue NW & NW 49th St experiences between 40-50 seconds of delay in the AM and PM peak hours. The improved traffic operations at 17th Avenue NW & NW Leary Way mean improved mobility for freight users.

15th Avenue NW & NW Market Street

Figure 26: 15th Avenue NW at NW Market Street, looking north

<u>Current Conditions:</u> The 15th Avenue NW & NW Market Street is currently a key intersection, serving as the primary gateway to Ballard and neighborhoods to the east and north. Northbound and Southbound BAT lanes allow for enhanced transit mobility across NW Market Street and allows for vehicles to make right turns on to NW Market Street. As a result, general purpose vehicles operate in two through lanes and one left turn lane at the intersection northbound and southbound. The intersection is congested, with 50 seconds of overall average delay in the AM peak and 59 seconds in the PM peak. Traffic making the westbound left turn movement experiences the most congestion, with about 80 seconds of delay during both the AM and PM peaks.

2042 Baseline and Network Scenario 1 Conditions: By 2042, roadway users at this intersection are anticipated to experience significantly higher levels of congestion for most movements during the AM and PM peaks due to the increase in vehicle traffic. In the AM peak, average intersection users will experience 176 seconds of delay, and 118 in the PM peak.

Network Scenario 2 (Mid-Height Bridge): Roadway users will experience similar levels of delay compared to the 2042 baseline scenario. Revised on and off-ramps to/from the Ballard Bridge will be available for southbound users via 17th Avenue NW & Leary Way and for northbound users on NW 49th Street in the mid-height bridge option assumed in this analysis. These new connections may provide some alternative pathways for auto and freight users to avoid traveling through this intersection. However, with the completion of WSBLE, additional pedestrian activity may require longer crossing times for people accessing the new WSBLE station. For the purposes of this study, the mid-height Ballard Bridge Planning Study Synchro network developed by SDOT was used north of Ballard bridge.

Freight Operations

Point-to-point travel time to key freight destinations was analyzed in the AM and PM peak periods. Freight travel times are based on movement delay from intersection operations analysis with adjustments made to consider grade and turning radius. The lower range represents the average travel time a vehicle experiences during the peak period, and the upper range is the typical highest travel time a vehicle experiences on days with high levels of congestion. Given the AM and PM peaks are typically when roadways experience the highest vehicle demand, these travel time estimates reflect the worst roadway conditions for freight throughout the day. However the peak freight period may deviate from the overall AM and PM peak hours measured on City streets, as freight often operates in off-peak periods when curbspace is more available, when stores are either closed or are not experiencing a high numbers of customers, or when traffic levels are lower to increase freight mobility. Long-haul freight operations can also lead to variations in when trucks arrive throughout the day given the distance and varying roadway environments freight experiences en-route.

As shown in **Table 3**, travel time in the northern part of the study area from 15th Avenue NW north of NW Market Street to key freight corridors is similar during the AM and PM peak periods. This analysis shows that bridge traffic does not significantly increase southbound freight travel time during the peak periods, with about a4-6 minute travel time to the Shilshole industrial area and about 4-6 minute to travel to Fisherman's Terminal; and about the same in the PM in the northbound direction. Bridges are not permitted to open for boat traffic during peak commute times, so the increase in travel time is likely due to roadway congestion.

Table 3. Existing (2020) Freight Travel Times to/from 15th Ave NW & NW Market St

Start Location	End Location	Route	Freight Travel Time (minutes)	
			AM	PM
15th Avenue NW (N of NW Market Street)	Shilshole-Industrial Area	via NW Leary Way/17th Avenue NW	4-6	4-5
	Fisherman's Terminal	via Emerson Place/21st Avenue W	4-6	4-6
	Terminal 91	via W Galer Street Flyover & Alaskan Way W	11-15	10-14
Shilshole-Industrial Area	15th Avenue NW (N. of NW Market Street)	via NW Leary Way/17th Avenue NW	4-5	4-6
Fisherman's Terminal		via Emerson Place/21st Avenue W	5-7	7-10
Terminal 91		via W Galer Street & Alaskan Way	10-14	10-15

Notes:
- Freight travel times are based on movement delay from intersection analysis results with delay adjustments made for grade and turning radius.
- Lower range represents the average travel time a vehicle experiences aggregated over the peak hours; the upper range represents the typical highest travel time a vehicle experiences on days with high levels of congestion, based on travel times collected along 15th Avenue in October, 2019 from SDOT's Acyclica ITS system.

Table 4 shows baseline/Network Scenario 1 (one-to-one Magnolia Bridge replacement) and Scenario 2 (Armory Bridge) travel time comparisons. Overall, travel time is expected to double for some segments compared to existing conditions, due to the increase in vehicle traffic. Travel time from north of 15th Avenue NW to Terminal 91 is expected to increase from 11-15 minutes to 25-35 minutes in the AM peak from the existing to baseline scenario, due to congestion across the Ballard Bridge and through Interbay due to background development trips and overall background growth. Northbound travel time stays relatively the same across all the scenarios, with additional travel time experienced from Terminal 91 to 15th Avenue NW & NW Market Street in Scenario 2 during the AM and PM compared to the existing and baseline scenarios.

Table 4. Baseline (2042) & Scenario 1 & 2 Freight Travel Times to/from 15th Ave NW & NW Market St

Start Location	End Location	Freight Travel Time (minutes)					
		2042 Baseline		Scenario 1		Scenario 2	
		AM	PM	AM	PM	AM	PM
15th Avenue NW (N of NW Market Street)	Shilshole-Industrial Area	8-11	4-6	7-9	4-6	7-9	4-6
	Fisherman's Terminal	8-11	5-6	8-12	6-8	8-12	5-8
	Terminal 91	25-35	15-21	25-35	15-21	24-33	10-14
Shilshole-Industrial Area	15th Avenue NW (N of NW Market Street)	5-7	7-9	5-7	6-9	5-7	6-9
Fisherman's Terminal		7-9	9-12	6-8	9-12	6-8	9-12
Terminal 91		12-16	19-26	12-16	19-26	16-22	21-30

Notes:
- Freight travel times are based on movement delay from intersection analysis results with delay adjustments made for grade and turning radius.
- Lower range represents the average travel time a vehicle experiences aggregated over the peak hours; the upper range represents the typical highest travel time a vehicle experiences on days with high levels of congestion, based on travel times collected along 15th Avenue in October, 2019 from SDOT's Acyclica ITS system.

Table 5. Existing (2020) Freight Travel Times to/from Elliott Avenue W

Start Location	End Location	Route	Freight Travel Time (minutes)	
			AM	PM
Elliott Avenue. W (South of W Galer St)	Shilshole-Industrial Area	via NW Leary Way/17th Avenue NW	8-11	9-12
	Fisherman's Terminal	via Emerson Place/21st Avenue W	6-8	7-10
	Terminal 91	via W Galer Street & Alaskan Way	2-3	2-3
Shilshole-Industrial Area	Elliott Avenue W (South of W Galer Street)	via NW Leary Way/17th Avenue NW	8-11	8-11
Fisherman's Terminal		via Emerson Place/21st Avenue W	11-15	11-15
Terminal 91		via W Galer Street & Alaskan Way	4-5	3-4

Notes:
- Freight travel times are based on movement delay from intersection analysis results with delay adjustments made for grade and turning radius.
- Lower range represents the average travel time a vehicle experiences aggregated over the peak hours; the upper range represents the typical highest travel time a vehicle experiences on days with high levels of congestion, based on travel times collected along 15th Avenue in October, 2019 from SDOT's Acyclica ITS system.

Compared to existing conditions, the baseline/scenario 1 and Scenario travel times generally see increases in travel time. Travel time to Fisherman's Terminal is expected to increase from 7-10 minutes to 20-28 minutes in the PM, due to increased development trips and due to general northbound commute patterns during the PM peak. Travel time between the two scenarios is similar, with northbound travel time seeing slight decrease in travel time, likely due to the reconfigured Ballard bridge access on the north sound south side of the bridge. Southbound travel time increases in the AM between the two future scenarios, likely due to the reconfiguration of the Armory Way intersection to accommodate the new bridge.

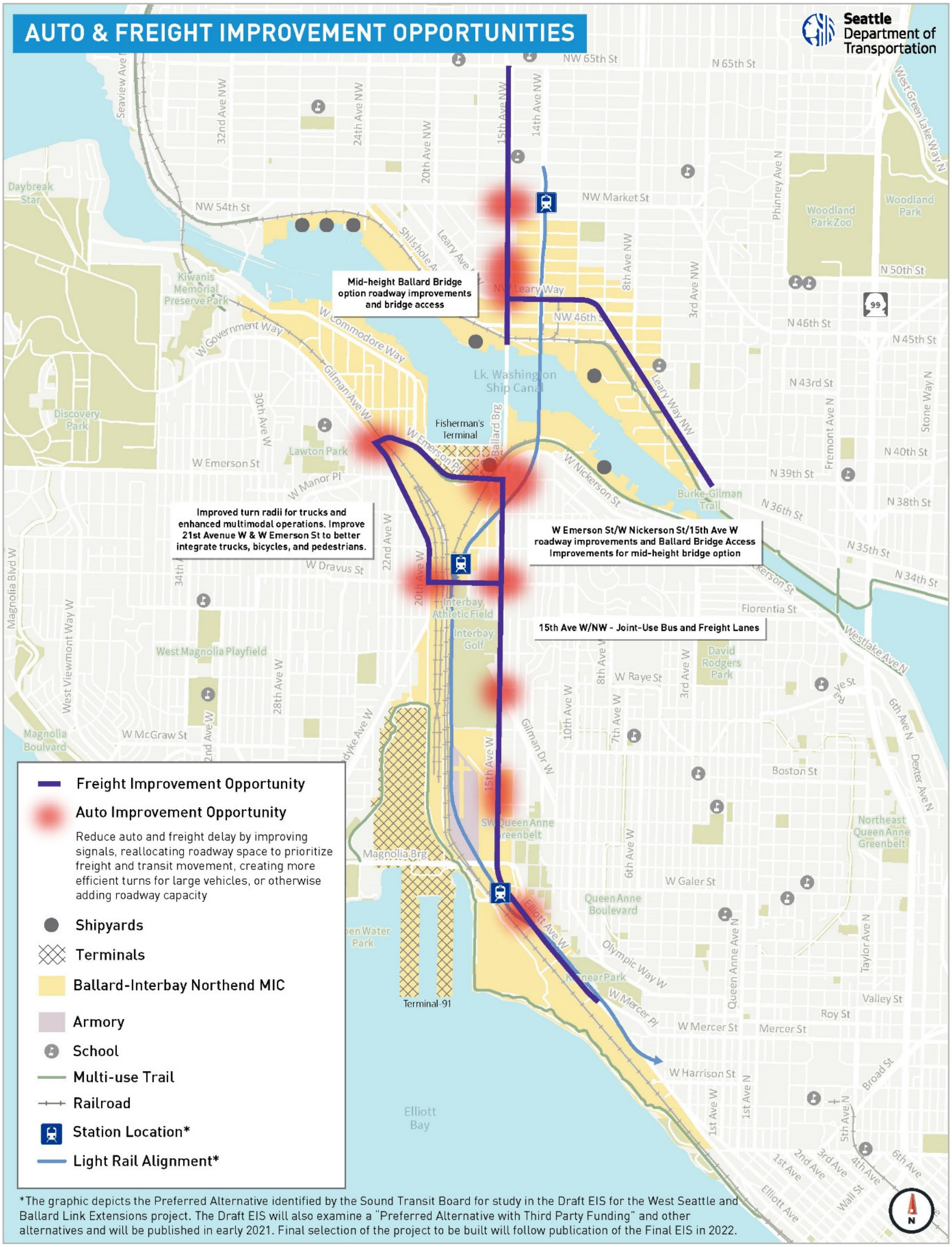
Table 6. Baseline (2042), Scenario 1 & 2 Freight Travel Times To/From Elliott Avenue W

Start Location	End Location	Freight Travel Time (minutes)					
		2042 Baseline		Scenario 1		Scenario 2	
		AM	PM	AM	PM	AM	PM
Elliott Avenue. W (South of W Galer St)	Shilshole-Industrial Area	12-17	20-27	11-15	20-27	10-14	21-29
	Fisherman's Terminal	9-13	18-25	10-13	19-25	9-13	20-28
	Terminal 91	7-10	7-10	7-10	7-10	4-6	7-9
Shilshole-Industrial Area	Elliott Avenue W (South of W Galer Street)	14-19	9-12	13-18	11-15	19-27	9-12
Fisherman's Terminal		16-22	12-17	12-16	7-10	18-24	8-11
Terminal 91		4-5	5-6	4-5	5-6	8-11	4-5

Notes:
- Freight travel times are based on movement delay from intersection analysis results with delay adjustments made for grade and turning radius.
- Lower range represents the average travel time a vehicle experiences aggregated over the peak hours; the upper range represents the typical highest travel time a vehicle experiences on days with high levels of congestion, based on travel times collected along 15th Avenue in October, 2019 from SDOT's Acyclica ITS system.

Based on projects and priorities in the Freight Master plan and concepts developed through review of auto and freight analysis, the following areas of opportunity and potential projects were identified. These concepts are shown in **Figure 27**. Specific projects to enhance freight mobility will be included in a project list being developed as part of this BIRT study.

Figure 27: Auto and Freight Areas of Opportunity and Potential Projects



5

Transit Network

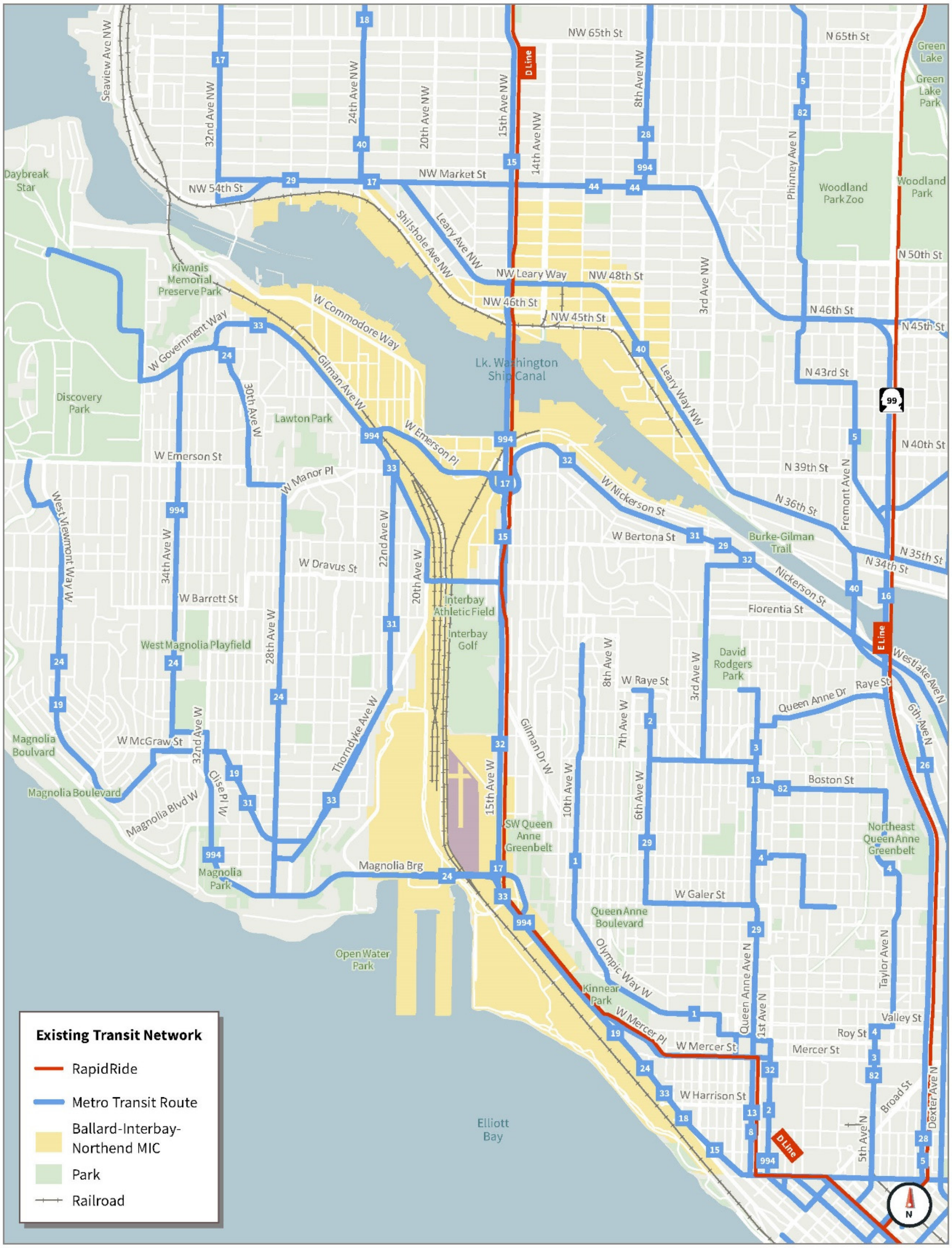
Transit in the project area is currently provided by King County Metro. The transit analysis outlined in this chapter provides an overview of transit travel times on key corridors to and from selected areas within Ballard, Magnolia, and Interbay. Existing and future conditions analysis uses Remix software to determine transit travel times for both the AM and PM peak hours, assumed to be 7-8 am and 5-6 pm, respectively. Future transit network assumptions are consistent with the WSBLE transportation network and include the new WSBLE line and METRO CONNECTS 2040 bus network.

Existing Conditions

The existing transit network consists primarily of King County Metro bus routes that provide connections to downtown Seattle. SDOT has identified priority transit routes in the Transit Master Plan, which ranks roadways by the type of transit service that suited to run on the roadway. As shown in **Figure 13**, roadways identified as part of the Transit Master Plan transit network cover much of the study area. In most cases, King County Metro operates service on transit priority corridors, with additional local connections outside of the priority corridors to Discovery Park and the south end of Magnolia. **Figure 28** shows King County Metro routes in the project area as of March 2020.

Due to the layout of industries in the BINMIC, employees in the area may need to walk or bike long distances to access transit. This is especially true for users near W Commodore Way, Fisherman's Terminal, and Smith Cove where access to frequent transit service may require a ¼ to ½ mile walk or a bus transfer. Employees in this area may work shifts outside of the peak or daytime transit schedules, which means the walking and biking environment may be dark and feel unsafe, and bus options may be limited. Employers in the BINMIC also may not actively encourage transit use, leading to a dependence on personal vehicles.

Figure 28: Existing Transit Network



Transit travel time in the study area can vary based on time of day, the direction of travel, and where someone is travelling. While service in the study area primarily provides connections between Ballard, Magnolia, and Downtown Seattle, east-west service is available on W Nickerson Street to make connections to Wallingford, the University District, and Laurelhurst. Transit service is most frequent on 15th Avenue W and NW, with multiple express and local routes using the corridor as well as the RapidRide D Line. Bus-only lanes on 15th Avenue W are available southbound during the AM peak and northbound during the PM peak allowing buses to stop in-lane and bypass congested areas. During off-peak times these lanes are available for parking.

To evaluate transit service in the study area, corridor travel times during the AM and PM peaks were developed using Remix software and the March 2020 Metro service network. Remix's travel time calculation is frequency based and includes time waiting for a bus, which is equal to half the headway. Study transit pathways were selected by reviewing key transit corridors in the study area, known travel patterns and key destinations. Since 15th Avenue W/NW forms a primary transit spine through Ballard and Interbay, connectivity on, to, and from this roadway was considered. The corridors and existing times are found in **Table 7**Error! Reference source not found. below.

Table 7. Existing PM Peak Direction Transit Travel Time

From	To	AM Travel Time	PM Travel Time
15th Avenue NW & NW Market Street	Downtown Seattle (3rd Avenue & Union Street)	45 minutes	45 minutes
15th Avenue NW & NW Market Street	W Prospect Street (Helix Pedestrian Bridge)	20 minutes	10 minutes
15th Avenue NW & NW Market Street	W Emerson Street & Gilman Avenue W	30 minutes	30 minutes
15th Avenue W and W Emerson Street	W Nickerson Street & 3rd Avenue W	20 minutes	20 minutes
Magnolia Village (W McGraw Street & 32nd Avenue W)	Downtown Seattle (3rd Avenue & Union Street)	60 minutes	45 minutes
Magnolia Village (W McGraw Street & 32nd Avenue W)	Magnolia Bridge (W Galer Street Flyover)	30 minutes	45 minutes
Magnolia Bridge (W Galer Street Flyover)	W Dravus Street & 20th Avenue W/Thorndyke Avenue W	30 minutes	10 minutes
Magnolia Bridge (W Galer Street Flyover)	SODO Busway & Spokane Street	45 minutes	45 minutes

Future Conditions

The future roadway transportation network in the BIRT study area includes implementation of WSBLE project, which will construct light rail through Interbay to Ballard and provide direct rail connections to Seattle Center, South Lake Union, Downtown Seattle, and points south. Three Sound Transit light rail stations are anticipated in the study area, which will provide direct bus transfer opportunities to light rail and may be designed to accommodate bus layover.

As a result of the WSBLE project, King County Metro anticipates major changes to the bus network that restructures service to enhance bus connections to light rail and other regional centers.

The baseline analysis in this section uses the 2040 METRO CONNECTS network and is also consistent with Network Scenario 1, the Magnolia Bridge one-to-one replacement since no changes to the transit environment would be made in this scenario. The future baseline transit/Scenario 1 network is shown in **Figure 29**. The Armory Way bridge option (Network Scenario 2) assumes all transit using the Magnolia Bridge in the baseline/Scenario 1 network would shift to Armory Way and use W Thorndyke Avenue to access the various transit pathways. The transit network assumed for Scenario 2 is found in **Figure 30**.

While SDOT does not include specific transit improvements within the study area in the *Transit Master Plan* (2016), NW Market Street, NW Leary Way, and 15th Avenue NW/W, are considered Priority Transit Corridors for Capital Investments, with NW Market Street and NW Leary Way identified as future RapidRide corridors. The *Transit Master Plan* identifies elements of RapidRide BRT service, including transit signal priority, enhanced passenger facilities, dedicated transit lanes, and enhanced fare collection systems to be implemented on Transit-Plus Multimodal corridors. Planning is currently underway for the Routes 44 Transit-Plus Multimodal Corridor project which will improve transit speed and reliability and passenger facilities to support existing transit service as well as future RapidRide service on the NW Market Street corridor to be implemented in 2023. Planning is also currently underway for the Route 40 Transit-Plus Multimodal Corridor project, which operates on 24th Avenue NW, NW Leary Way, and N 36th Street in the project area and will provide similar benefits to Route 44. Both SDOT and King County Metro have a standard "kit of parts" for transit facilities that would be implemented on new or enhanced transit routes.

WSBLE Station Utilization

Of the three planned Sound Transit light rail stations to be built as part of the WSBLE project in the study area, Ballard Station will likely have the highest number of transit transfers and pickups/drop-offs. By 2042, riders are expected to access these stations predominately through a mix of walking, biking, or transit transfer, with some riders being picked-up or dropped off. This highlights the importance of pedestrian, bicycle, and transit access for riders.

The Interbay and Smith Cove light rail stations are expected to see less ridership compared to Ballard Station. Sound Transit's forecasts anticipate about one-third as many riders will access light rail service at the Interbay station. Most riders are expected to arrive via buses that serve and provide access to the Magnolia and Queen Anne neighborhoods. At the Smith Cove Station, ridership would be slightly lower than at the Interbay station, with the majority of riders accessing the station on foot.

Figure 29: 2042 Baseline/Scenario 1 Transit Network

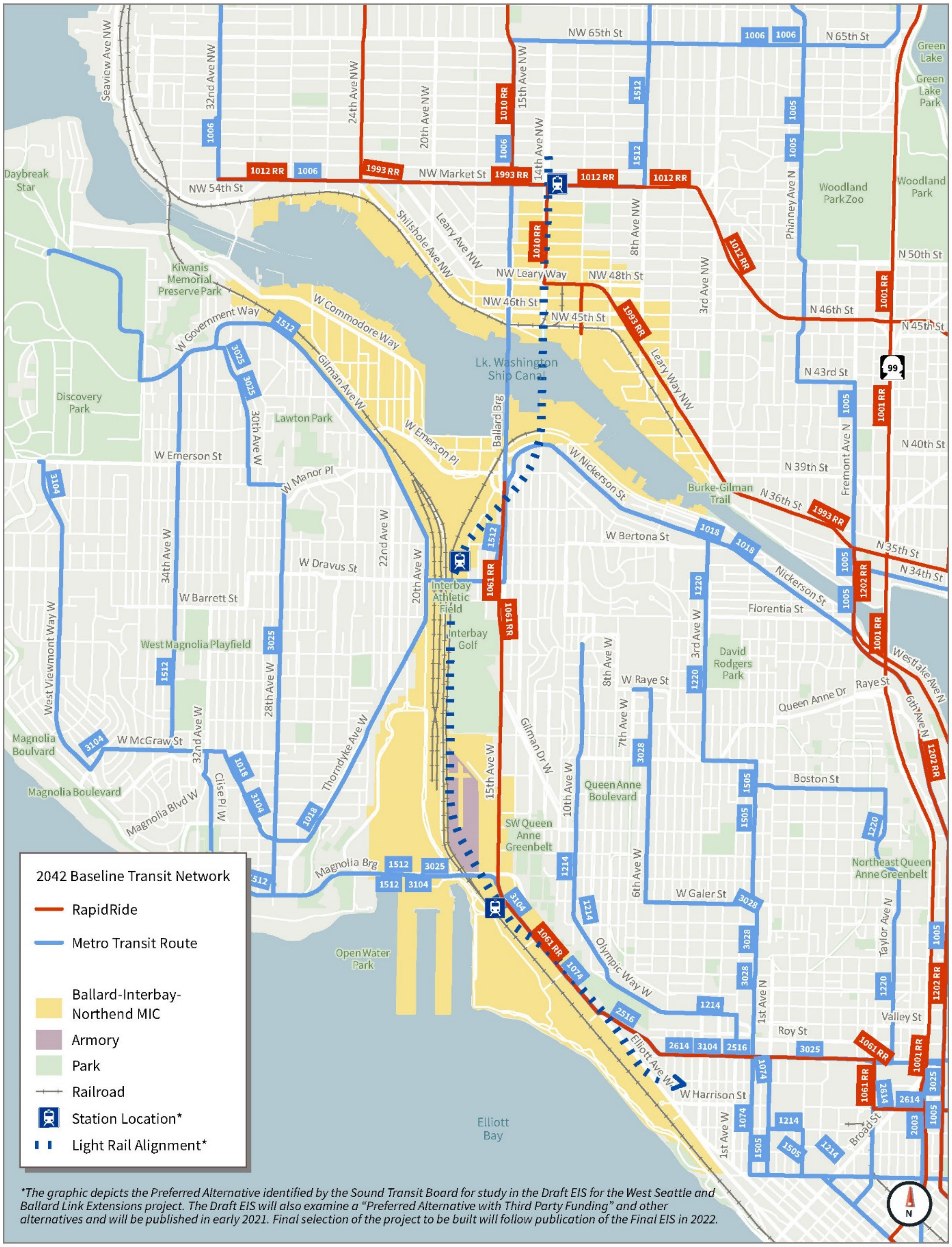


Figure 30: 2042 Network Scenario 2 Transit Network

Future Transit Travel Times to Key Destinations

The following corridors were evaluated for transit travel time in Remix using the METRO CONNECTS 2040 network that includes WSBLE implementation transit network during the AM and PM peak periods. The baseline network and Magnolia Bridge replacement (Scenario 1) networks are identical and assumed to have the same transit travel times due to Scenario 1 being a one-to-one replacement of the existing bridge. Scenario 2, which reflects a new bridge on Armory Way that connects to 20th Avenue W and Thorndyke Avenue W (replacing the existing Magnolia Bridge), assumes that all transit routes that had an alignment over the Magnolia Bridge would be rerouted via Armory Way and Thorndyke Avenue W. Routes maintain their 2042 METRO CONNECTS pathway at Thorndyke Avenue W.

Travel times include average wait times using scheduled transit arrival times for existing conditions and estimated transit frequency for the future scenarios. Origin/destination follows typical commute patterns of southbound in the AM and northbound in the PM. Since Remix software does not consider the roadway or intersection delay into travel time calculations, this analysis provides high-level travel time estimates primarily driven by route distance and speed. The 2040 METRO CONNECTS Remix network was provided by King County Metro and includes assumptions about future route runtimes and headways.

Table 8. 2042 Baseline/Scenario 1 and Scenario 2 Transit Travel Time Comparison

From	To	Baseline/ Scenario 1 AM Travel Time	Scenario 2 AM Travel Time	Baseline/ Scenario 1 PM Travel Time	Scenario 2 PM Travel Time
15th Avenue NW & NW Market Street	Downtown Seattle (3rd Avenue & Union Street)	30 minutes	30 minutes	30 minutes	30 minutes
15th Avenue NW & NW Market Street	W Prospect Street (Helix Pedestrian Bridge)	20 minutes	20 minutes	20 minutes	20 minutes
15th Avenue NW & NW Market Street	W Emerson Street & Gilman Avenue W	20 minutes	20 minutes	20 minutes	20 minutes
15th Avenue W and W Emerson Street	W Nickerson Street & 3rd Avenue W	20 minutes	20 minutes	20 minutes	20 minutes
Magnolia Village (W McGraw Street & 32nd Avenue W)	Downtown Seattle (3rd Avenue & Union Street)	45 minutes	45 minutes	45 minutes	45 minutes
Magnolia Village (W McGraw Street & 32nd Avenue W)	Magnolia Bridge (W Galer Street Flyover)	20 minutes	20 minutes	20 minutes	***30 minutes***
Magnolia Bridge (W Galer Street Flyover)	W Dravus Street & 20th Avenue W/Thorndyke Avenue W	20 minutes	20 minutes	20 minutes	20 minutes
Magnolia Bridge (W Galer Street Flyover)	SODO Busway & Spokane Street	45 minutes	45 minutes	***30 minutes***	***30 minutes***

Source: Remix, 2020.

The 2042 Baseline transit network shows an overall improvement in transit travel time, likely due to implementation of WSBLE and the restructure of the bus network to provide efficient transfers to WSBLE stations and direct connections to downtown Seattle. Other findings include:

- Travel between Ballard and downtown Seattle decreases from 45 minutes to 30 minutes in both the AM and PM peaks.
- Travel to/from Magnolia Bridge to downtown Seattle also decrease from 60 minute in the AM to 45 minutes in the PM.
- There are minimal changes to transit travel time as a result of the Armory Way bridge, with a 15-minute increase in travel time from Magnolia Bridge to the Galer Street Flyover due to transit taking a pathway further north compared to the current Magnolia Bridge routing.
- Only minimal difference in travel time are present between the future baseline and Scenario 2 network alternatives. Additional transit delay may be present at new intersections and roadways as a result of Scenario 2, including at 15th Avenue W & Armory Way, and at new intersections along Thorndyke Avenue W where a majority of transit routes are relocated.

Opportunities and Potential Projects

Based on projects and priorities in the Transit Master Plan, METRO CONNECTS, RapidRide C and D Line Improvements Speed and Reliability Study, and concepts developed through review of transit analysis, the following areas of opportunity and potential projects were identified. These concepts are shown in **Figure 31**. Specific projects to enhance transit speed and reliability and passenger facilities will be included in a project list being developed as part of this BIRT study.

Figure 31: Transit Areas of Opportunity and Potential Projects

Appendix A: Intersection Level of Service

Figure 32: Existing and 2042 Baseline Intersection Level of Service

Figure 33: Existing, Baseline, Scenario 1 & 2 AM Intersection Level of Service

The graphic depicts the Preferred Alternative identified by the Sound Transit Board for study in the Draft EIS for the West Seattle and Ballard Link Extensions project. The Draft EIS will also examine a "Preferred Alternative with Third Party Funding" and other alternatives and will be published in early 2021. Final selection of the project to be built will follow publication of the Final EIS in 2022.

***Source: BIRT Traffic Analysis*

Figure 34: Existing, Baseline, Scenario 1 & 2 PM Intersection Level of Service

The graphic depicts the Preferred Alternative identified by the Sound Transit Board for study in the Draft EIS for the West Seattle and Ballard Link Extensions project. The Draft EIS will also examine a "Preferred Alternative with Third Party Funding" and other alternatives and will be published in early 2021. Final selection of the project to be built will follow publication of the Final EIS in 2022.

***Source: BIRT Traffic Analysis*

Table 9. Intersection Level of Service for Existing Conditions and Scenarios 1 & 2

			Existing Conditions				Baseline Conditions				Magnolia 1-1 Alternative					Armory Way Alternative				
			AM Peak		PM Peak		AM Peak		PM Peak			AM Peak		PM Peak			AM Peak		PM Peak	
ID	Intersection	Control Type	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Magnolia 1-1 Control Type	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Armory Way Control Type	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
1	NW Market Street/17th Ave. NW	Signal	11.8	B	13.3	B	17	B	20	B	Signal	16.8	B	19.8	B	Signal	16.8	B	19.8	B
2	NW Market Street/15th Ave. NW	Signal	49.8	D	58.7	E	176	F	118	F	Signal	176.2	F	117.7	F	Signal	153.8	F	109.5	F
3	NW Leary Way/17th Ave. NW	TWSC	2.6	A	3.3	A	6	A	6	A	TWSC	4.1	A	6.3	A	TWSC	4.1	A	6.3	A
4	NW Leary Way /15th Ave. NW SB Ramp	Signal	13.9	B	13.7	B	35	D	19	B	Signal	12.2	B	15.0	B	Signal	12.2	B	15.0	B
5	NW Leary Way /15th Ave. NW NB Ramp	Signal	16.9	B	25.9	C	43	D	44	D	Signal	19.2	B	14.8	B	Signal	19.2	B	14.8	B
6	NW Leary Way /14th Ave. NW	Signal	13.2	B	10.5	B	15	B	15	B	Signal	24.7	C	36.4	D	Signal	24.7	C	36.4	D
7	Shilshole Ave. NW/17th Ave. NW	TWSC	4.3	A	3.6	A	4	A	4	A	Signal	3.2	A	12.7	B	Signal	3.2	A	12.7	B
8	Shilshole Ave. NW/NW 46th St.	TWSC	0.1	A	0.3	A	0	A	0	A	TWSC	0.1	A	0.5	A	TWSC	0.1	A	0.5	A
9	NW 46th St/14th Ave. NW	AWSC	18.3	B	28.3	C	20	B	33	C	AWSC	19.6	B	99.8	F	AWSC	19.6	B	99.8	F
10	Gilman Ave. NW/W. Emerson Pl.	AWSC	69.8	E	133.1	F	112	F	200	F	AWSC	111.7	F	199.5	F	AWSC	111.7	F	199.5	F
11	23rd Ave. NW/W. Emerson Pl.	TWSC	0	A	0	A	0	A	0	A	TWSC	0.0	A	0.0	A	TWSC	0.0	A	0.0	A
12	W. Emerson St./19th Ave. W	Signal	4	A	8.3	A	11	B	20	B	Signal	10.7	B	19.8	B	Signal	10.7	B	19.8	B
13	W. Emerson St./W. Nickerson St.	AWSC	12.1	B	16.4	B	13	B	26	C	Signal	7.2	A	17.7	B	Signal	7.2	A	17.7	B
14	W. Nickerson St./15th Ave. W Ramps	AWSC	17.7	C	26	C	35	E	26	C	Signal	24.1	C	18.0	B	Signal	24.1	C	18.0	B
15	W. Nickerson St./13th Ave. W	Signal	6.9	A	8.3	A	10	A	10	A	Signal	9.8	A	9.9	A	Signal	9.8	A	9.9	A
16	W. Dravus St./20th Ave. W	Signal	32.1	C	57.4	E	49	D	94	F	Signal	48.6	D	94.2	F	Signal	65.0	E	137.6	F
17	W. Dravus St./17th Ave. W	Signal	5.6	A	10	B	7	A	15	B	Signal	6.9	A	15.0	B	Signal	6.9	A	16.2	B
18	W. Dravus St./15th Ave. SB Ramps	Signal	21.9	C	28.4	C	80	F	52	D	Signal	80.4	F	52.2	D	Signal	84.6	F	59.5	E
19	W. Dravus St./15th Ave. NB Ramps	Signal	16.8	B	48.6	D	29	C	55	D	Signal	29.4	C	54.9	D	Signal	29.6	C	61.1	E
20	W. Dravus St./14th Ave. W	TWSC	1.3	A	1.3	A	3	A	3	A	TWSC	2.5	A	2.9	A	TWSC	2.5	A	2.9	A
21	Thorndyke Ave. W/20th Ave. W	TWSC	0.9	A	0.5	A	1	A	1	A	TWSC	0.9	A	1.0	A	TWSC	2.6	A	3.2	A
22	Thorndyke Ave. W/21st Ave. W	TWSC	0.9	A	0.4	A	1	A	2	A	TWSC	0.9	A	2.0	A	TWSC	0.6	A	2.0	A
23	Gilman Dr. W/15th Ave. W	Signal	17.4	B	24.5	C	80	F	108	F	Signal	80.0	F	107.7	F	Signal	66.5	E	107.6	F
24	W. Armory Wy./15th Ave. W	Signal	9	A	8.7	A	69	E	35	D	Signal	69.1	E	35.0	D	Signal	229.6	F	62.7	E
25	W. Howe St./15th Ave. W	Signal	12.4	B	18.8	B	85	F	63	E	Signal	85.1	F	62.8	E	Signal	164.9	F	129.6	F
26	W. Blaine St./Thorndyke Ave. W	TWSC	2.2	A	1.1	A	2	A	1	A	TWSC	2.0	A	1.1	A	TWSC	75.4	E	47.7	D
27	W. Galer St./Thorndyke Ave. W	TWSC	5.5	A	1	A	8	A	2	A	TWSC	7.7	A	2.0	A	TWSC	24.7	C	14.1	B
28	23rd Ave. NW/Magnolia Bridge EB on-ramp	TWSC	0.4	A	0.4	A	0	A	0	A	TWSC	0.4	A	0.4	A	Does Not Exist	Not applicable for Alternative			
29	Terminal 91 Gate/Magnolia Bridge WB off-ramp	TWSC	6	A	6.9	A	7	A	8	A	TWSC	6.5	A	7.5	A	Does Not Exist	Not applicable for Alternative			
30	W. Garfield St.-Magnolia Bridge/15th Ave. W	Signal	12.3	B	9.0	A	40.1	D	47.5	D	Signal	40.1	D	47.5	D	Signal	59.3	E	118.5	F
31	W. Galer St. Flyover/Alaskan Way W	Signal	15.6	B	30.0	C	473.4	F	600.5	F	Signal	473.4	F	600.5	F	Signal	806.9	F	413.9	F
32	W. Galer Street/Alaskan Way W	AWSC	7.7	A	7.7	A	666.1	F	304.0	F	AWSC	666.1	F	304.0	F	AWSC	666.1	F	223.0	F
33	15th & W Galer St	Signal	7.5	A	4.9	A	12.7	B	25.0	C	Signal	12.7	B	25.0	C	Signal	7.4	A	82.5	F
34	W. Galer Flyover&Elliott Ave. W/15th	Signal	8.3	A	18.2	B	47.5	D	136.1	F	Signal	47.5	D	136.1	F	Signal	35.3	D	131.0	F
35	Alaskan Way W & T91 Entry	Does Not Exist	Not applicable for Alternative				Not applicable for Scenario				Does Not Exist	Not applicable for Alternative				Signal	2.2	A	7.8	A
36	Alaskan Way W & Magnolia Flyover	Does Not Exist	Not applicable for Alternative				Not applicable for Alternative				Does Not Exist	Not applicable for Alternative				TWSC	96.8	F	7.5	A
37	Thorndyke Ave W & Armory Bridge	Does Not Exist	Not applicable for Alternative				Not applicable for Scenario				Does Not Exist	Not applicable for Alternative				Signal	48.0	D	35.0	D
38	Emerson & North 15th Ramps	Does Not Exist	Not applicable for Alternative				Not applicable for Scenario				Signal	35.3	D	30.4	C	Signal	35.3	D	30.4	C
39	NW Leary Way & SB 15th Ave On Ramp	Does Not Exist	Not applicable for Alternative				Not applicable for Alternative				Signal	15.4	B	11.1	B	Signal	15.4	B	11.1	B
40	NB 15th Ave Off Ramp & 14th Ave NW	Does Not Exist	Not applicable for Alternative				Not applicable for Scenario				Signal	28.9	C	27.5	C	Signal	28.9	C	27.5	C

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Ballard Interbay Regional Transportation System (BIRT) Study

Appendix E: Community and Economic Assessment

November 2020

Seattle Department of Transportation

Ballard-Interbay Regional Transportation System Project

Community and Economic Assessment

August 19, 2020

Prepared by:

community attributes inc

Prepared for:

Seattle Department of Transportation

Community Attributes Inc. tells data-rich stories about communities that are important to decision makers.

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Contents

Executive Summary

This report includes a data-rich overview of the economic and community significance of the Ballard-Interbay Regional Transportation System (BIRT) study area. It provides an overview of the current economic and employment landscape, commute patterns, demographic and housing trends, development patterns and typical uses of the transportation network.

Role of 15th Ave W/NW, Ballard and Magnolia bridge

15th Ave W/NW is a principal arterial and the primary north-south corridor moving people and goods in the BIRT study area. A key part of this arterial, the Ballard bridge currently carries roughly 51,500 vehicles per day (including 1,500 trucks and over 300 bus trips) and 139 bicyclists in a 6-hour period during peak riding months (pre-COVID volumes)[1].

The Magnolia bridge connects to 15th Ave W to the south of the study area. Roughly 13,000 vehicles cross the Magnolia bridge every day[2]. This includes residents of Magnolia travelling to and from work, employees of local businesses in the Magnolia Village area, buses connecting Magnolia to Downtown Seattle, Queen Anne, Ballard and other neighborhoods further north, and visitors that neither live nor work in the area.

Commute Patterns

15th Ave W/NW and the two bridges are essential roadway connections in the BIRT study area and provide access to jobs. The most common places of work for residents in the BIRT study area include downtown Seattle, the Duwamish Manufacturing Industrial Center (MIC), the University of Washington / U. District, downtown Ballard, downtown Bellevue and the Bel-Red area[3].

People working in the BIRT study area predominantly commute from the north, as well as from immediate east and west of study area. Most workers live nearby in Ballard, Interbay, Magnolia, Loyal Heights, and Upper Queen Anne. A smaller number of workers live in Seattle neighborhoods to the north and in Shoreline.

Freight Movement

The Ballard-Interbay Manufacturing Industrial Center (BINMIC) is Seattle's other major industrial center, with maritime industries assets located in the

[1] City of Seattle, 2020; Ballard Bridge Planning Study Alternatives Comparison Report, SDOT, March 9, 2020.
[2] City of Seattle, 2020.
[3] U.S. Census Bureau, Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics, 2020.

BIRT study area. The 15th Ave W/NW corridor is heavily used for freight movement accordingly. Roughly 1,500 trucks cross the Ballard bridge every day, and the City projects that this will increase to 2,500 trucks by 2035[4].

Industrial businesses in the study area depend on access to the 15th Ave W/NW freight corridor to transport industrial materials, such as primary metals; intermediate products, like fabricated metals; and final goods, including airplanes, food and apparel, to local and regional markets. Many of these businesses are net exporters of products to the U.S. and the world and help drive Seattle's economy and jobs.

The 15th Ave W/NW freight corridor provides access to Port of Seattle facilities which are an international gateway for imports and exports. Maritime businesses in the BIRT study area, including commercial fishing and seafood processing operations, shipyards, and various related and support services often depend on the freight corridor to procure manufacturing components and inputs and move finished products to markets in the region. The freight corridor is also critical to economic activity in cruise and tourism.

Transit and Non-Motorized Connections

15th Ave W/NW (including the Ballard bridge) and the Magnolia bridge are identified as Major Transit Routes in the City of Seattle Transit Master Plan. Multiple express and local routes use the 15th Ave W/NW corridor, including the RapidRide D Line. The West Seattle and Ballard Link Extensions project will bring light rail to Interbay and Ballard, with three stations in the BIRT study area. The study area also contains several bike and pedestrian pathways such as the Burke-Gilman Trail and Elliott Bay Trail that link neighborhoods to business districts. These pathways also connect to recreation areas like Discovery Park and Golden Gardens Beach.

Socio-Economic Baseline

Population & Demographics

The total population in the BIRT study area was approximately 95,200 in 2019, representing almost 13% of the City of Seattle's total population[5]. Both Ballard and Interbay have experienced major population growth in the last decade. The growth has occurred almost exclusively within areas zoned for mixed use and multifamily development.

The study area population contains about 16% less residents over the age of 65 than the City of Seattle as a whole. However, the median age of the study

[4] City of Seattle Freight Master Plan, SDOT, September 2016.
[5] US Census Bureau, American Community Survey (ACS), 2019.

area was higher, at 38.2 years, compared with Seattle, at 35.2. On average, the percent of the non-institutionalized population with a disability in the study area was 6.1%, compared with 9.1% in the City of Seattle, as of 2018. Four census tracts – three in Ballard and one in upper Queen Anne – had rates of disability greater than 7%[6].

Compared to the City of Seattle as a whole, the population in the study area is less racially diverse, with a roughly 14% minority resident population. This includes a 6.2% Asian population, a 4.8% Hispanic population, and a 1.7% Black / African American population. In comparison, the City of Seattle had a 14% Asian population, a 6.4% Hispanic population, and a 7.2% Black / African American population. Areas with greater proportions of minority residents exist in the Interbay portion of the 15th Ave W corridor, the Loyal Heights and Greenwood neighborhoods at the north of the study area, northern Queen Anne, and central Magnolia.

The census block groups in the BIRT study area with the highest median household incomes are in the Sunset Hill section of Ballard, in southwestern Magnolia, and in the northern Queen Anne neighborhood. Downtown Ballard, lower Interbay, and around 65th and Greenwood near Phinney Ridge are areas with the lowest median household incomes.

Most of the study area is highly educated, like the City of Seattle. The most highly educated areas – those where at least two-thirds of residents have a bachelor's degree or greater – corresponded to wealthier, single-family zones of the BIRT study area.

Housing

According to the most recent U.S. Census 5-Year American Community Survey (ACS) data from 2014-2018, there are nearly 44,000 housing units of all types within the study area, with 16,200 in Ballard, followed by Magnolia (8,800) and Interbay (3,100). Downtown Ballard and 15th Ave W in Interbay have the highest housing density, from 1,760 to 2,181 housing units per block group in Downtown Ballard to 1,418 units in Interbay. Upper Queen Anne and central and western Magnolia have the lowest density at between 150 and 250 housing units per block group. Occupied housing units in Ballard and Interbay are majority rentals (69% and 56%, respectively), while Magnolia is 55% owner-occupied housing. Median home value and rent is highest in Magnolia and lowest in Interbay.

As of 2020, 840 multifamily buildings with 14,200 units exist in the study area. Average market rents per unit are highest in Ballard ($1,840) but absorption rates are the highest in Interbay, where 153 units (7.1% of

[6] U.S. Census Bureau ACS 5-Year Estimates, 2014-2018.

inventory) were leased over the last 12 months. Interbay also has the most multifamily construction underway in 2020 (93 units). Magnolia's multifamily construction market is the coolest with only 0.2% of inventory leased last year and no multifamily construction underway[7].

Across the whole study area, households are not cost burdened, meaning a household spends more than one-third of income on housing. Interbay is closest to this threshold with households spending 28% of income on rent, on average.

Industry & Employment

According to data from the Puget Sound Regional Council, employment[8] within the commercial study area grew by 2.1% annually from 2010 to 2018. The fastest growth has been in Greenwood (5.3%), while Magnolia, the North subarea (which includes Ballard), and South subarea (which includes most of Interbay) grew between 1.7% and 2.3% annually over the same period. During this period, employment in the construction and resources sector has seen the fastest growth across the commercial study area while the services sector has experienced the most absolute growth. In 2018, the services sector was the largest in the study area with roughly 50% of total employment. The growth in services has been concentrated in the northern portion of the commercial study area (Ballard neighborhood).

The Ballard-Interbay corridor is home to a wide range of industrial activities. The broader North Industrial area, a region that approximates the Ballard-Interbay corridor, contained 28,700 jobs in 2018 of which an estimated 12,000 jobs were freight-oriented and thus reliant on access to the Ballard-Interbay freight corridor. Many industrial businesses located in this corridor source or export products to other parts of the U.S. and the world and depend on access to a freight corridor connecting Northwest Seattle with Port of Seattle facilities in SODO.

Maritime is another important industrial activity in the BIRT study area. Fishermen's Terminal and Terminal 91 are both Port of Seattle properties and home to a large segment of the North Pacific Fisheries Fleet. In 2017, vessels utilizing either facility employed an estimated 7,200 workers and generated $671.3 million in business revenues.

[7] CoStar, 2020.

[8] Employment estimates in this report do not include jobs at the Expedia campus which opened in 2019. At the time of this study, the most recent employment estimates available from PSRC were for 2018.

Occupational & Workforce Analysis

Employment in the commercial study area includes a wide range of service and industrial occupations. Services are more prevalent, representing over half of study area jobs. Production, transportation and material moving, and construction and extraction occupations together represent 19% of occupational employment. Jobs in industrial occupations account for just 7% of resident employment compared to 19% of study area employment.

Study area workers earn slightly higher wages compared to the region overall. Approximately 57% of workers in the BIRT commercial study area earn more than the Seattle MSA median wage of $53,400[9].

More than half of jobs within the study area require a high school diploma or less and 32% require a bachelor's degree. Residents of the study area are more educated overall than the occupations within the area require, with 76% of residents having an associate degree or higher and most of them work outside the BIRT study area.

COVID-19 Impacts Overview

The global pandemic has adversely affected all aspects of the regional economy. The severity of impact has varied by industry, with customer-facing businesses hit hardest so far.

A City of Seattle survey conducted in March and May 2020 showed widespread concern among businesses in the study area. More than 1,000 temporary and 134 permanent layoffs were reported. Roughly 41% of responding businesses said they could not make rent payments and 43% were very worried about their business and did not know if they would make it through this crisis. The top three impacts experienced by businesses in the study area were decline in business activity due to uncertainty, fewer visitors to the region and reduced access to customers due to remote working.

[9] Puget Sound Regional Council, 2020; Washington State Employment Security Department, 2020; U.S. Census Bureau, 2020.

INTRODUCTION

Background and Purpose

Originally a salt marsh, the Interbay neighborhood hosts a diverse mix of businesses and industries representing the broad sweep of Seattle's history. North of Interbay, Ballard is one of Seattle's fastest growing neighborhoods and will be the terminus of Sound Transit's West Seattle and Ballard Link Extensions. The 2019 Washington State legislature allocated funds for the City of Seattle to develop a plan to improve mobility for people and freight in the Ballard-Interbay area.

The Ballard-Interbay Regional Transportation System (BIRT) plan is developed by an interagency team led by SDOT and including the City of Seattle, Port of Seattle, Sound Transit, King County, Washington State Department of Transportation, and the Washington State Military. According to the Washington State legislature:

"The plan must examine replacement of the Ballard bridge and the Magnolia bridge, which was damaged in the 2001 Nisqually earthquake. The city must provide a report on the plan that includes recommendations to the Seattle City Council, King County Council, and the transportation committees of the legislature by November 1, 2020. The report must include recommendations on how to maintain the current and future capacities of the Magnolia and Ballard bridges, an overview and analysis of all plans between 2010 and 2020 that examine how to replace the Magnolia bridge, and recommendations on a timeline for constructing new Magnolia and Ballard bridges."

In analyzing future transportation demand for the Ballard-Interbay area, the project will take into consideration future residential growth in nearby neighborhoods and additional employment at sites such as the Armory, Expedia and the Port of Seattle's Terminal 91. It will also adjust to reflect the recommendations of the Mayor's current Maritime and Industrial Lands Strategy.

This report represents an overview of the economic and community significance of the BIRT study area. It provides an overview of the current economic and employment landscape, commute patterns, demographic and housing trends, development patterns and typical uses of the transportation network. The analysis will help identify who will benefit from transportation system improvements and support the development of the economic and social benefits of the BIRT project per the City's preferred alternatives.

Methods

The analysis begins by identifying the BIRT study area which includes both residential and employment areas served by the Magnolia and Ballard bridge and the Interbay corridor. The assessment identifies main categories of users of the two bridges and the Interbay corridor and determines commute patterns for residents and workers in the study area. It also includes economic and social metrics to describe the role of the Ballard and Magnolia bridges in supporting economic activity and competitiveness of the region's economy.

This report draws on multiple data and information sources, including previous plans and studies, traffic analysis conducted as part of this study, state and federal sources such as the Washington State Employment Security Department, Office of Financial Management and U.S. Bureau of Labor Statistics, and stakeholder outreach.

Organization of Report

The remainder of this report is organized as follows:

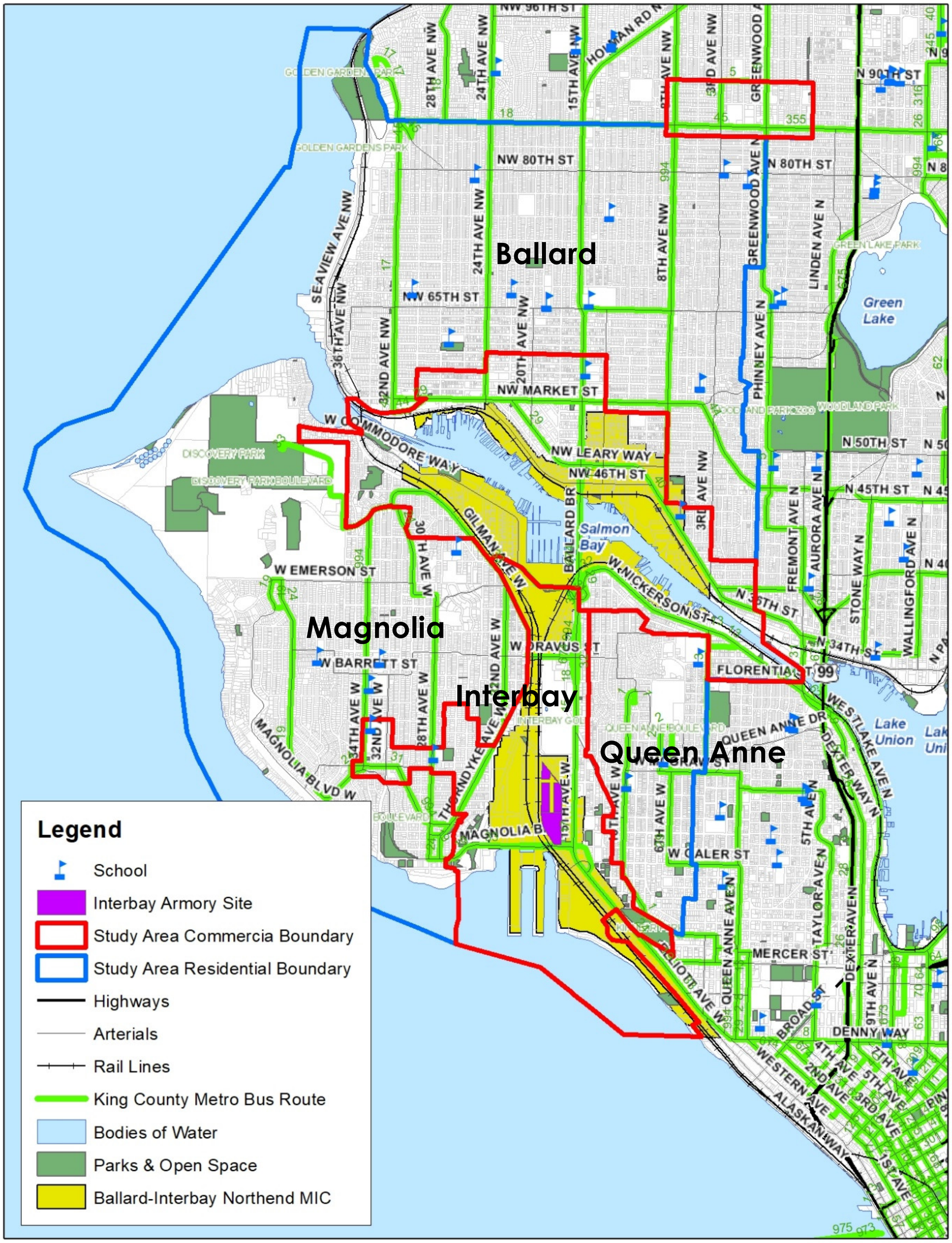
- **Study Area**. A description of the study area, including land use patterns and recent and future development in the area.
- **Role of 15th Ave W/NW, Ballard and Magnolia bridge**. A discussion of commute patterns, freight movement and alternative travel in the study area.
- **Socio-economic Baseline**. A summary of socio-economic metrics to describe the study area.
- **COVID-19 Impacts Overview.** A discussion of COVID-19 impacts on businesses in the study area.

Study Area

A critical framework to economic impact analysis is the geography within which impacts are analyzed. The area of direct project influence includes the Ballard, Interbay, and Magnolia neighborhoods. When defining the study area, the analysis looked at local and regional commuting, supply chain linkages and other travel patterns to capture all the important potential effects of the BIRT project.

The study area includes both residential and employment areas served by the Magnolia and Ballard bridges and the corridor. The residential boundary of the study area extends to NW 80th St to the north and Elliott Bay to the south. The commercial study area mostly consists of the Ballard Interbay Northend Manufacturing and Industrial Center (BINMIC), Magnolia's and Greenwood's business districts. (**Exhibit 1**)

Exhibit 1. BIRT Study Area



Sources: Community Attributes, 2020.

The **Interbay corridor** extends between Salmon Bay to the north and Elliott Bay to the south. While historically industrial, Interbay's residential population is growing, with a population of roughly 6,400 residents. It includes the BINMIC, a thriving urban industrial center with a diverse mix of businesses and some of Seattle's most productive working waterfront, wharfs, shipyards, and rail yards.

- The Salmon Bay area, stretching from the Ballard Locks to Fremont, supports intense marine-related industrial and manufacturing uses.
- BNSF Railway Balmer Yard in the central part of Interbay contains one of Seattle's major railroad yards, and related locomotive maintenance shops.
- Smith Cove on Elliott Bay at the south end of the corridor is home to Terminal 91, a large general cargo terminal complex, Pier 86, the Port of Seattle's export grain terminal, Smith Cove Park, Elliott Bay Marina, and Pier 90.
- Interbay is also home to a Washington Army National Guard armory, stadium, P-Patch (a large community garden), and a golf course.

Across Salmon Bay to the north is **Ballard**, a fast-growing Seattle neighborhood and manufacturing and industrial community with a population of roughly 34,800. Once a separate incorporated city to the north of Seattle whose economy centered on fishing and cedar shake shingles, Ballard has become a dense, mixed-use urban neighborhood that is one of the most desirable places to live in Seattle. Ballard is in the midst of several transportation improvements. The Ballard Multimodal Corridor aims to create a complete, multimodal corridor along the Ship Canal between the Ballard Locks and 11th Ave NW. The Sound Transit West Seattle and Ballard Link Extensions will provide fast, reliable light rail connections from downtown Seattle to Ballard.

Magnolia, the second largest neighborhood in Seattle by area, is also part of the study area. Magnolia is a predominantly low-density, single-family neighborhood of roughly 18,000 residents that is located on a hilly peninsula northwest of Downtown, connected to the rest of the city by three bridges over the tracks of the BNSF Railway. Magnolia's "Village" is the core of the neighborhood's business community, home to many specialty stores and professional services, industrial and marine services, and community functions such as the Farmer's Market and the Classic Auto Show.

In addition, small parts of the northern and western **Queen Anne** neighborhood of Seattle are included in the study area. The northern part of this neighborhood along Nickerson Street borders on the ship canal and includes large, significant maritime employers in seafood processing and shipyards. The western portion of Queen Anne located within the study area is comprised largely of older single-family neighborhoods and redeveloping apartment nodes along 14th Avenue and Gilman Street that utilize the Interbay corridor's commercial and transportation assets.

Land Use Overview

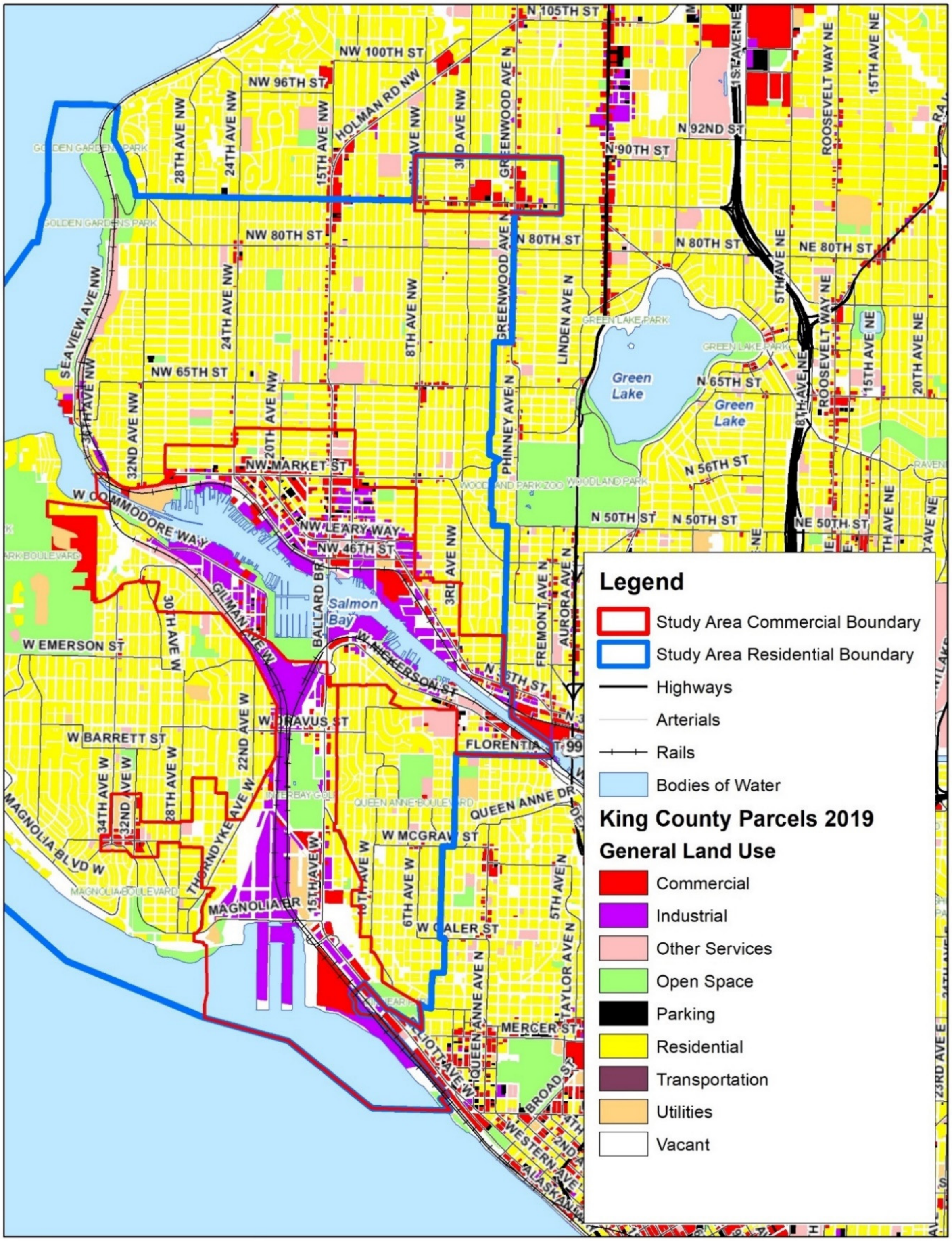
Exhibit 2 provides an overview of generalized land uses in the BIRT study area. This study is consistent with the City of Seattle Office of Economic Development Industrial and Maritime Strategy from 2020 in the land uses for industrial areas.

The study area is dominated by residential neighborhoods centered around Ballard, north of the Ship Canal, Magnolia, east of the Interbay corridor, and in the northern and western portions of the Queen Anne neighborhood. The greatest concentration of mostly neighborhood-serving retail and service uses are found in downtown Ballard, with smaller concentrations in lower Interbay, Magnolia, and Greenwood in the far northeast of the study area.

Ballard and Interbay contain a large concentration of industrial uses – including key maritime industry firms and assets along the Ship Canal, at Fishermen's Terminal, and at Pier 90; cruise ship terminals at Pier 91; freight rail and intermodal yards in Interbay; the Seattle Armory site, and other industries such as interior fixtures and furniture, food processing, and craft food and beverage makers.

Large open spaces in the study area include Discovery Park at the northwest corner of Magnolia, the Interbay Golf Course and athletic center, upper Queen Anne's Mt. Pleasant Cemetery, and Ballard's Golden Gardens Park. Large recreational boat marinas include Elliott Bay Marina in Magnolia, and Shilshole Marina in Ballard. Finally, major pedestrian and bike path routes traverse the area with the Burke-Gilman trail along the Ship Canal in Ballard, and the Elliott Bay trail following the BNSF rail through the Interbay corridor to Downtown Seattle.

Exhibit 2. BIRT Study Area General Land Use



Sources: King County Assessor, 2020; City of Seattle Office of Economic Development, Industrial Lands Land Use and Employment Study, 2017; Community Attributes, 2020.

Recent & Future Development

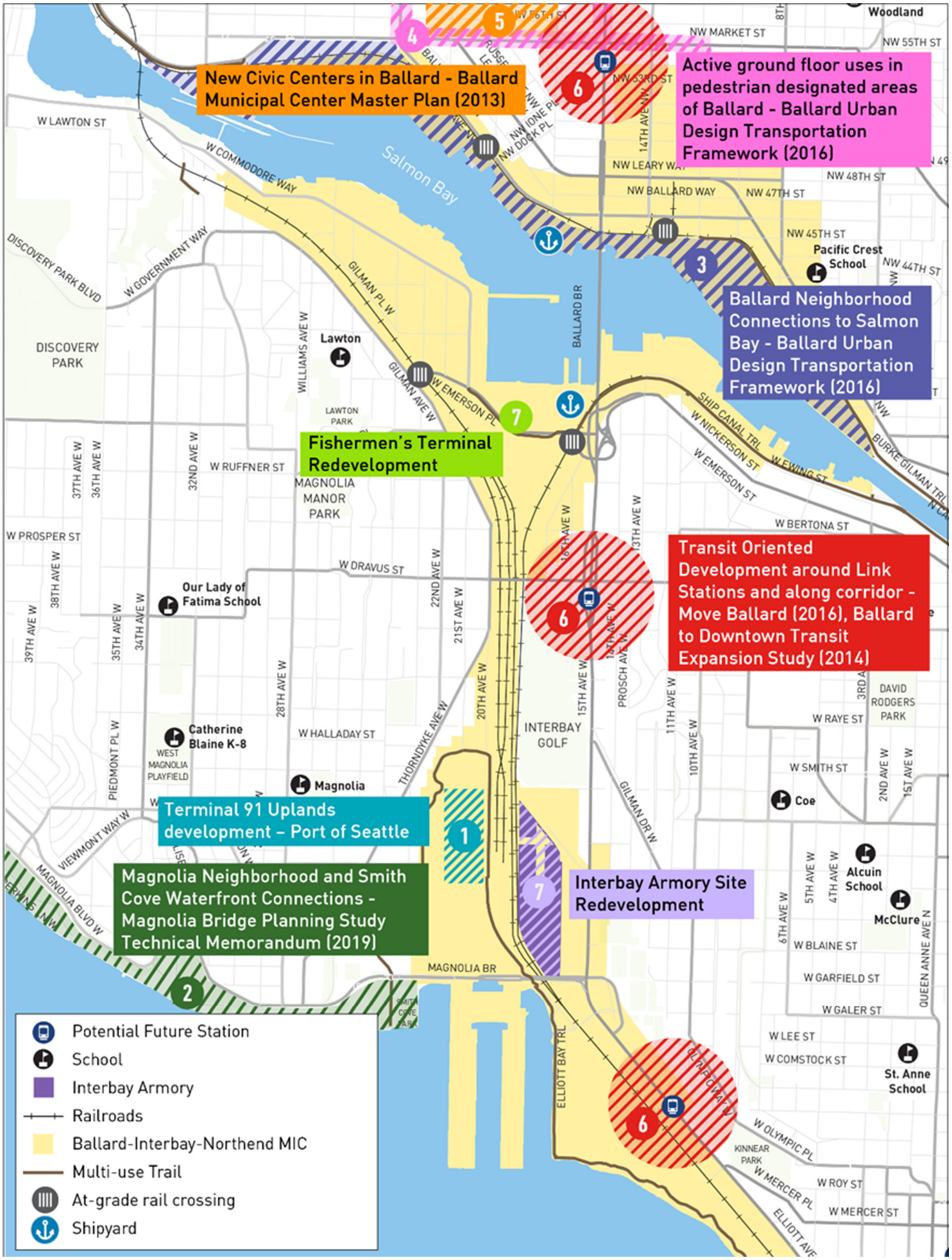
The Ballard and Interbay neighborhoods are experiencing significant residential and employment growth, with implications for land use patterns in these areas. Major projects and initiatives that will shape the future of Ballard-Interbay include the future West Seattle and Ballard Link light rail extensions, Terminal 91 Uplands development, Fishermen's Terminal redevelopment, National Guard Armory redevelopment, the new Expedia corporate campus, and the City of Seattle Industrial and Maritime Strategy. (Error! Not a valid bookmark self-reference.)

Sound Transit's West Seattle and Ballard Link Extensions (WSBLE) and transit service improvements by SDOT and King County Metro will enhance transit access in the study area. Improving transit service and implementing supportive land use policies such as transit-oriented development can encourage more compact, mixed, multi-modal development in the Ballard-Interbay area.

The redevelopment of Terminal 91 Uplands, the National Guard Armory site, and Fishermen's Terminal will increase light industrial space in the BINMIC and support continued growth of manufacturing and industrial uses:

- Armory site development proposals include a mix of uses including housing, office, and open space.
- Phase I development in the Terminal 91 Uplands over the next 10-15 years will consist of approximately 100,000 square feet of light industrial space and associated site infrastructure improvements, with phase II developing another 300,000 square feet of light industrial facilities.
- The Fishermen's Terminal redevelopment (2019-2023) will include roughly 60,000 square feet of new light industrial space for complementary maritime businesses by the end of 2022. A new "Gateway" building is planned in the existing vacant bank building and Net Sheds 7 and 8.

Exhibit 3. Recent and Future Development in the BIRT Study Area, 2020



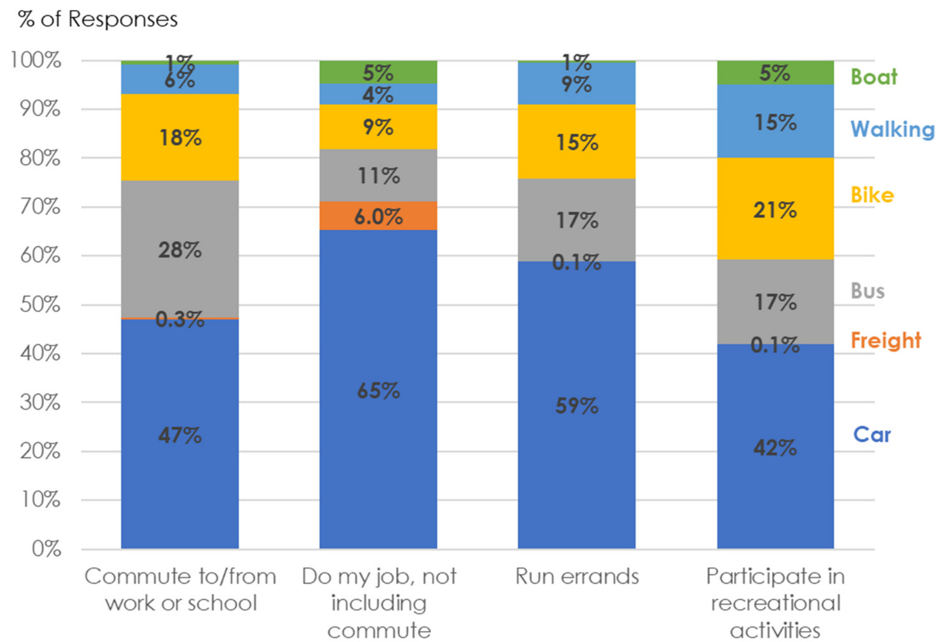
Sources: Seattle Department of Transportation, 2020; Community Attributes, 2020.

ROLE OF 15TH AVE W/NW, BALLARD AND MAGNOLIA BRIDGES

This section of the report assesses the relative role of the corridor and the two bridges on the businesses, residents, and communities in the study area to gain insight into potential impacts of transportation improvements. It identifies main categories of users, analyzes commute patterns of corridor and bridge users, and discusses the importance of the Ballard bridge and the Interbay corridor for freight movement.

The Ballard bridge spans the Lake Washington Ship Canal, the waterway that links Shilshole Bay in the Puget Sound with Lake Washington. The bridge connects Ballard to Magnolia, Queen Anne to the south and Downtown via 15th Ave West and Interbay. The bridge serves key industries and economic centers in the area, such as the BINMIC, and is part of a local commute route for urban communities throughout the study area.

Exhibit 4. Mode Share by Travel Purpose, Ballard Bridge, 2019



Source: City of Seattle, 2020.

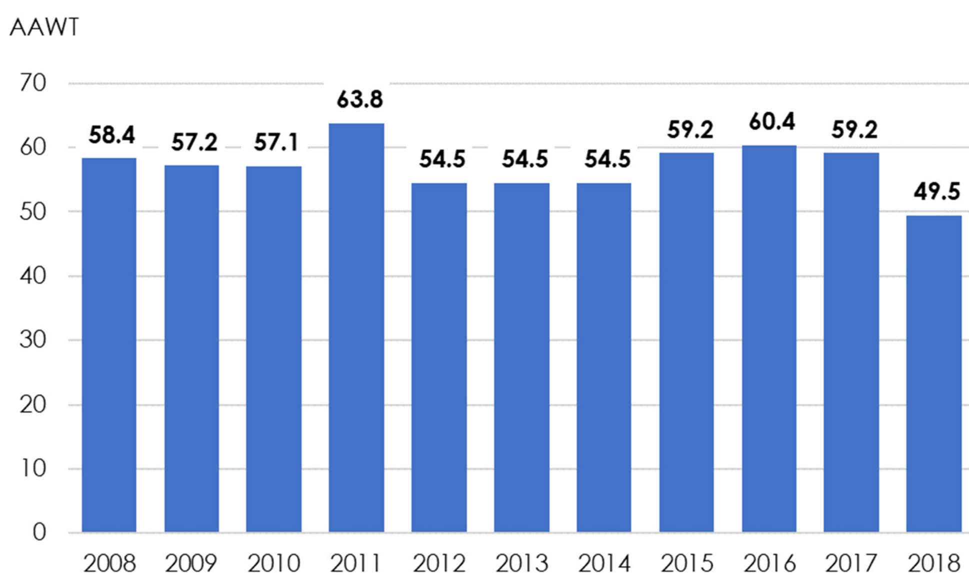
According to a survey conducted by SDOT in August 2019, 83% of bridge users travel the bridge by car and most of the car travel takes place on weekends[10]. The same survey found that most respondents travel across or under the Ballard bridge to run errands and participate in recreational activities. Roughly 46% of respondents indicated they use the bridge to commute to/from work or school and 13% to do their job (including freight,

[10] Seattle Department of Transportation, Ballard Bridge Planning Study Survey Summary, August 2019.

deliveries, rideshare and other). The car is the preferred travel mode across all purposes. A significant share of commuters takes the bus, while biking and walking is used most by respondents participating in recreational activities. (**Exhibit 4**).

The bridge carried 49,500 vehicles per day on average in 2018 and was one of the top ten arterials by traffic volume in the City of Seattle.[11] Average annual weekday traffic (AAWT) in 2018 was at its lowest level in the past ten years (**Exhibit 5**).

Exhibit 5. Average Annual Weekday Traffic Ballard Bridge Count Station, 2008 – 2018



Sources: City of Seattle, 2020.

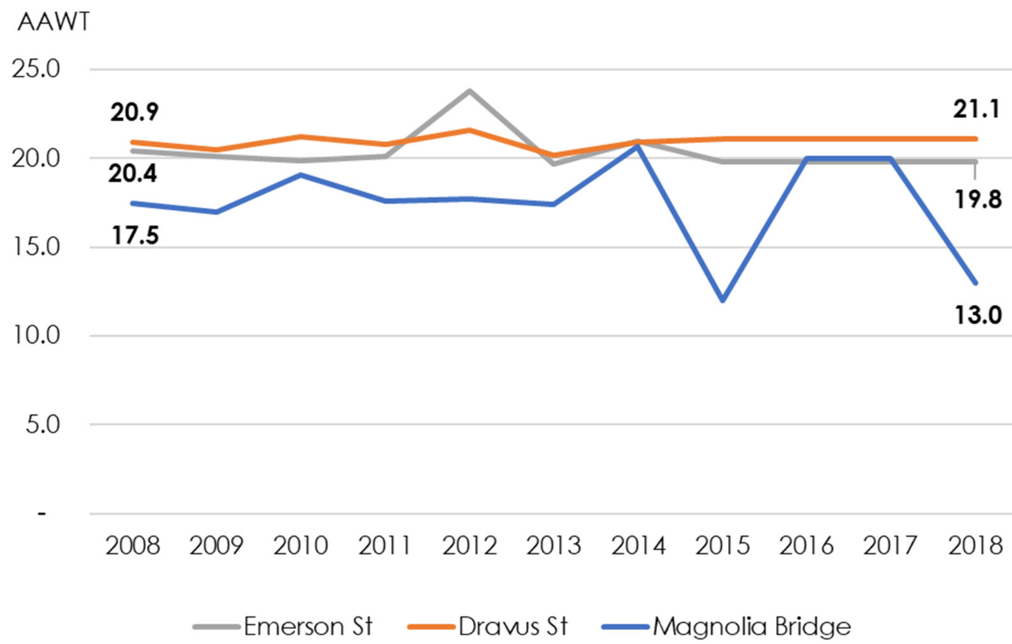
The Magnolia bridge connects southern Magnolia to Interbay and is one of the three existing connections from the Magnolia neighborhood to the rest of Seattle. The bridge serves the approximately 18,000 residents of Magnolia as well as the local businesses in the Magnolia Village area and any visitors that neither live nor work in the neighborhood. The bridge is also used by King County Metro buses serving Magnolia and emergency services that need to reach the neighborhood.

Of the 1,104 people who participated in SDOT's online open house about the Magnolia Bridge replacement, 91% were neighborhood residents and 84% commute to work in and out of Magnolia. Travel is overwhelmingly done by

[11] Seattle Department of Transportation, 2019 Traffic Report.

car with 85% driving a personal vehicle alone or with a family member. Another 8% ride transit and 3% walk or bike.[12]

Exhibit 6. Average Annual Weekday Traffic (AAWT) Magnolia Bridge and Other Magnolia Entrance Routes, 2008 – 2018



Sources: City of Seattle, 2020.

In 2018, 13,000 vehicles per day on average travelled over the bridge, compared to 21,100 vehicles on the W Dravus Street bridge and 19,800 on the West Emerson Street bridge. AAWT across the Emerson and Dravus Street routes into Magnolia has held steady over the last ten years, with slight annual variations (**Exhibit 6.** Average Annual Weekday Traffic (AAWT) Magnolia Bridge and Other Magnolia Entrance Routes, 2008 – 2018). Dravus St and Emerson St consistently recorded higher AAWT than the Magnolia Bridge.

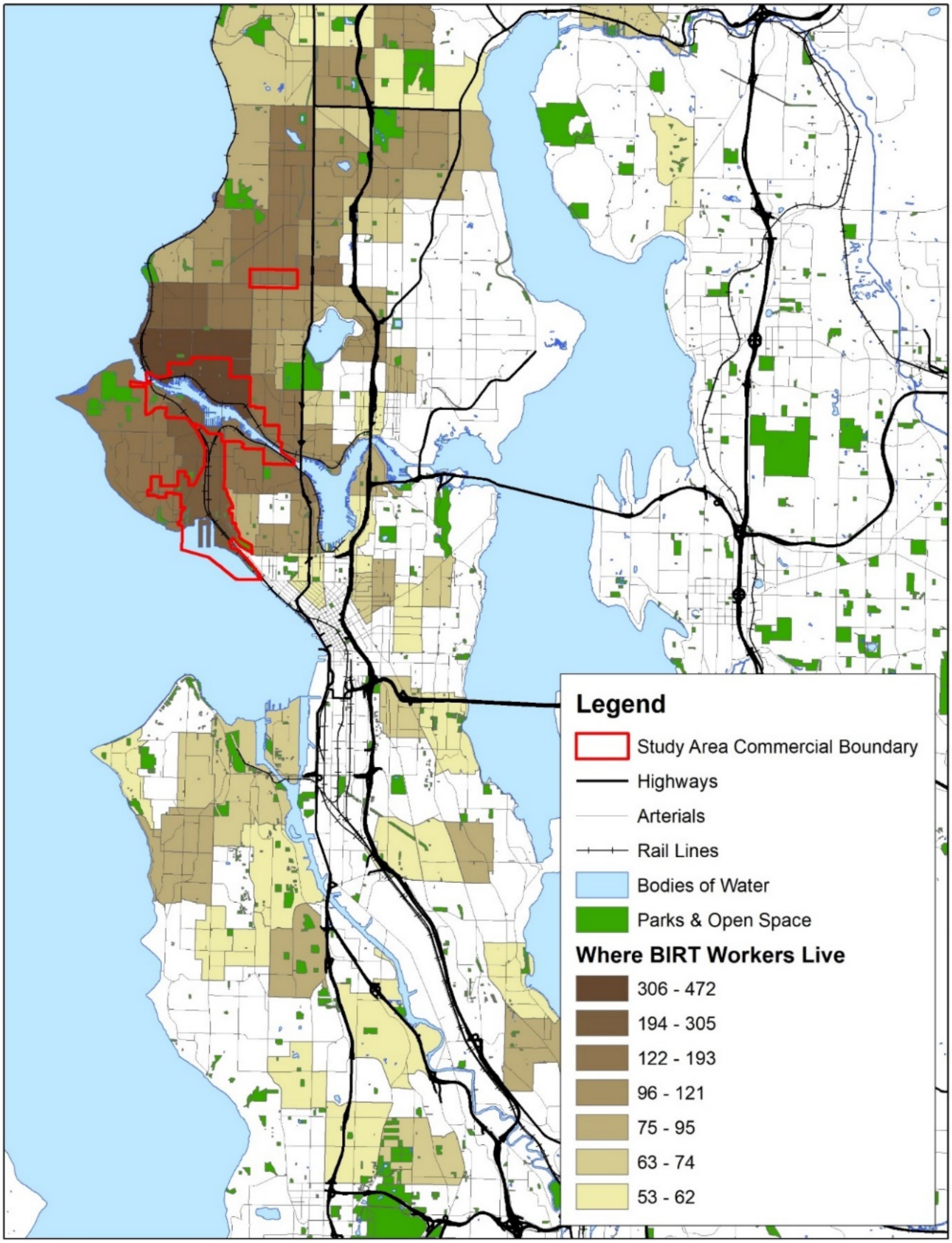
Commute Trip Analysis

An analysis of commuter trips to, within, and from the study area was performed using the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics. The most recent data available shows that the greatest numbers of residents of the

[12] Seattle Department of Transportation, Magnolia Bridge Planning Study, July 2018. https://www.seattle.gov/Documents/Departments/SDOT/BridgeStairsProgram/bridges/Magnolia/MagnoliaBridge_Outreach%20Summary_July2018.pdf

study area commute to jobs in downtown Seattle, the University of Washington / U. District, the Duwamish MIC and downtown Ballard – and, to a lesser extent, to downtown Bellevue and Bel-Red (**Exhibit 7**).

The greatest number of employees that work in the study area's commercial and industrial zones (the red boundary in **Exhibit 8.** Where BIRT Workers Live



) live nearby in Ballard, Interbay, Magnolia, Loyal Heights and Upper Queen Anne. A smaller number of workers live in and commute from Seattle neighborhoods to the north and in parts of southern Snohomish County including Shoreline, Edmonds and Lynnwood. This implies that BIRT workers predominantly commute from the north, as well as from immediate east and west of study area.

According to LEHD data, nearly 23,000 workers commute into the study area's commercial and industrial zones from outside, with only 850 living and working within the commercial boundaries. Around 3,100 of these people live within the residential study area boundaries. This is similar to other commercial and industrial employment centers in the region such as the Seattle's Duwamish MIC and the Kent Valley MIC, where nearly all workers commute in from outside the MIC.

The commuter origin and destination data is consistent with traffic volumes shown in **Exhibit 9** indicating that the 15th Ave W/NW corridor is the primary north-south artery into and through the study area. Those commuting to the south for downtown Seattle and the Duwamish employment destinations would use the Ballard Bridge, Magnolia Bridge, and 15th Ave W/NW corridor. In addition, residents commuting east from northern neighborhoods of the study area to UW or across 520 to Bellevue and Bel-Red use 45th Street heavily. Commuters east from southern study area use the Magnolia Bridge to access Elliott Ave W, and onward to Mercer Street and I-5.

Exhibit 7. Where BIRT Residents Work

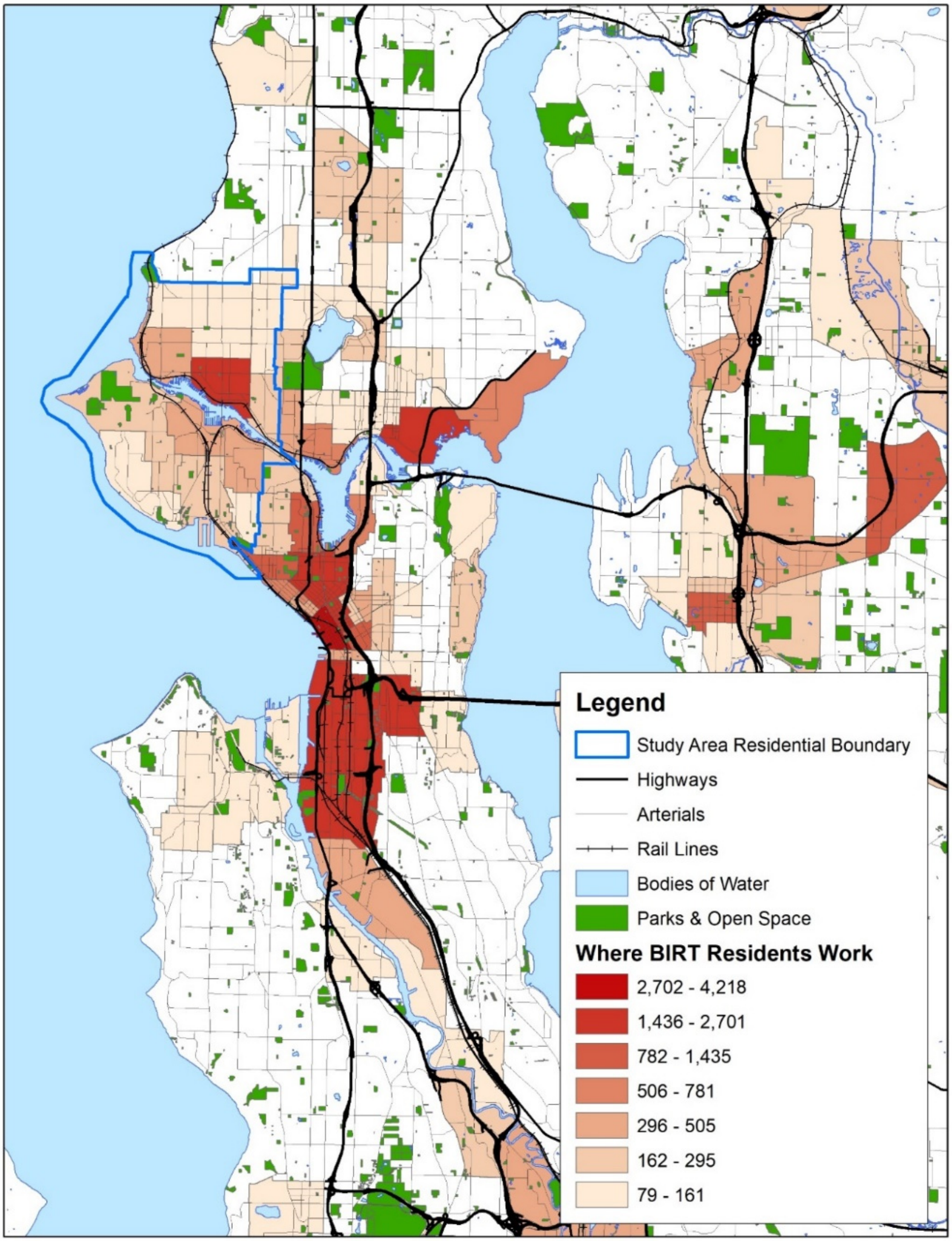


Exhibit 8. Where BIRT Workers Live

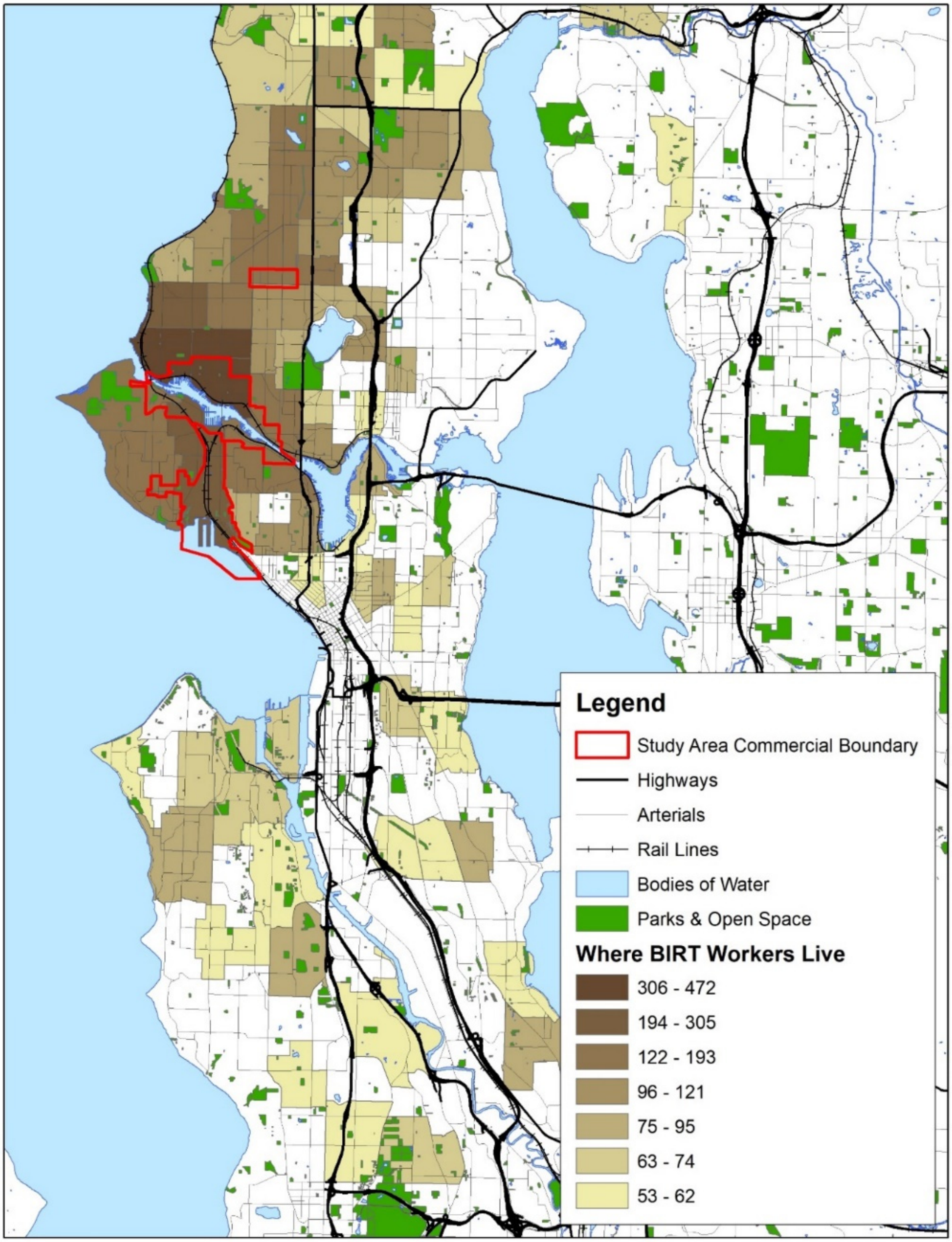
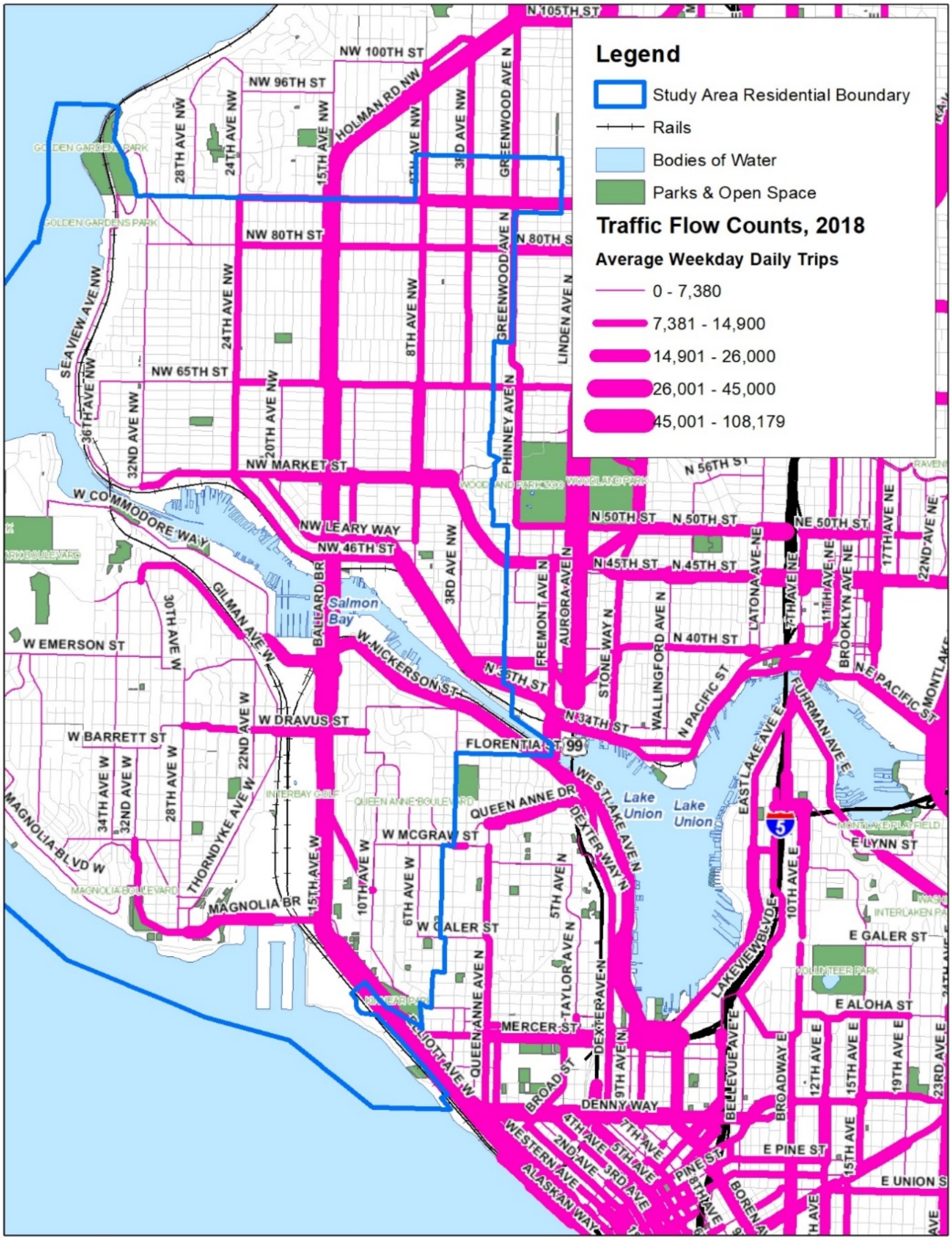


Exhibit 9. Study Area Traffic Flow, Average Annual Weekday Traffic, 2018



Sources: City of Seattle, 2020; Community Attributes, 2020.

Freight Movement Along the Ballard-Interbay Corridor

The BIRT study area is home to thriving ecosystem of industrial businesses with supply chain linkages both within and outside the region. These include light manufacturing, maritime, food and beverage production, warehouse uses and others. Industrial properties representing the Ballard-Interbay Northern Manufacturing Industrial Center and several industrial adjacent properties on the north of Lake Union are a source of high-wage jobs in the Seattle area and were home to 28,700 jobs in 2018. Many of these businesses rely on the Holman Road – 15th Avenue W/NW freight corridor to reach local and regional suppliers, customers, or other transportation corridors.

This freight corridor is the main North-South freight route in Northwest Seattle. It is a designated major truck street as part of Seattle's 2005 Transportation Strategic Plan (TSP), meaning it carries over 500 trucks per day, and an over-legal route[13], meaning it can accommodate oversized or overweight trucks. Over 1,500 trucks a day travel on 15th Ave W/NW over the Ballard bridge. The City of Seattle Freight Master Plan forecasts that this will increase to roughly 2,500 by 2035. Employment growth in high freight-generating sectors such as wholesale, retail trade and manufacturing is projected to be one of the main drivers of demand for goods movement through the BIRT study area.

The 15th Avenue W/NW corridor is a seaport highway connector, providing reliable connection between the interstate and Seattle's seaports. The corridor provides North-South connection for several maritime assets, including shipyards in BINMIC, Ballard Locks, and the Port of Seattle facilities in Interbay.

The Port of Seattle operates the Fishermen's terminal; T-91 terminal, which is the Port's largest seaport facility and accommodates a cruise terminal, seafood storage and processing, a business complex and various storage facilities; and T-86, the Port's grain elevator. In 2019, the cruise industry at the Port of Seattle[14] directly generated roughly $468 million in business revenues and nearly 3,000 jobs.

The 15th Avenue W/NW corridor also connects to the railroad facility at Balmer Yard. The 80-acre intermodal yard is owned by BNSF Railway and it is mainly used for railcar storage and sorting. Rail is a great asset to the City and rail freight is critical to the success of manufacturing and industrial uses in the study area.

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[13] The Heavy Haul legislation was approved by the City of Seattle in October 2015 to allow movement of heavier cargo containers between the Port of Seattle, industrial businesses, and rail yards with appropriate permits.

[14] Including Pier 66 facility.

The 15th Avenue W/NW corridor passes through local urban villages. Ballard is a fast-growing neighborhood experiencing rapid residential, retail, and business growth. This growth in economic activity simultaneously increases the need for freight access serving the area and restricts freight access due to congestion and limited on-street parking and loading zones.

Transit and Non-Motorized Connections

There are several King County Metro bus routes that use the Ballard and Magnolia bridge and serve residents and workers in the Ballard-Interbay corridor. Metro's RapidRide D Line is the first bus rapid transit service in the study area. The D Line operates daily between Downtown Seattle, Uptown, and over the bridge to Ballard and Crown Hill. It carried around 14,000 riders per day in 2018. Other routes crossing the Ballard bridge include:

- Route 29 connects Downtown Seattle, Queen Anne, and Ballard, with 1,100 weekday riders in 2018
- Route 15X connects Downtown Seattle, Ballard, Crown Hill, and Blue Ridge, with 1,400 weekday riders in 2018
- Route 17X connects Downtown Seattle, Ballard, and Sunset Hill, with 1,100 weekday riders in 2018
- Route 18X connects Downtown Seattle, Ballard, and Loyal Heights, with 1,100 weekday riders in 2018.

Magnolia neighborhood is also served by transit that crosses the Magnolia bridge:

- Route 19 and route 24 connect Magnolia to Downtown Seattle, with 300 and 2,300 weekday riders in 2018
- Route 33 connect Magnolia to Discovery Park to the north and Downtown Seattle to the south, with 2,100 weekday riders in 2018.

Several of these transit routes (RapidRide D Line, 15X, 17X, 18X and 33) have been identified by King County Metro in their 2019 system evaluation as overcrowded routes and require investment to expand capacity. Of these, the RapidRide D Line needs the most investment and requires three additional daily trips.

Future Transit Service Expansion
MetroConnects, King County Metro Transit's vision, includes 26 RapidRide lines around the county by 2040. The 2040 enhanced network envisions new bus services from east Seattle and east King County terminating in the Interbay area. Other planned investments include bus-only lanes and transit priority features.

Sound Transit's West Seattle and Ballard Link Extensions will provide a light rail connection to residential and job centers in Interbay, with three stations planned in the study area: Smith Cove, Interbay, and Ballard stations. The Ballard to Downtown segment is planned to be completed by 2035 and will add 7.1 miles of light rail service from downtown Seattle to Ballard, including a new downtown Seattle rail-only tunnel.

Pedestrian and Bicycle Access
Bicycle and pedestrian facilities in the study area link neighborhoods to business districts and create connections with recreational and natural areas within the region.

The study area includes several bike facilities. The Elliott Bay Trail in Interbay runs from Century Link Field in the south to Smith Cove in Magnolia to the north. A section of the trail between W. Galer St. and Centennial Park has been improved as part of Expedia's work on its new campus in the area and surrounding public amenities.

Protected bike lanes and safer intersections are being delivered along 20th Ave W, Gilman Ave W, W Government Way, and W Emerson Pl as part of a project called out in the city's Bicycle Master Plan. The project allows bicyclists to ride from the downtown waterfront to Discovery Park and the Ballard Locks almost entirely separated from car traffic. Further north in Ballard, the completion of the Burke Gilman Trail missing link planned to start in 2020 will create a regional facility that provides east-west bicycle connection. Other bike facilities in the study area include the Ship Canal Trail, bicycle lanes without separation and neighborhood greenways.

Socio-Economic Baseline

Important social and economic equity considerations exist with respect to BIRT regional transportation improvements in the study area. Several demographic and economic metrics were analyzed to better understand the racial, educational, and economic dynamics of the resident and workforce populations of the study area.

Population and Demographics

The total population in the study area was approximately 95,200 in 2019, representing almost 13% of the City of Seattle's total population (753,700, according to 2019 ACS estimates). Of the three neighborhoods comprising the project study area, Ballard and Interbay have experienced major population growth over the last decade.

Ballard's population has increased from approximately 26,200 in 2010 to 34,800 in 2019. The number of residents in Interbay has grown from approximately 4,600 in 2010 to 6,400 in 2019. Magnolia's population grew from approximately 16,400 to 17,800 in that same period. (**Exhibit 10**)

Exhibit 10. Study Area Population by Neighborhood, 2010 and 2019

Neighborhood	2010 Population	2019 Population (Est.)	Annual Growth (CAGR)
Ballard	26,200	34,800	3.2%
Interbay	4,600	6,400	3.7%
Magnolia	16,400	17,800	0.9%
Other Neighborhoods	33,200	36,200	1.0%
All Study Area	**80,400**	**95,200**	**1.9%**

** All Study Area includes census block groups (Other Neighborhoods) located outside of the three named neighborhood sub-boundaries, including areas north and east of Ballard, and areas of Queen Anne.*

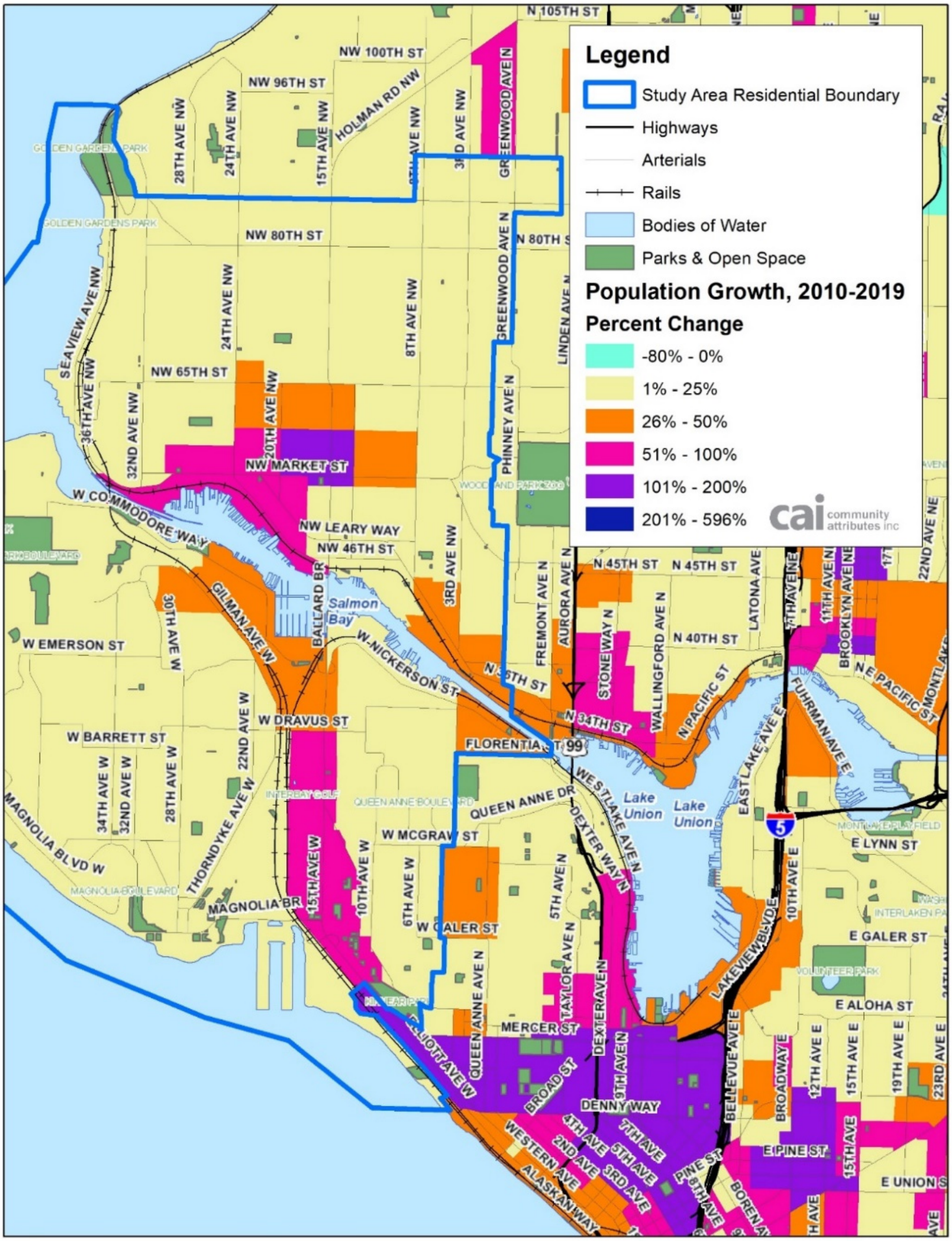
Sources: U.S. Census Bureau, 2019; Community Attributes, Inc, 2020.

The growth in population in the study area has occurred almost exclusively within areas zoned for mixed use and multifamily development in Interbay and, especially, in Ballard, where a city-designated Urban Village occupies most of the downtown area (**Exhibit 11**). The 15th and Market area of downtown Ballard has seen its population more than double (118% growth) from 2010 to 2019, according to latest U.S. Census estimates. The rest of downtown Ballard has seen a 95% population growth in the same period. The development of numerous large mixed-use and multifamily condo and apartment projects have added thousands of units to Ballard's Urban Village in the last decade.

When viewed at the census block group level (**Exhibit 11),** the geography of exceptional population growth seen over the last decade in Ballard and Interbay corresponds closely to a number of significant development sites in the corridor that will shape the economic landscape of the area in years to come. The growth has occurred directly along the corridor that is planned for Sound Transit's West Seattle and Ballard Link Extensions (WSBLE), as well as RapidRide transit service improvements by SDOT and King County Metro. The Terminal 91 Uplands redevelopment, Fishermen's Terminal redevelopment, National Guard Armory site redevelopment, and the new Expedia corporate campus also all intersect these specific areas of high growth.

In upper Interbay, near the employment-rich Fishermen's Terminal area where residential populations were historically non-existent, two large multi-family projects fronting Dravus Street – the Axle and Crane buildings, respectively – have been responsible for a 32% population increase. This number is likely to rise dramatically as these buildings are only now coming to full occupancy.

Exhibit 11. Population Growth in the BIRT Study Area, 2010-2019



Sources: U.S. Census Bureau, 2019; Community Attributes, Inc, 2020.

South of Dravus along 15th Ave W in central and lower Interbay, several other large-scale mixed-use residential projects (including Slate Lofts, The Flats at Interbay, Interbay Place, and Interbay Work Lofts) have further transitioned the formerly industrial corridor toward a residential district. These projects have resulted in a population increase of 76% from 2010-2019.

Both areas correspond to planned expansions of transit-oriented development based on anticipated investments in high-capacity transit such as RapidRide and Link light rail. The 2014 Ballard to Downtown Transit Expansion Study, 2016 Move Ballard plan, and 2017 Metro Connects plan have all included expanded TOD recommendations for this corridor.

Exhibit 12. Sample Interbay Multifamily Housing Development

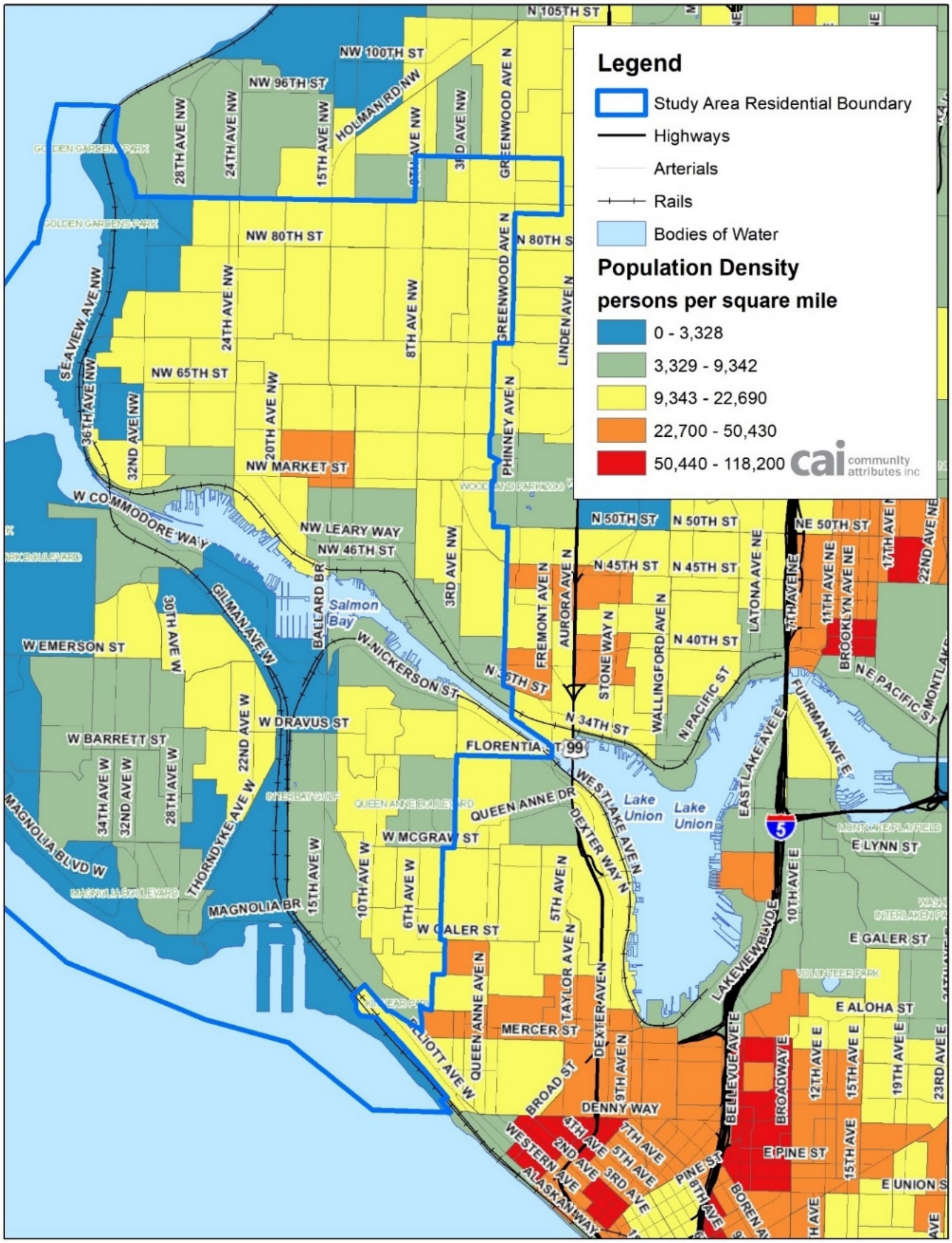
Unico Development's Slate Lofts and Apartments, a 236-unit multifamily housing development in the heart of the Interbay neighborhood in the BIRT study area. Source: Unico

Population Density

The average population density of the City of Seattle was 8,882 persons per square mile in 2019. According to the most recent U.S. Census population estimates, most of the study area north of the Ship Canal had 2019 population densities[15] greater than the City average. The census block group surrounding 15th and Market Ave. in Ballard had the highest population density in the study area (**Exhibit 13**).

[15] Population density is expressed in terms of persons per square mile, by census block group.

Exhibit 13. Population Density in the BIRT Study Area, 2019



Sources: U.S. Census Bureau, 2019; Community Attributes, Inc, 2020.

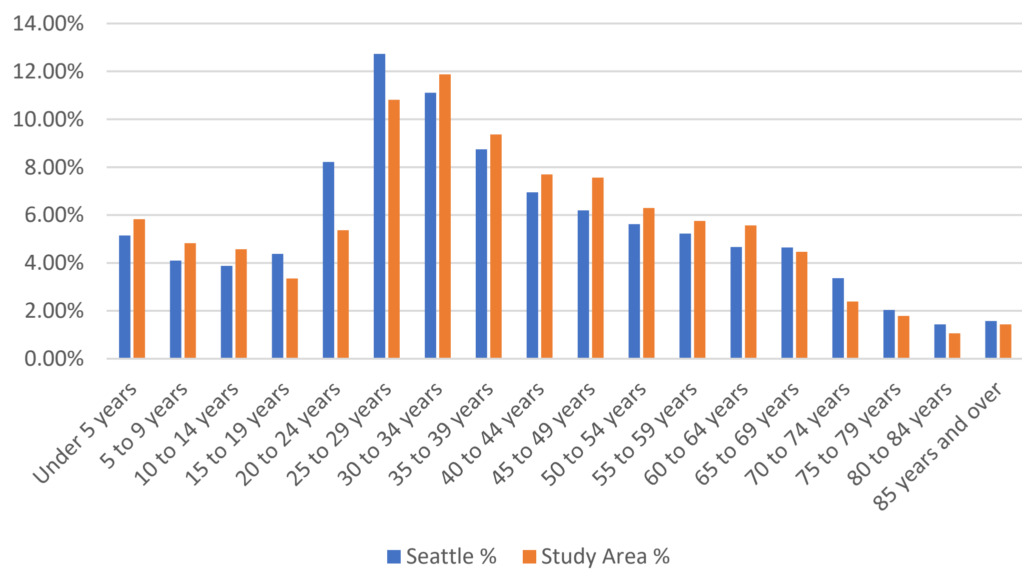
Residents in these high-population density zones will be directly served by planned Link light rail and RapidRide bus transit improvements, better linking Ballard residents to local and regional employment centers (**Exhibit 7**).

Two of the three census block groups comprising the Interbay neighborhood had some of the lowest population densities in the study area – unsurprising given the concentration of non-residential uses in these areas. Commercial and industrial areas of Ballard also had less population density than the City average. While these areas currently have relatively low population density, they are planned for both transit-oriented-development (TOD) expansion, and redevelopment of key area employment anchors. Other areas of low population density include the wealthier sections of Sunset Hill in Ballard, and Briarcliff and Southwestern Magnolia.

Population Distribution by Age & Disability

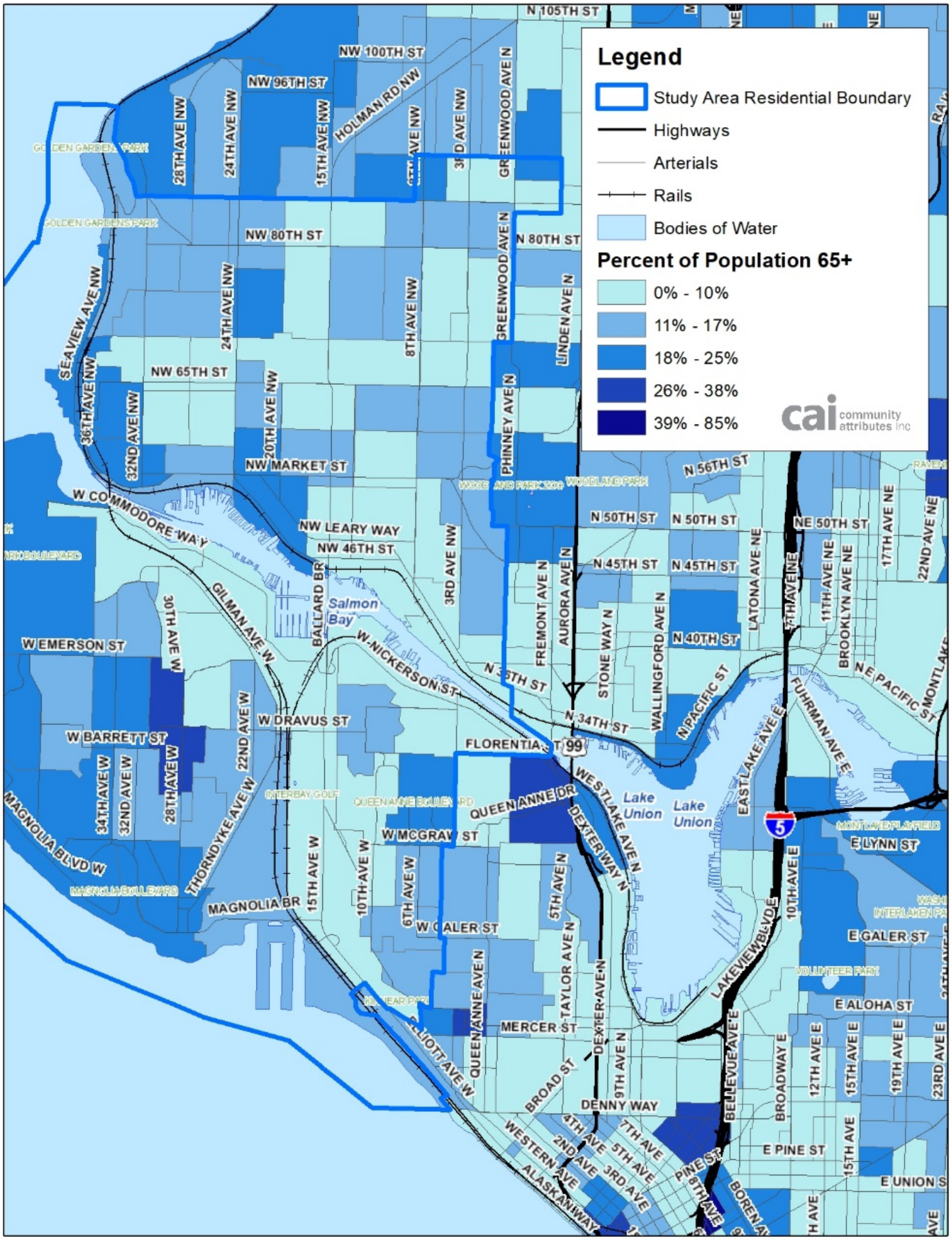
The study area population contains about 16% less residents over the age of 65 than the City of Seattle as a whole. However, the median age of the study area was higher, at 38.2 years, compared with Seattle, at 35.2. According to U.S. Census 5-Year ACS estimates for 2014-2018, the percent of the total population in the study area that was over age 65 was 11% - almost 16% less than the City of Seattle figure (13.1%) for this period. Another 1.6% of the population of the study area was 85 years of age or over (**Exhibit 14**). **Exhibit 15** illustrates the distribution of residents over the age of 65 throughout the study area.

Exhibit 14. Age Distribution, Study Area and City of Seattle, 2014-2018



Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

Exhibit 15. Distribution of Residents Aged 65+, 2014-2018



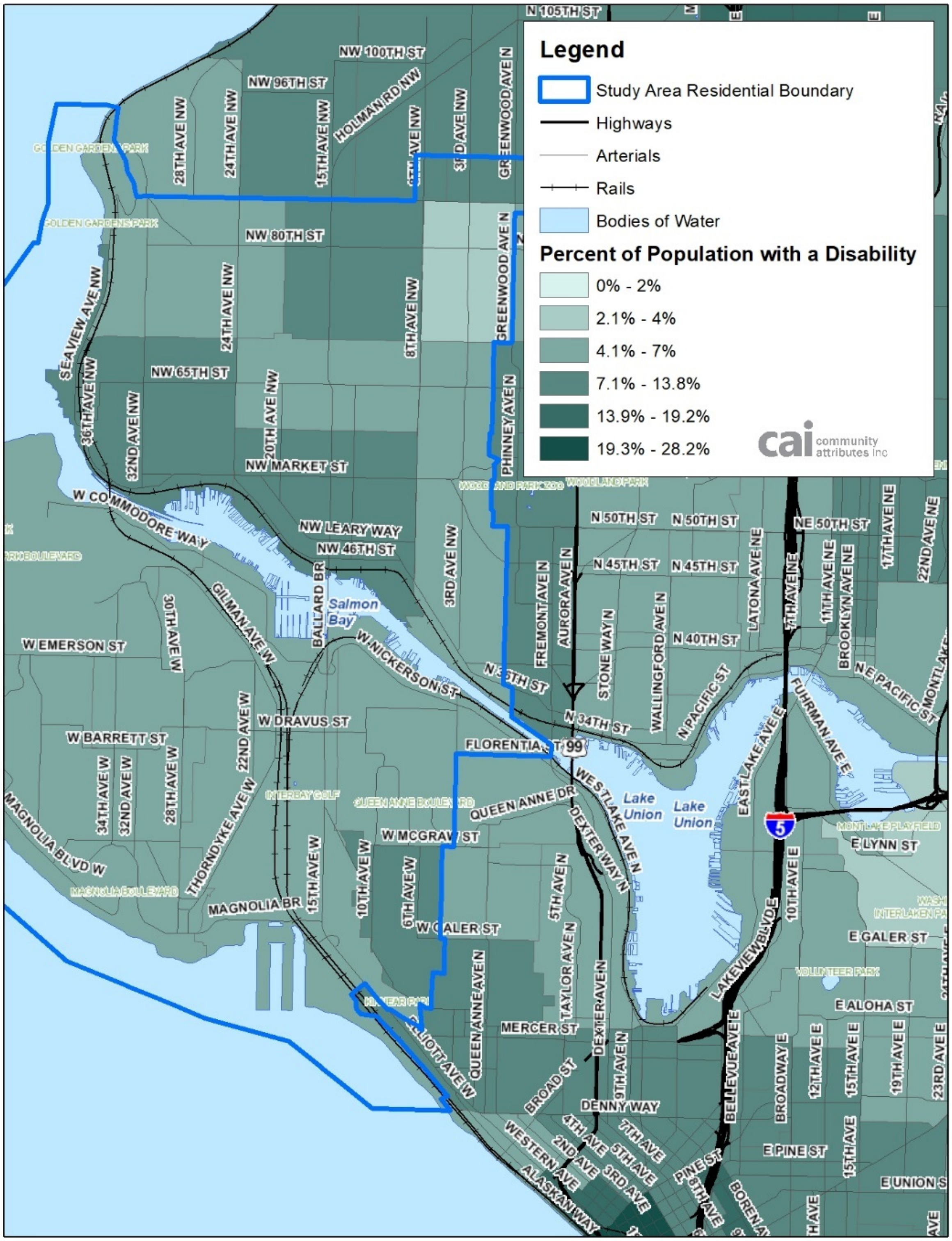
Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

According to U.S. Census 5-Year ACS estimates for 2014-2018, on average, the percent of the total non-institutionalized population with a disability[16] in the BIRT study area was 6.1% from 2014 to 2018, compared to 9.1% in the City of Seattle. Disabilities included hearing difficulty, vision difficulty, cognitive difficulty, ambulatory difficulty, self-care difficulty, and independent living difficulty.

The tracts with the highest disability rates included downtown Ballard and Crown Hill. Four census tracts – three in Ballard and one in upper Queen Anne – had rates of disability greater than 7% (**Exhibit 16**). The tracts with the lowest disability rates were all found at the eastern edge of the study area border, further from the main 15th Avenue NW corridor transit routes. While the proportions of residents over the age of 65 and population with disabilities are both lower than for the City of Seattle as a whole, their distributions are largely distinct apart from some overlap in Downtown Ballard and in Crown Hill.

[16] The non-institutionalized population excludes persons residing in institutions such as nursing homes, prisons, jails, mental hospitals, and juvenile correctional facilities. Institutions house approximately 4 million persons of whom 2.1 million (52.7%) have a disability (ACS 2011).

Exhibit 16. Percentage of Total Non-Institutionalized Population with a Disability, 2014-2018



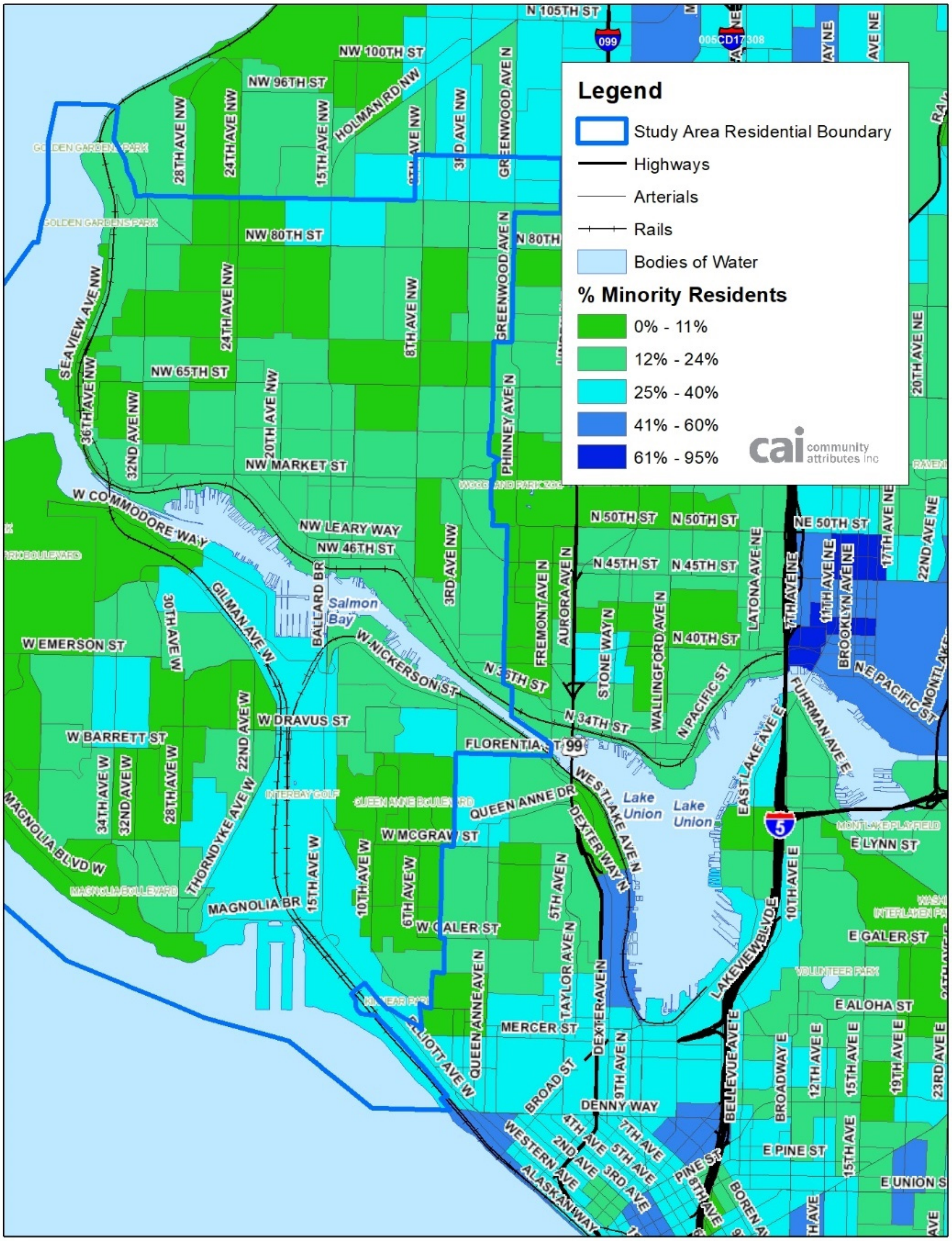
Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

Population Distribution by Race

The overall minority percentage of the population in the study area was roughly 14.4%, compared with 35% for the City of Seattle as a whole, according to U.S. Census 5-Year ACS data from 2014-2018. The breakdown of the study area minority population included a 6.2% Asian population, a 4.8% Hispanic (of all races) population, and a 1.7% Black / African American population. In comparison, the City of Seattle had a 14% Asian population, a 6.4% Hispanic population, and a 7.2% Black / African American population. The Black / African American population in the study area was 76% less than Seattle as a whole, and the Asian population was 56% less. Census tracts with greater proportions of minority residents exist in certain locations of the study area.

The population distribution by race for the study area (**Exhibit 13**) indicates that greater proportions of minority Seattle residents would be served by BIRT transportation improvements in the Interbay portion of the 15th Ave NW corridor. In addition to Interbay, census block groups in the Loyal Heights and Greenwood neighborhoods at the north of the study area, northern Queen Anne, and central Magnolia have higher share of minority residents than the study area as a whole. (**Exhibit 16**).

Exhibit 16. Population Distribution by Race, 2014-2018



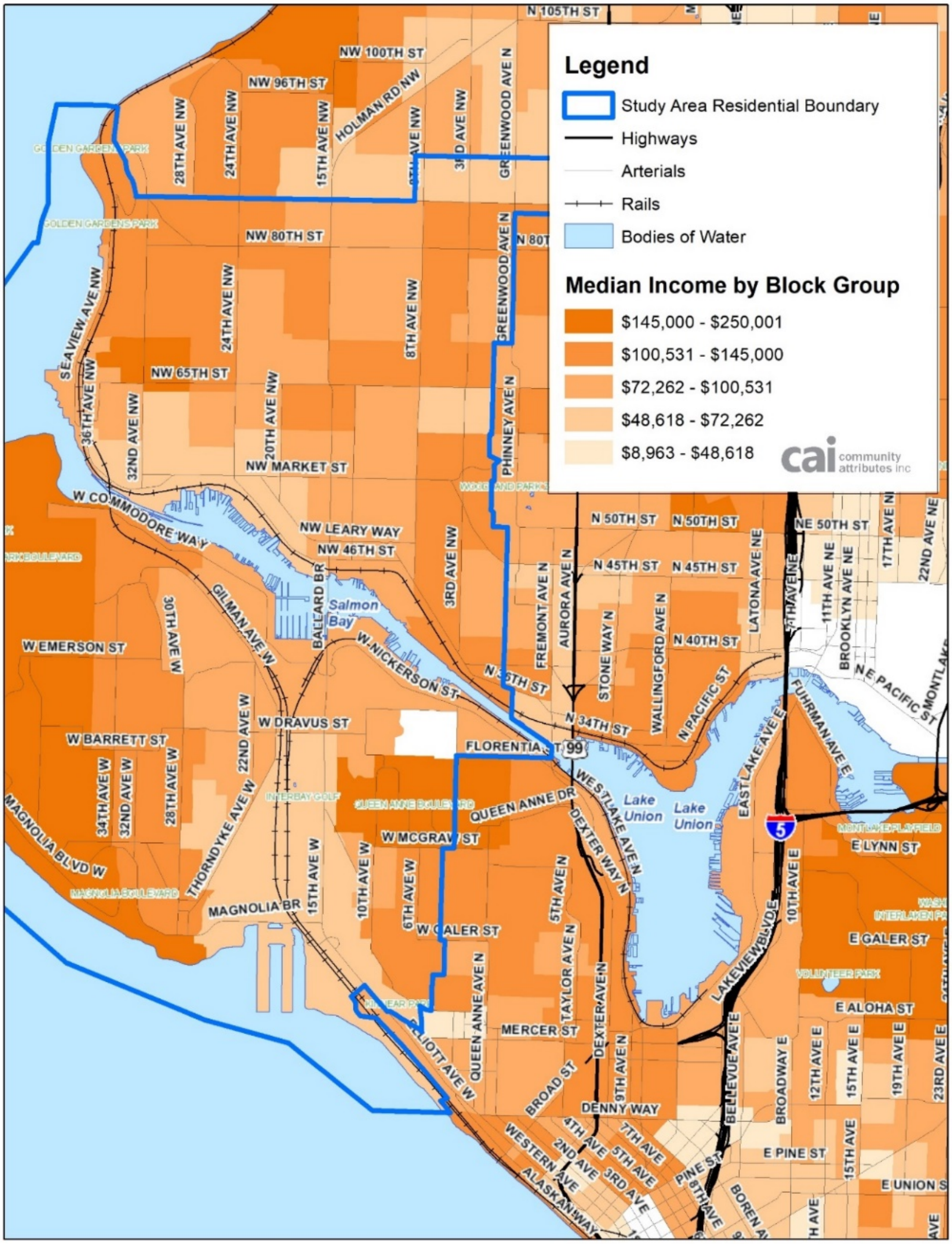
Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

Median Household Income

The census block groups with highest median household incomes for the period 2014-2018 were found in the Sunset Hill section of Ballard, in southwestern Magnolia, and in the northern Queen Anne neighborhood (**Exhibit 17**). The areas with the lowest median household incomes were found in downtown Ballard, lower Interbay, and around 65th and Greenwood near Phinney Ridge.

Residents of areas of low median household income are more likely to have fewer mobility options to meet their basic travel needs, which can impact their quality of life and productivity. Low income households and workers are faced with the rapid rise of the cost of housing in the Seattle area, which has shrunk the choices of residences available that have transit access to jobs. BIRT study area transportation improvements and the Ballard Link light rail and RapidRide expansions could increase employment opportunities for residents of these areas.

Exhibit 17. Median Household Income in the BIRT Study Area, 2014-2018

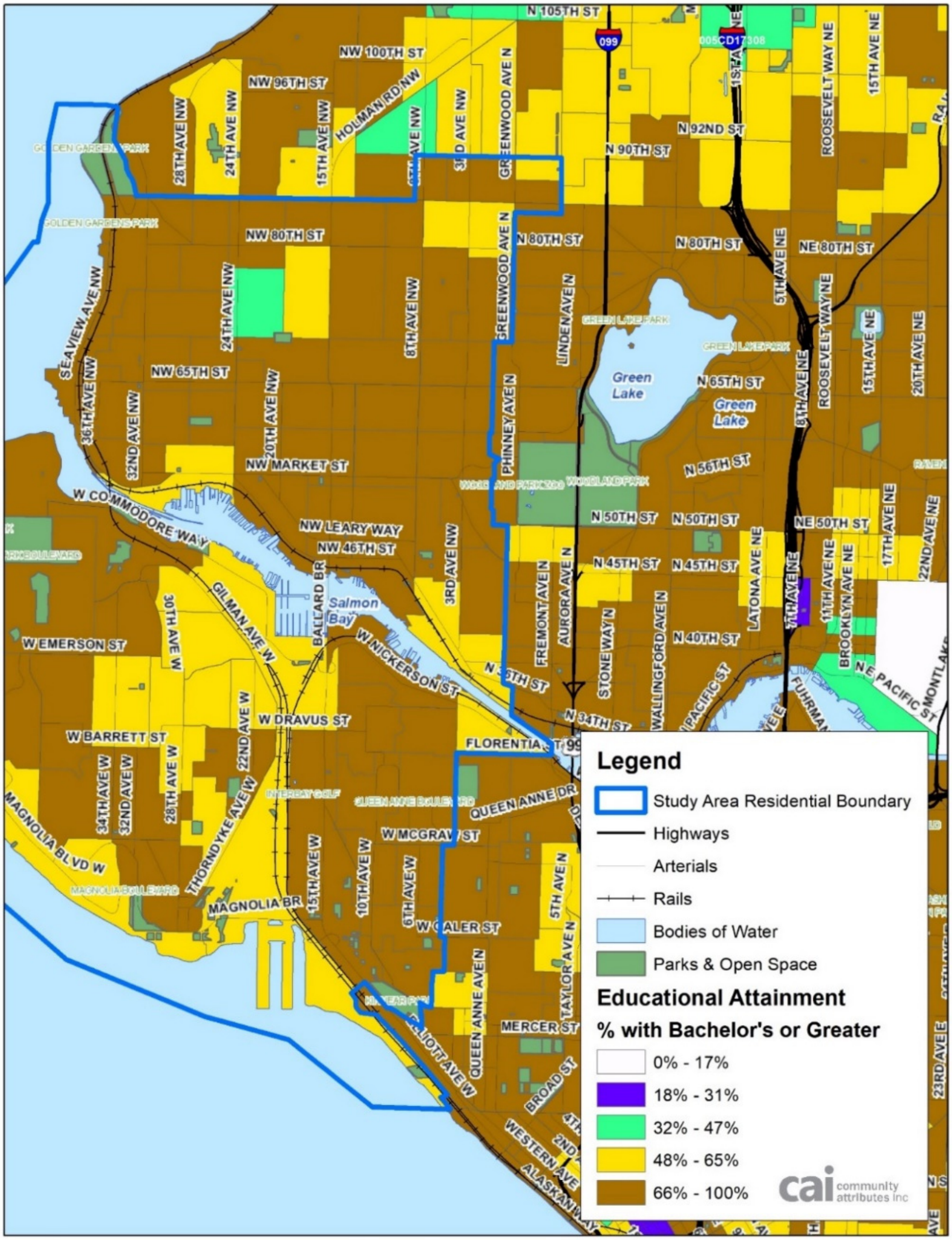


Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.
Note: White regions on the map represent null values in the U.S. Census ACS dataset, including block groups in Queen Anne, and around the University of Washington.

Educational Attainment by Place of Residence

Most of the study area is highly educated, like the City of Seattle. According to ACS estimates, 48% to 100% of residents in all but one on the study area's census block groups had a bachelor's degree or greater. The most highly educated areas – those where at least two-thirds of residents have a bachelor's degree or greater – corresponded to wealthier, single-family zones of the BIRT study area. In most of Interbay, as well as in downtown Ballard and parts of Loyal Heights and Greenwood, only 48%-65% of residents had a bachelor's degree or greater (**Exhibit 18**).

Exhibit 18. Educational Attainment in the BIRT Study Area, 2014-2018



Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

Housing

American Community Survey estimates for the period 2014-2018 indicate that there are a total of nearly 44,000 housing units of all types within the BIRT study area boundaries (**Exhibit 19**). The 21 census block groups comprising the Ballard neighborhood[17] contained 37% of those units, Interbay contained 7% of the units, and Magnolia contained 20%.

Exhibit 19. ACS 5-Year BIRT Housing Units & Occupancy, 2014-2018

Neighborhood	Total Housing Units	% of All Study Area Housing Units	Occupied Housing Units	Vacant Housing Units	Housing Unit Vacancy
Ballard	16,212	37%	15,409	803	5.0%
Interbay	3,093	7%	2,867	226	7.3%
Magnolia	8,827	20%	8,277	550	6.2%
Other Neighborhoods	15,700	36%	15,143	557	3.5%
All Study Area*	43,832	100%	41,696	2,136	4.9%

** All Study Area includes census block groups (Other Neighborhoods) located outside of the three named neighborhood sub-boundaries, including areas north and east of Ballard, and areas of Queen Anne.*

Note: Disaggregated homeowner and rental vacancy rates are only calculated by ACS for mid- to large-size geographies such as MSAs. Multifamily vacancy rates are presented further along in this section using CoStar data.

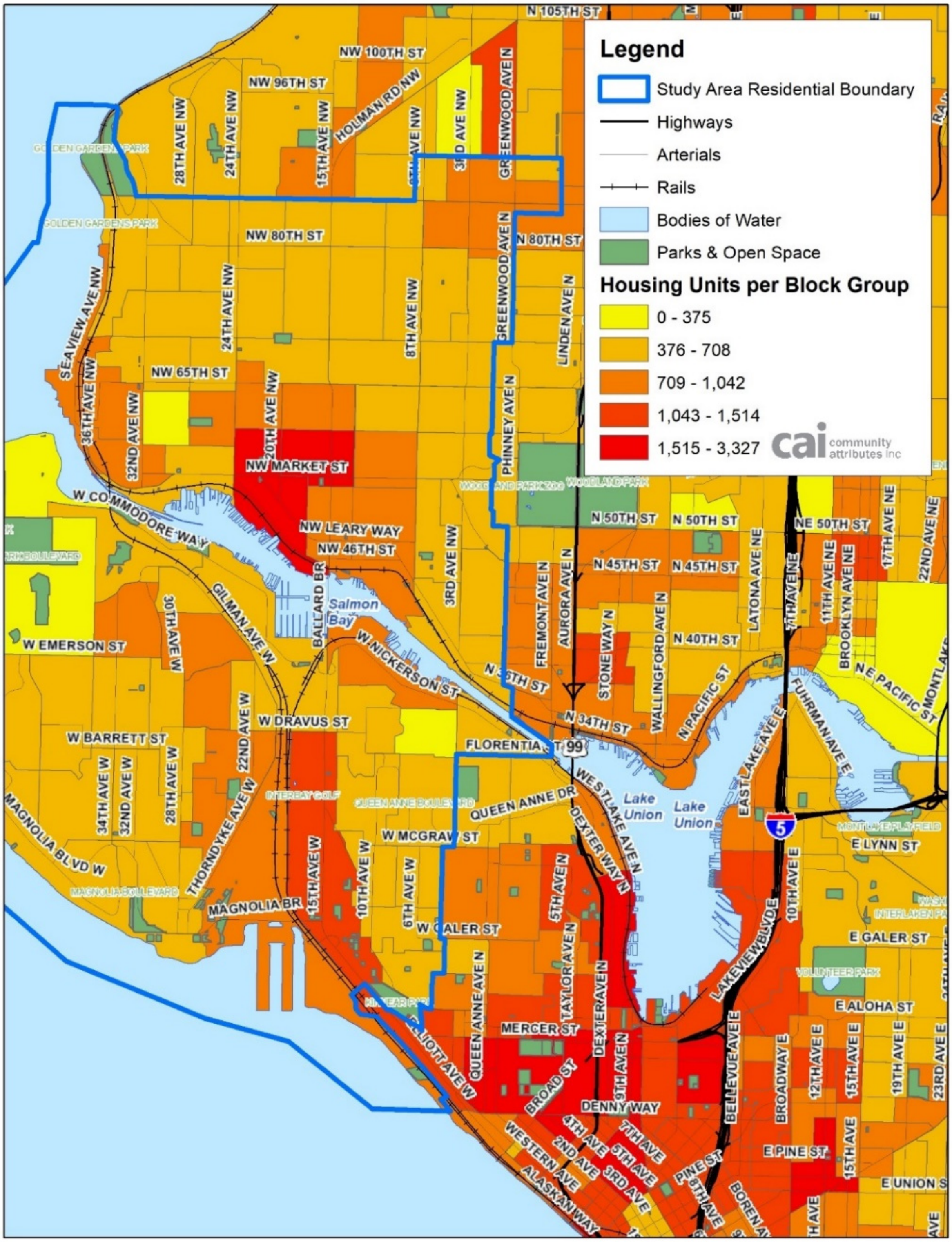
Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

Overall, from 2014 to 2018, around 5% of all housing units were vacant (**Exhibit 19**). Interbay and Magnolia had slightly higher vacancy rates. Many pockets of higher housing unit vacancy corresponded to concentrations of older, multifamily housing buildings, such as along 32nd and 24th Avenues in Ballard and Loyal Heights, and along Gilman in Magnolia (**Exhibit 21**).

The greatest density of housing units was found in the downtown Ballard area, as well as along 15th Ave W in Interbay. Areas of lower density in housing units were in the study area north of 65th Street, east of 8th Ave., in central and western Magnolia, and upper Queen Anne. (**Exhibit 20**)

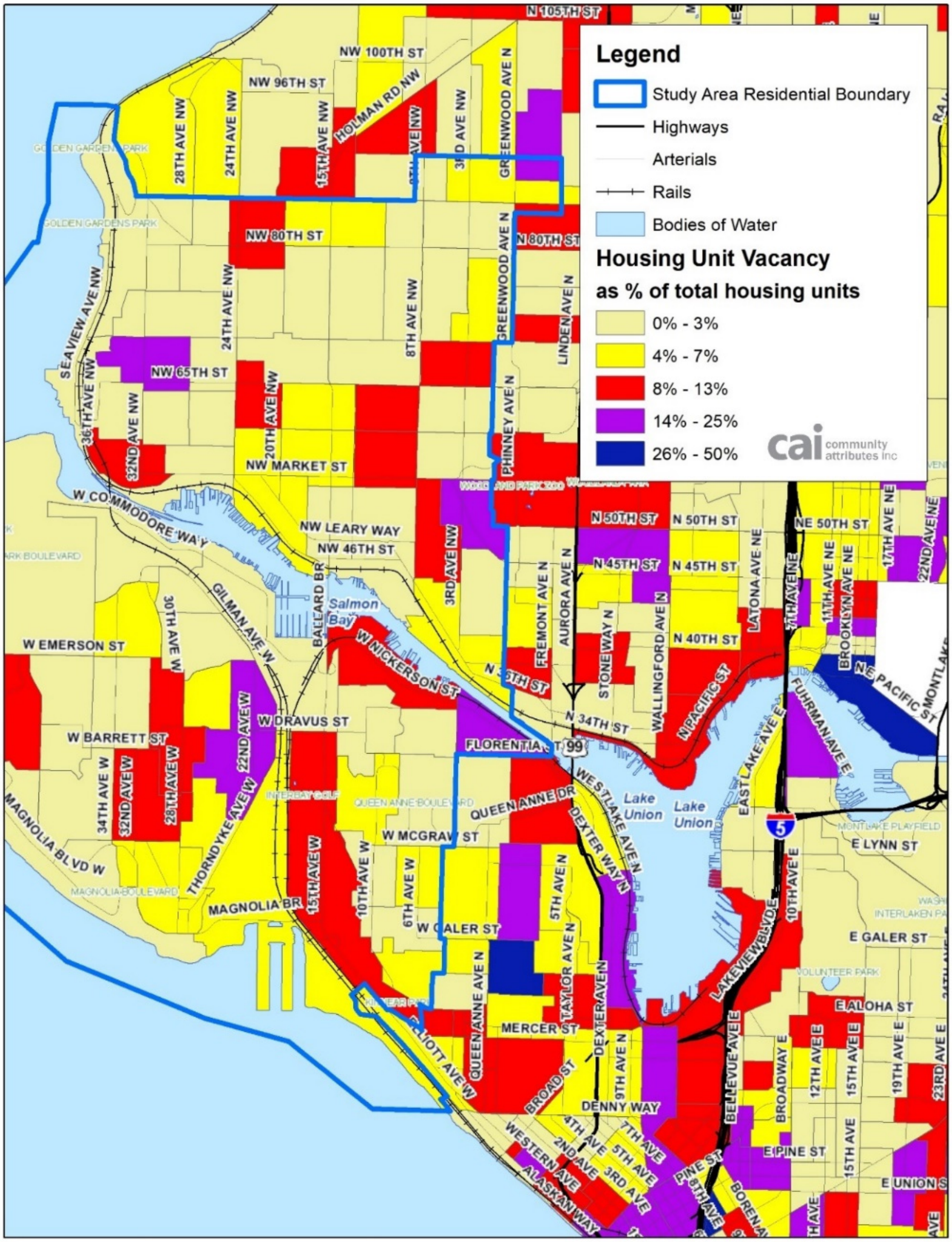
[17] From the Ship Canal north to 70th Street and from Shilshole Bay east to Greenwood Ave.

Exhibit 20. Total Housing Units per Block Group, 2014-2018



Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

Exhibit 21. Housing Unit Vacancy Rates, 2014-2018



Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

Among occupied housing units, Interbay and Ballard had a greater proportion of rental units (69% and 56%, respectively) than owner-occupied units (**Exhibit 22**). Magnolia had a greater proportion of owner-occupied housing (55%). The median value of owner-occupied housing units was highest in Magnolia, and lowest in Interbay. Median rents were again highest in Magnolia and lowest in Interbay.

Additionally, when analyzing median gross rent as a percentage of household income, all three neighborhoods considered, and the study area were below the housing cost burden threshold. Generally, households paying more than one-third of income on housing are cost burdened. The closest was Interbay, where households were found to be spending, on average, nearly 29% of their income on rent.

Exhibit 22. ACS 5-Year BIRT Housing Tenure, Home Value, & Gross Rents, 2014-2018

Neighborhood	Occupied Housing Units	Owner-Occupied Units	Renter-Occupied Units	Median Value of Owner-Occupied Units	Median Gross Rent	Median Gross Rent as a % of Household Income**
Ballard	15,409	6,789	8,620	$603,690	$1,510	24.7
Interbay	2,867	885	1,982	$575,200	$1,422	28.9
Magnolia	8,277	5,690	2,587	$718,180	$1,759	25.9
Other Neighborhoods	15,143	9,407	5,736	$736,380	$1,545	25.8
All Study Area*	41,696	22,771	18,925	$658,363	$1,559	26.3

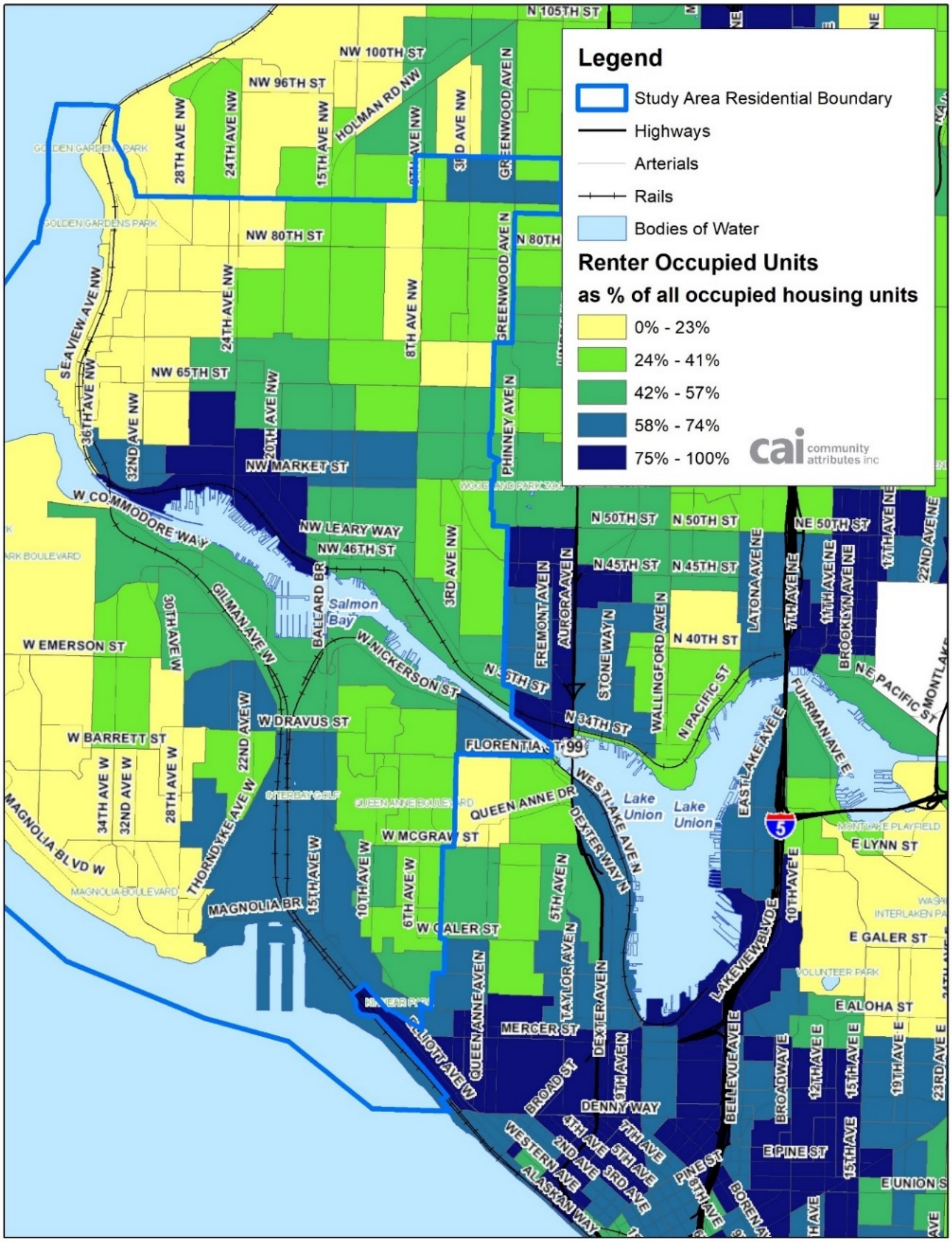
** All Study Area includes census block groups (Other Neighborhoods) located outside of the three named neighborhood sub-boundaries, including areas north and east of Ballard, and areas of Queen Anne.*

*** Renter-occupied housing, last 12 months.*

Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

The greatest concentrations of renter-occupied housing units were found in downtown Ballard, along other areas of Market Street in Ballard, and along 15th Ave W in Interbay (**Exhibit 23**). The areas of least concentration of renter-occupied housing were found in the Sunset Hill section of Ballard and in Briarcliff and southwestern Magnolia.

Exhibit 23. Renter-Occupied Housing Concentrations, 2014-2018



Sources: U.S. Census Bureau ACS 5-Year Estimates, 2014-2018; Community Attributes, Inc, 2020.

In addition to U.S. Census ACS data, commercial property data from CoStar was used to analyze the latest multifamily housing market data available for the study area[18]. As of the first quarter of 2020, a total of 14,164 multifamily units, in 840 buildings, existed in the BIRT study area (**Exhibit 24**). The overall multifamily vacancy rate for the study area was 5.2%, with the greatest vacancy in Ballard, and the lowest in Magnolia.

Exhibit 24. CoStar BIRT Multifamily Housing Market Summary, Q1 2020

Neighborhood	Existing Buildings	Inventory Units	Vacant Units	Vacancy Rate	Average Market Rent / Unit	Average Market Sale Price / Unit	Absorption (12 mo. absorption % of inventory)	Pipeline (under construction units)
Ballard	450	8,139	469	5.8%	$1,839	$349,000	2.8%	53
Interbay	115	2,150	71	3.3%	$1,775	$415,000	7.1%	93
Magnolia	94	1,482	44	3.0%	$1,746	$348,000	0.2%	0
Other Neighborhoods	181	2,393	152	5.4%	$1,792	$440,000	0.7%	259
All Study Area*	840	14,164	736	5.2%	$1,788	$388,000	2.7%	405

** All Study Area includes many census block groups located outside of the three named neighborhood sub-boundaries, including areas north and east of Ballard, and areas of Queen Anne.*

Sources: CoStar, 2020; Community Attributes, Inc, 2020.

Average market rents per unit (averaging studio, one-bedroom, two-bedroom, and 3-bedroom units) were highest in Ballard at $1,839 in Q1, 2020 (**Exhibit 24**). However, the greatest average market sale prices per unit were found in Interbay. The Interbay multifamily units also saw the greatest one-year absorption rate – with 153 units (7.1% of inventory) leased in the previous 12 months. Magnolia had the coolest rental market, with only .2% of inventory leased in the last year.

The pipeline in multifamily housing consisted of 405 total units under construction in the study area from Q1 2019 through Q1 2020. 93 of these units were in Interbay, 53 in Ballard, and zero in Magnolia.

Industry and Employment

The commercial study area (**Exhibit 1** for commercial study area boundaries**)** has been divided into four subareas for the purpose of industry and employment analysis: south of W Emerson St, north of W Emerson St, Magnolia business district and Greenwood business district.

Overall, employment within the BIRT commercial study area has grown by 0.7% annually since 2000 and by 2.1% annually since 2010. The north portion of the commercial study area, which includes Ballard, has grown at 2.0% annually since 2010. The southern portion of the commercial study area, which includes most of Interbay, has grown only slightly slower at 1.7%

[18] No data was available for the single-family home market.

annually. Both the Greenwood and Magnolia subareas have been growing faster in terms of employment than the commercial study area as a whole, by 5.3% and 2.3% respectively (**Exhibit 26**).

Throughout the commercial study area, the construction and resource sector has seen the fastest rate of growth, while the services sector has seen the most growth in absolute terms. The growth in services has been concentrated in the northern portion of the commercial study area and has averaged more than 3% annually. Employment growth in the Interbay or southern portion of the study area has been concentrated in manufacturing and construction and resources. Only government and manufacturing employment have decreased between 2010 and 2018.

Exhibit 25. Employment by Industry and Neighborhood, 2018

	North	South	Greenwood	Magnolia	Total
Const/Res	2,420	420	40	30	2,910
FIRE	670	260	60	80	1,070
Manufacturing	3,120	1,120	20	10	4,260
Retail	2,700	550	510	130	3,880
Services	12,610	2,120	1,130	640	16,500
WTU	2,350	630	70	10	3,050
Government	620	230	30	30	910
Education	-	80	-	80	160
Total	**24,480**	**5,400**	**1,860**	**1,010**	**32,750**

Source: Puget Sound Regional Council, 2020.

Note: FIRE represents Finance, Insurance and Real Estate. WTU represents Wholesale, Transportation and Utilities.

Exhibit 26. Change in Employment by Industry and Neighborhood, 2010 – 2018

	North	South	Greenwood	Magnolia	Total
Const/Res	4.4%	9.1%	3.7%	14.7%	5.1%
FIRE	-0.4%	8.0%	2.3%	1.7%	1.5%
Manufacturing	-2.2%	3.5%	-4.9%	0.0%	-1.0%
Retail	1.6%	0.9%	4.8%	0.0%	1.8%
Services	3.6%	0.0%	6.0%	3.4%	3.2%
WTU	1.1%	0.0%	11.2%	-8.3%	0.9%
Government	-3.0%	3.1%	5.2%	-3.5%	-1.4%
Education	0.0%	1.7%	0.0%	1.7%	1.7%
Total	**2.0%**	**1.7%**	**5.3%**	**2.3%**	**2.1%**

Source: Puget Sound Regional Council, 2020.

Industrial Activity in the Commercial Study Area

The Ballard-Interbay corridor is home to a wide range of industrial activities. These include port operations, manufacturing, and maritime businesses. The broader North Industrial area, a region that approximates the Ballard-Interbay corridor but with some additional parcels along South Lake Union, was to home to 28,700 jobs in 2018. Of these, an estimated 12,000 jobs were in industries considered to be freight-oriented, and thus reliant on access to the Ballard-Interbay freight corridor for delivery or shipment of components, intermediate, and finished goods.

Of the remainder, other major industries with a strong presence in the area include information and communication technology (ICT; 5,600 jobs), other types of manufacturing (1,200 jobs), and various other services (6,500 jobs). A large share of job growth for non-freight-oriented industries between 2000 and 2018 came from the information and community technology (ICT) sector.

Exhibit 27. Employment in Seattle's North Industrial Areas by Industry, 2000-2018

Industry	2000	2018
Freight-oriented activities		
Construction and Utilities	2,300	2,100
Distribution & E-commerce	700	1,300
Food & Beverage Production	600	600
Aerospace	700	700
Transportation & Logistics	100	500
Maritime	4,700	5,600
Fishing	600	2,500
Other Manufacturing	2,100	1,200
Non-freight-oriented activities	7,600	16,700
Total	**18,800**	**28,700**

Sources: Puget Sound Regional Council, 2020; Community Attributes Inc., 2020.

Fishermen's Terminal and Terminal 91 are both Port of Seattle properties and home to a large segment of the North Pacific Fisheries Fleet. In 2017, vessels utilizing either facility, such as repairs or maintenance, offloading, or moorage during the offseason employed an estimated 7,200 workers and generated $671.3 million in business revenues. These vessels earned approximately half a billion dollars in revenues in the Alaska fisheries.[19] Terminal 91 includes commercial fishing facilities for loading and offloading larger catcher-processor vessels, providing critical infrastructure for Seattle-based fishing operations.

Many industrial businesses located in the Ballard-Interbay corridor are highly tradable, meaning they either source and/or export products to other parts of the U.S. and world. For example, the commercial fishing companies, along with many other food manufacturers in Washington state, on average

[19] Port of Seattle, Port of Tacoma, and The Northwest Seaport Alliance Economic Impact Analysis, 2019.

export more than 50% of their finished products to other parts of the U.S., and nearly 20% overseas.[20] Manufacturing businesses depend on access to a freight corridor to source inputs and ship products using the corridor connecting Northwest Seattle with Port of Seattle facilities in SODO.

Occupational and Workforce Analysis

The services sector supports a wide range of office and administrative support occupations as well as computer and mathematical occupations within the commercial study area, each representing more than 10% of employment. Production, transportation and material moving, and construction and extraction occupations together represent nearly 20% of occupational employment and more than 6,000 jobs. These occupations are mostly found in the manufacturing; warehousing, transportation and utilities; and construction and extraction sectors. (**Exhibit 28**)

Exhibit 28. Occupational Categories by Place of Work, Commercial Study Area, 2018

Occupation	Study Area Employment	Share of Employment
Office and Administrative Support Occupations	3,960	12%
Computer and Mathematical Occupations	3,210	10%
Sales and Related Occupations	2,950	9%
Business and Financial Operations Occupations	2,930	9%
Food Preparation and Serving Related Occupations	2,560	8%
Management Occupations	2,270	7%
Production Occupations	2,160	7%
Transportation and Material Moving Occupations	2,050	6%
Construction and Extraction Occupations	2,010	6%
Healthcare Practitioners and Technical Occupations	1,370	4%
Installation, Maintenance, and Repair Occupations	1,090	3%
Personal Care and Service Occupations	1,060	3%
Architecture and Engineering Occupations	950	3%
Building and Grounds Cleaning and Maintenance Occupations	680	2%
Healthcare Support Occupations	670	2%
Educational Instruction and Library Occupations	650	2%
Arts, Design, Entertainment, Sports, and Media Occupations	630	2%
Protective Service Occupations	450	1%
Life, Physical, and Social Science Occupations	370	1%
Community and Social Service Occupations	360	1%
Legal Occupations	250	1%
Farming, Fishing, and Forestry Occupations	130	0%
Total	**32,750**	**100%**

Sources: Puget Sound Regional Council, 2020; Washington State Employment Security Department, 2020; U.S. Census Bureau, 2020; Community Attributes, Inc, 2020.

[20] Washington State Office of Financial Management, "Washington State Input-Output Model," 2012.

As ICT employment has grown throughout Seattle, industrial areas and the Ballard-Interbay area, software developers are a common occupation. Other common occupations within the Ballard-Interbay area include retail salespersons, food preparation and serving workers, and office clerks. Service-related occupations dominate employment within the commercial study area. The service sector represents more than 50% of employment in 2018, an increase of 29% since 2010.

Exhibit 29. Average Wage by Occupational Category, Commercial Study Area, 2018

Occupation	Study Area Employment	Average Wage
Management Occupations	2,270	$128,800
Healthcare Practitioners and Technical Occupations	1,370	$114,800
Computer and Mathematical Occupations	3,210	$109,800
Architecture and Engineering Occupations	950	$90,900
Legal Occupations	250	$86,200
Business and Financial Operations Occupations	2,930	$80,000
Life, Physical, and Social Science Occupations	370	$78,900
Protective Service Occupations	450	$70,200
Arts, Design, Entertainment, Sports, and Media Occupations	630	$68,500
Construction and Extraction Occupations	2,010	$62,200
Sales and Related Occupations	2,950	$62,000
Installation, Maintenance, and Repair Occupations	1,090	$58,100
Educational Instruction and Library Occupations	650	$57,800
Community and Social Service Occupations	360	$56,600
Transportation and Material Moving Occupations	2,050	$55,600
Office and Administrative Support Occupations	3,960	$47,600
Production Occupations	2,160	$46,600
Building and Grounds Cleaning and Maintenance Occupations	680	$46,300
Farming, Fishing, and Forestry Occupations	130	$45,500
Healthcare Support Occupations	670	$44,600
Personal Care and Service Occupations	1,060	$41,100
Food Preparation and Serving Related Occupations	2,560	$35,800
Total	**32,750**	

Sources: Puget Sound Regional Council, 2020; Washington State Employment Security Department, 2020; Bureau of Labor Statistics, 2020; Community Attributes Inc., 2020.

Note: Average Wage figures are for Seattle-Tacoma-Bellevue MSA.

Study area workers earn slightly higher wages compared to the region overall. The median wage throughout the Seattle-Tacoma-Bellevue MSA is $53,360. Approximately 57% of workers in the BIRT commercial study area earn more than the Seattle MSA median wage. An estimated 21% of workers earn wages less than $35,000, and another 21% earn between $35,000 and $50,000. (**Exhibit 30**).

Exhibit 30. Wage Percentiles, Commercial Study Area, 2018

	Study Area Employment	Share of Employment
Less than $35,000	7,030	21%
$35,000-$50,000	7,020	21%
$50,000-$85,000	9,520	29%
$85,000-$125,000	5,010	15%
More than $125,000	4,170	13%
Total	**32,750**	**100%**

Sources: Puget Sound Regional Council, 2020; Washington State Employment Security Department, 2020; Bureau of Labor Statistics, 2020; Community Attributes Inc., 2020.

Note: Average Wage figures are for Seattle-Tacoma-Bellevue MSA.

Across the study area, 63% of occupations do not require higher education for entry (**Exhibit 31**). For comparison, 24% of residents in the study area have less education than an associate degree. Individuals in the study area generally have a higher level of education than the occupations within the area. The average wage among employees in the study area is $69,700 and the average wage of residents in the area is $60,300. On average workers in the study area earn more than residents of the study area.

Exhibit 31. Typical Education Level Required for Occupations in Commercial Study Area, 2018

Educational Requirement	Study Area Employment	Share of Jobs
No formal educational credential	6,970	21%
High school diploma or equivalent	11,090	34%
Postsecondary nondegree award	1,580	5%
Some college, no degree	900	3%
Associate degree	780	2%
Bachelor's degree	10,330	32%
Master's degree	480	1%
Doctoral or professional degree	620	2%
Total	**32,750**	**100%**

Sources: Puget Sound Regional Council, 2020; Washington State Employment Security Department, 2020; U.S. Census Bureau, 2020; Community Attributes, Inc, 2020.

Exhibit 32. Occupational Categories by Place of Residence, Residential Study Area, 2018

Occupation	Resident Employment	Share of Employment
Sales and Related Occupations	3,330	10%
Office and Administrative Support Occupations	3,230	10%
Management Occupations	2,950	9%
Arts, Design, Entertainment, Sports, and Media Occupations	2,830	9%
Educational Instruction and Library Occupations	2,750	9%
Healthcare Practitioners and Technical Occupations	2,710	8%
Business and Financial Operations Occupations	2,460	8%
Food Preparation and Serving Related Occupations	1,710	5%
Architecture and Engineering Occupations	1,500	5%
Legal Occupations	1,390	4%
Personal Care and Service Occupations	1,210	4%
Transportation and Material Moving Occupations	820	3%
Computer and Mathematical Occupations	760	2%
Life, Physical, and Social Science Occupations	760	2%
Community and Social Service Occupations	730	2%
Production Occupations	700	2%
Construction and Extraction Occupations	690	2%
Healthcare Support Occupations	560	2%
Building and Grounds Cleaning and Maintenance Occupations	360	1%
Installation, Maintenance, and Repair Occupations	350	1%
Protective Service Occupations	250	1%
Farming, Fishing, and Forestry Occupations	20	0%
Total	**32,070**	**100%**

Sources: U.S. Census Bureau, 2020; Community Attributes, Inc, 2020.

Residents of the Ballard-Interbay study area are employed in a diversity of occupation types. In total, nearly 30% of residents are employed in management occupations, sales occupations, and office and administrative occupations (**Exhibit 32**). These occupational categories represent 28% of employment within the area. Another 26% of resident occupations are made up of arts and recreation, educational instruction, and healthcare occupations. The same group accounts for 8% of employment in the study area.

Common occupations among more traditional industrial activities are underrepresented among residents compared to workers within the area. Occupations like production, transportation and material moving, and construction and extraction occupations represent 7% of jobs among residents and 19% of jobs in the study area.

COVID-19 IMPACTS OVERVIEW

The sudden emergence and spread of the COVID-19 have adversely affected all aspects of the regional economy. These impacts vary in intensity based on industry and economic activities. Between the middle of March and mid-June, there have been 733,000 initial unemployment claims made among workers in King, Pierce, and Snohomish counties. Most claims are from workers in industries that directly interact with customers, such as retail, accommodation, and food services. Even before the spread of COVID-19 in Washington state, factory closures in China disrupted supply chains for many Washington state businesses.

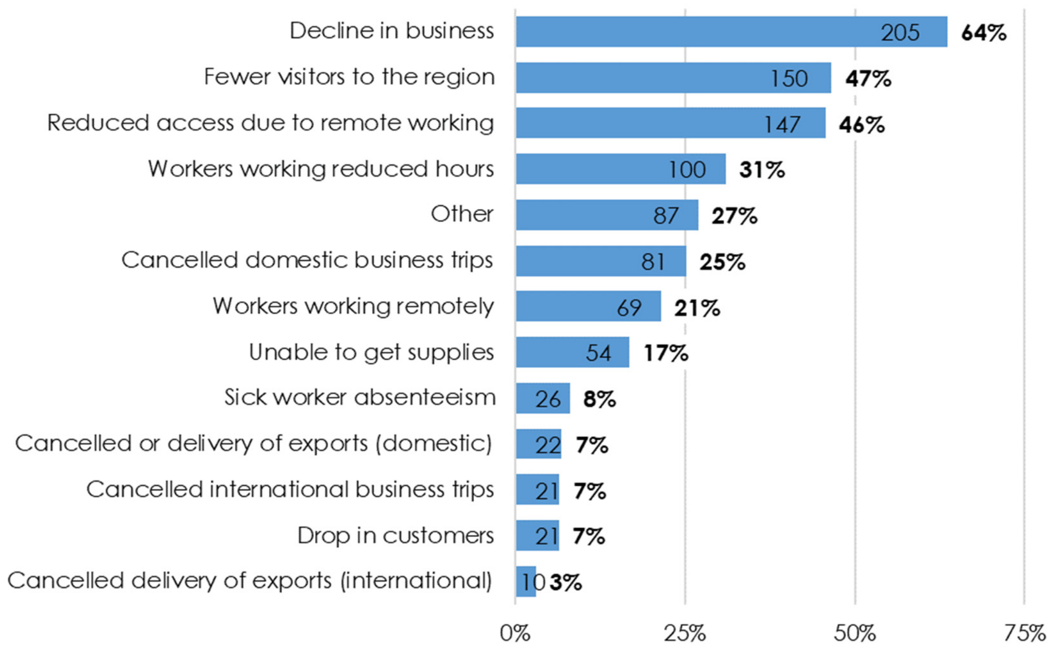
These impacts materialize into costs directly for businesses, workers, and households that utilize the Ballard-Interbay corridor. Many types of manufacturing have been temporarily prohibited or curtailed in compliance with social distancing. Many of these businesses were already and continue to be impacted by supply chain disruptions brought on by the virus, such as seafood processors in Interbay that rely on Chinese facilities for processing of Alaskan-caught seafood for re-export. Many commuters—especially those traveling to downtown Seattle from areas northwest—and households in the Ballard-Interbay region employed in non-essential industries have worked from home during this period, reducing traffic volumes.

The City of Seattle distributed a survey on business impacts and concerns due to COVID-19 in March and May 2020, collecting nearly 8,100 responses across both surveys. Of these, 321 were from businesses and workers in the BIRT study area. Approximately half these businesses have no employees and another 38% have less than five employees. 82% made less than $1 million in revenue in 2019. Roughly 48% are women-owned and 19% are minority or person of color owned.

The following are findings related to COVID-19 impacts among the businesses from the study area:

- 1,001 temporary and 134 permanent layoffs were reported. Roughly 63% did not anticipate any further layoffs.
- 36% were unsure whether they could make rent or mortgage payments and 41% said they could not.
- 83% were worried or very worried about their business and did not know if they will make it through.
- The top three impacts experienced by businesses in the study area were decline in business activity due to uncertainty, fewer visitors to the region, and reduced access to customers due to remote working (**Exhibit 33**).

Exhibit 33. COVID-19 Related Business Impacts Among Businesses in the Study Area, 2020



Sources: City of Seattle Office of Economic Development, 2020; Community Attributes, Inc, 2020.

Outlook for Virus Recovery for the Local Economy and Relevant Industries

Most national projections show the deepest economic contractions occurring in the second quarter, followed by economic recovery in the third and fourth quarters of 2020. The first quarter of 2020 experienced a 4.8% annualized contraction in the U.S. economy. Projections for the second quarter, where the impacts of the virus in terms of laid off or furloughed workers and reduced consumer spending have been most severe, range between -30% and -40%, on an annualized basis.

Even after national output rebounds later this year, there will likely be a prolonged lag effect on employment recovery. Some workers will be able to go back to work, but for others the businesses they were employed in—especially in the case of restaurants—may close permanently.

Several uncertainties could dramatically shape the future labor market. These include expedited or accelerated adoption of new work settings, business operations, and household consumption habits, such as remote work, scaling back of air travel and certain business expenses, and greater and sustained reliance on e-commerce and in-home entertainment. The pandemic has also caused some U.S. businesses to diversify their supply chains away from China, which could affect business costs and sourcing options for Ballard-Interbay manufacturers.

The virus may also induce more lasting, transformative changes amongst Seattle residents and businesses. These could include an increase in household savings rates and reluctance of consumers to patronize restaurants and crowded spaces. Downtown businesses might reassess their office real estate needs and support remote work. These changes may affect daily traffic volumes and activity along the Ballard-Interbay corridor.

Ballard Interbay Regional Transportation System (BIRT) Study

Appendix F: Corridor Management Strategies

November 2020

Seattle Department of Transportation

Ballard-Interbay Regional Transportation System

Summary of Corridor Management Strategies - FINAL

Submit to: Diane Wiatr, Chisaki Muraki-Valdovinos; SDOT
Submitted by: Tony Woody, Steve Diebol; Concord Engineering
Copied: Tom Brennan; Nelson/Nygaard, Kendra Breiland; Fehr and Peers
Date: August 14, 2020 (Updated October 6, 2020)

1. Introduction and Overview

The Multi-Modal Needs Assessment report documented the traffic operations analysis previously conducted for the Existing, Future 2042 Baseline, and base conditions of two Future Bridge Scenarios for the Ballard-Interbay Regional Transportation (BIRT) system project. A list of additional network improvement projects was developed with the goal of enhancing transportation system operations, person throughput, goods and freight movements, and overall system reliability beyond the base conditions of the bridge projects. The purpose of the corridor management strategies (CMS) analysis is to evaluate the traffic operational benefits of these additional network improvements.

2. Study Area and Corridor Descriptions

The transportation analysis study area is bound by NW Market Street to the north, 14th Avenue W to the east, W Mercer Place to the south, and Thorndyke Avenue W to the west. A primary concern about transportation is the throughput along the major study area corridors. For this reason, proposed projects were packaged into corridor management strategies for each of six major corridors listed below.

- 15th Avenue NW/W: Market St. to Mercer Pl. (Corridor 1)
- NW Leary Way: 17th Ave. NW to 14th Ave. NW (Corridor 2)
- W Emerson Street/W Nickerson St.: Gilman Drive to 13th Avenue NW (Corridor 3)
- W Dravus Street – 20th Ave. NW to 14th Ave. NW (Corridor 4)
- Armory Way Bridge – Thorndyke Ave. to 15th Avenue W via Armory Bridge (Corridor 5)
- Magnolia Bridge – 23rd Ave. NW to Terminal 91 (Corridor 6)

The project list developed by the BIRT consultant team for the multi-modal needs assessment included projects specifically targeting improvements for pedestrians, bicyclists, general purpose traffic, freight, and transit. The primary purpose of the corridor management strategies is to identify the impacts and benefits of projects on vehicular operations with the stated objective of improving person throughput and the movement of goods and freight. It should be noted that conflicts between these vehicular-focused projects and other modes of travel are expected to be evaluated in other studies. Figure 1 provides a map of the study corridors and Table 1 provides a summary of the traffic, freight, and transit characteristics of each of the corridors.

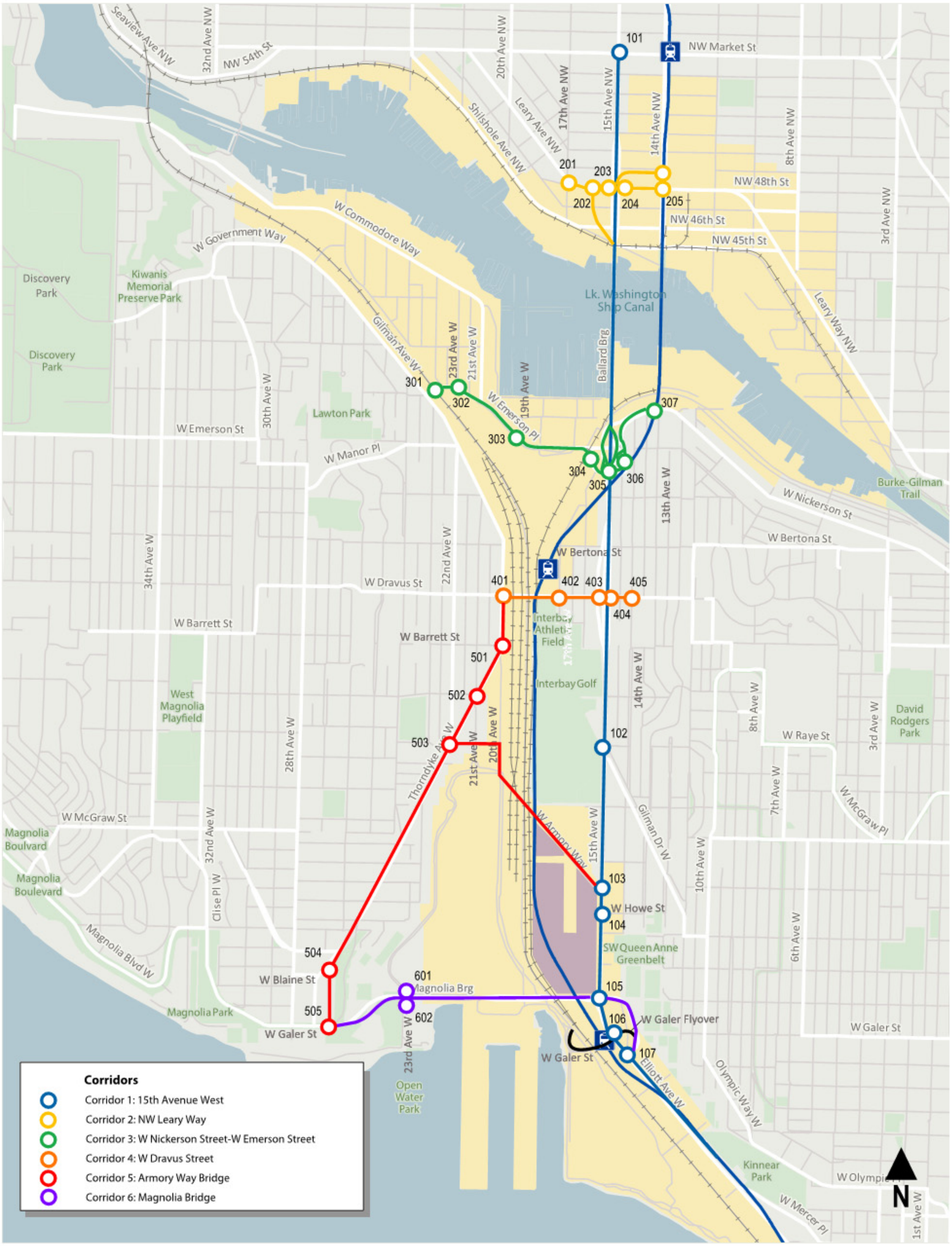


Figure 1. Study Corridors and Intersections

Table 1. Traffic, Freight, and Transit Characteristics of Corridors

Corridor	Extents	Classification	Posted Speed	ADT	AM/PM Peak Traffic	AM/PM HV%	Transit Routes
15th Ave. W (Corridor 1)	NW Market St. / W Mercer Pl.	Principal Arterial	35	59,000	3,600 / 3,700	5 / 3	15, 17, 18, 19, 24, 29, 32, 33, D Line
NW Leary Way (Corridor 2)	17th Ave. NW / 14th Ave. NW	Principal Arterial	35	21,200	1,200 / 1,600	6 / 2	17,18,40
W Emerson St./ W Nickerson St. (Corridor 3)	Gilman Ave. W / 13th Ave. W	Principal Arterial	25/35	18,700	1,200 / 1,400	4 / 3	29, 31, 32
W Dravus St. (Corridor 4)	20th Ave. W / 14th Ave. W	Principal Arterial	35	16,200*	1,000 / 1,300	2 / 2	994 (school route)
Armory / Thorndyke (Corridor 5)	W Galer St. & Thorndyke Ave. W / W Galer St. Flyover & Elliot Ave. W	Minor Arterial	35	5,000*	300 / 500	5 / 2	31, 33
Magnolia Bridge (Corridor 6)	W Galer St. & Thorndyke Ave. W / W Galer St. Flyover & Elliot Ave. W	Minor Arterial	30	20,000*	1,100 / 1,200	5 / 4	19, 24, 33

Notes:
-*Daily volumes estimated from peak hour counts

3. Corridor Opportunities and Needs

3.1 Analysis Methodologies

The multi-modal needs assessment report documented the existing and future 2042 baseline conditions for the BIRT study area. The analysis was conducted using Synchro Highway Capacity Manual (HCM) 2000 Level-of-Service and Delay reporting for the AM and PM peak hours. Forecast year 2042 peak hour traffic projections for two bridge replacement scenarios were developed as part of the traffic analysis effort. The two scenarios included; *Scenario 1: Mid-Height Ballard Bridge and Magnolia Bridge 1-1 replacement and Scenario 2: Low-Height Ballard Bridge with Armory Way Bridge alternative*. The future year projections were based on an EMME model from the West Seattle Ballard Link Extension study, originally derived from PSRC land use models.

For the corridor management strategies analysis, the models were updated to incorporate individual intersection improvements packaged together by corridor for the purposes of improving the mobility of people and goods. For each of the corridors, additional improvement strategies to relieve traffic, transit, and freight related congestion were identified above and beyond the projects already identified in the bridge replacement scenarios developed as part of the BIRT study.

3.2 Summary of Corridor Performance and Needs

Congestion impeding the movement of people and goods was the primary need identified for all six of the study corridors under the two bridge improvement scenarios. To quantify the congestion peak hour movement delay was calculated at key intersections along the corridors for freight and transit vehicles. Table 2 provides the average delay and Level-of-Service (LOS) for the worst performing traffic movement for freight and transit vehicles at each intersection along the study corridors by peak hour under the two bridge replacement scenarios. Table 3 shows the average travel time under normal conditions for freight and transit along the six study corridors under the 2042 base bridge replacement scenarios.

Table 2. Freight and Transit Intersection Movement Level-of-Service; 2042 Base Alternatives

ID	Corridor/ Intersection	Control	Freight LOS				Transit LOS			
			AM Peak		PM Peak		AM Peak		PM Peak	
			2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2
Corridor 1: 15th Avenue W										
101	NW Market St	Signal	F (SBT)	F (SBT)	F (NBT)	F (NBT)	C (SBT)	C (SBT)	C (NBT)	C (NBT)
102	Gilman Dr W	Signal	F (SBT)	E (SBT)	F (NBT)	F (NBT)	A (SBT)	A (SBT)	B (NBT)	B (NBT)
103	W Armory Way	Signal	F (SBT)	F (SBT)	D (NBT)	F (NBT)	A (SBT)	D (SBT)	A (NBT)	A (NBT)
104	W Howe St	Signal	F (SBT)	F (SBT)	F (NBT)	F (NBT)	B (SBT)	A (SBT)	E (NBT)	E (NBT)
105	W Garfield St	Signal	E (SBT)	F (SBT)	F (NBT)	F (NBT)	A (SBT)	A (SBT)	A (NBT)	A (NBT)
106	W Galer St	Signal	B (SBT)	A (SBT)	D (NBT)	F (NBT)	A (SBT)	A (SBT)	B (NBT)	B (NBT)
107	Galer Flyover	Signal	F (NBT)	A (SBT)	F (NBT)	F (NBT)	F (NBT)	A (NBT)	B (NBT)	A (NBT)
Corridor 2: NW Leary Way										
201	17th Ave NW	TWSC	C (WBT)	A (WBT)	C (WBT)	A (WBT)	C (WBT)	A (WBT)	C (WBT)	A (WBT)
202	15th Ramps (new)	Signal	C (EBT)	A (EBT)	C (EBT)	A (EBT)	C (EBT)	A (EBT)	C (EBT)	A (EBT)

Table 2. Freight and Transit Intersection Movement Level-of-Service; 2042 Base Alternatives

ID	Corridor/ Intersection	Control	Freight LOS				Transit LOS			
			AM Peak		PM Peak		AM Peak		PM Peak	
			2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2
203	15th SB Ramps	Signal	C (EBT)	E (EBT)	C (WBT)	D (EBT)	C (EBT)	E (EBT)	C (WBT)	D (EBT)
204	15th NB Ramps	Signal	C (WBT)	B (WBT)	B (WBT)	D (WBT)	C (WBT)	B (WBT)	B (WBT)	D (WBT)
205	14th Ave NW	Signal	B (WBT)	A (WBT)	D (WBT)	B (WBT)	B (WBT)	A (WBT)	D (WBT)	B (WBT)
Corridor 3: W Emerson Place / W Nickerson Street										
301	Gilman Ave W	AWSC	F (SEL)	F (SEL)	F (WBR)	F (WBR)	F (SEL)	F (SEL)	F (WBR)	F (WBR)
302	23rd Ave W	TWSC	A (EBT)	A (EBT)	A (WBT)	A (WBT)	A (EBT)	A (EBT)	A (WBT)	A (WBT)
303	19th Ave W	Signal	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)
304	SB 15th Off Ramp	Signal	B (EBR)	B (EBR)	C (NBL)	C (NBL)	B (EBR)	B (EBR)	C (NBL)	C (NBL)
305	15th Ramps	Signal	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)
306	NB 15th Ramps	Signal	B (NBR)	B (NBR)	B (WBL)	B (WBL)	B (NBR)	B (NBR)	B (WBL)	B (WBL)
307	13th Ave W	Signal	B (EBT)	B (EBT)	A (EBT)	A (EBT)	B (EBT)	B (EBT)	A (EBT)	A (EBT)
Corridor 4: W Dravus Street										
401	20th Ave W	Signal	D (EBT)	E (EBT)	F (WBT)	F (WBT)	D (EBT)	E (EBT)	F (WBT)	F (WBT)
402	17th Ave W	Signal	A (EBT)	A (EBT)	B (WBT)	B (WBT)	A (EBT)	A (EBT)	B (WBT)	B (WBT)
403	SB 15th Ramps	Signal	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)
404	NB 15th Ramps	Signal	D (WBT)	D (WBT)	F (WBT)	F (WBT)	D (WBT)	D (WBT)	F (WBT)	F (WBT)
405	14th Ave W	TWSC	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)
Corridor 5: Thorndyke Avenue W & W Armory Way										
501	20th Ave W	TWSC	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)

Table 2. Freight and Transit Intersection Movement Level-of-Service; 2042 Base Alternatives

ID	Corridor/ Intersection	Control	Freight LOS				Transit LOS			
			AM Peak		PM Peak		AM Peak		PM Peak	
			2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2	2042 Scen. 1	2042 Scen. 2
502	21st Ave W	TWSC	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)
503	W Armory Way	Signal	NA	F (WBL)	NA	C (WBL)	NA	F (WBL)	NA	C (WBL)
504	W Blaine St	TWSC	B (EBL)	F(EBL)	B (EBL)	F (EBL)	B (EBL)	F (EBL)	B (EBL)	F (EBL)
505	W Galer St	TWSC	F (SBL)	F (SBR)	C (SBR)	C (SBR)	F (SBL)	F (SBR)	C (SBR)	C (SBR)
Corridor 6: Magnolia Bridge										
601	23rd Ave NW	TWSC	A (EBLR)	A (EBLR)	A (EBLR)	A (EBLR)	A (EBLR)	A (EBLR)	A (EBLR)	A (EBLR)
602	Terminal 91 Gate	TWSC	A(NBR)	A(NBR)	A(NBR)	A(NBR)	A (NBR)	A (EBLR)	A (NBR)	A (EBLR)

Notes:
- Red Shading – LOS F (average vehicular delay >80 seconds for signalized intersections, >55 seconds for unsignalized intersections)
- Yellow Shading – LOS E (average vehicular delay 55-79 seconds for signalized intersections, 35-55 seconds for unsignalized intersections)
- Level-of-Service (LOS) based on Highway Capacity Manual (HCM) 2000 methodology
- Worst-performing traffic movement for each scenario/peak hour shown as follows: (XXY) XX is approach direction (NB – Northbound, SB – Southbound, EB – Eastbound, WB – Westbound) and Y is the movement (L – Left, T – Thru, R – Right)
- Scenario 1: Mid-Height Ballard Bridge and Magnolia Bridge 1-1 replacement
- Scenario 2: Low-Height Ballard Bridge with Armory Way Bridge alternative

Table 3. Freight and Transit Travel Times by Corridor, Base Bridge Replacement Scenarios

Corridor/ Segment	Direction	Free^ Flow (mins)	Freight Travel Time (minutes)				Transit Travel Time (minutes)			
			AM Peak		PM Peak		AM Peak		PM Peak	
			Scen. 1	Scen. 2	Scen. 1	Scen. 2	Scen. 1	Scen. 2	Scen. 1	Scen. 2
Corridor 1: 15th Ave W	SB	5.2	14.8	21.9	7.4	7.7	10.6	12.0	10.7	12.1
	NB	5.2	8.2	8.4	21.0	24.6	12.6	12.9	13.3	17.3
Corridor 2: NW Leary Way	EB	0.5	1.7	1.9	1.9	1.5	2.2	2.4	2.4	2.0
	WB	0.5	1.7	1.0	2.2	1.5	2.2	1.5	2.7	2.0
Corridor 3: W Emerson Pl / W Nickerson St	EB	2.0	5.3	5.3	4.1	4.1	4.8	4.8	3.6	3.7
	WB	2.0	4.7	4.7	10.8	10.8	4.3	4.3	10.4	10.4
Corridor 4: W Dravus St.	EB	0.6	4.6	5.0	3.2	3.6	4.5	4.9	3.1	3.5
	WB	0.6	2.2	2.3	4.8	6.2	2.1	2.2	4.7	6.1

Table 3. Freight and Transit Travel Times by Corridor, Base Bridge Replacement Scenarios

Corridor/ Segment	Direction	Free^ Flow (mins)	Freight Travel Time (minutes)				Transit Travel Time (minutes)			
			AM Peak		PM Peak		AM Peak		PM Peak	
			Scen. 1	Scen. 2	Scen. 1	Scen. 2	Scen. 1	Scen. 2	Scen. 1	Scen. 2
Corridor 5: Thorndyke Ave W / W Armory Way	EB	3.5	NA	7.3	NA	18.4	NA	8.5	NA	11.3
	WB	3.5	NA	16.0	NA	7.9	NA	11.8	NA	8.8
Corridor 6: Magnolia Bridge	EB	2.0	4.9	NA	2.7	NA	4.4	NA	2.2	NA
	WB	1.9	3.8	NA	3.8	NA	3.3	NA	3.3	NA

Notes:
- ^ Freeflow travel time represents the travel time a general purpose vehicle would experience when no traffic congestion is present
- Expected travel times are calculated by the vehicle running time plus average intersection delay, with dwell time added to transit movements and reduced turning speeds for turns and grade for freight vehicles. Travel times during congestion expected to be up to 50% greater than the values listed.
- Scenario 1: Mid-Height Ballard Bridge and Magnolia Bridge 1-1 replacement
- Scenario 2: Low-Height Ballard Bridge with Armory Way Bridge alternative

The following bulleted lists summarize the existing needs relative to improving the movement of people and goods by evaluating freight and transit travel times and bottleneck locations with excessive delay.

15th Avenue W (Corridor 1)

Primary Needs:

- Southbound congestion in AM and
- Northbound congestion in PM

Scenario 1 Bottlenecks:

- Southbound through in AM at all intersections but W Galer St., with cumulative delay for freight over 5 minutes
- Northbound through in PM at Galer Flyover, Gilman Dr W, NW Market St. with all intersections cumulatively delaying freight by over 11 minutes and transit by over 3 minutes

Scenario 2 Bottlenecks:

- Southbound through in AM at NW Market St., W Armory Way, and W Howe St. with all intersections cumulatively delaying freight by over 12 minutes and transit by 2 minutes
- Northbound through in PM at all intersections except W Armory Way with all intersections cumulatively delaying freight by over 15 minutes and transit by nearly 7 minutes

NW Leary Way (Corridor 2)

Primary Needs:

- Increase mobility of people and goods through closely spaced signalized, high-access locations

Scenario 1 Bottlenecks:

- No locations with through movement worse than LOS D, but southbound left turn from 17th Avenue W is LOS F. Little impact on through movement travel time of freight and transit.

Scenario 2 Bottlenecks:

- Eastbound through in AM at 15th Avenue W southbound ramps is LOS E, however not a significant cause of delay to freight and transit along the short corridor.
- Southbound left turn from 17th Avenue W is LOS F.

W Emerson Place / W Nickerson Street (Corridor 3)

Primary Needs:

- Maintain mobility of people and goods while balancing serving access points.

Scenario 1 Bottlenecks:

- W Emerson Pl & Gilman Ave W as an all-way stop controlled intersection has excessive delay on multiple approaches, 19th Avenue W and at northbound off ramp approaches are LOS E. Little delay for through movements of freight and transit except at Gilman Ave W.

Scenario 2 Bottlenecks:

- Same as Scenario 1

W Dravus Street (Corridor 4)

Primary Needs:

- Trucks unable to make turning maneuvers in lane at intersections with 15th Avenue W ramps

Scenario 1 Bottlenecks:

- 20th Avenue W intersection in both peak hours, eastbound through movement at 15th Avenue West southbound ramps in AM peak, westbound through movement at 15th Avenue W northbound ramps in PM peak. Eastbound and westbound freight and transit delayed by 1-2 minutes due to congestion in both peaks.

Scenario 2 Bottlenecks:

- Same as Scenario 1, except with 10-50 percent more delay due to higher vehicular demand to use W Dravus Street with the Armory Way bridge alternative. Eastbound and westbound freight and transit delayed by 2-4 minutes due to congestion in both peaks.

Thorndyke Avenue W / W Armory Way (Corridor 5)

Primary Needs:

- Maintain mobility of people and goods while balancing serving access points.

Scenario 1 Bottlenecks:

- Not Applicable

Scenario 2 Bottlenecks:

- Eastbound W Blaine Street in both peak hours, Southbound W Galer Street left turn in AM peak, westbound W Armory Way left turn in AM peak, similar bottlenecks along 15th Avenue W from W Armory Way intersection along shared corridor segment connecting to the W Galer Street Flyover intersection as in Corridor 1, Scenario 2.

Magnolia Bridge (Corridor 6)

Primary Needs:

- Maintain mobility of people and goods

Scenario 1 Bottlenecks:

- Westbound left turn on W Galer Flyover at 15th Avenue W.

Scenario 2 Bottlenecks:

- Not Applicable

4. Corridor Management Strategies

4.1 Strategy Categories and Sources

A set of corridor management strategies were drawn from a variety of previous studies including the Magnolia Bridge Planning Study (MBPS), Ballard Bridge Planning Study (BBPS), SDOT Freight Master Plan (FMP), SDOT programmed improvements (SDOT), the Expedia Campus Transportation Technical Report (EXP), Move Ballard (MB), and new concepts developed by the Ballard-Interbay Regional Transportation Study consultant team (BIRT). The corridor management strategies were grouped and organized in the following categories:

- Signal Operations
- ITS Strategies
- Traffic Control
- Channelization/Striping
- Access Management
- Capital Improvements

The corridor management strategies were analyzed individually at the intersection level and as a package at the corridor level in order to determine independent value as well as to determine overall benefits for freight or transit travel along the six study corridors. The overall congestion relief attributed to some of the strategies is not able be quantified due to limitations in traffic modeling tools but were still included if they were believed to qualitatively provide congestion relief to freight or transit travel.

4.2 Summary of Corridor Management Strategies

Several corridor management strategies were compiled and analyzed to determine potential performance improvements for each key corridor. Table 4 provides a summary of the corridor management strategy types along each corridor. A full list of all corridor management strategies is included in Attachment A of the memo.

Table 4. Summary of Corridor Management Strategies by Type and Corridor

Corridor	Strategy Type					
	Signal Operations (SO)	ITS Strategies (ITS)	Traffic Control (TC)	Channelization/ Striping (CHAN)	Access Management (AM)	Capital Improvements (CI)
15th Ave. W (Corridor 1)	1	1	1	7	3	
NW Leary Way (Corridor 2)	4	1		2	2	1
W Emerson St. / W Nickerson St. (Corridor 3)	4	3	1			
W Dravus St. (Corridor 4)	2	3		3	1	
Thorndyke Ave. W / Armory Bridge (Corridor 5)		1	1	4		3
Magnolia Bridge (Corridor 6)				2		1
Total	11	9	3	18	6	5

Tables 5 - 7 provide a detailed description each of the corridor management strategies, including demonstrated needs, strategy details and expected performance improvement after implementation. The tables are broken out by strategies that can be applied independently from the bridge scenarios 1 and 2 (independent utility strategies), strategies that must be implemented with bridge scenario 1 and strategies that must be implemented with bridge scenario 2. Figure 2 shows a graphic summary of the strategies for each corridor.

Table 5. Corridor Management Strategies with Independent Utility

Corridor	Location/ Strategy ID	Description of Need	Strategy	Type	Primary Modal Benefit	Vehicle Delay Savings
15th Ave. W (Corridor 1)	100	AM congestion SB and PM congestion NB	Install adaptive signal system & suite of ITS strategies	SO/ITS	GP	<30 sec
	101	Freight LOS F SB in AM & NB in PM	Convert BOLs to FAT lanes	CHAN	F	>2 min
	102	Freight LOS F SB in AM & NB in PM; Transit LOS F SB in AM	Convert BOLs to FAT lanes	CHAN	F	>2 min
	103a	Freight LOS F SB in AM	Convert BOLs to FAT lanes	CHAN	F	>2 min
	104a	Freight LOS F SB in AM & NB in PM, Transit LOS E NB in PM	Convert BOLs to FAT lanes	CHAN	F	>2 min
	105a	Freight & Transit LOS F NB in PM	Convert BOLs to FAT lanes	CHAN	F	30 sec – 2 min
	106	Continuity and signal coordination	Convert BOLs to FAT lanes	CHAN	F	<30 sec
	107	Freight and Transit LOS F NB in AM	Convert BOLs to FAT lanes	CHAN	F	>2 min
Corridor 2: NW Leary Way	200	Congestion impedes freight and transit	Install adaptive signal system & suite of ITS strategies	SO/ITS	GP	<30 sec
	201	Minor street approaches LOS E	Optimize adjacent signals to add gaps	SO	GP	<30 sec
	203b	Freight & Transit LOS E EB in AM	Implement FAT lanes	CHAN	F, T	<30 sec
	204b	Moderate congestion (LOS D) westbound in PM	Implement FAT lanes	CHAN	F, T	<30 sec
	205	Minor street approaches LOS D	Optimize signal operations	SO	GP	<30 sec
	300	Congestion impedes freight and transit	Suite of ITS strategies	ITS	GP	<30 sec

Table 5. Corridor Management Strategies with Independent Utility

Corridor	Location/ Strategy ID	Description of Need	Strategy	Type	Primary Modal Benefit	Vehicle Delay Savings
Corridor 3: W Emerson Pl / W Nickerson St	301	Freight and Transit LOS E EB in AM & LOS F WB in PM	Install traffic signal	TC	GP	30 sec – 2 min
	302	Minor street approach LOS E	Optimize signal operations	SO	GP	<30 sec
	303	Minor street approach LOS F	Optimize signal operations	SO	GP	<30 sec
	304	Moderate congestion (LOS D) in both peak hours	Optimize signal operations	SO	GP	<30 sec
	305	Eastbound and Westbound through movements high LOS D in both peak hours	Optimize signal operations	SO	GP	<30 sec
	306	15th Ave. off ramp queuing and delay	Add queue detectors	ITS	GP	<30 sec
	307	Conflicts with trains, trail traffic on north leg	Upgrade vehicle, ped/bike, and queue detectors	ITS	GP	<30 sec
Corridor 4: W Dravus St	400	Multi-modal conflicts with freight/transit	Update channelization/striping	CHAN	F, T	<30 sec
	401a	Freight & Transit LOS F WB in PM, GP LOS F NB & SB	Optimize signal operations	SO	GP	<30 sec
	401b	Driveway access conflicts	Modify driveway access	AM	GP	<30 sec
	402	Maintain freight and transit mobility	Optimize signal operations	SO	GP	<30 sec
	403	Geometric constraints for large vehicles	Channelization and detection upgrades	CHAN, ITS	F, T	<30 sec
	404	Geometric constraints for large vehicles	Channelization and detection upgrades	CHAN, ITS	F, T	<30 sec
	405	Congestion impedes freight and transit	Suite of ITS strategies	ITS	F, T	<30 sec

Table 5. Corridor Management Strategies with Independent Utility

Corridor	Location/ Strategy ID	Description of Need	Strategy	Type	Primary Modal Benefit	Vehicle Delay Savings
Corridor 5: Thorndyke Ave W / W Armory Way	500a	Congestion impedes freight and transit	Suite of ITS strategies	ITS	GP	<30 sec
	501	Geometric constraints for large vehicles	Update channelization/striping	CHAN	GP	<30 sec
	502	Multi-modal conflicts	Update channelization/striping	CHAN	GP	<30 sec
	505	Freight & Transit SB right turn LOS F in AM	Install traffic signal	TC	GP	<30 sec

Notes:

Orientation Key:
NB – Northbound, SB – Southbound, EB – Eastbound, WB - Westbound
Strategy Key:
BOL – Bus Only Lane FAT – Freight and Transit Lane, SO – Signal Operations, ITS – Intelligent Transportation Systems, TC – Traffic Control, CHAN – Channelization & Striping, AM – Access Management, CI – Capital Improvements
Primary Modal Benefit Key:
GP – General Purpose Traffic, F – Freight, T – Transit
Benefit: Listed value is either the quantifiable delay savings at the location from Synchro model analysis or a qualitative benefit from strategies that could not be adequately modeled in this study

Table 6. Corridor Management Strategies: Implementable in Scenario 1

Corridor	Location/ Strategy ID	Description of Need	Strategy	Type	Mode Target	Vehicle Delay Savings
Corridor 2: NW Leary Way	202	Ballard Bridge Replacement	Construct new southbound 15th Ave on ramp with Mid-Height Ballard Bridge scenario	CI	GP	30 sec – 2 min
	601	Unclear intersection control	Update channelization/striping	CHAN	GP	<30 sec

Table 6. Corridor Management Strategies: Implementable in Scenario 1

Corridor	Location/ Strategy ID	Description of Need	Strategy	Type	Mode Target	Vehicle Delay Savings
Corridor 6: Magnolia Bridge	602	Unclear intersection control	Update channelization/striping	CHAN	GP	<30 sec

Notes:

Orientation Key:
NB – Northbound, SB – Southbound, EB – Eastbound, WB - Westbound
Strategy Key:
BOL – Bus Only Lane FAT – Freight and Transit Lane, SO – Signal Operations, ITS – Intelligent Transportation Systems, TC – Traffic Control, CHAN – Channelization & Striping, AM – Access Management, CI – Capital Improvements
Primary Modal Benefit Key:
GP – General Purpose Traffic, F – Freight, T – Transit
Benefit: Listed value is either the quantifiable delay savings at the location from Synchro model analysis or a qualitative benefit from strategies that could not be adequately modeled in this study

Table 7. Corridor Management Strategies: Implementable in Scenario 2

Corridor	Location/ Strategy ID	Description of Need	Strategy	Type	Mode Target	Vehicle Delay Savings
Corridor 1: 15th Ave. W	105b	Freight LOS F SB in AM, Freight & Transit LOS F NB in PM	Remove traffic signal, prohibit left turns	TC/AM	GP	>2 min
Corridor 2: NW Leary Way	203a	Freight & Transit LOS E EB in AM	Prohibit WB left, force through movement then right turn loop via 17th/49th	AM	GP	<30 sec
	204a	Moderate congestion (LOS D) westbound in PM peak	Prohibit EB left, force through movement then right turn loop via 14th/Ballard Way	AM	GP	No Benefit
Corridor 5: Thorndyke Ave W / W Armory Way	500b	Congestion impedes freight and transit	Implement FAT lanes (may require widening in some locations)	CI/CHAN	GP	30 sec – 2 min
	503	Freight and Transit WB left LOS F in AM and PM	Add northbound right turn lane	CI	GP	<30 sec
	504	Eastbound approach LOS F in both peaks	Implement FAT lanes (requires widening)	CI/CHAN	GP	30 sec – 2 min

Notes:

Orientation Key:
NB – Northbound, SB – Southbound, EB – Eastbound, WB - Westbound
Strategy Key:
BOL – Bus Only Lane FAT – Freight and Transit Lane, SO – Signal Operations, ITS – Intelligent Transportation Systems, TC – Traffic Control, CHAN – Channelization & Striping, AM – Access Management, CI – Capital Improvements
Primary Modal Benefit Key:
GP – General Purpose Traffic, F – Freight, T – Transit
Benefit: Listed value is either the quantifiable delay savings at the location from Synchro model analysis or a qualitative benefit from strategies that could not be adequately modeled in this study

Figure 2. Summary of Corridor management Strategies

4.3 Corridor Management Strategies: Performance Summary

Study Intersection Performance

Intersection performance was evaluated using the worst LOS movement for freight and transit at each study location as shown in Tables 8 and 9 and Figures 3-6.

Freight LOS is measurably improved with the implementation of the following Corridor Management Strategies: 103-105 (Scenarios 1 and 2), 503 (Scenario 2), and 505 (Scenarios 1 and 2). Freight is most benefited by strategies including Freight and Transit lanes. At all other locations, LOS for freight remains the same or improves in one of the peak hours.

Although a LOS F designation is defined by 80 seconds or more of delay for signalized locations, many of the strategies provide significant delay savings despite the movement remaining at LOS F. Freight LOS degrades for strategy 204 under Scenario 2 in the PM peak, but there are no other freight movements that degrade in LOS with the implementation of any of the strategies.

Transit LOS is measurably improved with the implementation of the following corridor management strategies: 103 (Scenario 2), 104 (Scenario 2), 203 (Scenario 2), 503 (Scenario 2), and 505 (Scenarios 1 & 2). Transit delay increases with the implementation of the corridor management strategy at 204 under Scenario 2 in the PM peak. All other Transit movements remain at the same LOS as the base conditions.

Corridor Performance

Corridor performance was evaluated using the overall corridor travel time for freight and transit at each of the six study area corridors as shown in Tables 10 and 11.

Freight performance on Corridor 1 is greatly improved under both Scenarios, and transit performance improves under all conditions with one exception - southbound transit in the AM peak under Scenario 1 which increases by 1.2 minutes. Benefits for freight range from 0.4 minutes to 17.3 minutes of reduced travel time. Corridor 2 shows mixed results for both modes of travel; however, the travel times do not change by more than 0.7 minutes under any of the evaluated conditions. Freight and transit performance for Corridor 3 also shows mixed results, with the majority of added delay at W Emerson Pl. & Gilman Ave. W due to a change of traffic control, which does provide better overall operations. Corridor 4 shows slight benefits to both modes under Scenario 2 and little change under Scenario 1. Under Scenario 2, the corridor management strategies considerably improve freight and transit travel time. Freight and transit performance on Corridor 6 (Magnolia Bridge) is expected to degrade due to converting uncontrolled eastbound/westbound approaches on W Galer St. at Thorndyke Ave. W to signal control, and the modifications to timing at W Galer St. Flyover and W Elliot Ave. Travel time may increase by 0.1 to 1.7 minutes under Scenario 1.

Permitting freight to use existing bus only lanes by converting them to freight and transit Lanes does not appear to have negative impacts to transit travel time. Other spot improvements recommended generally show minor improvements to freight and transit.

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Table 8. Freight and Transit: Intersection Movements Level-of-Service; 2042 Alternatives Comparison – AM Peak

ID	Corridor/Intersection	Control	Freight LOS				Transit LOS			
			2042 Scenario 1: *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*		**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*		**2042 Scenario 1:** *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*		**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*	
			Base	w/CMS	Base	w/CMS	Base	w/CMS	Base	w/CMS
	Corridor 1: 15th Avenue W									
101	NW Market St	Signal	F (SBT)	C (SBT)	F (SBT)	C (SBT)	C (SBT)	C (SBT)	C (SBT)	C (SBT)
102	Gilman Dr W	Signal	F (SBT)	A (SBT)	E (SBT)	A (SBT)	A (SBT)	A (SBT)	A (SBT)	A (SBT)
103	W Armory Way	Signal	F (SBT)	A (SBT)	F (SBT)	C (SBT)	A (SBT)	A (SBT)	D (SBT)	C (SBT)
104	W Howe St	Signal	F (SBT)	B (SBT)	F (SBT)	A (SBT)	B (SBT)	B (SBT)	A (SBT)	A (SBT)
105	W Garfield St	Signal	E (SBT)	A (SBT)	F (SBT)	A (SBT)	A (SBT)	A (SBT)	A (SBT)	A (SBT)
106	W Galer St	Signal	B (SBT)	A (SBT)	A (SBT)	A (SBT)	A (SBT)	A (SBT)	A (SBT)	A (SBT)
107	Galer Flyover	Signal	F (NBT)	F (NBR)	A (SBT)	A (SBT)	F (NBT)	F (NBT)	A (NBT)	A (NBT)
	Corridor 2: NW Leary Way									
201	17th Ave NW	TWSC	A (WBT)	A (WBT)	A (WBT)	A (WBT)	A (WBT)	A (WBT)	A (WBT)	A (WBT)
202	New 15th Ave W SB Ramp	Signal	C (EBT)	C (EBT)	Not Applicable		C (EBT)	C (EBT)	Not Applicable	
203	15th Ave W SB Ramps	Signal	C (EBT)	C (EBT)	E (EBT)	D (EBT)	C (EBT)	C (EBT)	E (EBT)	D (EBT)
204	15th Ave W NB Ramps	Signal	C (WBT)	C (WBT)	B (WBT)	C (WBT)	C (WBT)	B (WBT)	B (WBT)	C (WBT)
205	14th Ave NW	Signal	B (WBT)	B (WBT)	A (WBT)	A (WBT)	B (WBT)	B (WBT)	A (WBT)	A (WBT)
	Corridor 3: W Emerson Pl/W Nickerson St									
301	Gilman Ave W	AWSC	F (SEL)	F (SEL)	F (SEL)	F (SEL)	F (SEL)	F (SEL)	F (SEL)	F (SEL)
302	23rd Ave W	TWSC	A (EBT)	(EBT)	A (WBT)	A (WBT)	A (EBT)	A (EBT)	A (WBT)	A (WBT)
303	19th Ave W	Signal	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)
304	SB 15th Ave W Off Ramp	Signal	B (EBR)	B (EBR)	B (EBR)	B (EBR)	B (EBR)	B (EBR)	B (EBR)	B (EBR)
305	North 15th Ave W Ramps	Signal	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)
306	NB 15th Ave W Ramp	Signal	B (NBR)	B (NBR)	B (NBR)	B (NBR)	B (NBR)	B (NBR)	B (NBR)	B (NBR)

Table 8. Freight and Transit: Intersection Movements Level-of-Service; 2042 Alternatives Comparison – AM Peak

ID	Corridor/Intersection	Control	Freight LOS				Transit LOS			
			2042 Scenario 1: *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*		**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*		**2042 Scenario 1:** *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*		**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*	
			Base	w/CMS	Base	w/CMS	Base	w/CMS	Base	w/CMS
307	13th Ave W	Signal	B (EBT)	B (EBT)	B (EBT)	B (EBT)	B (EBT)	B (EBT)	B (EBT)	B (EBT)
	Corridor 4: W Dravus St									
401	20th Ave W	Signal	D (EBT)	D (EBT)	E (EBT)	E (EBT)	D (EBT)	D (EBT)	E (EBT)	E (EBT)
402	17th Ave W	Signal	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)
403	SB 15th Ave W Ramps	Signal	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)
404	NB 15th Ave W Ramps	Signal	D (WBT)	D (WBT)	D (WBT)	D (WBT)	D (WBT)	D (WBT)	D (WBT)	D (WBT)
405	14th Ave W	TWSC	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)
	Corridor 5: Thorndyke Ave W / W Armory Way									
501	20th Ave W	TWSC	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)
502	21st Ave W	TWSC	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)
503	W Armory Way	TWSC	Not Applicable		F (WBL)	C (WBL)	Not Applicable		F (WBL)	C (WBL)
504	W Blaine St	TWSC	B (EBL)	B (EBL)	F (EBL)	F (EBL)	B (EBL)	B (EBL)	F (EBL)	F (EBL)
505	W Galer St	Signal	F (SBL)	B (SBL)	F (SBR)	A (SBR)	F (SBL)	B (SBL)	F (SBR)	A (SBR)
	Corridor 6: Magnolia Bridge									
601	23rd Ave NW	TWSC	A (EBLR)	A (EBLR)	Not Applicable		A (EBLR)	A (EBLR)	Not Applicable	
602	Terminal 91 Gate	TWSC	A(NBR)	A(NBR)	Not Applicable		A (NBR)	A (NBR)	Not Applicable	

Notes:

- CMS – Corridor Management Strategy
- Scenario 1 Strategies include: 100-102, 103a&b, 104a&b, 105a, 106, 107, 200-202, 203b, 204b, 205, 300-307, 400, 401a&b, 403-405, 500a, 501, 502, 505, 601-602
- Scenario 2 Strategies include: 100-102, 103a&b, 104a&b, 105b, 106, 107, 200, 201, 203a, 204a, 205, 300-307, 400, 401a&b, 403-405, 500a&b, 501-505
- Level-of-Service (LOS) based on Highway Capacity Manual (HCM) 2000 methodology
- Worst-performing traffic movement for each scenario/peak hour shown as follows: (XXY) XX is approach direction (NB – Northbound, SB – Southbound, EB – Eastbound, WB – Westbound) and Y is the movement (L – Left, T – Thru, R – Right)
- Red Shading – LOS F (average vehicular delay >80 seconds for signalized intersections, >55 seconds for unsignalized intersections)
- Yellow Shading – LOS E (average vehicular delay 55-79 seconds for signalized intersections, 35-55 seconds for unsignalized intersections)

Table 9. Freight and Transit: Intersection Movements Level-of-Service; 2042 Alternatives Comparison – PM Peak

ID	Corridor/Intersection	Control	Freight LOS				Transit LOS			
			2042 Scenario 1: *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*		**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*		**2042 Scenario 1:** *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*		**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*	
			Base	w/CMS	Base	w/CMS	Base	w/CMS	Base	w/CMS
Corridor 1: W 15th Ave										
101	NW Market St	Signal	F (NBT)	C (NBT)	F (NBT)	C (NBT)	C (NBT)	C (NBT)	C (NBT)	C (NBT)
102	Gilman Dr W	Signal	F (NBT)	B (NBT)	F (NBT)	B (NBT)	B (NBT)	B (NBT)	B (NBT)	B (NBT)
103	W Armory Way	Signal	D (NBT)	A (NBT)	F (NBT)	A (NBT)	A (NBT)	A (NBT)	A (NBT)	A (NBT)
104	W Howe St	Signal	F (NBT)	A (NBT)	F (NBT)	A (NBT)	E (NBT)	A (NBT)	E (NBT)	A (NBT)
105	W Garfield St	Signal	F (NBT)	A (NBT)	F (NBT)	A (NBT)	A (NBT)	A (NBT)	A (NBT)	A (NBT)
106	W Galer St	Signal	D (SBT)	B (SBT)	F (NBT)	B (NBT)	B (NBT)	B (NBT)	B (NBT)	B (NBT)
107	Galer Flyover	Signal	F (NBT)	B (NBT)	F (NBT)	A (NBT)	B (NBT)	B (NBT)	A (NBT)	A (NBT)
Corridor 2: NW Leary Way										
201	17th Ave NW	TWSC	A (WBT)	A (WBT)	A (WBT)	A (WBT)	A (WBT)	A (WBT)	A (WBT)	A (WBT)
202	New 15th Ave W SB Ramp	Signal	C (EBT)	C (EBT)	Not Applicable		C (EBT)	C (EBT)	Not Applicable	
203	15th Ave W SB Ramps	Signal	C (WBT)	A (WBT)	D (EBT)	D (EBT)	C (WBT)	A (WBT)	D (EBT)	D (EBT)
204	15th Ave W NB Ramps	Signal	B (WBT)	B (WBT)	D (WBT)	E (WBT)	B (WBT)	B (WBT)	D (WBT)	E (WBT)
205	14th Ave NW	Signal	D (WBT)	D (WBT)	B (WBT)	B (WBT)	D (WBT)	D (WBT)	B (WBT)	B (WBT)
Corridor 3: W Emerson Pl/W Nickerson St										
301	Gilman Ave W	AWSC	F (WBR)	F (WBR)	F (WBR)	F (WBR)	F (WBR)	F (WBR)	F (WBR)	F (WBR)
302	23rd Ave W	TWSC	A (EBT)	A (EBT)	A (WBT)	A (WBT)	A (EBT)	A (EBT)	A (WBT)	A (WBT)
303	19th Ave W	Signal	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)
304	SB 15th Ave W Off Ramp	Signal	C (NBL)	C (NBL)	C (NBL)	C (NBL)	C (NBL)	C (NBL)	C (NBL)	C (NBL)
305	North 15th Ave W Ramps	Signal	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)	D (EBT)
306	NB 15th Ave W Ramp	Signal	B (WBL)	B (WBL)	B (WBL)	B (WBL)	B (WBL)	B (WBL)	B (WBL)	B (WBL)
307	13th Ave W	Signal	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)

Table 9. Freight and Transit: Intersection Movements Level-of-Service; 2042 Alternatives Comparison – PM Peak

ID	Corridor/Intersection	Control	Freight LOS				Transit LOS			
			2042 Scenario 1: *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*		**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*		**2042 Scenario 1:** *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*		**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*	
			Base	w/CMS	Base	w/CMS	Base	w/CMS	Base	w/CMS
	Corridor 4: W Dravus St									
401	20th Ave W	Signal	F (WBT)	F (WBT)	F (WBT)	F (WBT)	F (WBT)	F (WBT)	F (WBT)	F (WBT)
402	17th Ave W	Signal	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)	B (WBT)
403	SB 15th Ave W Ramps	Signal	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)	F (EBT)
404	NB 15th Ave W Ramps	Signal	F (WBT)	F (WBT)	F (WBT)	F (WBT)	F (WBT)	F (WBT)	F (WBT)	F (WBT)
405	14th Ave W	TWSC	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)	A (EBT)
	Corridor 5: Thorndyke Ave W/W Armory Way									
501	20th Ave W	TWSC	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)
502	21st Ave W	TWSC	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)	A (NBTR)
503	W Armory Way	TWSC	Not Applicable		E (WBL)	D (WBL)	Not Applicable		E (WBL)	D (WBL)
504	W Blaine St	TWSC	B (EBL)	B (EBL)	F (EBL)	F (EBL)	B (EBL)	B (EBL)	F (EBL)	F (EBL)
505	W Galer St	Signal	C (SBR)	A (SBL)	C (SBR)	A (SBL)	C (SBR)	A (SBL)	C (SBR)	A (SBL)
	Corridor 6: Magnolia Bridge									
601	23rd Ave NW	TWSC	A (EBLR)	A (EBLR)	Not Applicable		A (EBLR)	A (EBLR)	Not Applicable	
602	Terminal 91 Gate	TWSC	A (NBR)	A (NBR)	Not Applicable		A(NBR)	A(NBR)	Not Applicable	

Notes:
- CMS – Corridor Management Strategy
- Scenario 1 Strategies include: 100-102, 103a&b, 104a&b, 105a, 106, 107, 200-202, 203b, 204b, 205, 300-307, 400, 401a&b, 403-405, 500a, 501, 502, 505, 601-602
- Scenario 2 Strategies include: 100-102, 103a&b, 104a&b, 105b, 106, 107, 200, 201, 203a, 204a, 205, 300-307, 400, 401a&b, 403-405, 500a&b, 501-505
- Level-of-Service (LOS) based on Highway Capacity Manual (HCM) 2000 methodology
- Worst-performing traffic movement for each scenario/peak hour shown as follows: (XXY) XX is approach direction (NB – Northbound, SB – Southbound, EB – Eastbound, WB – Westbound) and Y is the movement (L – Left, T – Thru, R – Right)
- Red Shading – LOS F (average vehicular delay >80 seconds for signalized intersections, >55 seconds for unsignalized intersections)
- Yellow Shading – LOS E (average vehicular delay 55-79 seconds for signalized intersections, 35-55 seconds for unsignalized intersections)

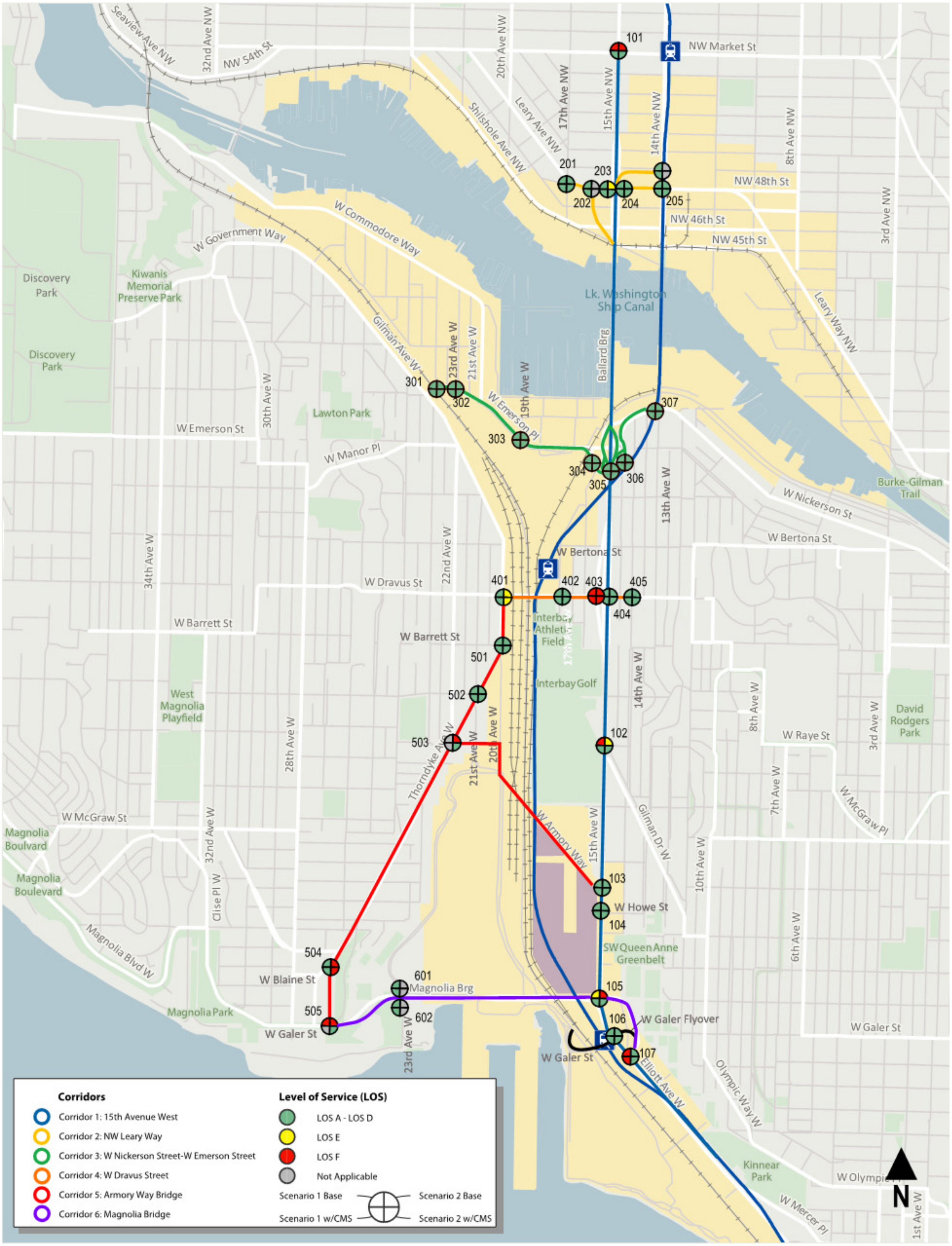

Figure 3. Freight LOS (Scenario 1 and Scenario 2) – AM Peak Hour

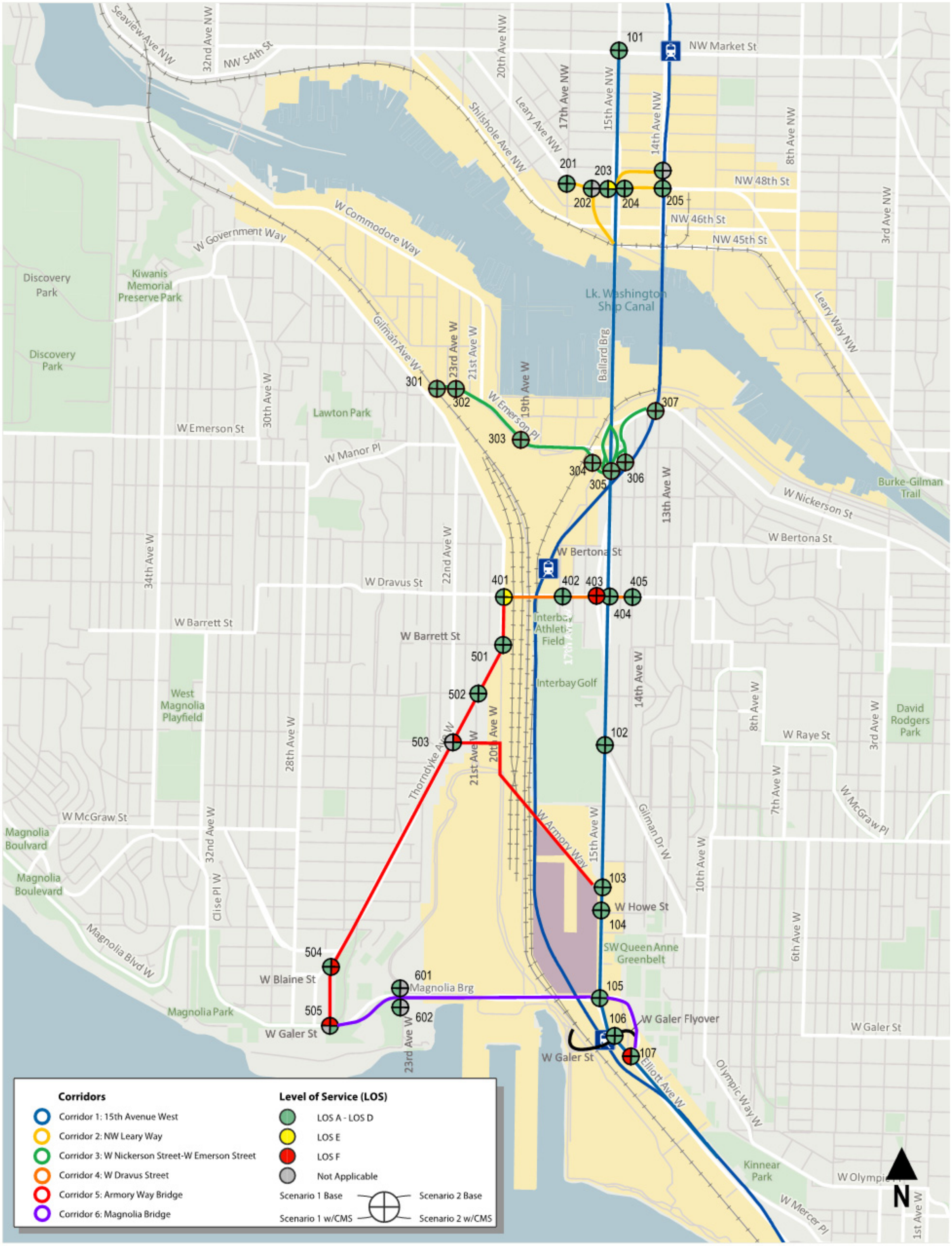

Figure 4 – Transit LOS (Scenario 1 and Scenario 2) – AM Peak Hour

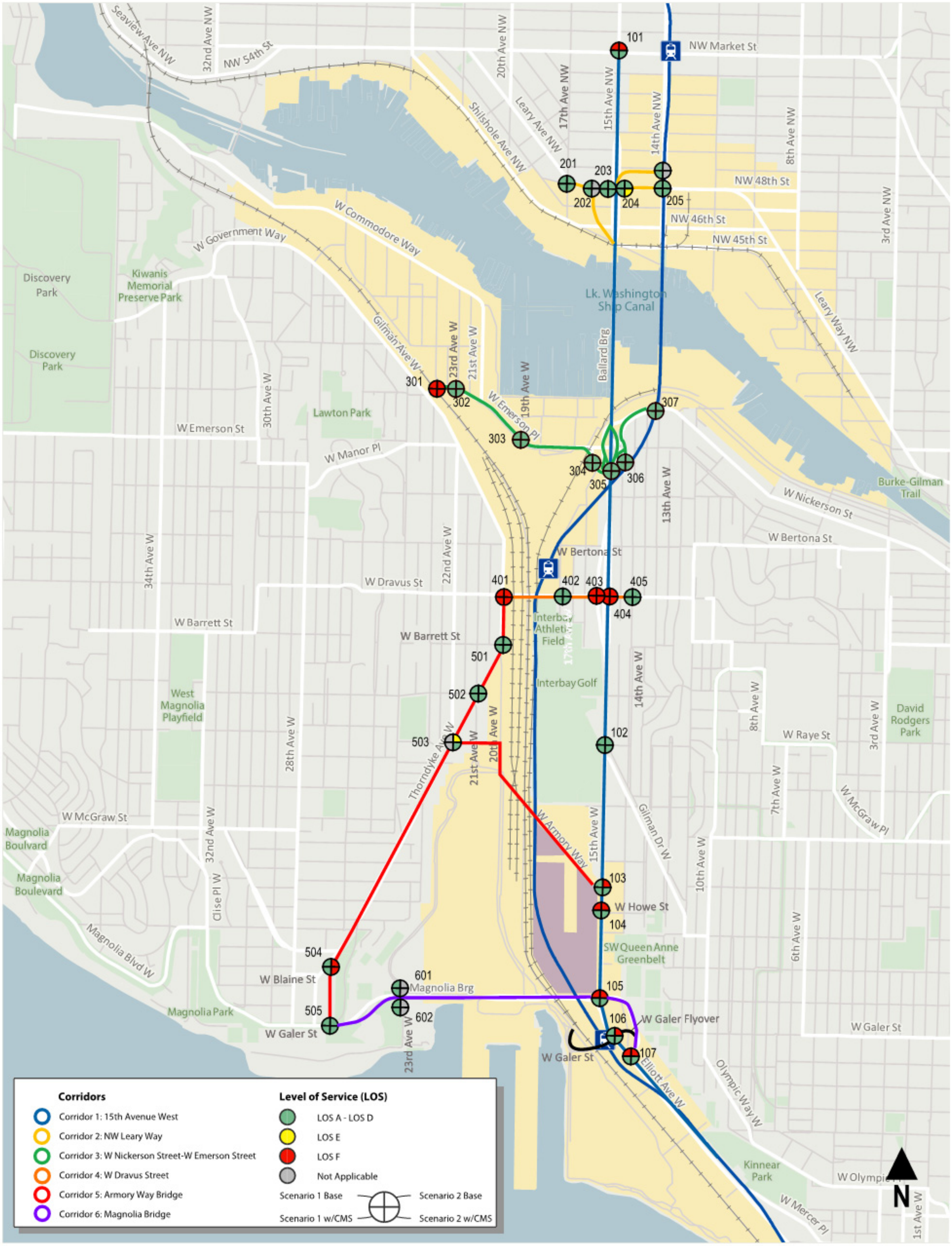

Figure 5 – Freight LOS (Scenario 1 and Scenario 2) – PM Peak Hour

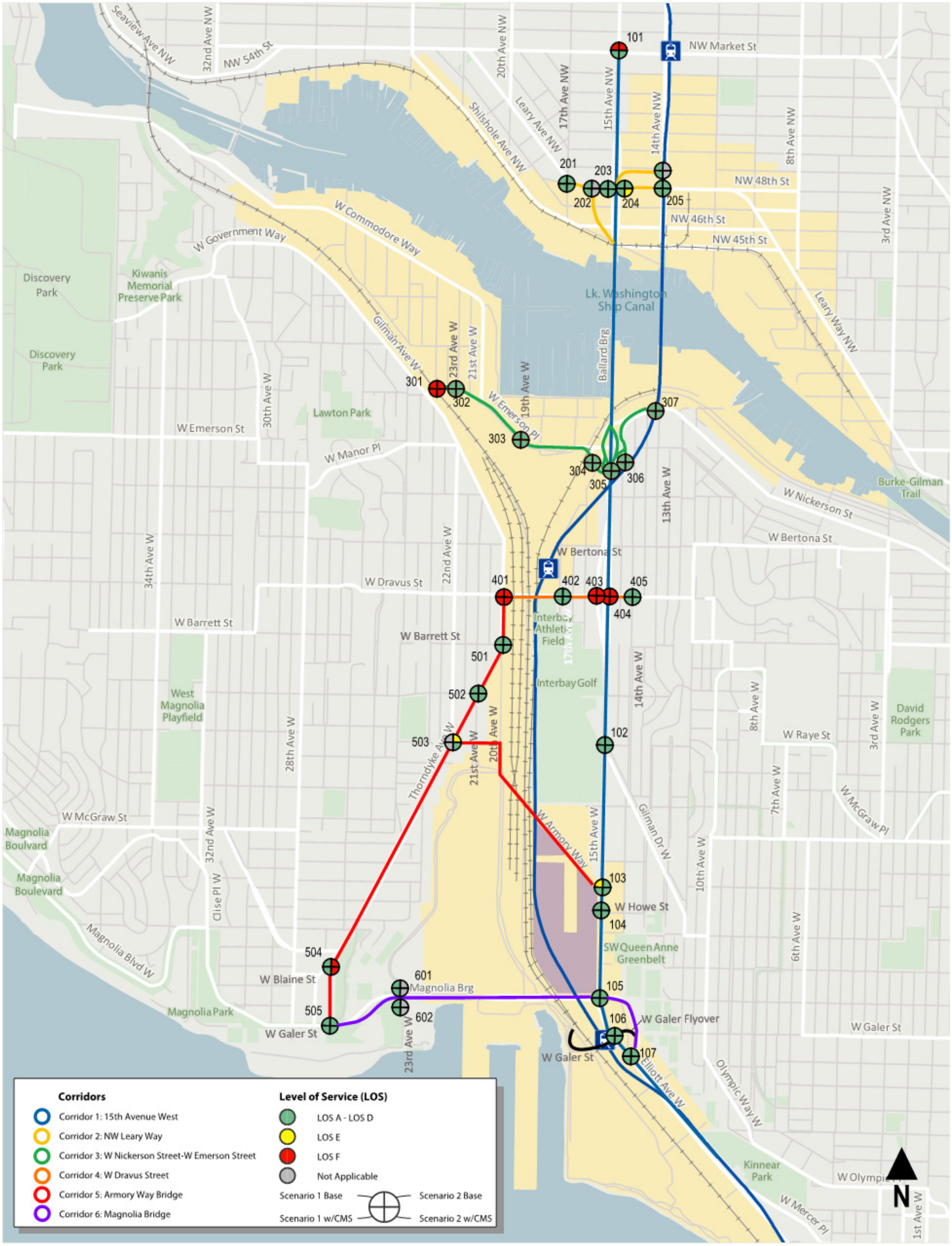

Figure 6 – Transit LOS (Scenario 1 and Scenario 2) – PM Peak Hour

Table 10. Corridor Travel Time Comparison: Freight and Transit: 2042 AM Peak Hour

Corridor/ Segment	Direction	Free Flow Travel Time^	Freight Travel Time						Transit Travel Time					
			2042 Scenario 1: *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*			**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*			**2042 Scenario 1:** *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*			**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*		
			Base	w/CMS	% Change	Base	w/CMS	% Change	Base	w/CMS	% Change	Base	w/CMS	% Change
Corridor 1: 15th Ave W	SB	5.2	14.8	6.9	-53.4%	21.9	7.5	-65.8%	10.6	9.1	-14.2%	12.0	10.9	-9.2%
	NB	5.2	8.2	7.6	-7.3%	8.4	7.6	-9.5%	12.6	10.4	-17.5%	12.9	11.8	-8.5%
Corridor 2: NW Leary Way	EB	0.5	1.7	1.6	-5.9%	1.9	1.4	-26.3%	2.2	1.9	-13.6%	2.4	1.9	-20.8%
	WB	0.5	1.7	1.1	-35.3%	1.0	1.3	30.0%	2.2	1.5	-31.8%	1.5	1.8	20.0%
Corridor 3: W Emerson Pl / W Nickerson St	EB	2.0	5.3	5.2	-1.9%	5.3	5.2	-1.9%	4.8	4.8	0.0%	4.8	4.8	0.0%
	WB	2.0	4.7	5.9	25.5%	4.7	5.9	25.5%	4.3	5.5	27.9%	4.3	5.5	27.9%
Corridor 4: W Dravus St	EB	0.6	4.6	4.6	0.0%	5.0	4.9	-2.0%	4.5	4.5	0.0%	4.9	4.9	0.0%
	WB	0.6	2.2	2.2	0.0%	2.3	2.3	0.0%	2.1	2.1	0.0%	2.2	2.2	0.0%
Corridor 5: Thorndyke Ave W / W Armory Way	EB	3.5	NA	NA	NA	7.3	5.3	-27.4%	NA	NA	NA	8.5	6.2	-27.1%
	WB	3.5	NA	NA	NA	16.0	10.1	-36.9%	NA	NA	NA	11.8	10.9	-7.6%
Corridor 6: Magnolia Bridge	EB	2.0	4.9	6.6	34.7%	NA	NA	NA	4.4	6.1	38.6%	NA	NA	NA
	WB	1.9	3.8	3.9	2.6%	NA	NA	NA	3.3	3.4	3.0%	NA	NA	NA

Notes:

- Green highlight indicates delay reduction of greater than 10%, red highlight indicates delay increase of greater than 10%

^ Freeflow travel time represents the travel time a general purpose vehicle would experience when no traffic congestion is present

- Expected travel times are calculated by the vehicle running time plus average intersection delay, with dwell time added to transit movements and reduced turning speeds for turns and grade for freight vehicles. Travel times during congestion expected to be up to 50% greater than the values listed
- Scenario 1 Strategies include: 100-102, 103a&b, 104a&b, 105a, 106, 107, 200-202, 203b, 204b, 205, 300-307, 400, 401a&b, 403-405, 500a, 501, 502, 505, 601-602
- Scenario 2 Strategies include: 100-102, 103a&b, 104a&b, 105b, 106, 107, 200, 201, 203a, 204a, 205, 300-307, 400, 401a&b, 403-405, 500a&b, 501-505

Table 11. Corridor Travel Time Comparison: Freight and Transit: 2042 PM Peak Hour

Corridor/ Segment	Direction	Free Flow Travel Time^	Freight Travel Time						Transit Travel Time					
			2042 Scenario 1: *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*			**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*			**2042 Scenario 1:** *Mid-Height Ballard Bridge with Magnolia 1-1 Bridge Replacement*			**2042 Scenario 2:** *Low-Height Ballard Bridge with Armory Way Bridge*		
			Base	w/CMS	% Change	Base	w/CMS	% Change	Base	w/CMS	% Change	Base	w/CMS	% Change
Corridor 1: 15th Ave W	SB	5.2	7.4	7.0	-5.4%	7.7	7.2	-6.5%	10.7	10.4	-2.8%	12.1	13.3	9.9%
	NB	5.2	21.0	7.3	-65.2%	24.6	7.3	-70.3%	13.3	10.5	-21.1%	17.3	12.8	-26.0%
Corridor 2: NW Leary Way	EB	0.5	1.9	2.4	26.3%	1.5	1.3	-13.3%	2.4	2.8	16.7%	2.0	1.8	-10.0%
	WB	0.5	2.2	1.7	-22.7%	1.5	2.0	33.3%	2.7	2.0	-25.9%	2.0	2.5	25.0%
Corridor 3: W Emerson Pl / W Nickerson St	EB	2.0	4.1	4.1	0.0%	4.1	4.2	2.4%	3.6	3.7	2.8%	3.7	3.7	0.0%
	WB	2.0	10.8	7.1	-34.3%	10.8	7.1	-34.3%	10.4	6.7	-35.6%	10.4	6.7	-35.6%
Corridor 4: W Dravus St	EB	0.6	3.2	3.2	0.0%	3.6	3.5	-2.8%	3.1	3.1	0.0%	3.5	3.5	0.0%
	WB	0.6	4.8	4.8	0.0%	6.2	5.8	-6.5%	4.7	4.7	0.0%	6.1	5.7	-6.6%
Corridor 5: Thorndyke Ave W / W Armory Way	EB	3.5	NA	NA	NA	18.4	5.5	-70.1%	NA	NA	NA	11.3	6.3	-44.2%
	WB	3.5	NA	NA	NA	7.9	7.5	-5.1%	NA	NA	NA	8.8	8.3	-5.7%
Corridor 6: Magnolia Bridge	EB	2.0	2.7	2.9	7.4%	NA	NA	NA	2.2	2.4	9.1%	NA	NA	NA
	WB	1.9	3.8	4.0	5.3%	NA	NA	NA	3.3	3.5	6.1%	NA	NA	NA

Notes:
- Green highlight indicates delay reduction of greater than 10%, red highlight indicates delay increase of greater than 10%
- ^ Freeflow travel time represents the travel time a general purpose vehicle would experience when no traffic congestion is present
- Expected travel times are calculated by the vehicle running time plus average intersection delay, with dwell time added to transit movements and reduced turning speeds for turns and grade for freight vehicles. Travel times during congestion expected to be up to 50% greater than the values listed.
- Scenario 1 Strategies include: 100-102, 103a&b, 104a&b, 105a, 106, 107, 200-202, 203b, 204b, 205, 300-307, 400, 401a&b, 403-405, 500a, 501, 502, 505, 601-602
- Scenario 2 Strategies include: 100-102, 103a&b, 104a&b, 105b, 106, 107, 200, 201, 203a, 204a, 205, 300-307, 400, 401a&b, 403-405, 500a&b, 501-505

Attachment A:

Corridor Management Strategies

Attachment A.1. Detailed Summary of Corridor Management Strategies

Corridor	Location/ Intersection	Description of Transportation Need	ID	Strategy Type	Strategy to Address Need	Primary Modes	Category	Performance Improvement w/Implementation	Strategy Source
15th Avenue West (Corridor 1)	Corridor Wide	• Peak period congestion in Northbound and Southbound direction	100	ITS Strategies	Install adaptive signal system along 15th Ave NW/W	Vehicle, Freight, Transit	Small, not bridge-related	• Improved corridor signal coordination • Adaptive timings to current conditions to minimize corridor delay	SDOT
	NW Market Street/ 15th Avenue NW	• Northbound thru LOS E in AM / LOS F in PM • Southbound thru LOS F in AM / LOS E in PM	101	Channelization & Striping	Convert Bus-Only Lanes (BOL) to Freight and Transit (FAT) lanes on 15th Ave NW, NB and SB movements	Freight, Transit	Large, not bridge-related	• FAT reduces freight delay by 0.5-3 minutes, slight increase in transit delay	BIRT
	Gilman Drive/ 15th Avenue W	• Northbound thru LOS E in AM / LOS F in PM • Southbound thru LOS F in AM	102	Channelization & Striping	Convert Bus-Only Lanes (BOL) to Freight and Transit (FAT) lanes on 15th Ave NW, NB and SB movements	Freight, Transit	Large, not bridge-related	• FAT reduces freight delay up to 2 minutes, transit has a slight reduction	BIRT
	W Armory Way/ 15th Avenue W	• Southbound thru LOS F in AM • Northbound thru LOS F in PM	103a	Channelization & Striping	Convert Bus-Only Lanes (BOL) to Freight and Transit (FAT) lanes on 15th Ave NW, NB and SB movements	Freight, Transit	Large, not bridge-related	• FAT reduces freight delay up to 2 minutes, transit has a slight reduction	BIRT
		• SE right turn in both peaks	103b	Access Management	Eliminate southern pedestrian crossing to decrease green time needed for Armory approach	Vehicle, Freight, Transit	Small, not bridge-related	• Fewer pedestrian conflicts for SE right turn	BIRT
	W Howe Street/ 15th Avenue W	• Southbound thru LOS F in AM • Northbound thru LOS F in PM	104a	Channelization & Striping	Convert Bus-Only Lanes (BOL) to Freight and Transit (FAT) lanes on 15th Ave NW, NB and SB movements	Freight, Transit	Large, not bridge-related	• FAT reduces freight delay by 2-3 minutes, transit reduced a half minute NB PM	BIRT
		• Eastbound/Westbound approaches LOS F in both peaks	104b	Access Management	Eliminate southern pedestrian crossing to decrease green time needed for Howe/Whole Foods approaches	Vehicle	Small, not bridge-related	• Fewer pedestrian conflicts for EB right • More efficient pedestrian crossings	BIRT
	W Garfield Street/ 15th Avenue W.	• Southbound thru LOS F in AM • Northbound thru LOS F in PM	105a	Channelization & Striping	Convert Bus-Only Lanes (BOL) to Freight and Transit (FAT) lanes on 15th Ave NW, NB and SB movements	Freight, Transit	Large, not bridge-related	• FAT reduces freight delay by 50-70 seconds, transit has a slight reduction	BIRT
		• Traffic signal may cause unwarranted delay for 15th Ave	105b	Traffic Control	Remove traffic signal, prohibit left turn movements. Reroute left turns to/from Terminal 91 to Galer Street flyover	Freight, Transit	Requires Scenario 2	• Under two way stop control 15th Ave northbound and southbound have no delay	BIRT

Attachment A.1. Detailed Summary of Corridor Management Strategies

Corridor	Location/ Intersection	Description of Transportation Need	ID	Strategy Type	Strategy to Address Need	Primary Modes	Category	Performance Improvement w/Implementation	Strategy Source
15th Avenue West (Corridor 1)	W Galer Street/ 15th Avenue W.	• Southbound thru LOS F in PM	106	Channelization & Striping	Convert Bus-Only Lanes (BOL) to Freight and Transit (FAT) lanes on 15th Ave NW, NB and SB movements	Freight, Transit	Large, not bridge-related	• FAT reduces freight delay by 0.5-2 minutes, no change to transit	BIRT
	W Galer Flyover/ Elliott Avenue	• Northwest bound thru LOS F in both peak hours • Delay for southeast bound left turn in AM, southwest bound left turn in both peak hours northwest bound through in both peak hours	107	Channelization & Striping	Convert Bus-Only Lanes (BOL) to Freight and Transit (FAT) lanes on 15th Ave NW, NB and SB movements	Freight, Transit	Large, not bridge-related	• FAT reduces freight delay by 2-3 minutes in PM, not effective in AM	BIRT
NW Leary Way (Corridor 2)	Corridor Wide	• Peak period congestion in Eastbound and Westbound direction impedes freight and transit	200	ITS Strategies	Install adaptive signal system along NW Leary Way	Vehicle, Freight, Transit	Small, not bridge-related	• Improved system coordination performance expected	MB
	NW Leary Way/ 17th Avenue NW	• Southbound stop-controlled approach LOS F	201	Signal Operations	Adjust signal coordination at adjacent signals to provide gaps for egressing trucks along mainline	Vehicle, Freight, Transit	Small, not bridge-related	• Reduced delays for side street approaches expected	BIRT
	NW Leary Way/15th Avenue SB On Ramp	• Ballard Bridge replacement	202	Capital Improvements	Install new southbound 15th Ave on ramp intersection on Leary Ave east of 17th Ave associated with Mid-Height Ballard Bridge scenario	Vehicle, Freight, Transit	Requires Scenario 1	• Eastbound delay reduced by ~30 seconds	BBPS
	NW Leary Way/ 15th Avenue SB Ramps	• Eastbound approach LOS E in AM due to left turns • Congestion impedes freight and transit	203a	Access Management	Prohibit WB left, force through movement then right turn loop via 17th/49th	Vehicle, Freight, Transit	Small, not bridge-related	• Freight delay reduced 10-30 seconds, but increased travel time for on ramp left turn movements	BIRT
			203b	Channelization & Striping	Install Freight and Transit (FAT) lanes	Freight, Transit	Small, not bridge-related	• Slight delay reductions for freight and transit	SDOT/BIRT
	NW Leary Way/ 15th Avenue NB Ramps	• Westbound approach high LOS D due to left turns • Congestion impedes freight and transit	204a	Access Management	Prohibit EB left, force through movement then right turn loop via 14th/Ballard Way	Vehicle, Freight, Transit	Small, not bridge-related	• Negative benefits for westbound, ITS and adaptive signals could help further	BIRT
			204b	Channelization & Striping	Install Freight and Transit (FAT) lanes	Freight, Transit	Small, not bridge-related	• Slight delay reductions for freight and transit	SDOT/BIRT

Seattle Department of Transportation

Attachment A.1. Detailed Summary of Corridor Management Strategies

Corridor	Location/ Intersection	Description of Transportation Need	ID	Strategy Type	Strategy to Address Need	Primary Modes	Category	Performance Improvement w/Implementation	Strategy Source
	NW Leary Way/ 14th Avenue NW	• Freight mobility along Leary Way	205	Signal Operations	Emphasize green time for freight movements and provide gaps for egressing trucks along mainline	Freight	Small, not bridge-related	• Improved system coordination performance expected	MB
W Emerson Place – W Nickerson Street (Corridor 3)	Corridor Wide	• Peak period congestion in Eastbound and Westbound direction • Enhance freight mobility along corridor	300	ITS Strategies	Install adaptive signal system along W Nickerson Street and W Emerson Street	Vehicle, Freight, Transit	Small, not bridge-related	• Improved system coordination performance expected	BIRT
	W. Emerson Place/ Gilman Avenue NW	• Overall intersection LOS F in both peak hours	301	Traffic Control	Install traffic signal to improve multi-modal interaction and replace inefficient all-way stop control	Vehicle, Freight, Transit	Small, not bridge-related	• Intersection remains LOS E/F but delays reduced 40-60 seconds	MBPS
	W Emerson Place/ 23rd Avenue NW	• Long gaps needed in Emerson Pl traffic to serve stop-controlled side streets	302	Signal Operations	In conjunction with traffic signal installed at Gilman & Emerson, coordinate timing to optimize gaps for mid-block side streets between Gilman Ave & 21st Ave	Freight	Small, not bridge-related	• Ensures freight movement not penalized by minor street movements	BIRT
	W Emerson Street/ 19th Avenue W	• Maintain freight mobility on Emerson Pl	303	Signal Operations	Maintain maximum green time for Emerson Pl approaches	Freight	Small, not bridge-related	• Ensures freight movement not penalized by minor street movements	BIRT
	W Emerson Street/ 15th Avenue W Southbound Ramps	• Eastbound left turn high LOS D in both peak hours	304	Signal Operations	Monitor signal timing and maintain mobility to and from 15th Ave	Vehicle, Freight, Transit	Requires Scenario 1 or 2	• Monitor operations to prevent freight delays	BIRT
	W Emerson Street/ 15th Ave North Ramps	• Eastbound and Westbound through movements high LOS D in both peak hours	305	Signal Operations	Monitor signal timing and maintain mobility to and from 15th Ave	Vehicle, Freight, Transit	Requires Scenario 1 or 2	• Monitor operations to prevent freight delays	BIRT
	W Nickerson Street/ 15th Avenue W Ramps	• 15th Ave. off ramp queuing and delay	306	ITS Strategies	Monitor queues and conflicts with ship canal trail, local business access points, consider queue detectors	Vehicle, Freight, Transit	Requires Scenario 1 or 2	• Prevents queue spillback to 15th Ave mainline	BIRT
	W Nickerson Street/ 13th Avenue W	• Conflicts between general purpose traffic, freight, non-motorized traffic	307	ITS Strategies	Monitor queues and conflicts with ship canal trail, local business access points, consider queue detectors	Vehicle, Non-Motorized	Small, not bridge-related	• Reduces vehicular/non-motorized conflicts and maintains freight access	BIRT

Attachment A.1. Detailed Summary of Corridor Management Strategies

Corridor	Location/ Intersection	Description of Transportation Need	ID	Strategy Type	Strategy to Address Need	Primary Modes	Category	Performance Improvement w/Implementation	Strategy Source
W Dravus Street (Corridor 4) W Dravus Street (Corridor 4)	Corridor Wide	• Truck turning maneuvers at tight intersections • Multi-modal trip interactions	400	Channelization & Striping	Improve intersection corner radii Monitor signal operations Maintain traffic control devices	Freight	Small, not bridge-related	• Enhanced freight mobility through intersections	FMP
	W Dravus Street/ 20th Avenue W	• Southbound left LOS F, northbound right LOS F	401a	Signal Operations	Implement flashing yellow arrow for southbound left and maintain bike/ped phases Add northbound right turn overlap phase	Vehicle, Non-Motorized	Small, not bridge-related	• Overall peak hour delays reduced by 10-20 seconds	BIRT
		• Driveways near intersection	401b	Access Management	Restrict adjacent driveways and on street parking	Vehicle, Freight, Transit	Small, not bridge-related	• Enhanced freight mobility through intersection	BIRT
	W Dravus Street/ 17th Avenue W	• Maintain freight mobility on W Dravus St	402	Signal Operations	Maintain maximum green time for W Dravus St approaches	Freight	Small, not bridge-related	• Monitor operations to prevent freight delays	BIRT
	W Dravus Street/15th Avenue W SB Ramps	• Insufficient space for truck turning maneuvers	403	Channelization & Striping	Channelization and minor curbing adjustments to better accommodate truck turning maneuvers	Freight	Small, not bridge-related	• Enhanced freight mobility through intersection	FMP
	W Dravus Street/ 15th Avenue W NB Ramps	• Insufficient space for truck turning maneuvers	404	Channelization & Striping	Channelization and minor curbing adjustments to better accommodate truck turning maneuvers	Freight	Small, not bridge-related	• Enhanced freight mobility through intersection	FMP
	W Dravus Street/ 14th Avenue W	• Maintain freight mobility on W Dravus St	405	Signal Operations	Adjust signal coordination to provide gaps for egressing trucks along mainline	Freight	Small, not bridge-related	• Monitor operations to prevent freight delays	FMP
Armory Way Bridge (Corridor 5)	Corridor Wide	• Freight mobility on Thorndyke/Armory Bridge	500a	ITS Strategies	Install dynamic message signs displaying routing and travel time information	Vehicle	Small, not bridge-related	• Improved wayfinding and routing decisions	BIRT
			500b	Channelization & Striping	Install Freight and Transit (FAT) lanes on Thorndyke from Blaine to Armory and on Armory from Thorndyke to 15th Ave	Freight	Requires Scenario 2	• Improved freight travel time through congested areas	BIRT
	Thorndyke Ave. W/20th Ave. W	• Insufficient space for freight turning maneuvers	501	Channelization & Striping	Improve turn radii for trucks	Freight	Small, not bridge-related	• Enhanced freight mobility through intersection	BIRT
	Thorndyke Ave. W/21st Ave. W	• Conflicts between general purpose traffic, freight, non-motorized traffic	502	Channelization & Striping	Improve visibility of traffic control devices	Vehicle, Non-Motorized	Small, not bridge-related	• Enhanced non-motorized safety	BIRT

Attachment A.1. Detailed Summary of Corridor Management Strategies

Corridor	Location/ Intersection	Description of Transportation Need	ID	Strategy Type	Strategy to Address Need	Primary Modes	Category	Performance Improvement w/Implementation	Strategy Source
	Thorndyke Ave W & Armory Bridge	• Westbound approach LOS E / F, southbound left LOS E	503	Capital Improvements	Install a northbound right turn lane on Thorndyke Ave	Vehicle, Freight, Transit	Requires Scenario 2	• Overall delay reduced 15-30 seconds in peak hours	BIRT
	W. Blaine St./Thorndyke Ave. W	• Freight mobility on Thorndyke • Eastbound approach LOS F	504	Channelization & Striping	Install Freight and Transit (FAT) lanes on Thorndyke	Freight	Requires Scenario 2	• Overall peak hour delays reduced by 20-30 seconds	BIRT
	W. Galer St./Thorndyke Ave. W	• Southbound approach LOS F in AM peak	505	Traffic Control	Install a traffic signal	Vehicle, Freight, Transit	Small, not bridge-related	• Overall peak hour delays reduced 10-15 seconds	EXP
Magnolia Bridge (Corridor 6)	23rd Ave. NW/Magnolia Bridge EB on-ramp	• Unclear intersection control	601	Channelization & Striping	Improve visibility of traffic control devices	Vehicle, Freight, Transit	Requires Scenario 1	• Enhanced vehicular traffic safety	BIRT
	Terminal 91 Gate/Magnolia Bridge WB off-ramp	• Unclear intersection control	602	Channelization & Striping	Improve visibility of traffic control devices	Vehicle, Freight, Transit	Requires Scenario 1	• Enhanced vehicular traffic safety	BIRT

Notes:

- Scenarios are described below:
- Network Scenario 1 (higher cost) - Land uses consistent with Needs Assessment Scenario 1; mid-height Ballard Bridge, which includes new access and signals north of bridge in Ballard and SPUI south of bridge; Magnolia Bridge Scenario 4 (one-to-one replacement of Magnolia Bridge)
- Network Scenario 2 (lower cost) - Land uses consistent with Needs Assessment Scenario 2; low-height Ballard Bridge (one-to-one replacement of Ballard Bridge) and new SPUI south of Ballard Bridge; Armory Way Bridge Scenario 1 (new bridge between 15th Avenue W & Armory Way and Thorndyke Avenue), Thorndyke Improvements, 20th Avenue Improvements, Alaskan Way Connector, Magnolia Bridge Spur, and West Uplands Perimeter Road

- Area Studies
- BIRT = Ballard-Interbay Regional Transportation Study (2020)
- MBPS = Magnolia Bridge Planning Study/Traffic Maintenance Plan (2019)
- BBPS = Ballard Bridge Planning Study (2020)
- FMP = Freight Master Plan (2016)
- SDOT = SDOT Programmed Improvement
- EXP = Expedia Campus Transportation Technical Report
- MB = Move Ballard (2016)

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Ballard Interbay Regional Transportation System (BIRT) Study

Appendix G: Project List

November 2020

Seattle Department of Transportation

Memo Map ID	Project ID	Final Report Project ID	In Final Report? (Y/N)	Project Title	Description in Final Report	Additional Details	Primary Mode	Roadway/Location	Extents (From)	Extents (To)	Subarea	Applicable Bridge Alternative	Source of Project Idea	Notes	Raw Composite Score	Composite Score
	MM-17	1	Y	Dravus Bridge Replacements	Replace the W Dravus St bridges over the BNSF railroad tracks and 15th Ave W, including widened sidewalks with buffers from traffic, improved lighting, protected bike lanes, and intersection improvements. Related project: W Dravus St Protected Bike Lanes (Project 5)		All Modes	W Dravus Street	20th Ave W	14th Ave W	Interbay	Both Alternatives	Project Team		35	3.26
2-7	P-6	2	Y	Improvements Along Elliott Ave W/15th Ave W	Enhance the pedestrian experience along Elliott Ave W and 15th Ave W from W Boston St to W Mercer Pl by widening sidewalks and adding landscaped buffer, ADA curb ramps, and pedestrian-scale lighting.		Pedestrian	15th Ave W/Elliott Ave W	W Boston Street	W Mercer Place	Smith Cove	Both Alternatives	WSBLE Project Team		34	3.19
2-3	BP-15	3	Y	Wheeler St Pedestrian Bridge	Connect W Wheeler St (east) across the BNSF tracks with the Elliott Bay Trail/20th Ave W via a new pedestrian and bicycle bridge. Applicable only to the Magnolia Bridge In-Kind Replacement		Bike & Pedestrian	W Wheeler Street	15th Ave W	20th Ave W	Interbay	Alternative 1	Project Team		30	2.86
	MM-19	4	Y	Dravus St/17th Ave Intersection Improvements	Evaluate existing right-of-way allocation at W Dravus St/17th Ave W to improve mobility for northbound and southbound vehicles, and make space for protected bike lanes. Options may include roadway rechannelization or expanding the Dravus St bridge west of the intersection. Related project: W Dravus St Protected Bike Lanes (Project 5); Dravus Bridge Replacements (Project 1)		All Modes	W Dravus Street & 17th Ave W	n/a	n/a	Interbay	Both Alternatives	Project Team		34	2.83

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2-5	B-13	5	Y	W Dravus St Protected Bike Lanes	Implement protected bicycle lanes (PBLs) on W Dravus St between 20th Ave W and the Elliott Bay Trail extension with a future long-term connection to 14th Ave W (requires redesign of the 15th Ave W bridge and ramp intersections).		Bike	W Dravus Street	20th Ave W	14th Ave W	Interbay	Both Alternatives	Bicycle Master Plan	Notes from conversations with SDOT: •Center turn lane could be removed to accommodate protected PBL width on both sides of roadway •Two-way cycle track could work and could link with two-way cycle track on 20th Ave W •PBL could be at-grade throughout corridor and ramp up at RAB via a shared path with green striping		31	2.61
2-6	BP-17; BP-3; BP-4	6	Y	Elliott Bay Trail Extension (East)	Create a parallel multi-use trail along the east side of the BNSF railroad tracks connecting people in the surrounding area to and from the future Smith Cove Link station at W Galer St and the future Interbay Link station at W Dravus St. Provide east-west connections at W Wheeler St, W Howe St, and W Garfield St.	This could potentially be located under the light rail alignment. Add enhanced crossings where the trail crosses roadways. Include a trail connection at W Garfield Street to connect to the GTB Trail in the SW Queen Anne Greenbelt. Add low-stress bicycle facilities and sidewalks on W Howe Street between the trail and 12th Ave W to help connect Queen Anne to the light rail stations, as well as on W Wheeler Street between the trail and 15th Ave W.	Bike & Pedestrian	Elliott Bay Trail	W Galer Street	W Dravus Street	Multiple	Both Alternatives	Bicycle Master Plan; WSBLE Project Team			26	2.57
	BP-18	7	Y	Elliott Bay Trail Upgrades	Widen the narrow northern segment of the Elliott Bay Trail between the Magnolia Bridge and 20th Ave W to allow shared use travel in both directions.	Collaborate with the Port of Seattle, Seattle Parks, Expedia, and the BNSF Railroad to bring the northern portion of the Elliott Bay Trail up to American Association of State Highway and Transportation Official (AASHTO) standards.	Bike & Pedestrian	Elliott Bay Trail	Magnolia Bridge	20th Ave W	Multiple	Both Alternatives	Community Feedback; Seattle Trails Upgrade Plan	Expedia had a MUP condition to participate in this project.		25	2.49
1-8	P-1	8	Y	Improvements Along W Dravus St	Widen sidewalks where feasible along W Dravus St (especially between 20th Ave W and 17th Ave W) and add a landscaped buffer and pedestrian-scale lighting.		Pedestrian	W Dravus Street	20th Ave W	15th Ave W	Interbay	Both Alternatives	WSBLE Project Team; WSBLE Station Charrette; WSBLE L2 nonmotorized workshop			27	2.45

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2-11	P-7; P-8; P-9; P-10	9	Y	Sidewalks within a 10-minute walk of future Link stations	Construct new sidewalks and repair existing sidewalks within the BINMIC, within a 10-minute walk of the future Smith Cove, Interbay, and Ballard light rail stations, and adjacent to RapidRide stations along 15th Ave NW.	Prioritize sidewalks that are currently missing, part of the Pedestrian Priority Investment Network, or in fair/poor condition. In Smith Cove, even though it does not fall within the 10-minute walkshed, build a sidewalk on W Mercer Place between Elliott Ave W and 5th Ave W. In Interbay, critical missing sidewalks are on the south side of W Emerson Street/Place and on 17th Ave W to access the light rail station. In addition, even though it does not fall within the 10-minute walkshed, build a sidewalk on W Nickerson Street west of 13th Ave W on the south side of the street and on Gilman Ave W per the Pedestrian Master Plan. A sidewalk should also be built on 20th Ave W on the east side of the roadway between W Dravus Street and W Bertona Street (it is missing from the sidewalk data). In the BINMIC, also construct/repair crosswalks. Prioritize crosswalks along freight routes or arterial/collector roadways. Consider conducting a survey of BINMIC businesses to identify priority sidewalk and crosswalk improvements.	Pedestrian	n/a	n/a	n/a	Multiple	Both Alternatives	Project Team			24	2.43
3-5	P-11	10	Y	W Emerson St Pedestrian Bridge and Overpass Stairs	Include a pedestrian bridge across 15th Ave W in the vicinity of W Emerson St with the SPUI design proposed with the Ballard Bridge alternatives. Add stairs and elevators to connect the sidewalks on 15th Ave W to the overpasses for people walking and rolling between the pedestrian bridge, sidewalk, and RapidRide stations along 15th Ave W. This project is only applicable to Ballard Bridge replacement alternatives. Related project: Interim 15th Ave/Emerson St Improvements (Project 11)		Pedestrian	Intersection of 15th Ave W & W Emerson Street	n/a	n/a	Interbay	Both Alternatives	Project Team; Community Feedback			24	2.40

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	MM-15	11	Y	Interim 15th Ave and Emerson St Improvements	Improve the intersection of 15th Ave W/ W Emerson St with underpass enhancements to address immediate mobility needs, understanding long-term Ballard Bridge replacement will include full intersection redesign.Related Project: W Emerson St Pedestrian Bridge and Overpass Stairs proposes longer-term improvements to this intersection associated with the Ballard Bridge replacement. (Project 10)	This could include but is not limited to: adding a crosswalk and shared use path on W Emerson Street per the recommendation in the Seattle Bridge Safety Analysis report; reconfiguring the intersection and adding a traffic signal (though this may not be feasible due to increased auto delay); building a pedestrian bridge across 15th Ave W in the vicinity of W Emerson Street; adding elevators down to the existing Ship Canal Trail connection below 15th Ave W; and/or other improvements to increase access to the RapidRide stops.	All Modes	Intersection of 15th Ave W & W Emerson St	n/a	n/a	Interbay	Both Alternatives	Project Team; City of Seattle Bridge Safety Analysis; Missed Connection: Ballard Bridge Safety Recommendations			25	2.37
	MM-16	12	Y	Interim Ballard Bridge Improvements	Improve the Ballard Bridge to address immediate mobility needs, understanding the Ballard Bridge will be replaced. Interim improvements could include wayfinding; pavement spot improvements; vertical delineation between the travel lanes and sidewalk; or adding wider sidewalks by cantilevering a walkway platform from the existing bridge. Related projects: Ballard Bridge low-level and mid-level alternatives		Bike & Pedestrian	Ballard Bridge	W Emerson Street	NW Ballard Way	Multiple	Both Alternatives	Project Team; City of Seattle Bridge Safety Analysis; Missed Connection: Ballard Bridge Safety Recommendations; Ballard Bridge Sidewalk Widening Concept Study			23	2.32
2-10	B-14	13	Y	Ballard Locks Connection	Build a bicycle connection through the Ballard Locks that can be used 24 hours a day, 7 days a week, and does not require bicyclists to dismount. Carefully consider impacts to Locks operations and Maritime Vessel Traffic priorities in design.		Bike	Ballard Locks	n/a	n/a	Interbay	Both Alternatives	Bicycle Master Plan	Potential to coordinate with the Lake Washington Ship Canal Master Plan, which is currently taking place.		22	2.27

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1-10	BP-5	14	Y	Ship Canal to Thorndyke Ave Connection	Add a trail connection between the Ship Canal Trail and Thorndyke Ave W west of 15th Ave W/W Emerson St intersection for a direct connection to the future Interbay light rail station, multi-use trails, and neighborhoods.		Bike & Pedestrian	Thorndyke Ave W/17th Ave W	Ship Canal Trail	W Dravus Street	Interbay	Both Alternatives	Bicycle Master Plan; WSBLE Project Team; WSBLE Station Charrette			24	2.23
1-9	P-2	15	Y	Improvements Along 14th Ave NW	Widen or improve sidewalks along 14th Ave NW from NW Leary Way to Gemenskap Park with upgraded ADA curb ramps, and pedestrian scale lighting. Enhance walking and biking priority along 14th Ave NW to facilitate access to the future Ballard Link station.		Pedestrian	14th Ave NW	NW Leary Way	Gemenskap Park	Ballard	Both Alternatives	WSBLE Project Team; WSBLE Station Charrette			23	2.21
	MM-18	16	Y	W Dravus St Signal Optimization	Optimize traffic signals along W Dravus St between 15th Ave W and 20th Ave W to support freight reliability with increased north gate traffic to and from Terminal 91. Related project: Dravus Bridge Replacements (Project 1)		Transit/Freight	W Dravus Street	15th Ave W	20th Ave W	Interbay	Both Alternatives	T91 Uplands Redevelopment Traffic Analysis Memorandum			25	2.13
	T-14	17	Y	Route 40 NW Leary Way Bus Lanes	Rechannelize NW Leary Way to include a bus-only lane in one or both directions between 15th Ave NW and NW Market St. 10% design is complete and partially funded via SDOT's Route 40 Transit Plus Multimodal Corridor (TPMC) project. Related project: Leary Way Corridor Management Strategy (Project 44)		Transit	NW Leary Way	15th Ave NW	NW Market Street	Ballard	Both Alternatives	Route 40 TPMC, Leary Way RapidRide			23	2.12

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	T-10; T-11	18	Y	Transit Signal Priority (TSP) at Thorndyke Ave/Armory Way	Add transit signal priority/queue jumps at Thorndyke Ave W and Armory Way Bridge to allow buses to make a southbound left onto the Armory Bridge, and westbound to allow buses onto Thorndyke Ave W. Applicable only to the Armory Way bridge alternative. Related project: In-lane bus stops on Thorndyke Ave W (Project 20).	Add transit signal priority/Queue Jump at Thorndyke Ave W & W Armory Way Bridge to allow buses to make a southbound left onto the Armory Bridge.	Transit	Intersection of W Armory Way Bridge & Thorndyke Ave W	n/a	n/a	Interbay	Alternative 2	Project Team			20	2.11
	T-12	19	Y	Mobility Hubs	Ensure adequate lighting, access to shared use mobility services, bike parking, and high-quality bus stop amenities (e.g., seating, weather protection, and real-time information signs) where multiple future routes will converge at multiple locations. Hubs are recommended at future light rail stations (Ballard, Interbay, and Smith Cove) and the west end of the Armory Way Bridge Armory Way Mobility Hub is applicable only to the Armory Way Bridge alternative.		Transit	Ballard Station area, Interbay Station area, Smith Cove Station area Thorndyke Ave W	Thorndyke Ave W	Armory Way Bridge	Interbay	Both Alternatives	Project Team			22	2.08
	T-5	20	Y	In-lane Bus Stops on Thorndyke Ave	Install transit islands on Thorndyke Ave W between W Blaine St and Armory Way Bridge to allow for in-lane bus stops and safe interface between buses and people riding in the protected bike lane. Related project: TSP at Thorndyke Ave/W Armory Way (Project 18)		Transit	Thorndyke Ave W	W Blaine Street	Armory Way Bridge	Interbay	Both Alternatives	Project Team			21	2.04
	T-1	21	Y	15th Ave NW/NW Market St Queue Jump	Install a northbound queue jump from the business access and transit (BAT) lane/northbound right turn lane to allow buses to pass		Transit	15th Ave NW & NW Market Street	15th Ave NW	NW Market Street	Ballard	Both Alternatives	RapidRide C and D Line Improvements Speed and Reliability Study			20	1.98

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					ahead of northbound through vehicles.												
2-8	MM-4	22	Y	15th Ave W/NW FAT Lanes	Allow for joint-use of bus-only lanes by transit and freight vehicles on 15th Ave W/NW from Denny Way to Market St NW during off-peak times. Freight can operate in bus-only lanes to bypass congestion, and benefits from transit priority treatments on the corridor such as queue jumps. Note: Pending policy review	Transit currently operates rapid and frequent routes on the corridor during peak times and should not be delayed by freight in the bus-only lanes. Transit on this corridor is planned to be reduced by 2042 when WSBLE implemented, at which time freight could operate at all times in the bus-only lanes and delivery vehicles could be permitted.	Transit/Freight	15th Ave W/NW/Elliott Ave/Western Ave	Denny Way	15th Ave NW & Market Street	Interbay	Both Alternatives	Project Team	This could be implemented sooner using existing infrastructure		23	1.96
	F-7	23	Y	15th Ave/Dravus Truck Turning and Signalization Improvements	Improve turn radii for trucks and enhanced multimodal operations at 15th Ave W and W Dravus St ramps, including pavement improvements to the bridge surface. Upgrade signal timing and hardware at ramp terminals to ensure vehicle queues on the bridge clear to allow trucks adequate space to turn at intersection. Related projects: Dravus St Signal Optimization (Project 16); Dravus Corridor Management Strategy (Project 39)		Freight	W Dravus Street	NB on/off-ramp	SB Off/On-ramps	Interbay	Both Alternatives	Freight Master Plan Project 7, Project Team			23	1.96
	F-9	24	Y	15th Ave W & Armory Way Intersection Improvements	Refine intersection operations at 15th Ave W/W Armory Way to improve pedestrian crossings, and accommodate frequent freight turning movements and freight access on at-grade roadways along W Armory Way. Applicable only to the Armory Way Bridge alternative.		Freight	Intersection of 15th Ave W & Armory Way	n/a	n/a	Interbay	Alternative 2	Project Team			22	1.94
	F-4	25	Y	Alaskan Way W/ W Galer St and W Galer St Flyover Intersection Improvements	Improve intersection operations at Alaskan Way W/W Galer St, and at Alaskan Way W/W Galer St Flyover.		Freight	Intersection of Alaskan Way W & W Galer Street Flyover	n/a	n/a	Smith Cove	Both Alternatives	Project Team			20	1.93

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1-2	BP-1	26	Y	Crossing Improvements at High Priority Signalized Intersections	Improve crossings for people walking and bicycling at priority signalized intersections. Related project: Dravus St/17th Ave Intersection Improvements (Project 4)	Priority intersections include: Ballard: 15th Ave NW/NW Market St, 14th Ave NW/NW Market St (Coordinate with potential projects associated with Route 44, which are currently funded) Interbay: W Dravus St/17th Ave W and W Dravus St/15th Ave W Smith Cove: 15th Ave W/W Wheeler St, 15th Ave W/W Garfield St, Elliott Ave W/W Galer St Flyover, Elliott Ave W/W Galer St, and Elliott Ave W/W Mercer Pl Pedestrian improvements may include default walk signal phases (eliminate need to press button), right-turn restrictions for vehicles, improved sightlines for pedestrian visibility, pedestrian refuge islands, ADA ramps, widened crosswalk striping, widened sidewalks to accommodate pedestrians waiting to cross, leading pedestrian intervals, retimed signals to reduce pedestrian crossing delay, longer walk phases, or all-walk phases. Bicycle improvements may include bike detection, bike signals, bike boxes, green paint through intersection, etc.	Bike & Pedestrian	Miscellaneous	n/a	n/a	Multiple	Both Alternatives	Project Team; WSBLE Project Team	Notes from conversations with SDOT about BINMIC traffic signals and operations: •Install pedestrian recall buttons at all intersections •Signal priority o Off-peak – Pedestrians o Peak modal priority – 1) Transit; 2) Freight		17	1.87
1-4	BP-2	27	Y	Safety and Crossing Enhancements at High Priority Unsignalized Locations	Evaluate the potential for signalized crossings and enhancements to existing crosswalks at unsignalized intersections and mid-block locations.	Priority locations include: Ballard: 14th Ave NW/NW 54th St, 14th Ave NW/NW 56th St, 14th Ave NW between NW 45th St and NW 54th St, NW Market St/11th Ave NW (Coordinate with potential projects associated with Route 44, which are currently funded), NW Market St/9th Ave NW Interbay: Thorndyke Ave W/21st Ave W/W Armory Way, 15th Ave W/W Bertona St, and at unsignalized intersections and mid-block locations along W Dravus St and 14th Ave W Smith Cove: Elliott Ave W/W Lee St, 15th Ave W between W Armory Way and W Wheeler St, W Galer St/29th Ave W Pedestrian improvements may	Bike & Pedestrian	Miscellaneous	n/a	n/a	Multiple	Both Alternatives	Project Team; WSBLE Station Charrette; WSBLE Project Team			19	1.87

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						include RRFBs, PHBs, signals, improved sightlines for pedestrian visibility, pedestrian refuge islands, ADA ramps, widened crosswalk striping, and widened sidewalks to accommodate pedestrians waiting to cross. Bicycle improvements may include bike detection, bike signals, bike boxes, green paint through intersection, etc.											
	P-4	28	Y	Pedestrian Improvements at Top Collision Locations	Make improvements at locations with a history of collisions involving people walking and locations with crash risk factors as defined in SDOT's Bike and Pedestrian Safety Analysis.		Pedestrian	Miscellaneous	n/a	n/a	Multiple	Both Alternatives	Bike and Pedestrian Safety Analysis	Specific locations are not legible in the plan's maps.		19	1.87
	F-2	29	Y	15th Ave W/Gilman Dr W Intersection Improvements	Improve intersection operations at 15th Ave W/Gilman Dr W.		Freight	Intersection of 15th Ave W & Gilman Drive W	n/a	n/a	Interbay	Both Alternatives	Project Team; Expedia Campus at 1201 Amgen Court W Transportation Technical Report			19	1.86
	F-3	30	Y	15th Ave W/W Howe St Intersection Improvements	Improve intersection operations at 15th Ave W/W Howe St.		Freight	Intersection of 15th Ave W & W Howe Street	n/a	n/a	Smith Cove	Both Alternatives	Project Team			23	1.85
		31	Y	15th Ave W/NW and Elliott Ave W Signal Optimization	Install adaptive signal system and a suite of ITS strategies	See Appendix F for additional details on this Corridor Management Strategy.						Both Alternatives	Project Team			21	1.85
3-14	T-13	32	Y	Signal at W Galer St/Thorndyke Ave W	Signalize W Galer St /Thorndyke Ave W to enhance transit mobility.		Transit	Intersection of W Galer Street & Thorndyke Ave W	n/a	n/a	Interbay	Alternative 1	Expedia Campus at 1201 Amgen Court W Transportation Technical Report			18	1.83
	B-17; BP-20	33	Y	Magnolia Trail and Neighborhood Greenway	Build a bicycle and pedestrian connection in Magnolia that connects W Galer St to W Marina Pl along the waterfront to facilitate accessing the Elliott Bay Trail. Install a neighborhood greenway on 32nd Ave W, W Galer St, and W Marina Pl to connect the new trail to the Elliott Bay Trail.		Bike & Pedestrian	W Marina Pl/W Galer Street/32nd Ave W	Elliott Bay Trail	Clise Pl W	Smith Cove	Both Alternatives	Bicycle Master Plan; Magnolia Trail Project: A Feasibility Analysis	This project may require environmental review due to potential hillside construction.		18	1.83

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1-5	B-1	34	Y	W Galer St and Magnolia Blvd Protected Bike Lane	Install protected bicycle lanes (PBLs) on W Galer St and Magnolia Blvd W from the Magnolia Bridge to W Howe St per the Bicycle Master Plan.		Bike	W Galer Street/Magnolia Boulevard W	End of Magnolia Bridge	W Howe Street	Interbay	Both Alternatives	Bicycle Master Plan			18	1.83
		35	Y	Magnolia Bridge Corridor Management Strategies	Incorporate channelization/roadway and capital improvements to efficiently move motorized vehicles through the corridor between W Galer Flyover and Thorndyke Ave W.	See Appendix F for additional details on this Corridor Management Strategy.						Alternative 1	Project Team			18	1.83
3-9	MM-13	36	Y	FAT Lanes: Thorndyke Ave W/W Blaine St	Add joint-use bus/freight lanes on Thorndyke Ave W and W Blaine St. Note: Pending policy review. Related project: In-lane bus stops on Thorndyke Ave (Project 20)		Transit/Freight	Thorndyke Ave W/W Blaine St	28th Ave W	W Halladay Street	Interbay	Alternative 2	Project Team			21	1.81
		37	Y	Armory Way Bridge Corridor Management Strategy	Incorporate signal operations improvements, traffic control, roadway striping/channelization, and capital improvement enhancements to efficiently move motorized vehicles on the Armory Way Bridge and Thorndyke Ave W between W Galer St and W Dravus St.	See Appendix F for additional details on this Corridor Management Strategy.						Alternative 2	Project Team			16	1.79
		38	Y	W Dravus St Corridor Management Strategy	Incorporate signal operations improvements, ITS strategies, road-way striping/channelization, and access management enhancements to efficiently move motorized vehicles through the corridor between 14th Ave W and 20th Ave W. Corridor management strategies are not dependent upon Magnolia and Ballard bridge replacement alternatives	See Appendix F for additional details on this Corridor Management Strategy.						Both Alternatives	Project Team			16	1.77
3-13	T-9	39	Y	15th Ave NW and NW Leary Way Rechannelization	Rechannelize southbound 15th Ave W to include a FAT lane for efficient bus and freight access across Leary Way NW and for buses to merge onto the Ballard Bridge after serving southbound RapidRide/express stop.		Transit	15th Ave NW & Leary Way	15th Ave NW	Leary Way	Ballard	Alternative 1	RapidRide C and D Line Improvements Speed and Reliability Study, Route 40 TPMC, Project Team			18	1.76

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					Related project: 15th Ave W/NW FAT Lanes (Project 22)												
	T-7	40	Y	RapidRide Leary Way NW: Passenger Facilities	Enhance passenger facilities in support of future RapidRide implementation on Leary Way NW. This generally includes upgrading existing Route 40 stops to RapidRide stations and their related amenities.		Transit	NW Market Street & NW Leary Way	8th Ave NW	24th Ave NW (Market), 14th Ave NW (Leary)	Ballard	Both Alternatives	Project Team			17	1.75
	F-1	41	Y	Leary Way NW Corridor Freight Master Plan (FMP) Improvements	Reconstruct and make operational/ITS improvements to the Leary Way NW and N 36th St corridor to better facilitate freight per the Freight Master Plan.		Freight	N 36th Street/Leary Way	8th Ave NW	24th Ave NW	Ballard	Both Alternatives	Freight Master Plan Projects 11 & 13			17	1.74
	B-6	42	Y	Bicycle Improvements at Top Collision Locations	Make improvements at locations with a history of collisions involving people biking and locations with crash risk factors as defined in SDOT's Bike and Pedestrian Safety Analysis.		Bike	Miscellaneous	n/a	n/a	Multiple	Both Alternatives	Bike and Pedestrian Safety Analysis	Specific locations are not legible in the plan's maps.		15	1.71
		43	Y	Leary Way NW Corridor Management Strategy	Incorporate signal operations improvements, ITS strategies, roadway striping/channelization, access management, and capital improvements to efficiently move motorized vehicles through the corridor between 14th Ave NW and NW Market St.	See Appendix F for additional details on this Corridor Management Strategy.						Both Alternatives	Project Team			19	1.70
1-1	MM-1	44	Y	21st Ave W/W Emerson Pl Intersection Improvements	Reconstruct 21st Ave W/W Emerson Pl intersection to improve safety for people walking and bicycling, and improve truck access (e.g. modify curb radii, design a new trail crossing consistent with upgraded curb ramps, change push button placement, and evaluate pedestrian crossing time).		All Modes	Intersection of 21st Ave W & W Emerson Place	n/a	n/a	Interbay	Both Alternatives	Freight Master Plan Project 12; Seattle Trails Upgrade Plan			16	1.67
	BP-6	45	Y	Stay Healthy Streets in Ballard, Interbay, Queen Anne, and Magnolia	Build permanent Stay Healthy Streets along planned neighborhood greenways and potentially along other roadways with high pedestrian activity and		Bike & Pedestrian	Miscellaneous	n/a	n/a	Multiple	Both Alternatives	Project Team			19	1.65

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					outdoor dining, such as Ballard Ave NW.												
	BP-12	46	Y	Wayfinding to WSBLE stations	Add wayfinding to the future light rail stations for people walking and bicycling along multi-use trails, Ballard Bridge, Magnolia Bridge, W Galer St Flyover, Terminal 91, and Queen Anne hill climbs.		Bike & Pedestrian	n/a	n/a	n/a	Multiple	Both Alternatives	Project Team			16	1.63
	B-18	47	Y	20th Ave W Protected Bike Lanes	Convert the sharrows on 20th Ave W to two-way, all ages and abilities bike lanes on the east side of the road between the Elliott Bay Trail west of the railroad tracks and Thorndyke Ave W.		Bike	20th Ave W	Thorndyke Ave W	Elliott Bay Trail	Interbay	Both Alternatives	Project Team	This connection is relatively low stress already, but there is room for improvement given all the driveways and industrial uses.		16	1.61
		48	Y	W Emerson St-W Nickerson St Corridor Management Strategy	Incorporate signal operations improvements, ITS strategies, and traffic control for more efficient motorized travel between Gilman Ave W and 13th Ave W. Some corridor management strategies are only applicable to certain Ballard Bridge alternatives while some are not dependent on bridge replacement alternatives	See Appendix F for additional details on this Corridor Management Strategy.						Both Alternatives	Project Team			17	1.58
3-1	MM-6	A	Y	Ballard Bridge Low-Level Alternative	The low-level Ballard Bridge alternative will be similar to the existing bridge but will include improved access for all modes at the south landing. Key elements of the Ballard Bridge low-level alternative include shared use paths on the east and west sides of the bridge, and a Modified Single Point Urban Exchange (SPUI) on the southern end of the bridge.		All Modes	15th Ave NW	Emerson-Nickerson St Interchange	NW Ballard Way	Ballard	Alternative 2	Ballard Bridge Planning Study (March 2020)			15	1.58
3-2	MM-7	B	Y	Ballard Bridge Mid-Level Alternative	The mid-level Ballard Bridge alternative replaces the existing bridge with a new moveable bridge that provides 60’-70’ vertical clearance, a 14’ shared use-path on the west side of bridge, new vehicle and shared use path access ramp		All Modes	15th Ave NW	Emerson-Nickerson St Interchange	NW 50th St	Ballard	Alternative 1	Ballard Bridge Planning Study (March 2020)			15	1.56

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					at 17th Ave NW /Leary Way, a vehicle ramp at NW 49th St/15th Ave NW, and a modified SPUI consistent with the low-level bridge alternative.												
3-4	MM-9	C	Y	Magnolia Bridge In-Kind Replacement	One-to-one replacement of the existing bridge. Improvements include a 10-foot wide multi-use path on the south side for pedestrians and bicyclists.		All Modes	Magnolia Bridge	W Galer Street	Magnolia Way W	Smith Cove	Alternative 1	Magnolia Bridge Planning Study (April 2019)			15	1.55
3-3	MM-8	D	Y	Armory Way Bridge (Magnolia Bridge Replacement)	This bridge alternative constructs a new street connection along W Armory Way with a bridge and a new Magnolia Bridge segment to Alaskan Way with new West Uplands Perimeter Road and improvements to 20th Ave W. The bridge alternative as proposed includes a multi-use path on the south side for pedestrians and bicyclists. Joint-use freight and transit (FAT) lanes could be implemented but may not be merited given projected transit volumes.		All Modes	Armory Way Bridge	15th Ave W	Thorndyke Ave W	Smith Cove	Alternative 2	Magnolia Bridge Planning Study (April 2019)	Notes from SDOT conversations: •If Magnolia Bridge is removed, new bike pathway connection between Smith Cove and T91 would be needed.		15	1.54
2-1	BP-13			Burke-Gilman Missing Link		Complete the Burke-Gilman Trail Missing Link project between NW Market Street and 11th Ave NW. The route is tentatively planned along Shilshole Ave NW/NW 45th Street, but the route may change to Leary Ave NW/NW Leary Way or another location per ongoing discussions and litigation.	Bike & Pedestrian	Burke-Gilman Trail	24th Ave NW	NW 45th Street & 11th Ave NW	Ballard	Both Alternatives	Burke-Gilman Trail Missing Link EIS; Bicycle Master Plan			17	1.54
2-2	BP-14			Emerson St Pedestrian Bridge		Construct a new pedestrian and bicycle bridge across the railroad tracks connecting W Emerson Place east of the tracks near 19th Ave W to Gilman Ave W west of the tracks near W Emerson Street.	Bike & Pedestrian	W Emerson Street	Gilman Ave W	19th Ave W	Interbay	Both Alternatives	Project Team			17	1.54
3-10	MM-14			Armory Way Bridge FAT Lanes		Add joint-use bus/freight lanes on the Armory Way Bridge.	Transit/Freight	Armory Way Bridge	Thorndyke Ave W	15th Ave W	Interbay	Alternative 2	Project Team			17	1.52
3-6	MM-10			Magnolia Bridge FAT Lanes: Magnolia Bridge		Allow for joint-use of bus-only lanes by transit and freight/delivery vehicles on Magnolia Bridge. Freight/delivery vehicles can operate in bus-only lanes to bypass congestion, benefitting from any transit	Transit/Freight	Magnolia Bridge	Elliott Ave	28th Ave W	Interbay	Alternative 1	Project Team			17	1.50

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						priority treatments on the corridor such as queue jumps.											
2-15	T-4			W Dravus St Transit and Bike Improvements		Enhance transit integration with the proposed protected bicycle lane on W Dravus Street through the use of transit islands and shared transit/bike/pedestrian facilities.	Transit	W Dravus Street	14th Ave W	20th Ave W	Interbay	Both Alternatives	Bicycle Master Plan; WSBLE Agency Workshop			14	1.49
1-11	P-3			Along the Roadway Improvements: NW Market Street		Enhance the pedestrian experience along NW Market Street by adding landscaping between the sidewalk and roadway, and adding pedestrian-scale lighting.	Pedestrian	NW Market Street	15th Ave W	9th Ave NW	Ballard	Both Alternatives	WSBLE Project Team; WSBLE Station Charrette			14	1.48
	F-5			Alaskan Way W & W Galer Street Intersection Improvements		Improve intersection operations at Alaskan Way W & W Galer Street	Freight	Intersection of Alaskan Way W & W Galer Street	n/a	n/a	Smith Cove	Both Alternatives	Project Team			13	1.42
	BP-16			Bertona St Pedestrian Bridge		Construct a new pedestrian and bicycle bridge across 15th Ave W connecting 16th Ave W (or 20th Ave W if feasible) to 14th Ave W.	Bike & Pedestrian	W Bertona Street	20th Ave W	14th Ave W	Interbay	Both Alternatives	Project Team			17	1.39
2-13	B-15			15th Ave/Elliott Ave Protected Bike Lanes		Build a protected bicycle lane/cycle track on 15th Ave W/Elliott Ave W from W Emerson Street to Broad Street.	Bike	15th Ave W/Elliott Ave W	W Emerson Street	Broad Street	Multiple	Both Alternatives	Community Feedback; WSBLE Agency Workshop	Notes from conversations with SDOT: •Strong interest in protected bike lanes on corridor •Bikes are currently permitted to ride in bus only lane – if PBL is not an option, maybe provide space for bike pull-offs if vehicles behind cyclist exceed X vehicles or to ensure safety and comfort of cyclist		13	1.39
	F-10			Alaskan Way W & Magnolia Flyover Intersection Improvements		Improve intersection operations at Alaskan Way W & Magnolia Flyover	Freight	Intersection of Alaskan Way W & Magnolia Flyover	n/a	n/a	Interbay	Alternative 2	Project Team			15	1.38

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	P-5			Pedestrian Hillclimb to Kinnear Park		Add pedestrian stairs with runnels to connect the intersection of W Prospect Street & Van Buren Ave W in Interbay to the top of the hill near Kinnear Park in Queen Anne.	Pedestrian	W Prospect Street	Van Buren Ave W	9th Ave W/W Prospect Street	Smith Cove	Both Alternatives	WSBLE Project Team		15	1.37
	BP-7			GTB Trail Upgrades		Formalize the GTB Trail connection from Queen Anne to W Garfield Street. Make it wide enough to accommodate both bicycles and pedestrians, where feasible.	Bike & Pedestrian	GTB Trail	W Blaine Street	W Garfield Street	Smith Cove	Both Alternatives	WSBLE Project Team	The GTB is very steep, so bicyclists would likely walk this connection.	16	1.29
	MM-3			Signalize W Emerson Pl/Gilman Ave W		Signalize W Emerson Pl/Gilman Ave W/W Thurman St to improve transit and freight mobility.	Transit/Freight	Intersection of Gilman Ave W & W Emerson Place & W Thurman Street	n/a	n/a	Interbay	Both Alternatives	Magnolia Bridge Traffic Maintenance Plan		16	1.29
	B-8			14th Ave Neighborhood Greenway (Queen Anne)		Install a neighborhood greenway on 14th Ave W and local streets connecting to 10th Ave W, and a bicycle lane on Gilman Drive W between 10th Ave W and 13th Ave W.	Bike	Miscellaneous	Nickerson Street	10th Ave W	Interbay	Both Alternatives	Bicycle Master Plan		16	1.27
2-7	BP-10			Along the Trail Improvements: Elliott Bay Trail		Enhance user experience on the Elliott Bay Trail by: •Continuing trail maintenance such as sweeping, vegetation trimming, and pavement repair, which will require ongoing collaboration with the Port of Seattle •Upgrading trail striping and markings to improve flow of trail users •Improving wayfinding to the Magnolia Bridge, W Galer Street flyover, Helix Pedestrian Bridge, W Thomas Street Bridge, light rail stations, North Queen Anne, Magnolia, and Downtown Seattle	Bike & Pedestrian	Elliott Bay Trail	n/a	n/a	Multiple	Both Alternatives	Seattle Trails Upgrade Plan		16	1.25
	B-3			East/West Bike Connection via Bertona St and Dravus St		Install bicycle lanes on W Bertona Street and 11th Ave W, and sharrows on W Dravus Street between 14th Ave W and 11th Ave W due to right-of-way and/or topography constraints.	Bike	Miscellaneous	14th Ave W	Nickerson Street	Interbay	Both Alternatives	Bicycle Master Plan		15	1.23

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	B-5			14th Ave NW Neighborhood Greenway		Install bicycle lanes on 14th Ave NW between NW 46th Street and NW 58th Street and a neighborhood greenway between NW 46th Street and NW 45th Street.	Bike	14th Ave NW	NW 45th Street	NW 58th Street	Ballard	Both Alternatives	Bicycle Master Plan			13	1.20
3-12	BP-19			Interim Ballard Bridge Connection: Shilshole to Bridge		Improve the bike and pedestrian connections from Shilshole Ave NW to NW Ballard Way on either side of 15th Ave NW, which is at ground level and adjacent to the Ballard Bridge. This includes widening sidewalks, adding lighting, and adding trail crossings at NW 46th Street. This also includes the recommendations for the Ballard Bridge on/off ramps at NW Ballard Way found in the Seattle Bridge Safety Analysis report. The design should ensure freight access and mobility is maintained.	Bike & Pedestrian	15th Ave NW	Shilshole Ave NW	NW Ballard Way	Ballard	Both Alternatives	Project Team; Seattle Bridge Safety Analysis			15	1.20
	B-9			East/West Bike Connection via Raye St and 23rd Ave		Install a neighborhood greenway on W Raye Street, 23rd Ave W, W Armour Street, and 21st Ave W. Add a crossing in the vicinity of W Armour Street & Thorndyke Ave W & 21st Ave W.	Bike	Miscellaneous	32nd Ave W	Elliott Bay Trail	Interbay	Both Alternatives	Bicycle Master Plan			15	1.20
	BP-11			Along the Trail Improvements: Ship Canal Trail		Enhance user experience on the Ship Canal Trail by: •Continuing trail maintenance such as sweeping and vegetation trimming •Upgrading trail striping and markings to improve flow of trail users •Improving wayfinding to the Ballard Bridge, light rail stations, Seattle Pacific University, North Queen Anne, Fremont via the Fremont Bridge, Cheshiahud Lake Union Loop, and Downtown Seattle	Bike & Pedestrian	Ship Canal Trail	n/a	n/a	Interbay	Both Alternatives	Seattle Trails Upgrade Plan			14	1.17
	F-11			Dynamic Freight Signage on 15th Ave W		Install dynamic message signs to provide travel conditions on major freight corridors prior to connecting to Major Truck Streets.	Freight	15th Ave W	Elliott Ave	Ballard Bridge	Interbay	Both Alternatives	Freight Master Plan			12	1.15

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	BP-9			Ship Canal Trail Access Management		Apply consistent intersection and driveway crossing treatments on the Ship Canal Trail east of the Ballard Bridge, where motor vehicles cross the trail to access businesses off of Nickerson Ave.	Bike & Pedestrian	Ship Canal Trail	15th Ave W	3rd Ave W	Interbay	Both Alternatives	Seattle Trails Upgrade Plan			14	1.08
	B-4			Thorndyke Ave Bike Lanes		Install bicycle lanes on Thorndyke Ave W between W Galer Street and W Plymouth Street to complete this connection. Consider removing center line and/or parking on one or both sides to accommodate protected bicycle lanes.	Bike	Thorndyke Ave W	W Galer Street	W Plymouth Street	Interbay	Both Alternatives	Bicycle Master Plan	Notes from conversations with SDOT about Thorndyke south of Blaine St: •Many homes have driveways and garages, so removal of off-street parking may be feasible to accommodate rechannelization. •Thorndyke Ave is long corridor with manageable grade •Roadway currently has bus stops at W Hayes St (NB) and W Blaine St (SB) which would need to be accommodated in roadway design •Magnolia Way W would be an alternative, would likely need some kind of signal at W Galer Street for bikes – potential sight distance issue to the east •If ROW is an issue, uphill climbing lane with downhill shared lane (sharrows) could be an option. •Consider removing center line to accommodate 6’ PBLs on both sides of roadway – effectively making 20’ shared roadways space for vehicles and transit.		11	1.05
2-14	B-16			Ballard Locks Connection: Bike Lanes Along 21st Ave and W Commodore Way		Install bicycle lanes on 21st Ave W and W Commodore Way between W Emerson Place and 31st Ave W, and sharrows between 31st Ave W and 33rd Ave W due to right-of-way and/or topography constraints.	Bike	21st Ave W/W Commodore Way	W Emerson Place	33rd Ave W	Interbay	Both Alternatives	Bicycle Master Plan; Community Feedback	This is an important connection because the bike route over the railroad line along 33rd Ave W to connect up to W Government Way is very slippery when the wooden bridge is wet, and the steep grade creates a serious challenge to this route being "all ages and abilities."		11	1.05

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3-11	MM-5			Leary Ave NW corridor study		Study the Leary Ave NW corridor to determine how to accommodate freight, transit, and bicycle travel. This project will consider the final results of the Freight Master Plan, Burke-Gilman Trail EIS, and the Route 40 BRT Corridor Study. This project could include priority lanes (e.g. transit/truck) and improved crossings.	All Modes	Leary Ave	17th Ave	NW Market Street	Ballard	Both Alternatives	Move Ballard		13	1.04
3-8	MM-12			Magnolia Bridge FAT Lanes: McGraw/Condon		Add joint-use bus/freight lanes on W McGraw Street/Condon Way W Street to allow for efficient bus, freight, and delivery access to Magnolia Village.	Transit/Freight	W McGraw St/Condon Way W	34th Ave W	28th Ave W	Interbay	Alternative 2	Project Team		12	1.00
3-7	MM-11			Magnolia Bridge FAT Lanes: McGraw/28th		Add joint-use bus/freight lanes on W McGraw Street/28th Ave W to allow for efficient bus, freight, and delivery access to Magnolia Village.	Transit/Freight	W McGraw St/28th Ave W	34th Ave W	W Galer Street	Interbay	Alternative 1	Project Team		12	0.98
	B-10			NW 50th St Neighborhood Greenway		Install a neighborhood greenway on NW 50th Street.	Bike	NW 50th Street	17th Ave NW	6th Ave NW	Ballard	Both Alternatives	Bicycle Master Plan		11	0.89
	B-2			Elliott Bay Trail to Waterfront Trail		Connect the Elliott Bay Trail to the Waterfront Trail on Alaskan Way through crossing improvements and wayfinding.	Bike	Alaskan Way	Broad Street	Clay Street	Smith Cove	Both Alternatives	Project Team		10	0.83
	T-3			Magnolia Mobility Hubs: Magnolia Village		Ensure adequate lighting, access to shared use modes, bike parking, and high quality bus stop amenities (shelter, real time information signs, etc.) at key points where multiple future routes converge - Magnolia Village	Transit	W McGraw St	W McGraw St	32nd Ave W	Interbay	Both Alternatives	Project Team		10	0.81
	T-2			Magnolia Mobility Hubs: 28th/Blaine		Ensure adequate lighting, access to shared use modes, bike parking, and high quality bus stop amenities (shelter, real time information signs, etc.) at key points where multiple future routes converge - 28th & Blaine St	Transit	28th Ave W	28th Ave W	W Blaine Street	Interbay	Both Alternatives	Project Team		9	0.74
	F-6			21st Ave W Freight Corridor		Reconstruct 21st Ave corridor to improve truck safety and mobility by better integrating with bicycle and pedestrian facilities.	Freight	21st Ave W / Commodore Way	W Emerson Place	33rd Ave W	Interbay	Both Alternatives	Freight Master Plan Project 12		9	0.74
	T-6			Rapid Ride Leary Way NW: Speed and Reliability		Enhance roadway facilities in support of future RapidRide implementation on Leary Way NW (route 1010, 1993). This generally includes signal and roadway enhancements to improve transit speed and	Transit	NW Market Street & NW Leary Way	8th Ave NW	24th Ave NW (Market), 14th Ave NW (Leary)	Ballard	Both Alternatives	Project Team		n/a	n/a

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						reliability, which will be planned as part of future study.										
	F-8			11th Ave NW Freight Corridor		New Freight Corridor on 11th Ave NW from Lake Washington Ship Canal to NW 52nd Street that would connect commercial and industrial uses to Leary Way and allow for 14th Ave NW to serve Ballard Station transit and vehicle trips. Improve turn radii to and from the corridor for freight mobility.	Freight	11th Ave NW	Ship Canal	NW 52nd Street	Ballard	Both Alternatives	Project Team		n/a	n/a
	B-11			20th Ave NW Bike Lane/Neighborhood Greenway		Install a neighborhood greenway on 20th Ave NW from Shilshole Ave NW to Leary Way NW, and bicycle lanes from Leary Way NW to NW Market Street.	Bike	20th Ave NW	Shilshole Ave NW	NW Market Street	Ballard	Both Alternatives	Bicycle Master Plan		n/a	n/a
	T-8			14th Ave NW Transit Enhancements		Improve 14th Ave NW corridor to prioritize new transit routes operating on this roadway that will serve Ballard Station	Transit	14th Ave NW	NW Leary Way	NW Market Street	Ballard	Both Alternatives	Project Team		n/a	n/a
	B-7			Ballard Bridge Bike Access: 17th Ave Neighborhood Greenway Connection		Connect the 17th Ave Greenway to the Ballard Bridge and Burke-Gilman Trail (BGT) per the BGT Missing Link EIS.	Bike	Intersection of 17th Ave & Ballard Ave to intersection of 45th Street & 11th Ave	TBD	TBD	Ballard	Both Alternatives	Move Ballard; Burke-Gilman Trail Missing Link EIS		n/a	n/a
2-4	BP-8			Bertona Pedestrian Hillclimb Upgrade		Upgrade the existing pedestrian stairs on W Bertona Street by adding runnels and pedestrian scale lighting.	Bike & Pedestrian	W Bertona Street	15th Ave W	14th Ave W	Interbay	Both Alternatives	Project Team		n/a	n/a
	B-12			16th/17th Ave W Neighborhood Greenway (Interbay)		Install a neighborhood greenway on 16th Ave W or 17th Ave W to connect to the light rail station.	Bike	16th Ave W or 17th Ave W	W Dravus Street	New Trail Connection at the end of Thorndyke Ave W	Interbay	Both Alternatives	Bicycle Master Plan; WSBLE Project Team; WSBLE Station Charrette		n/a	n/a

Ballard Interbay Regional Transportation System (BIRT) Study

Appendix H: Economic and Social Impacts Analysis

November 2020

Seattle Department of Transportation

Ballard-Interbay Regional Transportation System Project

Economic and Social Impacts Analysis

FINAL DRAFT

August 25, 2020

Prepared by:

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Prepared for:

SDOT Seattle Department of Transportation

Community Attributes Inc. tells data-rich stories about communities that are important to decision makers.

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Contents

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Executive Summary

The Economic and Social Impacts Analysis for the Ballard-Interbay Regional Transportation System (BIRT) presents a summary of the economic and social impacts of the selected alternatives for replacing the bridges.

The alternatives for the Ballard Bridge are:

- **Alternative 1**: Low-level bridge rehabilitation
- **Alternative 2**: Mid-level movable bridge

The alternatives for the Magnolia Bridge are:

- **Alternative 1**: Armory Way
- **Alternative 2**: In-Kind Replacement

Potential impacts of each bridge alternative considered include travel time, vehicle operating costs, safety, accessibility, market desirability, and costs. The study did not evaluate impacts from construction of bridge alternatives. All impacts are for the operational period of the bridges. This analysis does not make a recommendation on which bridge alternative SDOT should implement, rather it aims to provide an objective evaluation to support an informed decision.

Travel Time

The two Ballard Bridge alternatives considered are forecasted to have minimal impact on travel times[1].

- The Mid-level Bridge is expected to improve travel time by **0.6 minutes** per vehicle, resulting in total travel time savings of **$3.9 million** in 2042 (in 2018 dollars).
- The Low-level alternative is expected to improve travel time by **0.2 minutes** per vehicle, resulting in total travel time savings of **$1.4 million** in 2042 (in 2018 dollars).

For the Magnolia Bridge alternatives, the Armory Way Bridge will have the highest impact on travel time. The In-Kind Replacement Bridge, due to a similar design to the existing bridge, will not impact travel time significantly.

- The Armory Way Bridge is forecasted to increase travel times by **12.7 minutes** per vehicle, resulting in total travel time costs of **$23.1 million** in 2042 (in 2018 dollars).

[1] Travel times used for the estimation of travel time savings are average daily ravel times per vehicle, for all travel purposes including commuting, freight, and other (HOV, SOV).

- The In-Kind Replacement is forecasted to increase travel times by **0.7 minutes** per commuting and general purpose vehicle and by **1.3 minutes** per freight vehicle, resulting in total travel time costs of **$1.5 million** in 2042 (in 2018 dollars).

Operating Costs
Vehicle operating cost savings are realized when transportation improvements lead to a decrease in vehicle miles traveled (VMT). Data available at the time of analysis does not provide sufficient evidence to suggest any significant changes in VMT due to any of the bridge alternatives.

Safety[2]
The shared use path included in both alternatives for the Ballard Bridge has the potential to save **$2.65 million per fatal crash and $62,650 per injury crash** by reducing the risk of collision involving cyclists and pedestrians. According to data from the Federal Highway Administration, a shared use path can reduce current fatal and non-fatal crashes by 25%.

For the Magnolia Bridge alternatives, **minimal safety benefits** are expected for non-motorized access due to low levels of historic collisions involving bicyclists or pedestrians on the Magnolia Bridge and relatively small projected increase in pedestrian and cyclist volumes with both alternatives.

Accessibility
The Ballard Low-Level and Mid-Level alternatives and the Magnolia Bridge In-Kind Replacement are projected to have minimal impacts on travel times. There will likely be no impact to access to housing affordable to workers in the study area from these bridge replacement options. The Armory Way Bridge would increase the commute time on average per vehicle, per day, for housing located near the western terminus of the Magnolia Bridge. Most lower priced housing is located well north of the Magnolia Bridge western terminus.

Market Desirability
The Ballard Low-Level and Mid-Level alternatives and the Magnolia Bridge In-Kind alternative are expected to have minimal impact on travel time, with less than one minute change on average per day for all travel purposes. No change in market desirability is foreseen for these bridge replacement options due to continued market demand for the study area.

The Armory Way Bridge is forecasted to add 13 minutes on average per vehicle, per day for all travel purposes on routes that must pass through the

[2] This study does not project future crashes and therefore a full quantification of safety benefits was not possible.

current bridge termini. The travel time impact is measured from the west of the current Magnolia Bridge terminus at Thorndyke Avenue W and W Galer Street to the east at Elliot Avenue W and W Galer Street Flyover. Only a portion of the 20,000 vehicles that are forecasted to cross the bridge traveling from the southern portion of the Magnolia neighborhood will experience this level of change in travel time. The highly desirable attributes of residences affected are expected to sustain market desirability of all affected areas.

Costs
Cost estimates were sourced from existing bridge planning studies. Planning level cost estimates for the **Ballard Low-level Bridge** are **$471 million** for construction, maintenance and operations, and right-of-way, compared to **$971 million** for the **Mid-level alternative**[3].

The total cost for the Magnolia Bridge In-Kind Replacement is estimated at nearly **$398 million** including construction, soft costs, right-of-way, and contingency costs. The cost for the Armory Way alternative is estimated at **$266 million**.

[3] Ballard Bridge Planning Study Alternatives Comparison Report DRAFT, SDOT, March 9, 2020.

INTRODUCTION

Background and Purpose

Originally a salt marsh, the Interbay neighborhood hosts a diverse mix of businesses and industries representing the broad sweep of Seattle's history. North of Interbay, Ballard is one of Seattle's fastest growing neighborhoods and will be the terminus of Sound Transit's Ballard and West Seattle Link Extensions. The 2019 Washington State legislature allocated funds for the City of Seattle to develop a plan to improve mobility for people and freight in the Ballard-Interbay area.

The Ballard-Interbay Regional Transportation System (BIRT) plan is developed by an interagency team led by SDOT and including the City of Seattle, Port of Seattle, Sound Transit, King County, Washington State Department of Transportation, and the Washington State Military. According to the Washington State legislature:

"The plan must examine replacement of the Ballard bridge and the Magnolia bridge, which was damaged in the 2001 Nisqually earthquake. The city must provide a report on the plan that includes recommendations to the Seattle City Council, King County Council, and the transportation committees of the legislature by November 1, 2020. The report must include recommendations on how to maintain the current and future capacities of the Magnolia and Ballard bridges, an overview and analysis of all plans between 2010 and 2020 that examine how to replace the Magnolia bridge, and recommendations on a timeline for constructing new Magnolia and Ballard bridges."

In analyzing future transportation demand for the Ballard-Interbay area, the project will take into consideration future residential growth in nearby neighborhoods and additional employment at sites such as the Armory, Expedia, and the Port of Seattle's Terminal 91. It will also adjust to reflect the recommendations of the Mayor's current Maritime and Industrial Lands Strategy.

This report represents a summary of the analysis of economic and social impacts of alternatives for replacing the Magnolia and Ballard bridge. Potential impacts considered include travel time, vehicle operating costs, safety, accessibility, and market desirability. The analysis builds on the findings from the Community and Economic Assessment which was also conducted as part of the BIRT study. The report does not make a recommendation on which bridge alternative SDOT should implement. It aims to provide an objective evaluation to support an informed decision.

Methods

The analysis of economic and social impacts of the two bridges assesses the potential benefits and limitations of bridge replacement alternatives. The analysis includes a well-defined baseline to measure against the incremental benefits and limitations of the proposed alternatives. All bridge alternatives are assessed against the following criteria: travel time, operating costs, safety, accessibility, market desirability and costs.

This report draws on multiple data and information sources, including previous bridge plans and studies, traffic analysis conducted as part of this study, state and federal sources such as the Washington State Employment Security Department, Office of Financial Management, and U.S. Bureau of Labor Statistics.

Organization of Report

The remainder of this report is organized as follows:

- **Alternatives Overview**. A brief description of the Magnolia and Ballard bridge alternatives analyzed in this study.
- **Analysis Framework and Assumptions**. A discussion of criteria and assumptions included in the analysis of economic and social impacts.
- **Economic and Social Impacts**. A discussion of the economic and social impacts analysis of the bridge alternatives.
- **Impact Assessment Summary**. A matrix summarizing the findings from the economic and impact analysis to compare alternatives.

Alternatives Overview

This study assesses two alternatives each for the replacement of Ballard and Magnolia bridges. A brief description of each alternative is provided below.

Ballard Bridge

The Ballard Bridge Planning Study (2020) is currently underway and the final report will be released in 2020. The Planning Study is considering three options for the replacement of the Ballard bridge. Of those, two options that have the most support are analyzed in this report:

- **Alternative 1 – Low-level bridge rehabilitation** includes rehabilitation and strengthening of the existing Ballard bridge structures and creates a 14-foot wide Shared Use Path (SUP). The SUP would extend from Ballard Way at the north end to a new Modified Single Point Urban Interchange at the south end.

- **Alternative 2 – Mid-level movable bridge** replaces the existing bridge with a higher profile mid-level movable bridge that improves the vertical clearance by approximately 20-ft. Other components include construction of new bascule bridge and approach structures for 15th Ave W-NW, ramp structures to NW Leary Way, a Modified Single Point Urban Interchange (MSPUI) at Emerson-Nickerson. This alternative requires a temporary detour bridge to facilitate construction.

Magnolia Bridge

The Magnolia Bridge Planning Study (2019) analyzed and compared four bridge replacement options. Of those options, the following are being considered for this study:

- **Alternative 1 – Armory Way** constructs a new bridge over the railroad tracks connecting 15th Avenue W & W Armory Way to Thorndyke Avenue W just south of W Raye Street. The new Armory Way bridge would include a Western Perimeter Road to Smith Cove Park/Elliot Bay Marina. Thorndyke Avenue W and 20th Ave W would be improved to allow access to the marina and port properties. Additional bridge components, such as a new ramp down to Alaskan Way W on the north side of the bridge, are designed to provide alternative access to Terminal 91, Port of Seattle property, and Expedia campus. Under this alternative, the existing Magnolia Bridge would be decommissioned.
- **Alternative 4 – In-kind replacement** constructs a new bridge immediately south of the existing Magnolia bridge, following a similar alignment and functionality as the current bridge. The new bridge would feature a 10-foot wide shared use path on the south side, though it would not connect to the Elliott Bay Trail.

Analysis Framework and Assumptions

The Magnolia and Ballard bridge replacement alternatives were assessed against the following criteria:

- **Travel time**. How will the bridge replacement alternatives impact travel time for commuters and freight that use the bridges?
- **Operating costs**. How will the alternative impact vehicle operating costs for transport users?
- **Safety.** How will each bridge alternative impact safety for various modes of transportation?
- **Accessibility.** How will each bridge alternative impact access to housing for workers in the study area?
- **Market desirability.** How will each bridge alternative impact market demand for affected areas?

- **Costs.** What are cost estimates of each bridge replacement alternative?

The analysis follows a conservative estimation of the impacts and assesses some of the impacts qualitatively. Where possible, the potential impacts expected to result from each bridge replacement alternative were monetized.

The analysis leveraged the U.S. Department of Transportation Benefit-Cost Analysis Guidance for Discretionary Grant Programs. Generally, standard factors and values accepted by federal agencies are used for the benefits calculation except in cases where more project specific values or prices are available. In all such cases, modifications are noted, and references are provided for data sources. The impacts are expressed in constant 2018 dollars, the year in which standard values are provided in the guidance, to avoid forecasting future inflation, unless otherwise stated.

Construction Impacts

There is insufficient data and information on detour routes, traffic volumes diverted or the impact on travel times to quantify the effects from construction of bridge alternatives. A review of information on construction impacts from current bridge studies was completed and summarized in this section.

The Ballard Bridge Planning Study (2020) did not evaluate traffic conditions during construction[4].

- The Ballard Bridge Low-Level alternative would require single lane shutdowns as needed across the bridge during construction, with no need for a detour. Further analysis would be required to determine how the Modified Single-Point Urban Interchange (that replaces existing interchange at the W Nickerson St/W Emerson St/15th Ave W intersection) could be constructed while retaining through traffic on 15th Ave W as well as all connections to W Nickerson St and W Emerson St. The Low-level Bridge has the shortest construction duration of the three alternatives considered in the Ballard Bridge Planning Study.
- The Ballard Bridge Mid-Level alternative would require complete closure of the existing Ballard Bridge during construction, and a temporary bridge and detour route. Fremont and Aurora Bridge do not have enough capacity to accommodate diverted traffic. Further traffic and design analysis are required to determine configuration and location of a temporary crossing.

Existing planning studies for the Magnolia Bridge provide some information on change in traffic patterns for the No Build scenario. The Magnolia Bridge

[4] SDOT Ballard Bridge Planning Study Transportation Discipline Report, Appendix A, March 10, 2010.

Traffic Maintenance During Bridge Closure (2017) study evaluated the impact to traffic during a potential closure of the existing bridge, either because of a catastrophic event or because of the need to detour traffic during construction of a permanent facility. The analysis performed assumes that traffic would divert to either W Dravus St or W Emerson St based on existing travel patterns and these alternate routes are expected to become congested. The congestion hot spots identified include: W Dravus St / 15th Ave W ramp intersections; W Dravus St / 20th Ave W; W Emerson St / Gilman Ave W; and W Emerson St / W Nickerson St. Transit would have to be rerouted using the currently designated snow route or other alternative route.

The Magnolia Bridge Planning Study (2019) estimates that the Magnolia Bridge alternatives will have a similar construction duration. The Armory Way Bridge will take 29 months to complete, compared to 31 months for the In-Kind Replacement. However, the construction impacts for the In-Kind Replacement in terms of significant impact to traffic are expected to last almost twice as long (27 months) as for the Armory Way alternative (14 months).

ECONOMIC AND SOCIAL IMPACTS

This chapter provides a summary of the analysis of each alternative against the economic and social criteria.

Travel Time

The analysis of travel time impacts measures the value of changes to travel time with the implementation of the proposed Magnolia and Ballard Bridge replacement alternatives. Travel time impacts are estimated using data on projected traffic volumes and travel time changes for the different corridors provided by Fehr & Peers and Concord Engineering. The forecasts are produced for the 2042 future year for the AM and PM peak periods for two network scenarios:

- **Network Scenario 1.** Mid-level Ballard Bridge and Armory Bridge Alternative 1; land uses and transportation network consistent with the West Seattle Ballard Link Extension (WSBLE) model and inclusion of interim Armory Development land use.
- **Network Scenario 2.** Low-level Ballard Bridge and In-kind replacement Alternative 4 for Magnolia Bridge, as well as new intersections at 20th Avenue W and Thorndyke Avenue, and new flyover ramp access at Galer Street for access across BSNF rail to Pier 91 and adjacent facilities; land uses and transportation network consistent with the West Seattle and Ballard Link Extensions (WSBLE) model.

The existing and projected travel times and traffic volumes from this study differ from previous Ballard and Magnolia Bridge studies because of distinct horizon year, analytical methods, and project extents.

The forecasted travel time impacts of the bridge replacement alternatives are compared to the No Build option in 2042. The No Build option for the Magnolia and Ballard bridge assumes no changes to the existing transportation network. **Exhibit 1** and **Exhibit 2** show the change in travel time by corridor and scenario for general purpose traffic and freight for the AM, PM peak hour, and average daily.

Exhibit 1. Travel Time Savings, General Purpose Traffic, 2042

Corridor	Scenario	AM - Average TT*	AM - Peak TT**	PM - Average TT	PM - Peak TT	Average Daily TT***
Ballard Bridge	Scenario 1 (Mid Level)	0.8	1	0.1	0.2	0.3
	Scenario 2 (Low Level)	0.5	0.7	0.3	0.5	0.2
Magnolia Bridge	Scenario 1 (In-Kind)	-2.1	-3.1	-0.2	-0.3	-0.7
	Scenario 2 (Armory Way)	-18.2	-25.2	-21.8	-30.2	-12.7
NW Leary Way	Scenario 1	0.2	0.2	-0.4	-0.6	-0.1
	Scenario 2	0	-0.1	0	-0.1	0.0
W Emerson Street/ W Nickerson Street	Scenario 1	-1.8	-2.5	-0.8	-0.9	-0.7
	Scenario 2	-1.8	-2.5	-0.8	-0.9	-0.7
W Dravus Street	Scenario 1	0	0	0	0	0.0
	Scenario 2	-0.5	-0.7	-1.8	-2.4	-0.6

Source: Concord Engineering, 2020; Community Attributes, 2020.

Note: For further details on the origin and destination points for the corridors in this table please refer to Appendix A.

Exhibit 2. Travel Time Savings, Freight, 2042

Corridor	Scenario	AM - Average TT*	AM - Peak TT**	PM - Average TT	PM - Peak TT	Average Daily TT***
Ballard Bridge	Scenario 1 (Mid Level)	0.7	1.1	0.0	0.0	0.2
	Scenario 2 (Low Level)	0.5	0.8	0.2	0.3	0.2
Magnolia Bridge	Scenario 1 (In-Kind)	-3.7	-1.2	-0.9	-1.4	-1.3
	Scenario 2 (Armory Way)	-18.3	-27.5	-20.7	-31.1	-12.6
NW Leary Way	Scenario 1	-0.5	-0.8	-1.1	-1.7	-0.5
	Scenario 2	0.0	0.0	0.0	0.0	0.0
W Emerson Street/ W Nickerson Street	Scenario 1	-2.7	-4.1	-1.6	-2.4	-1.2
	Scenario 2	-2.7	-4.1	-1.6	-2.4	-1.2
W Dravus Street	Scenario 1	-0.2	-0.3	-0.2	-0.3	-0.1
	Scenario 2	-0.7	-1.1	-2.0	-3.0	-0.8

Source: Concord Engineering, 2020; Community Attributes, 2020.

*Note: *Average TT represents the average travel time a vehicle is expected to experience aggregated over the peak hour. Running time plus intersection delay.*

***Peak TT represents the typical highest travel time a vehicle may experience on days with high levels of congestion. This value is based on peak factors created from 95th percentile peak travel times collected along 15th Avenue in October, 2019 from SDOT's Acyclica ITS system.*

****Data was not available from the travel demand model for average daily travel time. This was calculated as the weighted average of the AM peak, PM peak and free flow travel times. Average Daily TT = ((2hrs*AM Average TT+1hr*AM Peak TT)+10hrs*(Average(Free Flow TT, AM Average TT, PM Average TT)+(2hrs*PM Average TT+1hr*PM Peak TT)+8hrs*Free Flow TT)/24hrs).*

Ballard Bridge

Based on traffic volume data from Fehr & Peers, just over 5,600 vehicles are forecasted to cross the Ballard Bridge under both alternatives during the PM peak hour in 2042. This represents an average annual increase of 0.9% from existing volumes. Roughly 23% of future traffic volumes are commuters, 17% is freight and the remaining 60% are High Occupancy Vehicles (HOV) and Single Occupancy Vehicles (SOV) travelling for other purposes, such as business or personal.

Both Ballard Bridge alternatives are forecasted to have minimal impact on travel time for private vehicles and freight crossing the bridge. The Mid-level alternative may improve travel time by 0.6 minutes on average per vehicle, for all travel purposes. This includes the time savings associated with reduced bridge openings of roughly 22 seconds per vehicle[5]. Multiplying the annual hours lost by average vehicle occupancy (1.3) and value of time by travel purpose, yields total travel time savings of $3.9 million in 2042 (in 2018 dollars). (**Exhibit 3**)

Exhibit 3. Value of Travel Time Savings, All Travel Purposes, Ballard Bridge, 2042 (Mils $2018)

Corridor	Scenario	Commuting	Freight	Other	Total
Ballard Bridge	Scenario 1 (Mid Level)	$0.8	$0.8	$2.3	$3.9
	Scenario 2 (Low Level)	$0.3	$0.3	$0.9	$1.4

Source: Concord Engineering, 2020; Fehr & Peers, 2020; U.S. Department of Transportation Benefit-Cost Analysis Guidance for Discretionary Grant Programs; Community Attributes, 2020.

The Low-level alternative is expected to decrease travel time by 0.2 minutes on average per vehicle crossing the bridge, for all travel purposes. The total

[5] According to the Ballard Bridge Planning Study (2020) the Mid-Level Bridge will eliminate about 70% of the bridge openings. The average delay per vehicle would decrease from about 31 seconds per vehicle to 9 seconds per vehicle.

estimated value of travel time benefits is $1.4 million in 2042 (in 2018 dollars).

Magnolia Bridge

Total traffic volume for the Magnolia Bridge alternatives is forecasted at approximately 1,500 in the PM peak hour in 2042. This implies an average annual growth of 0.2% from existing traffic volumes. The projected mode split differs slightly between the Armory Way bridge and In-Kind Replacement alternatives. While commuting volumes represent roughly 18% under both alternatives, freight volumes are estimated at 23% for the In-Kind Replacement and 17% for the Armory Way bridge. High Occupancy Vehicles (HOV) and Single Occupancy Vehicles (SOV) travelling for other purposes make up 60% of total traffic volumes for the In-Kind Replacement alternative and 65% for the Armory Way Bridge alternative.

The In-Kind Replacement alternative of the Magnolia Bridge will have minimal impact on travel times for private vehicles and freight crossing the bridge due to its similar design to the existing bridge. It is estimated that the In-Kind Replacement bridge will increase travel time by 0.7 minutes on average for commuters and general purpose traffic and 1.3 minutes on average for freight. This results in total annual travel time costs of $1.5 million in 2042 (in 2018 dollars). (**Exhibit 4**)

Exhibit 4. Value of Travel Time Savings, All Travel Purposes, Magnolia Bridge, 2042 (Mils $2018)

Corridor	Scenario	Commuting	Freight	Other	Total
Magnolia Bridge	Scenario 1 (In-Kind)	-$0.2	-$0.6	-$0.7	-$1.5
	Scenario 2 (Armory Way)	-$3.8	-$4.4	-$14.9	-$23.1

Source: Concord Engineering, 2020; Fehr & Peers, 2020; U.S. Department of Transportation Benefit-Cost Analysis Guidance for Discretionary Grant Programs; Community Attributes, 2020.

The proposed Armory Way bridge is forecasted to increase travel times by roughly 13 minutes on average per vehicle for all travel purposes, with higher increases of up to 30 minutes in the PM peak hour. Economic impacts from travel time delays are estimated at $23.1 million in 2042 (in 2018 dollars) for the Armory Way bridge. This assumes that all 18,000 vehicles that are forecasted to cross the Armory Way bridge in 2042 will experience the full 13 minutes delay. The 13 minutes change in travel time is measured between the existing west Magnolia Bridge terminus at Thorndyke Ave W and W Galer Street and the east terminus at Elliot Avenue W and W Galer Street Flyover, via the new Armory Way Bridge.

Other Corridors

The analysis of travel time impacts also considered potential impacts to other corridors in the BIRT study area from changes to the network produced by the proposed Ballard and Magnolia bridge alternatives. According to travel time results provided by Concord Engineering, travel time impacts for general purpose and freight traffic are projected to be minimal on NW Leary Way between 17th Ave NW and 14th Ave NW, W Emerson Street / W Nickerson Street between Gilman Avenue W and 13th Avenue W and W Dravus Street corridors. (**Exhibit 1** and **Exhibit 2**)

There was no information provided on travel time impacts for corridors that include the Ballard Bridge segment and provide access to industrial businesses along the Ship Canal. The Ballard Bridge Planning Study (2020) reports some potential changes to vehicular and truck access and connectivity to industrial businesses along the Ship Canal and/or traffic served by NW Leary Way. The Low-Level Bridge retains ramp configuration at the north end of the bridge but would improve access at the south end due to the reconfiguration of the W Emerson St/W Nickerson St/15th Ave W interchange. The Mid-Level Bridge would improve traffic operations on both ends of the bridge, with the same reconfiguration of the interchange at the south end and longer one-way ramps connecting to the grid further away from 15th Ave NW on the north end.

Operating Costs

The analysis of economic impacts considers potential improvements to travel efficiencies on the proposed Ballard and Magnolia Bridge replacement alternatives that would reduce vehicle operating costs. Vehicle operating cost savings are realized when transportation improvements lead to less vehicle miles travelled (VMT).

Data provided by Fehr & Peers from the travel demand model shows a change in VMT by bridge crossing for commute and freight trips for both scenarios (**Exhibit 5**). However, the changes are attributed to model assumptions such as land use changes, rather than bridge alternative specific improvements. Fehr & Peers applied a version of the PSRC model that is currently being used for the WSBLE project. Post-processing of traffic volumes incorporated future pipeline projects such as T-91 development, Expedia Campus, and Armory Development for the baseline scenario.

Exhibit 5. Vehicle Miles Travelled (VMT) Savings, 2042

Corridor	Scenario	Commuting	Freight
Ballard Bridge	Scenario 1 (Mid Level)	607	-1943
	Scenario 2 (Low Level)	893	-1721
Magnolia Bridge	Scenario 1 (In-Kind)	809	-272
	Scenario 2 (Armory Way)	709	-463

Source: Fehr & Peers, 2020.

Note: VMT changes show the difference between the existing VMT and the future 2042 scenarios. VMT was calculated by multiplying the number of trips from origin to destination that cross each bridge by the distance between the origin and destination. Freight is defined as commercial vehicles, medium trucks, and heavy trucks and commuting are Home-Based Work trips.

There is insufficient evidence to suggest that the Ballard Bridge and Magnolia Bridge alternatives evaluated as part of this study will lead to a significant change in VMT.

Safety

The safety analysis considers whether the proposed Ballard and Magnolia Bridge alternatives reduce the likelihood of fatalities, injuries, and property damage and improve safety outcomes for residents and workers in the BIRT study area. Traffic collisions can impose various types of costs such as property damage, emergency services, traffic delays, medical and rehabilitation care, lost productivity and disability compensation costs, and non-market costs, including pain, grief, and reduced quality of life. Transportation projects that improve road safety can enhance economic performance by improving labor productivity and reducing economic losses that result from injuries and disabilities.

The expected effectiveness of the Ballard and Magnolia Bridge alternatives in reducing the frequency or severity of collisions is required to estimate the safety benefits. This study does not project future crashes and therefore a full quantification of benefits was not possible. The analysis considered alternative methods to tie the specific type of improvement being implemented with each bridge alternative to safety outcomes and sourced information available from previous bridge studies.

Ballard Bridge

Both Ballard Bridge alternatives considered as part of this study will provide improved facilities for bicycle and pedestrians that are likely to provide safer conditions for travel by these modes.

- The Low-level bridge alternative will create a 14-foot wide Shared Use Path (SUP) on the west side of the existing bridge, which will move cyclists using the traffic lanes today to the SUP. The SUP is expected to improve bicycle and pedestrian safety and accessibility. The east sidewalk on the approach structures would also be widened to 6-feet to match the existing bascule bridge.
- The Mid-level bridge alternative will also create a 14-foot wide SUP on the west side of the bridge but will not provide any bicycle or pedestrian facilities on the east side of the bridge.

The Ballard Bridge Planning Study looked at collisions data for the Ballard Bridge and the ramp junctions north and south of the bridge. Five years of collision data show no pedestrian or cyclist collisions on the main segment of the Ballard Bridge between the ramp junctions, and only one pedestrian/cyclist collision at each interchange on 15th Ave North and south of the bridge. (**Exhibit 6**) None of these collisions resulted in serious injuries or fatalities. However, this trend might not continue as the number of bicyclists and pedestrians crossing the Ballard Bridge could increase due to installing the Shared Use PAth and the opening of the light rail stations in Ballard.

Exhibit 6. Ballard Bridge Collision Summary (June 1, 2014 through June 1, 2019)

Location	Vehicle	Ped/ Cycle	Other	Total	Average /Year
15th Ave NW/NW Leary Way Interchange	36	1	17	54	10.8
15th Ave W / W Emerson St / W Nickerson St Interchange	34	1	11	46	9.2
Ballard Bridge (ramp to ramp roadway segment)	40	0	18	58	11.6

Source: SDOT Ballard Bridge Planning Study Transportation Discipline Report – Appendix A, 2020.
Note: Other collision types included insufficient information, driver inattention, parked car, and improper movement.

Data available through extensive research by USDOT and other organizations from the online Crash Modification Factor (CMF) Clearinghouse was used to estimate the potential change in the number of collisions from implementing a SUP. A Crash Modification Factor (CMF) is a multiplicative factor that indicates the proportion of crashes that would be expected after implementing a countermeasure. Installing a shared path may reduce current fatal and non-fatal crashes involving bicyclists by 25%[6]. The benefit of preventing a fatal crash is valued at $10.6 million in 2018 dollars, while the monetized value of an injury crash is $250,600 in 2018 dollars[7].

[6] Statewide Analysis of Bicycle Crashes, Alluri et al., 2017.
[7] Monetization values for injury crashes and fatal crashes are based on an estimate of approximately 1.44 injuries per injury crash and 1.09 fatalities per fatal crash,

Both Ballard Bridge alternatives will implement a Shared Use Path that has the potential to save $2.65 million in 2018 dollars per fatal crash and $62,650 in 2018 dollars per injury crash by reducing the risk of collisions involving bicyclists.

Magnolia Bridge

The In-Kind Replacement and the Armory Way alternative will feature a non-motorized, multi-use path on the south side. For the In-Kind Replacement alternative there are no planned connections to the Elliot Bay Trail, as opposed to the Armory Way bridge which would provide improved connections to the Elliot Bay Trail via 20th Ave W.

Although both alternatives would improve non-motorized facilities, previous transportation analysis conducted for the Magnolia Bridge Long Term Replacement Study suggests that people will likely continue using existing travel routes regardless of the alternative chosen because of the steep grades under both bridge replacement options. A relatively small increase in bicycle and pedestrian traffic is expected with both alternatives[8].

Like the Ballard Bridge, there have been no pedestrian or bicycle fatalities reported for the Magnolia Bridge over the past 5 years. SDOT collisions data reports no bicycle and pedestrian collisions on the Magnolia Bridge between 2014 and 2019. The low level of historic collisions combined with the relatively small increase in bicycle and pedestrian volumes would suggest safety benefits for non-motorized access are expected to be minimal for both alternatives.

Accessibility

The accessibility analysis assessed how the proposed bridge alternatives would impact access to housing for workers in the BIRT study area. The housing market within the residential boundary of the BIRT study area served by the Ballard and Magnolia Bridges is composed of approximately 44,000 housing units, of which just 5% are vacant. Nearly 55% of housing units throughout the area are owner-occupied. The median value of owner-occupied units across the area is nearly $660,000 and the median gross rent is nearly $1,600. While analysis of households within the area found that the median gross rent as a percentage of household income is below the cost burden threshold, just 9% of residents are also employed in the study area.

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based on an average of the last five years of data in NHTSA's National Crash Statistics. The fatal crash value is further adjusted for the average number of injuries per fatal crash.

8

An estimated 42% of study area workers earn less than $50,000 and 21% earn less than $35,000 (**Exhibit 7**). An estimated 15% of study area employment can afford up to $1,500 in monthly housing costs without experiencing housing cost burden. An additional 18% can afford monthly rents between $1,500 and $2,000[9]. Overall, an estimated 46% of study area employment can afford monthly housing costs up to $2,500 without experiencing cost burden. (**Exhibit 8**)

Exhibit 7. Wage Percentiles, Commercial Study Area, 2018

	Study Area Employment	Share of Employment
Less than $35,000	7,030	21%
$35,000-$50,000	7,020	21%
$50,000-$85,000	9,520	29%
$85,000-$125,000	5,010	15%
More than $125,000	4,170	13%
Total	**32,750**	**100%**

Sources: Puget Sound Regional Council, 2020; Washington State Employment Security Department, 2020; Bureau of Labor Statistics, 2020; Community Attributes Inc., 2020. Note: Wage figures are for Seattle-Tacoma-Bellevue MSA.

Exhibit 8. Study Area Employment by Monthly Housing Cost, 2018

	Study Area Employment	Share of Employment
Less than $1,500	5,010	15%
$1,500-$2,000	6,030	18%
$2,000-$2,500	4,130	13%
$2,500-$3,500	6,170	19%
More than $3,500	11,410	35%
Total	**32,750**	**100%**

Sources: Puget Sound Regional Council, 2020; Washington State Employment Security Department, 2020; Bureau of Labor Statistics, 2020; U.S. Census Bureau American Community Survey, 2020; Community Attributes Inc., 2020.

Housing data indicates that housing affordable to area workers – especially rental housing - does exist in the study area but is difficult to find due to very low vacancy rates for both rental and for-sale units. In the residential study area, there were almost 19,000 units of renter-occupied housing, but only 588 units of vacant-for-rent housing[10]. This rate of vacancy – around 3.0% - falls

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[9] Annual wages are converted to an estimated household wage based on 2018 American Community Survey data on Family Income by Number of Workers. Monthly housing cost is 30% of estimated annual household income, to account for housing cost burden, divided by 12.

[10] For the period 2014-2018, according to the U.S. Census American Community Survey.

well below what is generally considered to be a healthy market rental vacancy rate of 5%. However, again in the study area as whole, 51% of renter-occupied units and 57% or about 335 vacant-for-rent units were affordable to workers who can pay $1,500 a month in housing costs[11] (**Exhibit 9**). Another 31% of renter-occupied units were rented at between $1,500 and $2,000 a month. These more affordable renter-occupied units in the study area (those costing up to $2,000 per month in rent) were concentrated in Ballard and other northern neighborhoods of the study area.

Exhibit 9. Number of Renter-Occupied Housing Units by Neighborhood by Monthly Housing Cost, 2014-2018

	Number of Renter-Occupied Units with Cash Rent				
Housing Cost Levels Affordable to Study Area Workers	**Magnolia**	**Ballard**	**Interbay**	**Other Neighbor-hoods**	**Study Area**
Less than $1,500	1,300	4,495	986	2,761	9,542
$1,500-$2,000	730	2,892	599	1,619	5,840
$2,000-$2,500	238	761	114	633	1,746
$2,500-$3,500	250	342	234	527	1,353
More than $3,500	32	84	15	108	239
	2,550	**8,574**	**1,948**	**5,648**	**18,720**

Sources: U.S. Census Bureau American Community Survey, 2014-2018; Community Attributes Inc., 2020.

Exhibit 10. Number of Owner-Occupied Housing Units by Neighborhood by Monthly Housing Cost, 2014-2018

	Number of Owner-Occupied Units with Mortgage				
Housing Cost Levels Affordable to Study Area Workers	**Magnolia**	**Ballard**	**Interbay**	**Other Neighbor-hoods**	**Study Area**
Less than $1,500	568	398	152	676	1,794
$1,500-$2,000	479	861	170	1,028	2,538
$2,000-$2,500	820	1,359	89	1,511	3,779
$2,500-$3,500	1,137	1,951	220	2,232	5,540
More than $3,500	1,169	658	63	1,434	3,324
	4,173	**5,227**	**694**	**6,881**	**16,975**

Sources: U.S. Census Bureau American Community Survey, 2014-2018; Community Attributes Inc., 2020.

The story is different with owner-occupied and vacant-for-sale housing – such units (usually single-family detached housing) were less accessible to area workers who could only afford up to $2,000 per month in housing costs. Of

[11] Gross rent is the contract rent plus the estimated average monthly cost of utilities (electricity, gas, and water and sewer) and fuels (oil, coal, kerosene, wood, etc.) if these are paid by the renter (or paid for the renter by someone else).

the nearly 17,000 owner-occupied housing units in the study area for which a mortgage existed, only 10.6% cost $1,500 or less a month[12], and another 15% cost from $1,500 to $2,000 per month (**Exhibit 10**). The greatest number of owner-occupied units – just under a third – cost between $2,500 and $3,500 per month, with another 20% costing more than $3,500 per month. The total number of vacant-for-sale units was only 350 for the entire study area – an extremely low vacancy rate of 1.5% for owner occupied / vacant-for-sale housing units.

Given the minimal change in travel time for the Ballard Bridge alternatives and the Magnolia Bridge In-Kind Replacement, there will likely be no impact to access to housing. The Armory Way alternative could increase commute time for some workers in the Magnolia area that are already facing very low to extremely low vacancy rates for housing units that are more affordable to them. Besides vacant units, this includes just over 2,000 renter-occupied units costing up to $2,000 per month located in Magnolia. Most of these units are located to the north of the Magnolia Bridge. The further north of the bridge, the less of an increase of travel time would be experienced.

Market Desirability

Many residents in the study area have concerns about the impact of the bridge alternatives on home real estate values and marketability of all real estate. The assessment of market desirability effects describes the impact of the proposed Magnolia and Ballard Bridge replacement alternatives within the BIRT study area.

There are many factors that impact regional demand for real estate, real estate prices and availability. Demographics such as age, income, migration patterns, and population growth can have a large impact on how real estate is priced and what type of properties are in demand. Seattle and the region are growing faster that they have in decades. Over the past decade, Seattle added more than 143,000 people, of which roughly 15,000 were in the BIRT study area. The growth of ICT and other related companies has attracted more people to the area. Strong economic performance coupled with declining inventories and falling interest rates have led to an expensive real estate market in Seattle.

The Ballard Bridge alternatives and the Magnolia Bridge In-Kind alternative are expected to have minimal impact on travel time, with less than one minute change on average per day for all travel purposes. No change in

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[12] Mortgage and select owner costs include the sum of payments for mortgages, deeds of trust, contracts to purchase, or similar debts on the property; real estate taxes; fire, hazard, and flood insurance on the property; utilities (electricity, gas, and water and sewer); and fuels (oil, coal, kerosene, wood, etc.). It also includes, where appropriate, the monthly condominium fee for condominiums and mobile home costs.

market desirability is foreseen for these bridge replacement options due to continued market demand for the study area.

The Magnolia Bridge Armory Way alternative is expected to increase travel time by 13 minutes on average, with longer delays during the AM and PM peak, for all travel purposes on routes that must pass through the current bridge termini. The travel time change is measured for the corridor that starts to the west of the current Magnolia Bridge terminus at Thorndyke Avenue W and W Galer Street and ends to the east at Elliot Avenue W and W Galer Street Flyover. Only a portion of current Magnolia Bridge users will experience the full 13 minutes delay. Trip origins and destinations north of the bridge on the eastern side of Magnolia will experience lower increases in travel time. Trips beginning or ending on the western side will find alternative routes as well, pending additional analysis of route alternatives.

The highly desirable attributes of residences affected are expected to sustain market desirability of all affected areas. Continued growth and demand for housing in the area will more than offset considerations of travel time with the Armory Way bridge. Traffic patterns shifts may cause micro-level market variances within Magnolia, but the overall demand for living in Magnolia will sustain the interests of prospective buyers and renters.

Costs

The Ballard Bridge Planning Study includes planning-level cost estimates of construction, maintenance and operations, and right-of-way. Design and construction costs are estimated at $390 million in 2019 dollars for the Low-level alternative, compared to $857 million for the Mid-level alternative. Right-of-way cost is estimated at $81 million in 2019 dollars for the Low-level alternative, compared to $114 million for the Mid-level alternative[13].

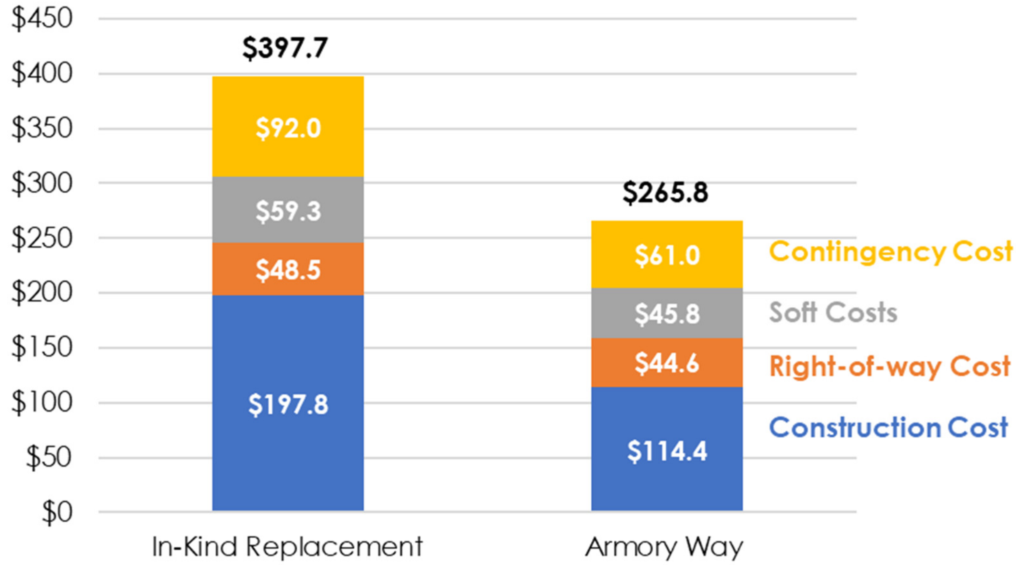
The Low-level bridge will maintain the same structure as the existing Ballard Bridge with a rehabilitated bascule section. Given the older structure, it will require more ongoing maintenance than the Mid-level alternative. The Mid-level bridge is also expected to require less ongoing operations staff and movable bridge maintenance than the rehabilitated structure because the number of bridge openings will be reduced.

The Magnolia Bridge Planning Study provides planning-level cost estimates of construction, right-of-way, engineering, and administration. The total cost for the In-Kind Replacement is estimated at $397.7 million, compared to $265.8 for the Armory Way bridge. A breakdown of the different cost

[13] Ballard Bridge Planning Study Alternatives Comparison Report DRAFT, SDOT, March 9, 2020.

components for the Magnolia Bridge alternatives is illustrated in **Exhibit 11**.

Exhibit 11. Magnolia Bridge Alternatives Cost Estimate, Mils $ 2018



Source: Magnolia Bridge Planning Study, 2019.

Impact Assessment Summary

Exhibit 12 and **Exhibit 13** below provide a summary of the evaluation outcomes for each bridge alternative.

Exhibit 12. Ballard Bridge Alternatives Impact Assessment Results

Criteria	Low-level bridge rehabilitation	Mid-level movable bridge
Travel Time Savings	**0.2 minutes** per vehicle (average daily, all travel purposes) Value of travel time savings, 2042: **$1.4 million ($2018)**	**0.6 minutes** per vehicle (average daily, all travel purposes, including savings from reduction in bridge openings) Value of travel time savings, 2042: **$3.9 million ($2018)**
Operating Costs	Insufficient evidence to suggest impact.	
Safety	Safety benefits from implementing a Shared Use Path: **$2.65 million per fatal crash** and **$62,650 per injury crash** ($2018) This alternative will also widen the east sidewalk to 6-feet with potential additional safety benefits to pedestrians.	Safety benefits from implementing a Shared Use Path: **$2.65 million per fatal crash** and **$62,650 per injury crash** ($2018)
Accessibility	**No impact** to access to housing due to minimal change in travel time.	
Market Desirability	**No change** in market desirability foreseen due to continued market demand for the study area.	
Costs	Design, construction, and right-of-way costs: **$471 million** ($2019) Older structure requires **more ongoing maintenance**.	Design, construction, and right-of-way costs: **$971 million** ($2019) New structure will require **less ongoing maintenance** than rehabilitated structure.

Exhibit 13. Magnolia Bridge Alternatives Impact Assessment Results

Criteria	Armory Way Bridge	In-Kind Replacement
Travel Time Savings	**-12.7 minutes** per vehicle (average daily, all travel purposes) Value of travel time savings, 2042: -**$1.5 million ($2018)**	**-0.7 minutes** per vehicle (average daily, all travel purposes, including savings from reduction in bridge openings) Value of travel time savings, 2042: -**$23.1 million ($2018)**
Operating Costs	Insufficient evidence to suggest impact.	
Safety	**Minimal benefits for non-motorized access** due to low level of historic collisions involving bicyclists or pedestrians on the Magnolia Bridge and relatively small projected increase in pedestrian and cyclist volumes for this alternative.	**Minimal benefits for non-motorized access** due to low level of historic collisions involving bicyclists or pedestrians on the Magnolia Bridge and relatively small projected increase in pedestrian and cyclist volumes for this alternative.
Accessibility	The Armory Way alternative **could increase commute time for some workers** in the Magnolia area that are already facing very low to extremely low vacancy rates for housing units that are more affordable to them.	**No impact** to access housing due to minimal change in travel time.
Market Desirability	Insufficient evidence to suggest that the change in travel time will correlate with an impact on market desirability for the Magnolia neighborhood.	**No change** in market desirability foreseen due to continued market demand for the study area.
Costs	Construction, soft costs, right-of-way, and contingency costs: **$265.8 million** ($2018)	Construction, soft costs, right-of-way, and contingency costs: **$397.7 million** ($2018)

Appendix A. Economic Analysis Assumptions

A list of assumptions for the inputs into the economic impact analysis is provided below. The list contains inputs for the calculation of travel time savings and safety benefits.

Input	Value	Source
Dollar year	2018	
Annualization factor	250	Number of working days in a
Share of AWDT that occurs in the PM peak hour	8%	SDOT Ballard Bridge Planning Study Transportation Discipline Report, 2020
Average Vehicle Occupancy – Ballard Bridge	1.3	Fehr & Peers, 2020
Average Vehicle Occupancy – Magnolia Bridge	1.4	Fehr & Peers, 2020
Value of Travel Time - Commuting	$15.2	USDOT BCA Guidance ($2018)
Value of Travel Time - Freight	$27.1	USDOT BCA Guidance ($2018)
Value of Travel Time – All Purposes	$16.6	USDOT BCA Guidance ($2018)
Average vehicle delay (sec/vehicle) from bridge openings - Low-Level (2040)	30.7	SDOT Ballard Bridge Planning Study Transportation Discipline Report, 2020
Average vehicle delay (sec/vehicle) from bridge openings - Mid-Level (2040)	9.2	SDOT Ballard Bridge Planning Study Transportation Discipline Report, 2020

Travel times were estimated for the following study area corridors:

- **Ballard Bridge**: 15th Avenue NW & NW Market Street to 15th Avenue W & Gilman Drive W.
- **Magnolia Bridge**: Thorndyke Avenue W & W Galer Street to W Galer Street Flyover & Elliot Avenue W
- **NW Leary Way**: 17th Avenue NW & NW Leary Way to 14th Avenue NW & NW Leary Way
- **W Emerson Street/W Nickerson St.**: Gilman Avenue W & W Emerson Street to 13th Avenue W & W Nickerson Street
- **W Dravus Street**: 20th Avenue W & W Dravus Street to 14th Avenue W & W Dravus Street